

**Value Chain Solutions-
Heartland Complex
(Bitumen Upgrader
and Specialty Refinery)
Expansion Project**

Detailed Project Description

February 2021

**Submitted to:
Impact Assessment Agency of Canada**

**Submitted by:
Value Chain Solutions, Inc.**





Acronyms

AAAQO	Alberta Ambient Air Quality Objective
ACO	Aboriginal Consultation Office
ADC™	Accelerated DeContamination™
AER	Alberta’s Energy Regulator
AIH	Alberta’s Industrial Heartland
bpd	barrels per day
CO	carbon monoxide
CO ₂	carbon dioxide
CO _{2e}	carbon dioxide equivalent
COCT™	Clean Oil Cracking™
COLF	Clean Oil La-Fit, VCS-H crude oils brand name
DCO	decontaminated oil
Dilbit	diluted bitumen
DRU	diluent recovery unit
EIA	environmental impact assessment
EPEA	<i>Environmental Protection and Enhancement Act</i>
FAP	Fort Air Partnership
GHG	greenhouse gas
H ₂ S	hydrogen sulphide
H ₂	hydrogen
IAA	<i>Impact Assessment Act</i>
IAAC	Impact Assessment Agency of Canada
LPG	liquefied petroleum gas
NH ₃	ammonia
NO _x	oxides of nitrogen
OSCA	<i>Oil Sands Conservation Act</i>
PM	particulate matter
PM _{2.5}	fine particulate matter less than 2.5 µm in diameter
ppm	parts per million
ROW	Right-of-Way
SO ₂	sulphur dioxide
VCI	Value Creation Inc.
VCG	Value Creation Group
VCS	Value Chain Solutions Inc.
VCS-H	Value Chain Solutions–Heartland Complex
WRHP™	Wide Range Hydroprocessing

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Updated General Information

Background Information

Value Chain Solutions Inc. (VCS) has the focused mission to achieve a fundamental shift in the Oil Sands Industry by converting bitumen into clean oil with best-in-class environmental performances in an economically competitive way. VCS, a wholly owned subsidiary of Value Creation Inc., is the operating company of a partially built bitumen upgrader and specialty refinery named Value Chain Solutions-Heartland Project, in short, VCS-H Project 1 in this document. Value Creation Inc. holds the regulatory approvals of VCS-H Project 1.

An Environmental Impact Assessment (EIA) was completed for the approved VCS-H Project 1 in 2004.¹ Diluted bitumen (DilBit) upgrading/specialty refining with a capacity up to 29,890 m³/day (188,000 barrels/day) was approved by the Alberta Energy Regulator (AER) under:

- *Oil Sands Conservation Act* (OSCA) Approval No. 10330B;
- *Environmental Protection and Enhancement Act* (EPEA) Approvals No. 203303-01-00, 203303-01-01; and
- *Water Act* (WA) Approval No. 1001178 and *Water Act* (WA) License No. 00224750-01-00 to withdraw water from the North Saskatchewan River.

A Tank Farm (petroleum storage facility) with a storage capacity of 256,600 m³ (1.6 million barrels)², serving VCS-H Project 1, was approved in 2017 under:

- EPEA Approval No. 387876-00-00.

1. Project Overview

VCS is proposing to construct and operate the Value Chain Solutions-Heartland Complex Expansion Project (the Expansion or the Project). The proposed Project is the expansion of the approved VCS-H Project 1, which will increase the input capacity by a factor of four, for a total combined capacity of up to 119,240 m³/day or 750,000 barrels/day. The combined approved VCS-H Project 1 and proposed Expansion is referred to as the VCS-H Complex. The Project life for the VCS-H Complex as a whole is anticipated to be over 50 years.

The proposed Expansion will also increase the petroleum storage capacity by 1,067,000 m³ (6.7 million barrels) to a total capacity of 1,323,600 m³ (8.3 million barrels) for the entire VCS-H Complex. The proposed Expansion will be implemented in 3 stages, named Project 2, 3 and 4 following the approved VCS-H Project 1.

VCS plans to prepare and submit an integrated EIA and application for the Expansion to amend OSCA Approval No. 10330B and EPEA Approval No.'s 203303-01-01 to the AER.

The Project will be located on private land immediately adjacent to the approved VCS-H Project 1. This land is situated northeast of Edmonton, in the designated Astotin Heavy Industrial Area of Strathcona County within Alberta's Industrial Heartland (AIH) (Figure 1). The proposed Expansion is centered at the south half of Section 11,

¹ No federal comprehensive study of environmental assessment was triggered under the *Canadian Environmental Assessment Act* (1992) in 2004-2005 during the VCS-H Project 1 EIA review stage.

² The Tank farm serving VCS-H Project 1 has a proposed petroleum storage capacity of 256,600 m³, under the threshold of designating physical activities for petroleum storage capacity of 500,000 m³ or more (SOR-2012-147, Schedule 14 as of 2016).

Township 056, Range 21, West of the 4th Meridian, approximately 18 km northeast of the City of Fort Saskatchewan and 8 km west of the Town of Bruderheim.

Similar to the approved VCS-H Project 1, the proposed Expansion will use proprietary technology to upgrade and refine diluted bitumen to value-added products, such as premium-medium synthetic crude oil, naphtha, diluent, ultra-low sulphur diesel, and additional blend products: cleaned heavy crude oil and low sulphur marine fuel. VCS-H Complex will reduce net greenhouse gas (GHG) emissions, add value within Alberta and Canada, free up the pipeline bottleneck, broaden the market, and achieve robust economics against volatilities in oil price and light/heavy price differentials.

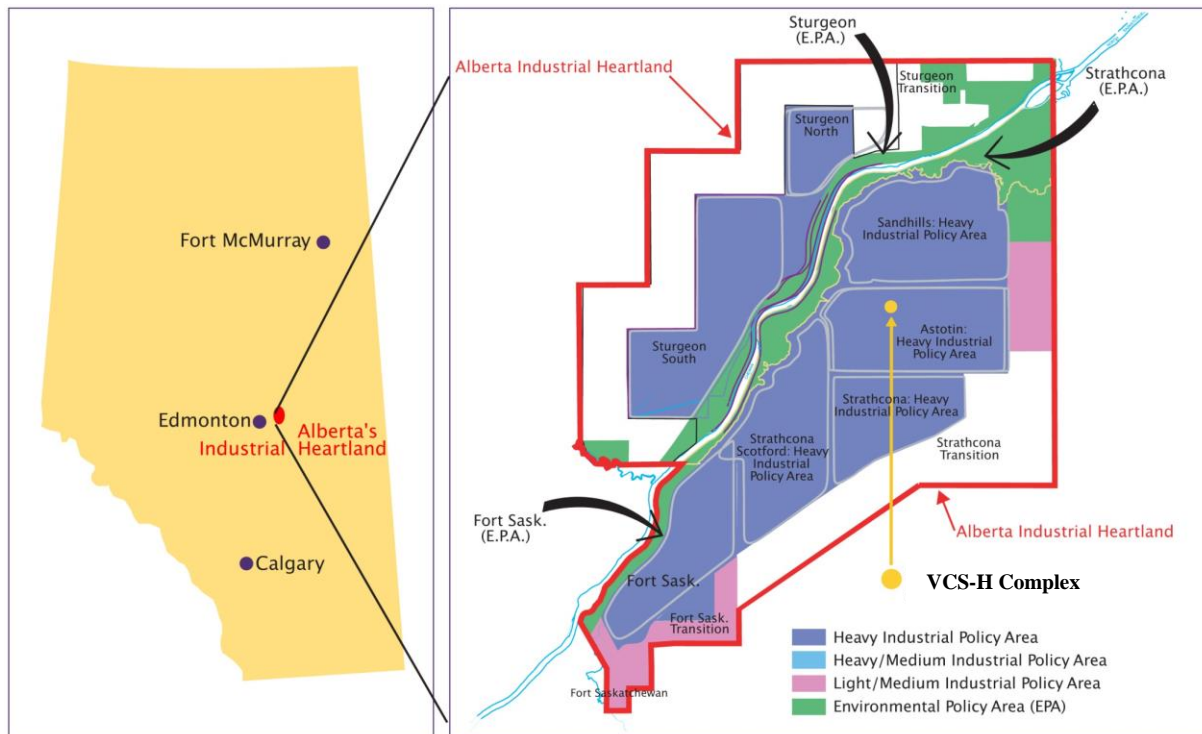


Figure 1 Location of VCS-H Complex in Alberta's Industrial Heartland

2. Contact Information

The Project proponent is Value Chain Solutions Inc. (VCS), a wholly owned subsidiary of Value Creation Inc. (VCI).

Value Chain Solutions Inc.
1100, 635-8th Avenue SW Calgary, Alberta T2P 3M3
Telephone: 403.539.4500 (Calgary) or 1-855-908-8800 Fax: 403.539.4501
Website: www.vcsb2co.com

Contacts for the purpose of the description of the proposed Expansion:
Cindy Yin, Coordinator – VCS-H Regulatory Applications
Iva Georgieva – Government, Regulatory & Stakeholder Relations

Project email: VCS.Heartland@vctek.com

Planning Phase Results

3. Engagements Undertaken

Early engagement on the proposed Expansion has included communication with the local municipal authorities (City of Fort Saskatchewan, Town of Bruderheim and Strathcona County), the AER and the Impact Assessment Agency of Canada (IAAC). In addition to the posted Initial Project Description and this Detailed Project Description, VCS plans to prepare and submit an integrated EIA and application for the Expansion to the AER. VCS is working with independent environmental consultancy agencies to summarize environmental baseline information and to prepare the applications.

Comments on VCS's Initial Project Description from Canadian Transportation Agency, Environment and Climate Change Canada, Fisheries and Oceans Canada, Health Canada, Indigenous Services Canada, Natural Resources of Canada, Parks Canada Agency, Transport Canada and Women and Gender Equality Canada were taken into accounts for the preparation of the current document as well as for a potential Impact Assessment. Additional provincial agencies such as Alberta Transportation will also be contacted regarding the Expansion for traffic impact assessment for the EIA and subsequent railway works approvals.

The municipal authority (Strathcona County) is updated regularly on the status of the approved VCS-H Project 1 and future site plans, including the proposed Expansion.

No major issues or concerns on the proposed Expansion have been raised to date by government agencies. General inquiries on Project timeline and water usage requirements were received and discussed during early engagement activities.

4. Indigenous Group and Public Engagements

Indigenous Group Engagements

VCS is committed to timely, continuous, open and meaningful consultation with potentially affected First Nation(s) and/or Metis Settlement(s) in support of the Expansion. The consultation process is transparent and continuous throughout the life of the Project both pre- and post-approval, including site preparation, construction, commissioning, operation, decommissioning and reclamation phases, in a manner designed to understand opportunities and meaningfully address issues, including potential effects on traditional lands. The consultation process is intended to establish a positive foundation for building respectful and effective relationships that can help shape and guide the longer-term commercial development of the proposed Expansion.

In July 2019, VCS submitted a pre-consultation assessment request to the Aboriginal Consultation Office (ACO) of the Government of Alberta for the Expansion to amend the existing *Environment Protection and Enhancement Act* approvals. After reviewing the Project information, ACO determined that no Indigenous consultation is required. VCS will submit a separate pre-consultation assessment request under the *Water Act* for the proposed Expansion when additional information is available.

In September 2019, VCS alongside leading Alberta First Nations jointly [announced](#) an Alliance Agreement for meaningful participation and investment interests in the VCS-H Project. This alliance hopes to extend beyond the initial First Nation communities.

Engagement activities with Indigenous communities in the region were initiated for the Project through the distribution of letters and Public Disclosure Documents. VCS invited Indigenous communities to meet and receive more information on the Expansion and to hear and share interests and/or concerns.

Below is a summary of issues sent to IAAC from several Indigenous groups. Subsequently, VCS contacted those Indigenous groups for further discussions and better understanding of their comments (see the consultation log in Appendix II for more details).

- Project could adversely impact Indigenous communities' rights include the use of traditional lands, waters and resources for subsistence, medicinal, spiritual, economic, commercial, recreational and culture purposes;
- Right assessments require a baseline traditional land use study;
- Potential impacts to cultural value of North Saskatchewan River Valley;
- Air quality impacts on the quality of traditional resources in the area including plant and medicine resources;
- Water quality and quantity concerns;
- Effects of malfunctions and accidents of storage and pipe/rail transport;
- Consultation approach and capacity funding requirements;
- Potential impacts to *Species of Concerns* and *Migratory Birds*;
- Project focus on current use of lands and resources for traditional purposes rather than IAA clauses or intention as well as consideration of the impacts to rights;
- Cumulative impacts to the physical and biological environment with others within the AIH;
- Encroachment on traditional land use and potential effects and impacts to traditional capacity for hunting, fishing, trapping, living, medicinal harvesting and ancestor' artifacts and tools;
- Impact on soil and reclamation of the land;
- Company internal policies regarding racism and discrimination as well as cultural sensitivity training;
- Clarity and details on future participation and support of initiatives to retain relaying of historical Indigenous knowledge, culture and language, traditional hunting and gathering territory;
- Indigenous people's health and well-being impacted by ecosystems and social and economic circumstances;
- Impact on fish and fish habitat, more specifically, on trout and suckers (i.e.: white suckers);
- Impact on wildlife and birds, more specifically, on ducks, geese and ungulates and mitigation plans for the protection;
- Impact on physical and culture heritage, change to Indigenous Knowledge, Indigenous Language or Indigenous culture;
- Potential archaeological findings;
- Indigenous communities' Treaty and Aboriginal rights and their land interests;
- Plan of inclusion of Indigenous groups in economic and business opportunities, support to Indigenous communities, and support Indigenous members for educational and/or training goals;
- LGBTQIA2S+ policies to reduce discrimination and intended scope of gender inclusion;
- Long-term relationships beyond construction activities;
- Impacts to crown lands and provincially protected natural areas including wetland area;
- Impacts to the North Saskatchewan River valley and Astotin creek;
- Water license approvals when Indigenous communities have existing water issues;
- Climate change and greenhouse gas emissions; and
- Destruction or degradation of waterways from stream bed and bank alteration, more specifically to Astotin creek.

Below is a summary of discussions with Indigenous communities held to date:

- VCS is dedicated to protecting North Saskatchewan River throughout the life of the Project;
- Once approved, Indigenous communities will be included in the notification list in case of major incidents/emergency during construction and operation of the Project;
- Some Indigenous communities are open to combine technical review and traditional land use studies, as appropriate, for cost savings and time effective reviews; and
- Majority of Indigenous groups are interested in contractual bidding opportunities and participation in the alliance initiative.

VCS's response to inputs received from the review of the Initial Project Description and identified potential impacts to Indigenous consultation and engagement; Indigenous knowledge, traditional land use; Indigenous people's rights, health and well-being; spiritual, physical and cultural heritage; and social and economic conditions is provided in Appendix III.

VCS will continue to prepare application information and public notices for distribution to Indigenous communities in culturally sensitive, non-technical, plain-language formats. VCS will ensure that information on the proposed Expansion is directly provided to engaged Indigenous groups — First Nation(s) and/or Metis Settlement(s), at key regulatory milestones through a variety of methods, including:

- hand-delivery;
- mail and/or courier;
- web-based material; and
- email.

In addition to the above, VCS will continue engagement with Indigenous groups via in-person meetings and/or tele- and video-conferences, or other methods, as needed. The consultation will synchronize with the planning stage and possible Impact Assessment stage during the Impact Assessment Process led by the IAAC. VCS will actively participate in the Engagement Process involving Indigenous communities as regulated by the *Impact Assessment Act* led by the IAAC.

Overall, VCS has been met with broad general acceptance of the proposed Expansion. Most Indigenous communities have expressed interest in contract/service, investment opportunities and alliance-partnership participation. Future engagement will include regular Project updates to Indigenous communities on key upcoming activities, such as VCS-H Project 1 sanction, service bidding opportunities, employment/apprentice training programs and the Expansion progress.

Public Engagements

VCS remains committed to working with neighbors and community organizations to provide appropriate information about the proposed Project and related potential impacts, benefits and opportunities.

VCS held an Open House on March 26th, 2019 in Fort Saskatchewan for early engagement and consultation on the Expansion plan and options. VCS also held an information booth and presented at the Life in the Heartland event at Lamont Community Hall on April 25th, 2019 for Project update and general public information. There was strong interest and support from the stakeholders for the future growth of the VCS-H Complex.

As part of its early public engagement for the Expansion, VCS distributed notification packages including a Public Disclosure Document and a Public Involvement Area map to the identified nearby residents and businesses.

Stakeholders have been directed to access the VCS website for updates and contact information for both general and specific queries and/or concerns.

VCS is in discussion with a small business owner with a residence near the Project site to address the owners' early concerns and mitigation measures for potential Project-specific impacts. The key issues that were raised by this business owner are listed below and these issues and potential mitigation means on Project-specific impacts are expected to be addressed in the detailed environmental impact assessment report:

- potential noise during construction and operation;
- chemicals emitted from proposed upgrader and refinery;
- increase in local traffic;
- light; and
- groundwater impacts to their business-owned residence.

Consultation and engagement with stakeholders will continue throughout the regulatory approval process and the life of the Project.

5. Regional Environmental Study

Alberta's Industrial Heartland (AIH) is an active heavy industrial area with multiple projects which have been approved following an EIA and regulatory review process. The environmental studies carried out for adjacent projects are summarized in Table 1.

Table 1 Summary of Environmental Studies Completed for Projects in the Vicinity of the Proposed Project

Proponent and Project Name	Environmental Study Performed	Project Status ¹
Shell Canada Scotford Upgrader	Environmental Impact Assessments of Upgrader (1998), Upgrader Expansion (2005), Upgrader 2 (2007), Quest CSS (2010)	In operation
VCS-Heartland Processing Plant (previous Heartland Upgrader Project)	EIA (2004), EPEA Amendment (2016), and Tank Farm environmental assessment (2016)	Pending sanction
North West Upgrader and Bitumen Refinery	EIA (2006), EPEA renewal (2017)	In operation
Synenco Northern Lights Upgrader	EIA (2006), Application withdrawn (2008)	Cancelled
PetroCanada Fort Hills Sturgeon Upgrader	EIA (2006), EPEA approval (2007)	Suspended
StatoilHydro Canada Upgrader	EIA (2007), Project withdrawn (2008)	Cancelled
Total E&P Canada Upgrader	EIA (2007), EPEA approval (2009), application withdrawn (2010)	Cancelled
Alberta Sulphur Terminals (Hazco) Sulphur Forming and Shipping Facilities	EIA (2008) EPEA approval (2009)	Not available
Sasol Canada Canada GTL Project	EIA (2012) EPEA approval (2014)	Cancelled

Agrium Inc. Redwater Fertilizer Manufacturing Plant	Environmental Assessment (2008 EPEA renewal)	In operation
Heartland Sulphur Ltd. Heartland Sulphur Terminal	Environmental Assessment (2016 EPEA approval)	In operation

¹Obtained from company websites and public information online

Although there are no regional assessments as defined in Sections 92 and 93 of the *Impact Assessment Act* in the Expansion Project region, applicable provincial or municipal management plans that will be considered in the EIA include:

- Alberta Environment and Sustainable Resource Development Cumulative Effects Management System building on:
 - Water Management Framework for the Industrial Heartland and Capital Region
 - Capital Region Air Quality Management Framework
 - Elemental Sulphur Management Framework for the Industrial Heartland
 - Water Management Framework for the Industrial Heartland and Capital Region: Effluent Characterization Program
- Capital Region Land Use Plan
- Northeast Capital Industry Association:
 - Regional Noise Management Plan
 - Regional Groundwater Monitoring
- Strathcona County Management Plans:
 - Land Use Bylaw 6-2015
 - Heartland Industrial Area Structure Plan Bylaw 24-2018
 - Municipal Development Plan Bylaw 20-2017
- Fort Air Partnership Air Monitoring Plan

6. Strategic Assessment

The strategic assessment of climate change, published in July 2020, is a strategic assessment conducted under subsection 95(2) of the *Impact Assessment Act*, and it applies to all designated projects under the *Impact Assessment Act*.

Government of Alberta Strategic Analysis

As a result of the 2013 recommendation by the Alberta Standing Committee on Alberta’s Economic Future, the Government of Alberta implemented the Bitumen Royalty-in-Kind program to sustain and enhance the diversification of Alberta’s petroleum product portfolio (Government of Alberta 2013). In 2018, the Energy Diversification Advisory Committee recommended the Government of Alberta to promote upgrading and refining of bitumen for energy diversification (Government of Alberta 2018a). The approved VCS-H Project 1 was elected for support by the Alberta Partial Upgrading Program in early 2019, consistent with the Alberta interest for Economic Diversification and Restoring the Alberta advantage. The new Alberta Government discontinued the Partial Upgrading Program grants and loan guarantees within its budget framework constraints in late 2019.

Project Information

7. Purposes/Needs and Potential Benefits

Oil Sands bitumen is a highly viscous extra-heavy-oil that is loaded with high carbon-content micro-solids and inorganic contaminants. For pipeline transportation, approximately half a barrel of diluent is needed for one barrel of bitumen to lower its viscosity for transportation. Therefore, it is expensive to transport bitumen for Alberta's Oil Sands producers because of the added diluent cost as well as limited available transportation options. In addition to logistic limitations, bitumen can only be processed in energy-intensive deep-conversion (vacuum residue conversion) refineries that have high capital and operating costs and represent only a fraction of all crude oil refineries. All of above result in steep bitumen price discounts detrimental to bitumen producers and potentially higher environmental impacts associated with these deep-conversion refineries.

The purpose of the proposed Expansion is to increase the capacity to upgrade and refine Alberta Oil Sands diluted bitumen into clean crudes and high-quality fuel products in an economically and environmentally sustainable way. The VCS-H Complex (approved plus proposed) will upgrade/refine up to 119,240 m³ or 750,000 barrels per day of diluted bitumen feedstock to produce COLF³ Premium (a premium medium crude), COLF Heavy (a cleaned heavy crude), diesel, diluent and marine fuels in Alberta.

The available North American conventional refining capacity for medium crudes is widening as a result of significant growth in the production of light oil combined with the steady decline of Alaskan North Slope crude oil. The proposed Expansion will produce COLF Premium to meet the widening demand for medium crude oil, COLF Heavy for existing heavy crude refineries/future customized refinery, diluent to return to the local bitumen producers, ultra-low sulphur diesel and low sulphur marine fuel conforming IMO standard 2020.

The overall GHG emissions will be lowered over the life-cycle due to reduced emissions in transportation and crude upgrading/refining. The VCS-H Project, as an upgrading/refining project, is not subject to the 100 megatonne carbon emission cap for the bitumen producing industries. The net GHG reduction is aligned with Canada's goal to reach the GHG emissions reduction target of 2030. In addition, emerging technologies in carbon capture and storage are expected to mature in the coming decades, which can then help the Project to further improve toward net-zero emission by 2050.

The VCS-H Complex is part of VCS's Value Chain Solutions strategy and development, in which VCS has been granted rights to use VCI's proprietary technologies. The VCS-H Complex, including the proposed Project, will bring the following benefits:

- reducing net greenhouse gas (GHG) emissions by de-carbonizing bitumen upfront (*i.e.*, removing asphaltenes early in the upgrading-refining process);
- adding value within Alberta and Canada;
- freeing up the pipeline bottleneck;
- broadening the market to accept bitumen-derived clean crude oils; and
- achieving robust economics against volatilities in oil price and light / heavy oil price differential over the Project life.

³ COLF, standing for Clean Oil La-Fit, is VCS-H crude oils' brand name.

Environmental Benefits

The application of VCI's proprietary upgrading/refining technologies reduces the life cycle GHG emissions by approximately 25-30% as compared to conventional upgrading/refining technology from DilBit processing to gasoline/fuel retailing (DilBit-to-Fuel or DilBit-to-Tank), which is enabled by:

- The de-carbonization (and de-contamination via VCI's ADC™ technology) of bitumen upfront, at the Project site, with the removal of asphaltenes. This is compared with the conventional approach of transporting DilBit over long distances, being processed in deep-conversion refineries through multiple processing units, and having the asphaltenes in DilBit rejected in the form of petroleum coke.
- The elimination of the need for diluent due to the application of VCI proprietary technologies, resulting in reduced emissions associated with the transportation of the diluent in DilBit and pure diluent stream to bitumen producers.
- The intrinsic energy efficiency in VCI's proprietary processes. The VCS-H Complex has a relatively simple process configuration as compared to conventional upgrading/refining, which results in lower energy use per unit of feedstock. In particular, unlike a conventional refinery, the VCS-H Complex does not produce coke as in a coking process or burn coke as in a catalytic cracking process.
- The unique properties of the medium crude (COLF Premium) which makes it possible to be processed in a simple and energy efficient refinery.

In terms of local emissions from the Project itself, the high environmental performance is achieved by the following factors:

- VCS will apply economically achievable Best Available Technologies / Best Environmental Practices (BAT/BEP) in designing and operating the process units, in particular, the process heaters, sulphur recovery unit, and wastewater treatment and disposal.
- VCS will minimize water consumption by maximizing recycling of the water used in the utilities and upgrading process.

Additional environmental benefits of VCI's proprietary upgrading/refining technologies come from the production of higher quality fuel products:

- The high-quality diesel will reduce NO_x/particulate matter emission with improved engine performance.
- The low sulphur marine fuel conforms to the [IMO2020](#) clean fuel standard and will reduce SO₂ emissions.

Socioeconomic Benefits

The socioeconomic benefits of the proposed Expansion include:

- increasing the value of the Oil Sands production within the province by going up the value chain, rather than only selling the raw resources;
- increasing Federal, Provincial and Municipal government revenues through taxes;
- providing business and employment opportunities related to facilities engineering, fabrication, construction, operation and maintenance;
- providing employment opportunities with peak construction person power of 2000+, which could be maintained for over a decade, leading to tens of thousands person years of Project execution-related employment in the region; and
- providing long-term operating employment opportunities in the hundreds for each stage of the VCS-H Complex, for decades.

Benefits to Indigenous Groups

The anticipated benefits associated with the proposed Expansion to Indigenous groups are as follows:

- VCS is developing genuine, long-term, win-win alliances/partnerships with interested Indigenous communities for direct investment that would lead to sustainable wealth and wellness for their communities, limiting vulnerability as a consequence of the volatility of industrial fluctuations.
- VCS offers the solutions to transform the Oil Sands Industry to Clean Oil Industry, re-vitalizing the industry and Alberta's economy with sustainable and responsible development.

Indirect Benefits

The following are indirect benefits which are anticipated as a result of the construction and operation of the proposed Expansion:

- value added to Alberta through deploying the most cost-effective bitumen upgrading and specialty refining technology available;
- optimal pipeline utilization through diluent removal and return to local producers, removal of asphaltene volume and use of alternative transportation means such as rail for cleaned heavy crude and specialty refined products to various markets;
- market broadening as most global refineries are built for medium crudes rather than the extra-heavy bitumen blend, which will best-fit growing Asian markets and will reduce Alberta products' reliance on the single market enabling achievement of world price;
- robust economics against volatilities in oil price and light / heavy price differential with upgraded products; and
- return of investment to Alberta and Canada.

Long-term Vision

Value Creation Group (VCG), including Value Creation Inc. and Value Chain Solutions, Inc., plans to develop its vast oil sands resources responsibly; and through synergistic integration with its proprietary technology, build a dynamic, successful energy organization with robust, sustainable growth across the full oil sands value chain.

It is VCG's strategic plan to expand the VCS-H Complex to serve local bitumen producers and brings a greater benefit to the Oil Sands industry. This merchant complex could be duplicated at other major logistic hubs as well.

VCG is planning to apply for a major commercial project in the Athabasca region, for regionally integrated resource development and merchant bitumen upgrading.

In addition to the above, as part of its long-term vision, VCG is planning to work with alliance partners to build a future Coastal Clean Oil Refinery, with expected dominant competitiveness, enabled by unique tailored crude from VCG Clean Oil Complexes and our innovative/synergistic design capability.

8. Provisions

Provision 38 (a) of SOR/2019-285 *Physical Activities Regulations* reads "The expansion of an existing oil refinery, including a heavy oil upgrader, if the expansion would result in an increase in input capacity of 50% or more and a total input capacity of 10 000 m³/day or more;" is interpreted to mean that the proposed Expansion from the approved

capacity of 29,890 m³/day or 188,000 barrels/day to up to 119,240 m³/day or 750,000 barrels/day, an increase in input capacity of 300%, is a designated activity under the *Impact Assessment Act*.

Provision 38 (e) of SOR/2019-285 *Physical Activities Regulations* reads “The expansion of petroleum storage facility, if the expansion would result in an increase in storage capacity of 50% or more and a total storage capacity of 500,000 m³ or more;” is interpreted to mean that the proposed expansion of tank farm storage capacity from the approved capacity of 256,600 m³ to approximately 1,323,600 m³, an increase in storage capacity of 416%, is also a designated activity under the *Impact Assessment Act*.

Provision 54 (b) of SOR/2019-285 *Physical Activities Regulations* reads “The construction, operation, decommissioning and abandonment of (b) a new railway yard with a total area of 50 ha or more;” is interpreted to mean that the proposed Expansion rail yard is *not* a designated activity under the *Impact Assessment Act* as the total area (railway and affiliated structures) is approximately 32 ha.

9. Activities, Infrastructure, Structures and Physical Works

Approved Facilities (VCS-H Project 1)

Construction of the approved VCS-H Project 1 was halted in 2008. Site development that was completed includes:

- site preparation;
- installation of underground fire water loop piping and hydrants;
- oily water sewers;
- storm water sewers;
- storm water pond;
- several field constructed tanks;
- API oil-water separator; and
- buildings including the control room/warehouse and administration buildings.

As shown in Figure 2 within the purple boundaries, the approved VCS-H Project 1 site is under a preservation program and is manned 24/7. Construction for pilings, foundations for equipment and pipe-racks are well advanced for the entire site. Equipment is preserved on site and stored either in warehouses or kept outdoors with appropriate corrosion-prevention measures. The site is connected to high voltage power, natural gas and river water from the North Saskatchewan River. VCS will contract from a third party for water supply for VCS-H Project 1 usage through an existing license under Alberta’s *Water Act* for the diversion of water from the North Saskatchewan River.

VCS-H Project 1 includes the approved tank farm (within the orange boundaries as in Figure 2), which has a separate provincial regulatory approval (EPEA Approval No. 387876-00-00). The tank farm will cover approximately 45 ha to house all storage tank requirements for feeds and products for VCS-H Project 1 as well as rail and truck loading facilities required to move products and by-products to the market.

Proposed Project Activities

The proposed Expansion will be located adjacent to the approved VCS-H Project 1, within the green boundaries as in Figure 2, within the VCI owned land. Construction and operation of the Expansion will be implemented in multiple stages (i.e. 3 stages, Project 2 through Project 4).

Table 2 Project Activities and Locations

Value Creation Inc. Owned Lands	Area (ha)	Project Activities	
		Approved Project 1	The Proposed Expansion
SW 10-056-21 W4M (+Portion NW 03)	93	Main facility for VCS-H Project 1 and Tank Farm	-
SE 10-056 21 W4M	65	Main facility for VCS-H Project 1	-
SW 11-056 21 W4M	64	-	Main facility for the Expansion*
NW 11-056 21 W4M	58	-	Main facility for the Expansion*
SE 11-056 21 W4M	57	-	Main facility for the Expansion* Realigned Astotin Creek*
NE 03-056 21 W4M	59	Railway loop for the VCS-H Project 1 and storm water pond inside railway loop	Tank farm for the Expansion* Railway loop for the Expansion
NW 02-056 21 W4M	62	Rail spur to connect with CP Railway	Tank farm for the Expansion*
NE 02-056 21 W4M	62	-	Storm water pond and flare stacks for the Expansion* Realigned Astotin Creek*
NW 01-056 21 W4M	19	-	Soil storage pile for the Expansion*
Sum Area (ha)	539	179	260

Asterisks(*) denote the Designated Activities as described in Section 9.

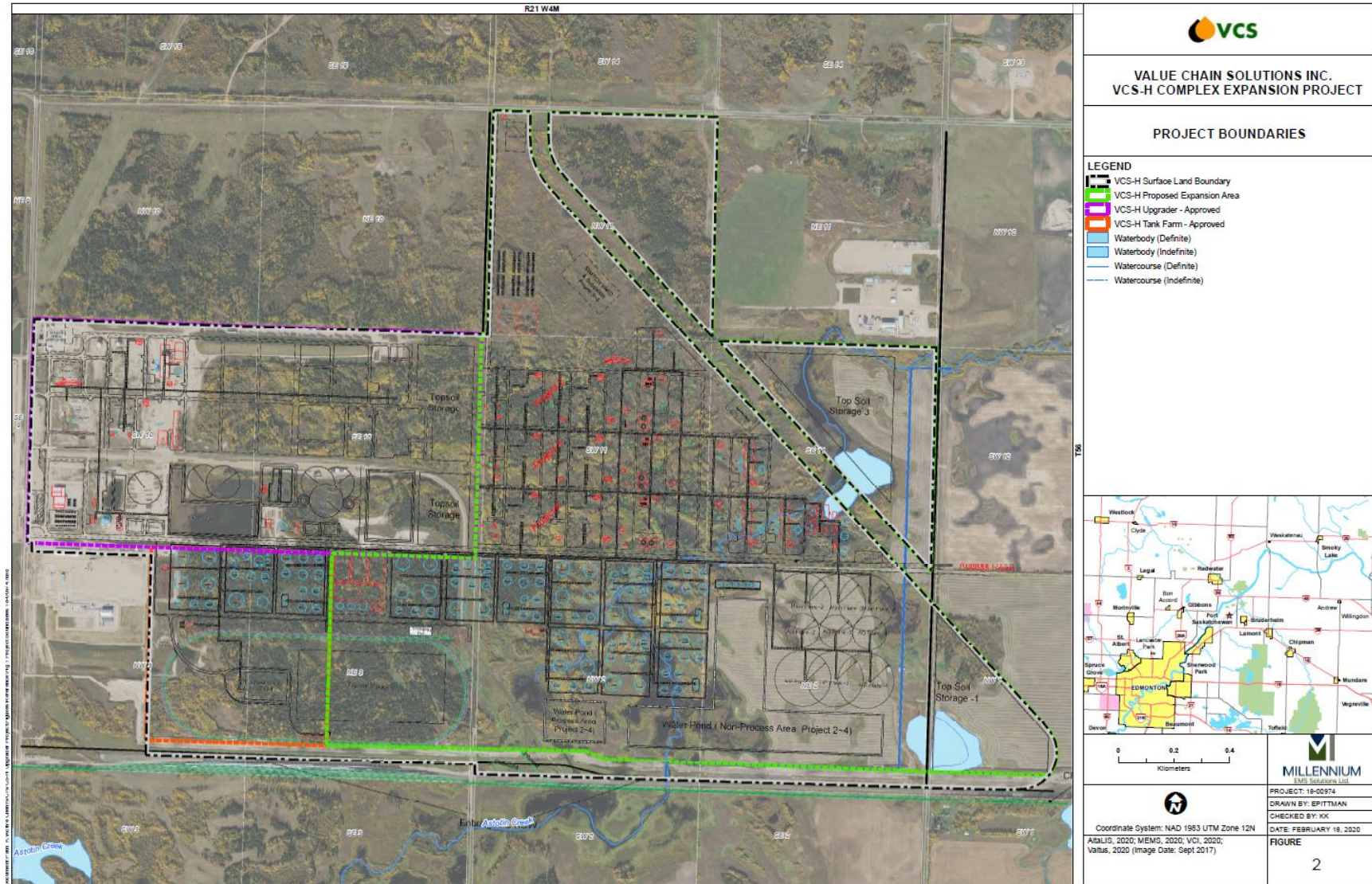


Figure 2 Site Map Showing the VCS-H Complex Boundaries and Components

Planned construction activities for the Expansion will include:

- site clearing and grubbing followed by site grading, timber salvage and mulching;
- VCS' installation of a new pipeline connecting the Expansion site to a third party North Saskatchewan River water intake facility to be approved under a new *Water Act* license;
- construction of additional water treatment, distribution and disposal facilities;
- installation of a storm water system including a pond, pumps and piping connections;
- construction of administration and new control room buildings and supporting infrastructure with laydown areas and a parking lot;
- additional connection to the electrical grid and a new substation;
- construction of a tank farm for diluted bitumen and storage of products;
- additional railway loops, connections and loading facilities;
- re-alignment of Astotin Creek;⁴
- upgrading and construction of access roads connecting to municipal road(s); and
- drilling and completion of water disposal wells.

Operations

Operation of the proposed Expansion and the approved VCS-H Project 1 will be similar. The main difference between the approved and proposed Projects will be in the transportation of the upgraded/refined products to the market. VCS-H Project 1 will make use of pipeline, truck and rail transportation due to the smaller volumes of product while the Expansion will maximize the use of pipeline and rail transportation due to the higher product volumes.

Activities associated with the Expansion Project include:

- commissioning and start-up of bitumen upgrading and refining process units;
- water treatment and use including wastewater/storm water treatment and disposal through deep-well injection;
- water recycling to reduce water disposal;
- planned and unplanned maintenance;
- diluted bitumen receiving; and
- products and byproducts loading and shipping.

Supporting process units for the Expansion include:

- Amine Treating Unit for the absorption of acid gases (such as H₂S and CO₂ from the cracking units) in the amine absorption towers: dissolved acid gases will be stripped off and sent to the Sulphur Recovery Unit, and amine solution is recycled for reuse through a regeneration tower.
- Sour Water Stripper for acid gases separation from sour water: H₂S and NH₃ are stripped off and sent to the Sulphur Recovery Unit, and the stripped water will be recycled for use in the Hydroprocessing units as wash water or in the desalter.
- Mercaptan Treatment Unit for mercaptans and other reactive sulphur compounds extraction and conversion.
- Asphaltene Handling Facilities that deal with the byproduct asphaltene dewatering and loading.
- Sulphur Recovery Unit that will convert the H₂S in sour gases through different stages (thermal stage and catalyst reaction stages) into elemental sulphur, degas the liquid sulphur, and store it prior to shipping.

⁴ The current proposed realignment follows the south and east boundary of the Project site on VCI-owned lands west of Range road 211. A conceptual plan for a proper realignment route will be submitted with environmental surveys, construction and monitoring program will be reviewed with AER and Fisheries and Oceans Canada accordingly.

- Hydrogen Manufacturing Unit that produces hydrogen (H₂) for hydroprocessing units from natural gas using the Steam Methane Reforming technology.

Utilities and off-sites supporting the Expansion include:

- expansion of Amelia substation or a new substation for Project electricity usage;
- river water treatment and wastewater treatment units;
- potable water and sanitary system, storm water ponds;
- cooling tower system;
- fuel gas and natural gas systems;
- nitrogen and air systems;
- steam and condensate systems;
- flare system;
- new petroleum storage tanks and dikes, pumps and piping, vapour recovery units and controlling units; and
- expansion of VCS-H Project 1 rail yard through adding more railway loops, connections, and supporting units including loading facility and unloading pits.

The regional infrastructure supporting the Expansion include:

- tie-in to existing natural gas pipelines;
- DilBit feed supply lateral pipeline(s);
- recovered diluent return lateral pipeline; and
- product sales lateral pipelines.

Activities incidental to the Designated Project Activities with possible third party contracting for construction and operation include:

- installation of high voltage power supply through the expansion of Amelia substation or building a new substation;
- installation of local water pipeline and pumps from water intake facility to Project site;
- transportation and storage of byproduct Asphaltene at depleted mine site(s); and
- construction and operation of Sulphur forming facilities.

Decommissioning and Reclamation

At the end of the Expansion Project life, any affected soils will be treated onsite or moved to approved disposal facilities. Belowground pipelines will be purged, capped and abandoned in place per regulatory standards. A conceptual conservation and reclamation plan will be provided as part of the environmental impact assessment.

10. Production Capacity and Process Descriptions

Project Capacity

At full build-out, the VCS-H Complex is expected to process a maximum⁵ of ~ 120,000 m³ per day or 750,000 barrels per day of DilBit to produce diluent, COLF Premium, COLF Heavy, diesel, marine fuels and smaller quantities of petrochemical products. Proposed capacity for DilBit and main products for the Expansion as well as VCS-H Project 1 approved capacity and VCS-H Complex total combined capacity are shown in Table 3.

Table 3 Proposed Capacity⁵ of the Expansion, Project 1 Approved Capacity and Total Combined Capacity

Project	Feed-stock	Feedstock Flow Rate		Main Products Before Blending	Product Flow Rate	
		Tonnes/stream day	m ³ /stream day		Tonnes/stream day	m ³ /stream day
The Expansion (Projects 2-4)	Diluted bitumen	77,458	82,803	Diluent Product	15,013	19,385
				Bypass DCO	21,714	22,263
				Straight-run Gas Oil	6,985	7,866
				Naphtha	3,663	5,081
				Diesel	10,571	12,672
				LPG	425	777
				Tail oil	4,910	5,417
				Asphaltene (dry basis)	12,942	
				Sulphur Recovered	768	
Approved (Project 1)	Diluted bitumen	25,734	27,601	Diluent Product	8,495	10,710
				Bypass DCO	1,383	1,351
				Naphtha	3,895	5,242
				Diesel	5,416	6,535
				LPG	301	546
				Tail oil	95	106
				Asphaltene (dry basis)	5,825	
				Sulphur Recovered	377	
VCS-H Complex Total	Diluted bitumen	103,192	110,404			

The water requirement for the Expansion is estimated to be 1,212 tonnes per hour. The Expansion will require a new *Water Act* application for the required water volume at an existing 3rd party water intake facility for its freshwater withdrawal from the North Saskatchewan River.

Description of the Production Processes

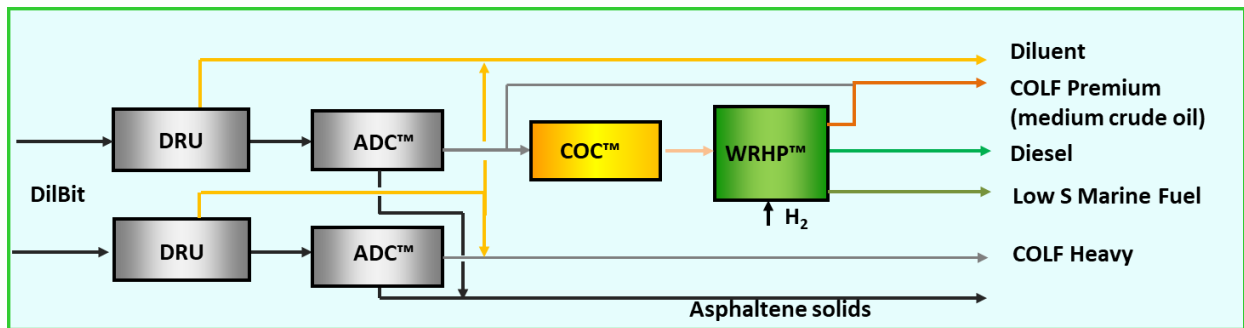
The main processing units of the Expansion include:

- the Diluent Recovery Unit (DRU), which separates the diluent from the bitumen in the diluted bitumen feedstock;

⁵ A maximum capacity is the capacity the VCS-H Complex could reach after further debottlenecking and optimization on operating conditions, it is expected the maximum total intake capacity of VCS-H Complex (Project 1 and the Expansion) will be ~120,000 m³/stream day or 750,000 barrels/stream day. Proposed capacity is the capacity as shown in the material balance in regulatory applications based on design conditions.

- the Accelerated De-Contamination unit (ADC™), which separates asphaltenes from the bitumen feed to produce De-Contaminated Oil (DCO);
- the Clean Oil Cracking unit (COC™), which thermally cracks half of the DCO into gas oil, distillate and naphtha with unconverted vacuum residue to be removed in the other ADC™ unit; and
- the Wide Range Hydroprocessing units (WRHP™), which accepts the vacuum gas oil, distillates and naphtha for hydrotreating and hydrocracking to produce diesel and refined products for blending into COLF Premium and low sulphur marine fuels.

The other half of the DCO is blended with the recovered diluent to produce COLF Heavy as shown in Figure 3, which presents a Process Schematic of the Expansion.



DRU- Diluent Recovery Unit; ADC™-Accelerated De-Contamination; COC™- Clean Oil Cracking; WRHP™-Wide Range Hydroprocessing

Figure 3 The Expansion Process Schematic

The ADC™ is a proprietary technology that separates asphaltenes from bitumen emulsion with high efficiency and high oil yield. The plan for offsite handling of the asphaltene byproduct is to use the asphaltenes as fill material for mine pit reclamation at depleted coal mines. Potential mine pit location(s) selection is under business discussions and regulatory planning. Alternative commercial non-combustion uses of asphaltenes are being explored with emerging technologies including the production of activated carbon, carbon fibers, road construction material and others.

The COC™ is a proprietary thermal cracking process based on conventional technology, with design optimization enabled by the DCO product generated by ADC™.

The Wide Range Hydroprocessing (WRHP™) unit processes the liquid products from the COC™ unit with hydrogen and catalysts into premium medium synthetic crude and refined products such as diesel.

11. Project Schedule

The staged expansion of the VCS-H Complex will follow conventional project management procedures— that include scoping, design, engineering, procurement and construction after which facilities are turned over to operations to maintain and operate for several decades prior to decommissioning and abandonment. Subject to regulatory approvals, market conditions and future investment decisions, design, construction and commissioning of each sub-Project stage of the Expansion will commence three to four years after the previous stage with the earliest Expansion operations in 2029 and then continuing for over 50 years. At its current location, there is no anticipation for further expansion beyond the proposed Expansion.

The Expansion is expected to operate successfully in the public interest for a long period of time to support world energy needs and as long as Alberta maintains Oil Sands bitumen harvesting.

With the Expansion located in Alberta's Industrial Heartland, the site is expected to be reclaimed for industrial use after decommissioning.

12. Alternative Considerations

Project Technology

The current commercial method of upgrading bitumen involves high capital costs, is energy intensive, and does not address the increasing demand for medium crude. It is Founder and CEO of Value Creation Group, Dr. Columba Yeung's vision, and VCS's mandate to implement VCI's proprietary upgrading/specialty refinery technologies to the Oil Sands industry to provide a fundamental transformation of the full value chain of Oil Sands development.

The key VCI technology, ADC™ technology, has successfully undergone bench scale and pilot scale tests, scale-up studies, commercial design and fabrication, hazard and operability studies ("HAZOP"), and safety integrity level ("SIL") evaluations. Each of these major steps has been witnessed, reviewed and/or validated by third-party consultants, independent engineers, and/or cold eye reviewers. VCS-H Project 1 was elected for support by the Alberta Partial Upgrading Program in early 2019, as the top-choice recommended by third-party reviewers among dozens of available competing upgrading technologies. VCS-H Project 1 will be the first VCS Project to commercialize the VCI technologies for bitumen upgrading and specialty refining. The Expansion will incorporate applicable optimizations from the engineering and execution of the VCS-H Project 1.

Technical Alternative to the Byproduct (Asphaltene) Use

The base plan is to store the asphaltenes in depleted coal mines – a form of solid carbon sequestration. VCS is in discussion with the Alberta Energy Regulator and working with mine and pit operators. The objective is to minimize footprint by using existing brownfield areas and this storage arrangement will provide transitional employment for miners.

Emerging technologies to make use of asphaltene include the making of paving and roofing asphalt using asphaltenes with other recycled materials including recycled plastics; production of activated carbon, and carbon fiber from asphaltenes.

Alternatives to Electrical Substation

The 240 kV AltaLink Amelia substation located immediately north of the VCS-H Complex is fully operational. VCS-H Project 1 will receive power through tie-in to the Amelia substation. For the Expansion, either the current substation will be expanded, or a new one will be built, subject to further assessments.

Alternatives to Water Supply

The majority of water supply for the proposed Expansion is expected to be from the North Saskatchewan River via a 3rd party river water intake facility, while alternatives to the river water supply could be from:

- groundwater wells with water from the Beverly Channel;
- storm water from the storm water pond onsite or from nearby facilities;
- discharged cooling water from cooling tower or other used process water.

Alternatives to Astotin Creek Realignment Route

The proposed Astotin Creek realignment route and other options were considered preliminarily based on Alberta Environment regulation guidelines and Codes of Practice (AENV 2000) with goals to:

- minimize wildlife habitat fragmentation and impacts on critical wildlife habitats;
- minimize length of realignment;
- use existing crossings across VCI land boundaries wherever possible and minimize the number of crossings with road, pipelines, and rail ROWs; and
- maximize integration with existing disturbance and ROWs.

The current proposed realignment follows the south and east boundaries of the Project site on VCI-owned lands west of Range Road 211. A conceptual plan for a proper realignment route will be submitted with environmental surveys, construction and monitoring program and will be reviewed with AER and Fisheries and Oceans Canada, accordingly.

A summary of the alternatives considered for the proposed Expansion is provided below in Table 4.

Table 4 Summary of Alternative Considerations

	Potential Alternative Considered
Means of carrying out the Project (technically and economically feasible, including best available technologies)	<ul style="list-style-type: none"> • Upgrading/refining technology <ul style="list-style-type: none"> • VCI’s proprietary technology is more efficient as compared to conventional technology and will be used in VCS-H Project • Byproduct-asphaltene use: <ul style="list-style-type: none"> • Long-term storage at depleted mine pits • Converting asphaltene using commercially ready technologies to paving and roofing asphalt, activated carbon and more in the future • Electrical substation for the Expansion electricity needs: <ul style="list-style-type: none"> • The expansion of the existing Amelia substation • Construction of a new substation • Water supply • Astotin creek realignment route
Alternative to the Project (technically and economically feasible and directly related to the Project)	<ul style="list-style-type: none"> • A newly built or revamped coastal refinery to refine customized crude streams from the VCS-H Complex • An upgrader/specialty refinery closer to the bitumen producers in the Athabasca region • An upgrader/specialty refinery at another logistic hub, i.e. Hardisty

Location Information and Context

13. Project Location Description

The proposed Expansion will be located adjacent to the approved VCS-H Project 1 facilities (built and planned), strategically located in the pivotal Oil Sands transportation hub in Alberta’s Industrial Heartland (AIH), in the Astotin Heavy Industrial Area of Strathcona County, northeast of Edmonton. The area of the VCS-H Complex is approximately 5.4 square kilometers (540 hectares) and includes the approved VCS-H Project 1 and the proposed Expansion facilities. The legal land description for the center of the proposed Expansion is the southern half of

Section 11, Township 056, Range 21, West of the 4th Meridian (latitude 53.8214°, longitude -113.0167°), approximately 18 km northeast of the City of Fort Saskatchewan and 8 km west of the Town of Bruderheim, as presented in Figure 4.

The Expansion site is located on private land zoned for heavy industrial activities which is owned by the parent company, Value Creation Inc. The land is also within the treaty land boundaries of Treaty 6 First Nations and Métis Nation of Alberta Region 4. The closest First Nation communities include the Enoch Cree Nation located approximately 60 km southwest and the Alexander First Nation approximately 60 km west of the Project site (Figure 4). AIH has been an active industrial area for the past 20 years.

Federal lands in the proximity of the Project include the Indigenous reserve land mentioned above, Elk Island National Park (approximately 25 km southeast of the Project in Figure 4), the Canadian Forces Base Edmonton (Edmonton Garrison, approximately 35 km southwest of the Project) and the Redwater Helicopter training site (approximately 15 km northeast of the Project).

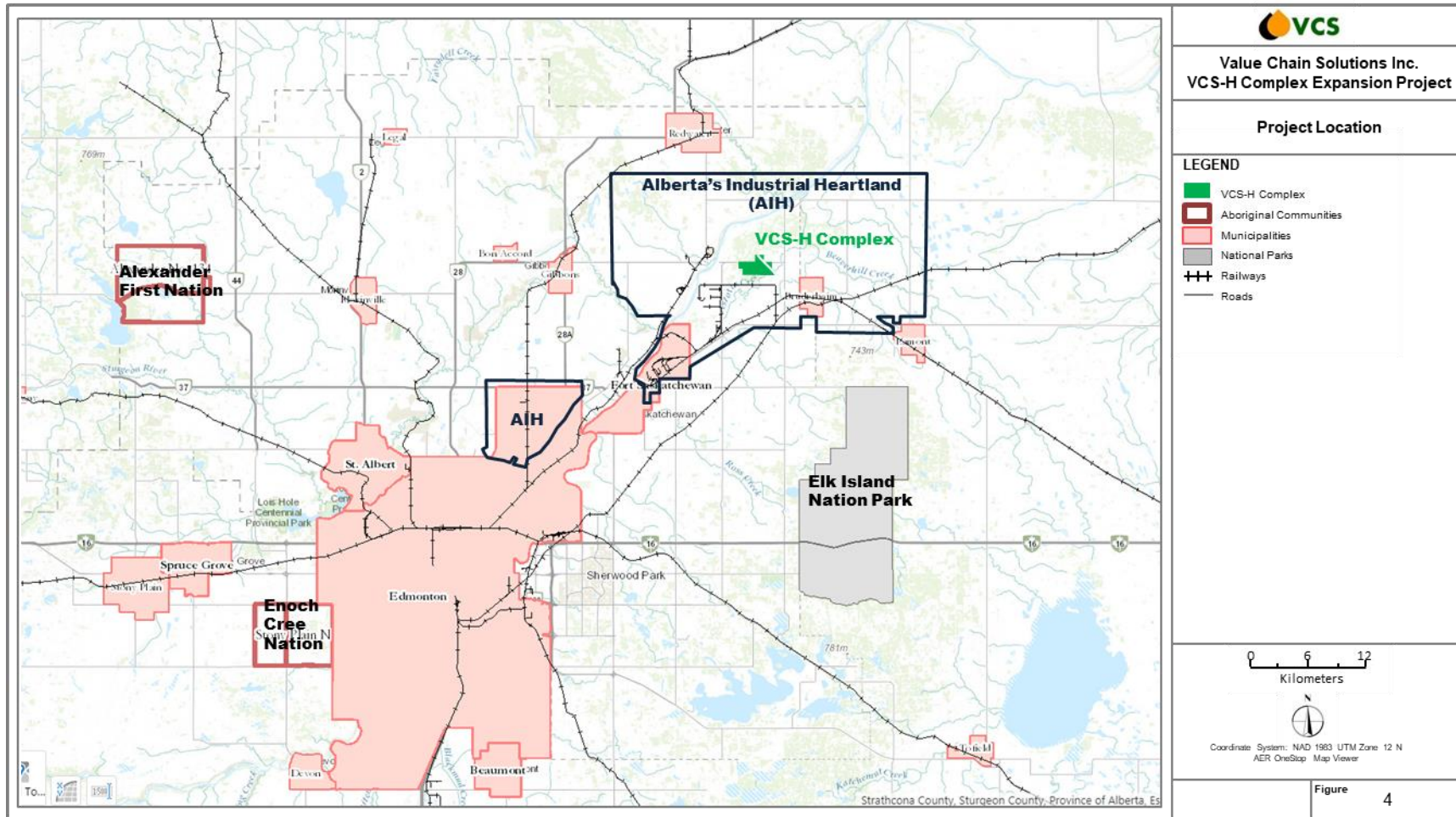


Figure 4 Project Location

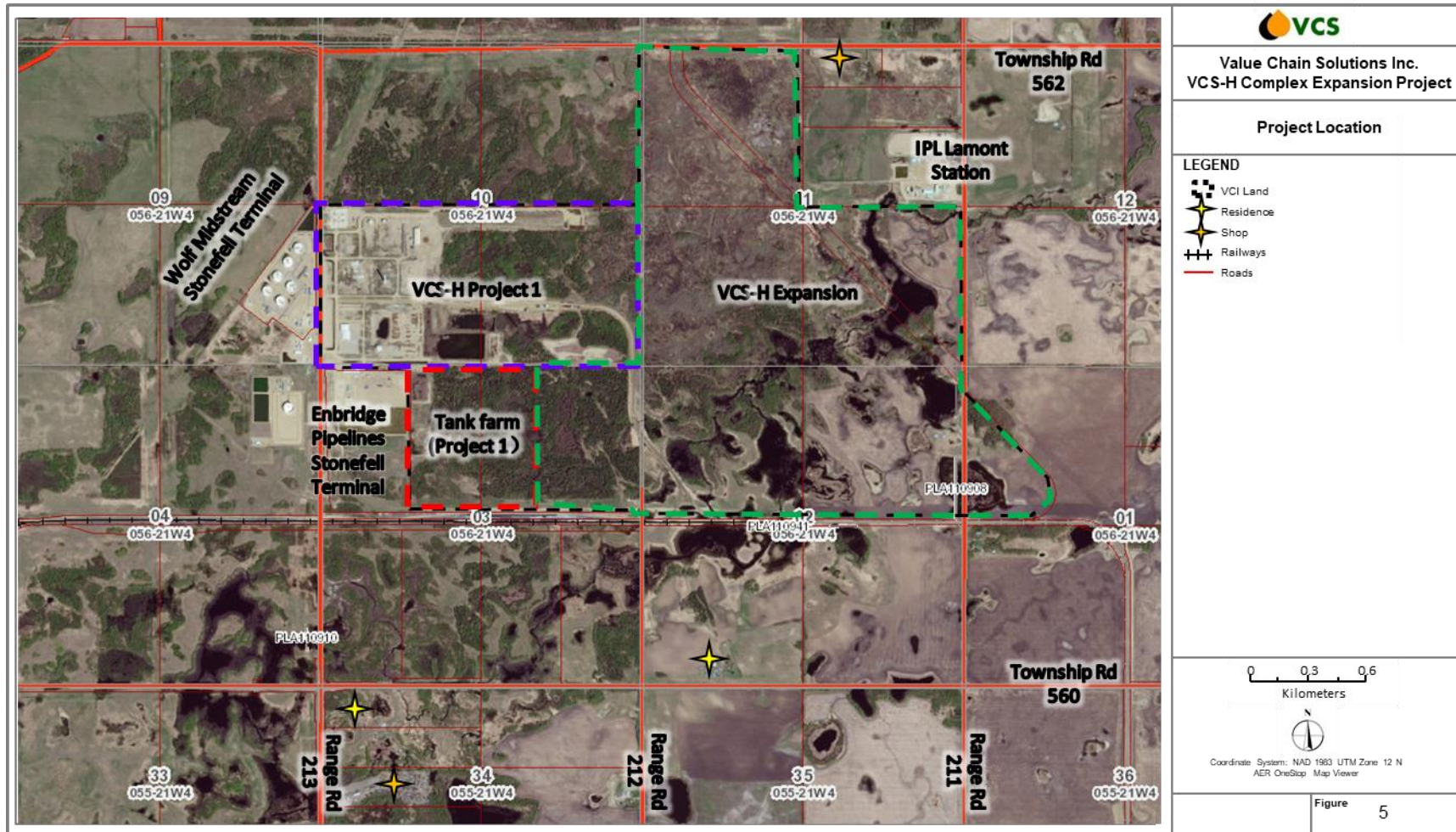


Figure 5 Site Map Showing the VCS-H Complex Location

Figure 5 is a site map of the VCS-H Complex with the approved VCS-H Project 1 (inside the purple boundaries), approved tank farm supporting VCS-H Project 1 (inside the orange boundaries), and the proposed Expansion (inside the green boundaries). The main facilities for the proposed Expansion include bitumen processing units with supporting units, utilities and offsites, storm water ponds, flare stacks, administration building/parking lots and topsoil storage piles.

The VCS-H Complex is situated at a major bitumen blend pipeline hub in Alberta and is in close proximity to existing infrastructure that provides:

- access to a range of diluted bitumen feedstocks from the Athabasca and Cold Lake Oil Sands region with lateral pipelines to access the Peace River region;
- access to refinery markets through major sales trunk pipelines;
- feedstocks to petrochemical plants, and
- connections to CP Railway including interchanges with CN Railway.

The updated 2018 Strathcona County Area Structure Plan (Strathcona County, 2018) for AIH reinforces that the area is primarily to be developed as heavy industrial with transitional border areas.

In addition to the public notification and Open House/industrial community meetings, VCS is committed to more tailored public engagement based on public safety, potential concerns and the emergency planning zone for the Expansion. This tailored engagement group includes the nearby residents, landowners and industry land users in the area inside and adjacent to the estimated emergency planning zone. In addition to the nearby industry land users outlined in Figure 5, there are three residence located about 1 km from the nearest VCS-H Complex boundaries to the south (two residence at approximately 750m and 1.1 km, one business shop at approximately 1.5 km) and one business residence (approximately 300 m) to the northeast.

14. Physical and Biological Environment

VCS and affiliated environmental consultants have conducted environmental baseline work that will be incorporated into an environmental impact assessment for the Project. All potential environmental and social impacts will be identified, and appropriate mitigation and monitoring will be proposed to minimize or eliminate potential Project effects.

The previous designation of the Astotin Natural Area located north of the Expansion Project area was repealed on December 19, 2007. As of 2007, BA Energy Inc. (BA, amalgamated into Value Creation Inc.) with Canadian Pacific Railway Company had reached agreements with the Province of Alberta, represented by Alberta Tourism, Parks, Recreation and Culture and Alberta Sustainable Resource Development. The agreements were about exchanging lands with equal or greater environmental benefit and market value to be added to the Provincial Parks and Protected Areas network. Lands that were exchanged as part of the agreement include lands near Miquelon Lake Provincial Park, the Lois Hole Centennial Park, the Ministik Lake Game Bird Sanctuary and Beaverhill Lake Heritage Rangeland Natural Area. Subsequently, the Astotin Natural Area designation on the west half of Section 11, Range 056, Township 21, West of the 4th Meridian was repealed.

For the proposed Expansion Project area, approximately 60 ha of land is cleared (approximately 17%, contract farmed), and the remaining area is undisturbed land (300 ha, approximately 83%).

Subject to further discussion with the Strathcona Country, two range roads can be used to access the Project site: Range Road 213 along the west end (primarily for VCS-H Project 1 access) and Range Road 211 along the east, which

will be used to access the Expansion Project site. Township Road 562 runs along the north boundary of the VCS-H Complex, which will also provide access for the Expansion (Figure 5).

The Expansion Project site is surrounded by major industrial facilities, linear disturbances and agricultural lands with environmental considerations as described in the following sections.

Air Quality

The climate in AIH features cold and dry winters with average monthly temperatures reaching a low of -12°C in January and mild summers that seldom exceed 30°C in summer. Mean annual precipitation in AIH ranges from 400 to 500 millimeters (mm). Daily precipitation maximums generally occur in June and July and are in the range of 80 to 92 mm. The average annual wind speed reported at the Fort Saskatchewan air quality monitoring station is 9.1 km/h. The windiest month is April with average wind speeds of 11 km/h with prevailing winds from the west and southwest directions in the summer, and from the northwest direction in the winter.

AIH is an area designated by the Province of Alberta for heavy industrial growth. Ambient air quality in the Heartland is monitored and reported by Fort Air Partnership with 10 continuous monitoring stations that measure certain air contaminants on a 24-hour basis, and a network of 47 passive monitors that measure concentrations of sulphur dioxide and hydrogen sulphide on a monthly average basis. The continuous monitoring stations are located in Fort Saskatchewan, Gibbons, Lamont County, Redwater, Elk Island National Park, Scotford Temporary, Ross Creek, Range Road 220 and a portable station currently located in Chipman. Ambient air quality in the Heartland can vary with location depending on the proximity to industrial sites, traffic corridors and urban centers in the region. Exceedances of the Alberta Ambient Air Quality Objectives (AAAQO) have been existent for substances such as SO_2 , H_2S , benzene (not since 2015) and $\text{PM}_{2.5}$. Not all of the exceedances are attributable to industrial activity (as many $\text{PM}_{2.5}$ exceedances are caused by forest fires, and some H_2S exceedances are caused by natural processes in bogs and slews). Air quality is in the low health risk level, as measured by the Air Quality Health Index most of the time (refer to Fort Air Partnership website for details).

Noise

There are significant existing and proposed regulated industrial noise sources nearby. The Expansion is located within AIH, which consists of dozens of large-scale industrial facilities that are regulated by the AER as well as the Alberta Utilities Commission. Operational facilities within approximately 4 km include:

- Wolf Midstream Stonefell Terminal [Immediately west of Range Road 213]
- Enbridge Pipelines Stonefell Terminal [Immediately east of Range Road 213]
- Inter Pipeline Lamont Pump Station [1,500 m east]
- ATCO Pipelines Salt Caverns Facility [2,800 m south]
- Shell Scotford Facility [2,200 m southwest]
- Nutrien Redwater Fertilizer Operations (RFO) [3,000 m northwest]

There are also several other facilities beyond 4 km. All existing industrial facilities within the study area will be included in the noise assessment for the EIA, using the regional noise model that has been generated by the Northeast Capital Industrial Association (NCIA).

Nearby significant roads include Secondary Highway 830 (approximately 3.2 km east of the VCS-H Complex), and Highway 15 (approximately 4.8 km south of the VCS-H Complex). There is also a heavily used railway that runs approximately 800 m south of the VCS-H Complex.

Soils and Terrain

The Redwater Plain District is an undulating plain with slope gradients generally ranging between one and three percent (Agriculture Canada 1986). The proximity of the Redwater Plain to the North Saskatchewan River explains the presence of sandy, glaciofluvial deposits that dominate the area. A portion of these deposits have been wind-worked into dune topography and subsequently stabilized by vegetation. This dune topography consists of low-relief parabolic or U-shaped dunes with slope gradients ranging from two to nine percent. The stabilized dunes are interspersed with well-drained Chernozemic soils and poorly-drained Organic and Gleysolic soils. Dune soils are typically Eutric Brunisols and, combined with the moderately to strongly rolling topography, are rapidly-drained to well-drained (Timoney and Robinson 1998).

Aquatic Resources

The Expansion is situated in the Astotin Creek watershed. Astotin Creek originates at Astotin Lake located in Elk Island National Park and drains into the offsite Beaverhill Creek which, in turn, drains into the offsite North Saskatchewan River. Known fish species in the Project area and in the Astotin Creek watershed are almost exclusively small-bodied fish species with the exception of white sucker, which is the only large-bodied fish species recovered in the Astotin Creek watershed from more than 180 fish inventories conducted in the watershed between 1997 and 2018 (Alberta Environment and Parks 2019). The section of offsite Beaverhill Creek from the confluence of Astotin Creek to its confluence with the offsite North Saskatchewan River contains both small-bodied and large-bodied fish species, with the large-bodied fish species being exclusively from the sucker family. No sport fish species have been recovered in either Astotin Creek or the lower section of the offsite Beaverhill Creek, and none of the fish species known to reside in either Astotin Creek or the lower section of offsite Beaverhill Creek are listed in any of the schedules of the *Species at Risk Act* (Government of Canada 2019) or as candidate species by COSEWIC (Committee on the Status of Endangered Wildlife in Canada 2019).

Surface Water

The Expansion will overlap Astotin Creek and several open water, fen, marsh, and swamp wetlands (Alberta Environment and Parks 2018a). The Project area is located within the Dry Mixedwood Natural Subregion. Lakes within this subregion are among the least sensitive to acid deposition compared to other lakes in Alberta (AENV 1999). The undisturbed area is currently natural, undeveloped land. Disturbed areas include some acquired acreage homes and some lands are presently being contract farmed. Previous field inspection and examination of surveyed topographic data conducted for the original application (BA Energy 2004) indicates that the land generally slopes in a southeasterly direction towards Astotin Creek.

Previous environmental assessments (Total E&P Canada 2007 and recent baseline field survey by VCS) indicate the following regarding the surface water quality of Astotin Creek:

- it is slightly alkaline, very hard, and with high levels of alkalinity, total dissolved solids, and conductivity;
- it has an ionic composition that is dominated by magnesium and calcium cations and the bicarbonate anion;
- it is eutrophic; and
- it has concentrations of total and dissolved metals that, with few exceptions, are within provincial water quality guidelines for the protection of aquatic life (Government of Alberta 2018b).

Groundwater

The regional geology in the Fort Saskatchewan area has been influenced by pre-glacial, glacial and postglacial events. The geological sequence consists of a succession of unconsolidated Neogene and Quaternary-aged deposits unconformably overlying Cretaceous-aged deposits.

The Beverly Channel is a major pre-glacial valley incised within the upper bedrock and consisting of buried sand and gravel deposits (Andriashek 1988). The channel is roughly coincident with the present-day North Saskatchewan River Valley and the buried sand and gravel deposits form an important regional aquifer. The upper bedrock consists of the Belly River Formation. The Belly River Formation includes sandstone units that form local or regional aquifer/aquitard systems such as the Oldman Aquifer, the Continental Foremost Aquifer and the Milan Aquifer (Stein 1976).

The North Saskatchewan River is a major regional groundwater discharge feature for bedrock aquifers and the Beverly Channel. Water wells in the Fort Saskatchewan area are completed in the surficial sand deposits, the sand and gravel deposits of the Beverly Channel, and the upper bedrock. The majority of the wells are for domestic or domestic and agricultural use. There are no known active groundwater wells in close proximity to the Expansion Project site.

Vegetation

The Project site is located within the Dry Mixedwood Natural Subregion, which is characterized by aspen forests, cultivated lands, and fens typically occurring in low-lying areas (Natural Regions Committee 2006). The aspen-dominated forests are comprised of species-rich understories of low bush cranberry (*Viburnum edule*), beaked hazelnut (*Corylus cornuta*), prickly rose (*Rosa acicularis*), wild sarsaparilla (*Aralia nudicaulis*), cream colored vetchling (*Lathyrus ochroleucus*), purple peavine (*Lathyrus nevadensis*), and bluejoint (*Calamagrostis canadensis*). Pure or mixed stands of balsam poplar (*Populus balsamifera*), aspen (*Populus tremuloides*) and white spruce (*Picea glauca*) occur on moist, rich sites with understories containing prickly rose (*Rosa acicularis*), red-osier dogwood (*Cornus sericea*), and a variety of herbaceous species. Treed and shrubby fens are common in wet, poorly drained sites and the vegetation species largely depend on the nutrient status and water levels in each site (Natural Regions Committee 2006).

Following a review of the Schedule 1 species of the *Species at Risk Act* and the candidate species assessed by COSEWIC, no federally-listed vegetation species at risk are known or expected to occur within the Project area.

Wildlife

The Project is located in a portion of Strathcona County that falls within AIH, an area that is predominantly characterized by agricultural and industrial land uses. Wildlife habitat within a fragmented landscape is largely a function of forest clearings and the amount of edge habitat relative to interior habitat. Closed deciduous and mixedwood forests in the Project area are the core interior habitats used by numerous wildlife species, including ungulates, birds and small mammals. Agricultural and anthropogenic lands generally have little value for wildlife, whereas wetland, grassland, and forest/shrub habitat types will have the highest value for wildlife.

Large concentrations of northern breeding ducks, geese and swans stage on Alberta lakes during spring and fall migration, with a large proportion of these birds using habitats within Strathcona County. The Project area overlaps Astotin Creek and several open water, fen, marsh and swamp wetlands according to the Alberta Merged Wetland Inventory, which will provide aquatic habitat for water-dependent birds (ducks, geese and shorebirds), semi-aquatic mammals (beaver, muskrat and mink) and amphibians (frogs and toads) during the breeding season.

Several species that are considered to be of “Special Concern” or are Schedule 1 species as defined under the *Species at Risk Act* are known to occur in the Fort Saskatchewan Area, including: northern leopard frog (*Lithobates pipiens*), western tiger salamander (*Ambystoma mavortium*), bank swallow (*Riparia riparia*), evening grosbeak (*Coccothraustes vespertinus*), horned grebe (*Podiceps auratus*), olive-sided flycatcher (*Contopus cooperi*), rusty blackbird (*Euphagus carolinus*), short-eared owl (*Asio flammeus*), Sprague’s pipit (*Anthus spragueii*), western grebe (*Aechmophorus occidentalis*), and yellow rail (*Coturnicops noveboracensis*).

15. Health, Social and Economic Regional Information

A human health risk assessment and socioeconomic impact analysis is underway and will cover detailed analyses in due course. Following is an overview of the background information on health and socioeconomics in the region.

According to the Community Social Profile published in 2018 by Strathcona County, there are 27,345 residents living in the rural area of Strathcona County in 2016 with 70,700 residents in the urban Sherwood Park. This places Strathcona County as the fourth largest municipality in Alberta after Calgary, Edmonton and Red Deer. Four percent (4%) of the Strathcona County population was identified as Aboriginal as of 2011.

The median age of the population in Strathcona County was 37.8 in 2006, 39.1 in 2011 and 40.1 in 2016, indicating a larger portion of the population is aging from 2006 to 2016. The life expectancy in the Edmonton Zone where Strathcona County lies within is 81.8-82.0 years from 2011 to 2017, as compared to that of 81.8-82.1 years in Canada.

The economics of the region was affected largely by the energy industry downturn due to the economic effect of a decline in oil prices. The workforce population reached the lowest point in July 2016 and slowly recovered but is not back to the level that was observed in 2013. As of 2016, the unemployment rate in Strathcona County is 6.5%, as compared to 9% in Alberta.

As health data are typically reported on a regional basis (or “by zone”) across Alberta, it is important that the data concerning the current health status in the area (i.e., baseline health data) be interpreted with a certain degree of caution. Baseline health data are publicly available on a relatively broad scale, wherein information is presented for the primary urban centres or for large geographic areas. Limited specific baseline health data are currently available for most of the communities in the vicinity of the Project (e.g., Redwater, Gibbons, Bruderheim, etc.). Although some of the information that will be presented in detail in the EIA may not be specifically relevant to the residents of the study area, it can still be useful for identifying critical receptors as well as in interpreting the health risk assessment in the context of population baseline, project and cumulative risks.

In the past, it’s been reported that the residents of the Capital Health Region (wherein the Project will be located) are generally in good health and rank highly on many standard measures of population health. For instance, mortality rates for heart disease in the Capital Health Region have been lower than the provincial average and mortality rates for stroke and cancer are generally similar to the provincial average.

In their 2013 community profile for Strathcona County, Alberta Health indicated the following:

- In 2010, the disease with the highest prevalence rate (per 100 population) in Strathcona County was hypertension. The rate associated with this disease was similar to the provincial average (13.7 vs. 14.2 in Alberta).
- The age-standardized rate for people with three or more chronic diseases (per 100 population) was similar in Strathcona County compared to the province (2.1 vs. 2.2 in Alberta).

- The mortality rate (per 100,000 population) due to all causes was similar in the County compared to the province (497.6 vs. 519.2 in Alberta), and the most frequent cause of death reported between 2001 and 2010 was diseases of the circulatory system.

In 2012, Strathcona County undertook a telephone survey to assess residents' perceptions about health and lifestyle issues. Survey respondents were asked to rate their personal health. The key findings of the health aspects of the survey were that:

- two-thirds (67%) of Strathcona County residents rated their personal health as very good/excellent; and
- higher proportions of rural residents (71%) rated their personal health as very good/excellent as compared to Sherwood Park residents (66%).

Although conducted more than a decade ago, but still relevant with respect to baseline health, Alberta Health's Fort Saskatchewan and Area Community Exposure and Health Effects Assessment Program examined health records to compare residents of Fort Saskatchewan with residents of a reference location (Lethbridge, Alberta) for selected morbidity and mortality measures, with a particular focus on respiratory disease. The study concluded that Fort Saskatchewan had higher rates of doctor visits for respiratory diseases (including the common cold), but not for illness or death from asthma, bronchitis, chronic obstructive pulmonary disease (COPD) or other chronic respiratory diseases.

The baseline health assessment of the application will present a comparative analysis of various health indicators for the region using Alberta's Interactive Health Data Application.

Benefits of the VCS-H Complex to the local and broader socio-economy and economy can be found in Section 7. A detailed human health risk assessment, a socioeconomic impact assessment and a gender-based analysis plus (GBA+) will be addressed in the EIA.

Federal, Provincial, Territorial, Indigenous and Municipal Involvement and Effects

16. Federal Financial Support

VCS has not received Federal financial support to date, while VCS is open to funding programs supporting the GHG benefits this Project will bring.

17. Federal Land Use

No federal land will be used for the development of the Expansion.

18. Jurisdictions with Powers, Duties or Functions

The Federal jurisdictions potentially having powers, duties or functions in relation to the assessment of the proposed Expansion's environmental effects are listed in Table 5.

Table 5 Federal Jurisdictions and Legislative Acts

Federal Jurisdiction	Legislative Acts	Related Permits
Impact Assessment Agency of Canada	<ul style="list-style-type: none"> • <i>Impact Assessment Act</i>, 2019 • <i>Migratory Birds Convention Act</i>, 1994 (MBCA) • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	Notice of Determination and Decision statement for Impact Assessment (if required)
Environment and Climate Change Canada	<ul style="list-style-type: none"> • <i>Migratory Birds Convention Act</i>, 1994 (MBCA) • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	<i>Species at Risk Act</i> Permit
Fisheries and Oceans Canada	<ul style="list-style-type: none"> • <i>Species at Risk Act</i>, 2002 (SARA) • <i>Fisheries Act</i>, 2019 	<i>Fisheries Act</i> Authorization <i>Species at Risk Act</i> Permit

Subject to review by IAAC, and governed by the newly passed *Impact Assessment Act*, this document serves as the Detailed Project Description for the proposed Expansion.

An EIA together with OSCA and EPEA applications are in preparation for the AER to review under Alberta provincial legislations. Other provincial authorities will review and dispense permits as required prior to construction and/or operation of the Expansion under the *Water Act* and the *Railway (Alberta) Act*.

A municipal development permit will also be required before construction activities commence under Land Use Bylaw 6-2015 of the Municipality of Strathcona County.

Potential Effects of the Project

19. Changes to the Environment within the Fisheries Act, Species at Risk Act and Migratory Birds Convention Act

(a) Fish and Fish Habitat within the *Fisheries Act*

The Expansion Project may cause changes to fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act*, specifically in Astotin Creek. A summary of the potential changes to fish and fish habitat are as follows.

Potential Effects from Changes to Surface Cover: The proposed Project footprint will be comprised of a number of facilities and infrastructure developments, which may potentially affect runoff to Astotin Creek. The assessment will consider a worst-case condition, whereby the Project footprint is considered completely enclosed for the life of the Project and none of the runoff from the Project footprint returns to Astotin Creek.

Potential Effects from Changes in Drainage Patterns and Changes in Channel Morphology: While there will be no transfer of water from one watershed to another as a result of the Project, the proposed Project footprint will cross Astotin Creek, which will be realigned from its current channel in NW 02, SE 11, Township 056, Range 11 W4M. The fish resources that have been recovered in the portion of Astotin Creek that would be re-aligned consist of mostly small-bodied species, one large-bodied species, and no game fish species. This portion of Astotin Creek is classified as *Stream-Recurring*, i.e., a river/stream with a stream bed that is often dry during certain times of the year due to

climatic conditions and/or a limited area of drainage⁶. The proposed Astotin Creek realignment work will be in accordance with all applicable provincial requirements and the Federal Department of Fisheries requirements as stated in the *Fisheries Act*. Potential effects from changes in channel morphology downstream of the Project area, including changes in frequency of channel overtopping and flooding, are not anticipated. Similarly, because effects of any changes in surface runoff associated with Project development are expected to be negligible, sediment concentrations in Astotin Creek are not expected to increase.

Potential Effects from Surface Disturbance and Construction Activities: Surface disturbance and fill handling during construction (clearing and stripping of vegetation and topsoil to facilitate Project construction), operation, and decommissioning and dismantling of Project infrastructure may result in sediment deposition to the aquatic environment, which may affect surface water quality and sediment quality.

Potential Effects through Discharge of Project-Affected Waters and Accidental Spills: Discharge of Project-affected water into surface waters is not proposed for the Project. It is expected that process-produced water from the Project will be recycled to the extent possible. Accidental spills of fuels, hydrocarbons, chemicals, and waste products used for the Project could negatively affect water quality and sediment quality. Oily water ponds lined with synthetic liner and skimmers will be used to capture surface runoff from process areas as well as wastewater from routine washing and maintenance activities. The skimmed hydrocarbons and the water will be recycled back into the process. The storage and handling of deleterious substances (*e.g.*, fuels, chemicals, contaminating materials, *etc.*) or hazardous materials would be dictated by applicable environmental legislation, regulations, standards, or codes.⁷

Potential Effects from Changes in Groundwater Quality and Quantity: Project activities present a potential risk of contaminating groundwater, which in turn has the potential to result in adverse effects on surface water quality and sediment quality. There are two potential pathways of concern with respect to groundwater contamination that will be investigated and assessed: overland flow and accidental release of deleterious substances. The Project is located within the areal extent of the buried Beverly Channel aquifer. The buried channel is separated from surface activities by a thick layer of clay and clay till deposits (Andriashek 1988) and is not expected to be impacted by the Project.

Potential Effects through Instream Works: Watercourse crossings may be required as part of the proposed Project, and these will be designed and constructed in compliance with the *Alberta Code of Practice for Pipelines and Telecommunication Lines Crossing a Waterbody* (AESRD 2013a) and the *Alberta Code of Practice for Watercourse Crossings* (AESRD 2013b). Results from formal watercourse crossing assessments that will be conducted will guide the selection of appropriately sized crossing structures such that flows are not impeded during times of high flow and channel erosion does not occur.

Potential Effects due to Increased Fishing Pressure: Astotin Creek does not contain sport fish species. There is recreational fishing associated with larger waterbodies such as lower Beaverhill Creek and the North Saskatchewan River and the construction labour force for the Project may create incremental fishing pressure on local sport fish resources.

⁶ As defined in <https://geodiscover.alberta.ca/geoportal/catalog/search/resource/details.page?uuid=%7B7F9C0F33-6DDB-4479-B2D9-1419D79E2D26%7D>

⁷ Spill Response Plans will be in place as part of a comprehensive Emergency Response Plan. Accidental spills will be contained, reported and cleaned following the Alberta *Release Reporting Regulation* and the Alberta *EPEA*. Storage and handling of waste materials will follow the AER Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry.

Potential Regional Effects: The potential effects of the Project described above may extend regionally, to lower Beaverhill Creek and to the North Saskatchewan River. The Regional Study Area for aquatic resources will include lower Beaverhill Creek and an extended part of the North Saskatchewan River below the confluence of Beaverhill Creek so as to assess any potential regional effects.

Potential Effects of Acidifying Emissions: The Project may release acidifying emissions of NO_x and SO_x that can result in the acidification of waterbodies with subsequent effects on fish and fish habitat in those waterbodies. Evaluation of these potential effects will be conducted in the Regional Study Area adopted by the Air Quality component.

(b) Species Listed Under Schedule 1 of the *Species at Risk Act*

A number of wildlife species may occur in the Fort Saskatchewan Area that are listed federally as “Special Concern” (may become a threatened or an endangered species) or are Schedule 1 species as defined under the *Species at Risk Act*. These include northern leopard frog, western tiger salamander, bank swallow, barn swallow, evening grosbeak, horned grebe, olive-sided flycatcher, rusty blackbird, short-eared owl, Sprague’s pipit, western grebe, and yellow rail. Terrestrial and aquatic habitats in the Fort Saskatchewan Area may support one or more of these species of conservation concern and may be affected by Project development.

Potential Effects from Changes to Surface Cover: The proposed Project footprint will be comprised of a number of facilities and infrastructure developments, which may affect federally-listed wildlife species that potentially occur in the area through several mechanisms. These effects include direct (e.g., vegetation clearing, wetland drainage, channel realignment, etc.) and indirect (e.g., noise/sensory disturbance) loss and/or alteration of habitats and potential reductions in local and regional habitat connectivity (i.e., movement corridors) resulting from habitat fragmentation. The assessment will assume a worst-case scenario where the Project footprint will be altered for the life of the Project, particularly as it relates to changes in terrestrial and aquatic habitats.

Potential Effects from Surface Disturbance and Construction Activities: Surface disturbance and fill handling during construction (clearing and stripping of vegetation and topsoil to facilitate Project construction), operation, and decommissioning of Project infrastructure may result in increased mortality risk for any federally-listed bird and amphibian species. Potential concerns are associated with destruction of nests, wetland drainage, and channel realignment.

Potential Effects through Discharge of Project-Affected Waters and Accidental Spills: Discharge of Project-affected water into surface waters is not proposed for the Project. It is expected that process-produced water from the Project will be recycled to the extent possible with the remainder disposed of via an approved deep well disposal facility. Accidental spills of fuels, hydrocarbons, chemicals, and waste products used for the Project could negatively affect water quality and sediment quality and any terrestrial areas adjacent to a spill site which could directly and/or indirectly affect federally-listed wildlife species. Oily water ponds lined with synthetic liner and skimmers will be used to capture surface runoff from process areas as well as wastewater from routine washing and maintenance activities. The skimmed hydrocarbons and the water will be recycled back into the process. The storage and handling of deleterious substances (e.g., fuels, chemicals, contaminating materials, *etc.*) or hazardous materials would be dictated by applicable environmental legislation, regulations, standards, or codes.⁷

Potential Regional Effects: The potential effects of the Project described above on federally-listed wildlife species may extend regionally to adjacent terrestrial habitats to aquatic habitats associated with Astotin Creek and to the North Saskatchewan River. The Regional Study Area for wildlife will include terrestrial and aquatic habitats within a 50 km² area around the Local Study Area so that any potential regional effects on federally-listed species are addressed.

Potential Effects of Acidifying Emissions and Other Pollutants: The Project may release acidifying emissions of NO_x, SO_x, or other pollutants. The primary mechanisms through which federally-listed wildlife can be affected include effects on habitat quality (e.g., inhalation and deposition on terrestrial vegetation or into water) and availability and quality of food (e.g., ingestion of benthic invertebrates and/or terrestrial/aquatic vegetation). These potential effects will be assessed in the context of the Regional Study Area defined for the Air Quality component.

There are no aquatic species in Astotin Creek that are listed in any of the schedules of the *Species at Risk Act* or as a candidate species by COSEWIC. Therefore, no changes to aquatic species as defined in subsection 2(1) of the *Species at Risk Act* as a result of the Project are anticipated.

(c) Migratory Birds within the Migratory Birds Convention Act

The Expansion may affect migratory birds as defined by the *Migratory Birds Convention Act*. Potential Project-related effects on migratory birds are expected to be largely related to direct (e.g., vegetation clearing, wetland drainage) and indirect (e.g., noise/sensory disturbance) loss and/or alteration of habitat, and increased mortality risk (e.g. nest destruction, collisions with Project infrastructure, etc.).

Other potential effects on migratory birds resulting from the construction, operation and decommissioning of the Project may include increases in ambient concentrations of criteria air contaminants, or accidental spills of deleterious substances (e.g., wildlife health through inhalation or ingestion) and reductions in habitat security and abundance (habitat loss and species displacement to adjacent habitats).

(d) Mitigation Measures

To address the environmental aspects of the Expansion, VCS is committed to following appropriate adaptive Best Management Practices (BMP) to identify, analyze and consider economically achievable Best Available Technologies / Best Environmental Practices (BAT/BEP) and mitigation measures in the Project design and operation.

Based on Project characteristics, VCS mitigation measures will be developed to directly address every identified potential impact. A Construction Environmental Management System (CEMP) will be prepared to provide a targeted mitigation plan that focuses on addressing possible effects on various specific environmental resources.

As well, the CEMP will be based on applicable provincial and federal regulations and permit requirements, the environmental conditions at the site and mitigations developed from the environmental impact assessments processes will be implemented in a timely manner.

Furthermore, VCS will seek the services of qualified environmental professionals (QEP) from a reputable environmental consulting company to detail in a CEMP all the potential construction-related environmental aspects. The plan will identify, develop, document and implement applicable mitigation measures and BMPs to avoid or reduce adverse construction impacts on the identified environmental aspects.

A comprehensive Emergency Response Plan (ERP) will be developed to address mitigation measures and plans for potential accidents and malfunctions, including spills of fuels, hydrocarbons, chemicals and waste products, sour gas release, explosion or fire or incidents associated with other project components or activities, and means to mitigate or monitor effects. The overall goal of an ERP is to protect public safety and minimize impacts to the environment through its implementation.

Climate change impacts to the Project in design and emergency response planning will be described in the EIA. During the Project lifetime, climate change-induced extreme precipitation, temperature and related environmental conditions will be included in designing basis, mitigation and response planning.

20. Changes to the Environment to Federal Lands

The Expansion's environmental impact assessment will be addressed in detail in the EIA including any potential impacts to the nearby Federal lands included in:

- an air quality impact assessment, which will include:
 - a description of the potential for reduced air quality resulting from the Project;
 - an estimation of ground-level concentrations of appropriate air quality parameters;
 - a discussion of any expected changes to particulate deposition, nitrogen deposition or acidic deposition patterns; and
 - a description of air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, soil resources, vegetation resources and water quality.
- a noise impact assessment, which will include identification of components of the Project that have the potential to increase noise levels and a discussion of the implications, including:
 - potentially affected people and wildlife;
 - an estimate of the potential for increased noise resulting from the development; and
 - strategies to monitor and mitigate any increased noise levels.
- a human health risk assessment, which will evaluate the potential human health risks that would be posed by emissions from the Project.
- surface water and groundwater impact assessments, to describe and assess project components and activities that have the potential to affect groundwater resource quantity and quality at all stages of the Project.
- aquatic ecology, vegetation, wildlife and biodiversity impact assessments, to describe and assess the potential impact of the Project to fish and fish habitat, vegetation and wetland communities, wildlife populations and habitats and regional biodiversity.

The Expansion will enable an approximately 25-30% reduction of GHG emissions from upgrading and refining diluted bitumen to fuel products as compared to those of baseline without the Project (see Section 23 for details). The Expansion will not cause any changes to the environment outside of Alberta or Canada.

21. Impact to the Indigenous People of Canada on Physical and Cultural Heritage, Traditional Land Use and Historical Resources

The closest First Nation or Métis communities are approximately 60 km away. The proposed Expansion is located within AIH, an area dedicated to heavy industrial activities and development. Preliminary comments from the Indigenous groups can be found in Section 4, IAAC's issued summary of Issues and VCS's responses in Appendix III. Below is a summary of discussions with Indigenous communities held to date:

- VCS is dedicated to protecting North Saskatchewan River throughout the life of the Project;
- Once approved, Indigenous communities will be included in the notification list in case of major incidents/emergency during construction and operation of the Project;
- Some Indigenous communities are open to combine technical review and traditional land use studies, as appropriate, for cost savings and time effective reviews;
- Majority of the Indigenous communities are interested in contractual bidding opportunities and participation in the alliance initiative; and

- VCS will continue engaging with Indigenous people to determine the potential impacts to Physical and Cultural Heritage, Traditional Land Use and Historical Resources conditions due to the Project.

An historical, archaeological, and paleontological study including ground reconnaissance was conducted for VCS-H Project 1 which included part of the Expansion Project area in the 2004 EIA. An *Historical Resources Act* Clearance was granted for VCS-H Project 1 following the Historical Resource Impact Assessment. A record review is currently underway for the Expansion through a screening application to Alberta Culture, Multiculturalism and Status of Women. Any cabin sites, spiritual sites, cultural sites, graves and other traditional use sites considered historic resources under the *Historical Resources Act* (if the Indigenous community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns will be documented.

VCS will strive to understand and document any traditional land use areas including fishing, hunting, trapping, water use (e.g., for drinking, cooking and navigation) and nutritional, medicinal or cultural plant harvesting by affected Indigenous peoples (if the Indigenous community or group is willing to have these locations disclosed). VCS will include a discussion of:

- the availability of vegetation, fish and wildlife species for food, traditional, medicinal and cultural purposes in the identified traditional land use areas considering all project related impacts,
- access to traditional lands in the Project Area during all stages of the Project, and
- Indigenous views on land reclamation.

VCS will gather information, including potential impacts, related to Indigenous physical and cultural heritage, traditional land use, and historical, archaeological, paleontological or architectural significance for the proposed Expansion during the consultation process with Indigenous communities. Collected information will help VCS to incorporate into the Project, EIA development, the conservation and reclamation plan, monitoring and mitigation plans, determine the impacts of the Project on traditional, medicinal and cultural purposes and identify possible mitigation strategies of the proposed Project activities to Indigenous communities.

22. Impact to the Indigenous People of Canada on Health, Social or Economics

The nearest Indigenous communities are approximately 60 km away from the Expansion site. It is expected there are no adverse health, social or economic impact to the Indigenous People of Canada. Health risk assessment, socioeconomic impact assessment and gender-based analysis plus (GBA+) will be discussed within the regional and local study area centered at the Project in the EIA report.

It is expected that the Indigenous People of Canada will benefit from business/employment opportunities from the Project construction and potential partnership for direct economic benefits to uplift Indigenous wellbeing and wellness, all in harmony with sustainable growth of the Oil Sands upgrading industry.

23. GHG Emissions Estimates

The Expansion will generate GHG emissions throughout the construction, operation and decommissioning stages. During construction, the land-use change will have impact on carbon sinks (cropland and potential wetland within the Project area) and the estimation is shown in Table 6. Wetland impacts are not included in the estimation here, assuming replacement of equivalent wetland elsewhere will be implemented following Alberta's Wetland Mitigation Directive (AEP 2018b) after measures of avoidance/minimization of wetland impacts are exhausted.

Sources of GHG emissions during these stages include onsite stationary and mobile equipment/truck fuel combustion as well as the GHG emissions associated with the imported electrical energy.

GHG emissions associated with operations will primarily be generated through the upgrader/specialty refinery process units that use natural gas and some refinery gas as a fuel source in addition to imported electricity for energy inputs.

The direct and net GHG emissions as defined in Government of Canada’s Strategic Assessment of Climate Change estimated for the Expansion are listed below in Table 6.

Table 6 GHG Emissions for the Expansion Project

Source (Projects 2-4)	CO ₂ (kt/year)	CO (kt/year)	NO _x (kt/year)	CO _{2e} (kt/year)
Natural gas combustion	1127	-	-	-
Fuel gas combustion	1851	-	-	-
Stationary Combustion Total¹	2978	5	1.3	3386
Operation Emission Total (kt/year)				3386
Construction/Decommissioning ² /Fugitive/Land-use Change Emissions ³ (kt/year)				24
Strategic Assessment of Climate Change Defined Direct Emission Total,⁴ (kt/year)				3410
Direct Emission Intensity ⁵ (t/bbl bitumen)				0.02
Acquired Energy GHG emission for Imported Electricity ⁶ (kt/year)				658
Avoided Domestic GHG Emissions (kt/year)				3152
Net GHG Emissions (kt/year)				916

¹Combustion GHG emissions are based on maximum output from the Project after debottlenecking (i.e., all fired equipment operating at maximum fuel gas consumption).

²Construction/Decommissioning emissions over a 10 year period was prorated to the total Project life for total emission estimation.

³Land-use change GHG emission was assessed on land-use change from croplands to cleared ground based on IPCC Guidelines (IPCC 2006).

⁴Direct emission estimate here does not include the GHG emission from transportation inbound/outbound of Project fence-line, which is included in the life cycle GHG estimation below.

⁵The bitumen throughput for intensity calculation is the capacity after debottlenecking (600 kbpd of Diluted Bitumen or 442 kbpd of bitumen).

⁶Electricity emission factor (Alberta) is 0.57 tCO_{2e}/Mwh as published in Carbon Offset Emission Factors Handbook, v 2.0, November 2019, with the Expansion project electricity maximum inputs at 139 MW (1160 GWh/y).

$$\text{Net GHG Emissions} = \text{Direct GHG Emissions} + \text{Acquired Energy GHG Emissions} - \text{CO}_2 \text{ Captured and Stored} - \text{Avoided Domestic GHG Emissions} - \text{Offset Credits}$$

The benchmark for DilBit-to-Tank life cycle analysis has DilBit being transported via pipeline to an extra heavy oil refinery near Sarnia, Ontario with delayed coking process and refined to fuel products. Diluent that is separated from DilBit is then transported back to bitumen producers in the Athabasca region.

The Expansion case includes DilBit upgrading and refining at VCS-H Complex to produce ultra-low sulphur diesel and COLF upgraded crude oil blends. COLF blends are further refined into gasoline and diesel products at downstream medium or heavy oil refineries near Sarnia, Ontario, which benefit from the selective removal of carbon-rich asphaltenes. Asphaltene storage/alternative usage may qualify for offset credits although it is not included in the current calculations.

Avoided domestic GHG emissions were calculated based on a life cycle analysis comparing the GHG emissions with or without the application of VCI technologies (Matrix Solutions 2018). The pipeline transportation emissions were estimated based on fluid dynamic equations specifying fluid viscosity, pump efficiencies and pipeline diameters. Other transportation means considered include rail and trucking.

The emissions from bitumen refining and COLF crude oils refining were estimated based on crude properties and distillation curves. Virtual refinery process units were sized accordingly without constraints, and emissions were estimated based on industrial standards on various crude properties. The ratio of avoided domestic GHG emissions from transportation : refining is roughly 15% : 85%. The avoided domestic GHG emissions was estimated at 0.02 tonne CO₂e/barrel of bitumen processed.⁸

Emission intensity was estimated by the equation provided below (Government of Canada 2020) and the emission intensity is projected to be approximately 0.01 tonne CO₂e/barrel of bitumen for the Expansion and an updated number for net GHG emission is shown in Table 6.

$$\text{Emission Intensity} = \text{Net GHG Emissions/Unit Produced}$$

24. Waste and Emissions

The air emissions used in the Air Quality assessment includes Base Case emissions (i.e., emissions of existing and approved projects prior to the proposed Expansion application in a 120 km by 120 km study area centered at the Expansion site) plus the emission sources associated with the Expansion. Relative to the Base Case, the Expansion results in a small increase to regional SO₂, NO_x, particulate matter, or CO emissions in the range of 3% to 15%, as presented in Table 7.

Table 7 Expected Air Emissions from Operation of the Expansion

Emission Source	Emission Rate (t/d)			
	SO ₂	NO _x	Particulate Matter	CO
Base Case Including Planned Activities	134.2	104.3	10.2	97.1
The Expansion	12.5	3.1	0.61	15.0
% increase due to the Expansion	9%	3%	6%	15%

Additional types of waste that are expected to be generated from the Expansion include:

- disposal wastewater from water treatment;
- spent catalysts;
- spent adsorbent, ion exchange resins and catalyst supports;
- spent air desiccant; and
- other miscellaneous filters, containers etc.

A summary of the estimated quantities of these wastes that will be generated and anticipated disposal methods is presented in Table 8. The proposed Expansion will have mitigation measures and contingency plans for the waste in the event of leaks, spills, etc. as part of a detailed Waste Management Plan.

⁸ The avoided domestic GHG emissions could vary in a range depending on assumptions of refineries locations where bitumen or the COLF from VCS-H is refined. Current assumptions used in the model are Eastern Canada refineries to refine crudes received through pipelines.

Table 8 The Expansion Solid Waste and Wastewater Information

	Quantity [t]	Frequency	Disposal Method
Solid Wastes			
Spent Catalysts for Hydroprocessing	1,800	3 years	Return to supplier for recycle
Spent Catalysts for Hydrogen Manufacturing	90	3 years	Return to supplier for recycle
Spent Zinc Oxide from Hydrogen Manufacturing	143	year	Third-party landfill
Spent Shift Catalyst from Hydrogen Manufacturing	154	3 years	Third-party landfill
Spent Adsorbents for Hydrogen Manufacturing	377	20 years	Third-party landfill
Spent Catalysts for Sulphur Recovery	500	3 years	Return to supplier for recycle
Spent Ceramic Balls (catalyst support)	580	3 years	Third-party landfill
Spent Air Desiccant	100	10 years	Third-party landfill
Spent Ion Exchange Resins for Water Treatment	200	7 years	Third-party landfill
Miscellaneous (filters, containers, domestic garbage, etc.)	To be determined	year	Third-party landfill
Wastewater for Deep Well Disposal			
Desalter reject water from process units	276	hour	Deep Well Disposal
Reject water from water treatment units	50.5	hour	Deep Well Disposal

Liquid and semi-liquid (sludge) waste management includes waste oils, spent liquid chemicals, sanitary sewage, and wastewater (Table 8). Waste oils will be stored in the existing slop oil tank and re-processed in the process units if suitable. Spent liquid chemicals, including contaminated oily wastes that are not suitable for re-processing, will be stored in designated containers, and shipped offsite by licensed third-party contractors for disposal or recycle. Sanitary waste will be hauled off-site by a licensed third-party contractor for further treatment and disposal.

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Appendix I. Information Required in Detailed Description of Designated Project

(SOR/2019-283 Schedule 2)

PART A

Updated General Information

- 1 The project's name, type or sector and proposed location.
- 2 The proponent's name and contact information and the name and contact information of their primary representative for the purpose of the description of the project.

PART B

Planning Phase Results

- 3 A summary of and the results of any engagement undertaken with any jurisdictions or other party, including a description of how the proponent intends to address the issues raised in the summary referred to in subsection 14(1) of the Act (Summary of Issues).
- 4 A summary of and the results of any engagement undertaken with Indigenous peoples of Canada, including:
 - a list of the Indigenous groups that may be affected by the project, including those groups that identified themselves during the planning phase as being potentially affected; and
 - a description of how the proponent intends to address the issues raised in the Summary of Issues, including the perspective of Indigenous groups regarding any potential adverse impact that the project may have on the rights of the Indigenous peoples of Canada recognized and affirmed by section 35 of the Constitution Act, 1982.
- 5 Any study or plan, relevant to the project, that is being or has been conducted in respect of the region where the project is to be carried out, including a regional assessment that is being or has been carried out under section 92 or 93 of the Act, or by any jurisdiction, including by or on behalf of an Indigenous governing body, if the study or plan is available to the public.
- 6 Any strategic assessment, relevant to the project, that is being or has been carried out under section 95 of the Act.

PART C

Project Information

- 7 A updated statement of the purpose of and need for the project, including any potential benefits.
- 8 The provisions in the schedule to the *Physical Activities Regulations* describing the project, in whole or in part.
- 9 A description of all activities, infrastructure, permanent or temporary structures and physical works to be included in and associated with the construction, operation and decommissioning of the project, including their purpose, size and capacity.
- 10 An estimate of the maximum production capacity of the project and a description of the production processes to be used.

11 The anticipated schedule for the project’s construction, operation, decommissioning and abandonment, including any expansions of the project.

12 A description of potential:

(a) alternative means of carrying out the project that the proponent is considering and that are technically and economically feasible, including through the use of best available technologies; and

(b) alternatives to the project that the proponent is considering and that are technically and economically feasible and directly related to the project.

PART D

Location Information and Context

13 A description of the project’s proposed location, including

(a) its proposed geographic coordinates, including, for linear development projects, the proposed locations of major ancillary facilities that are integral to the project and a description of the spatial boundaries of the proposed study corridor;

(b) site maps produced at an appropriate scale in order to determine the project’s proposed general location and the spatial relationship of the project components;

(c) the legal description of land to be used for the project, including, if the land has already been acquired, the title, deed or document and any authorization relating to a water lot;

(d) the project’s proximity to any permanent, seasonal or temporary residences and to the nearest affected communities;

(e) the project’s proximity to land used for traditional purposes by Indigenous peoples of Canada, land in a *reserve* as defined in subsection 2(1) of the *Indian Act*, *First Nation land* as defined in subsection 2(1) of the *First Nations Land Management Act*, land that is subject to a comprehensive land claim agreement or a self-government agreement and any other land set aside for the use and benefit of Indigenous peoples of Canada; and

(f) the project’s proximity to any federal lands.

14 A description of the physical and biological environment of the project’s location, based on information that is available to the public.

15 A description of the health, social and economic context in the region where the project is located, based on information that is available to the public or derived from any engagement undertaken.

PART E

Federal, Provincial, Territorial, Indigenous and Municipal Involvement and Effects

16 A description of any financial support that federal authorities are, or may be, providing to the project.

17 A list of any federal lands that may be used for the purpose of carrying out the project.

18 A list of the permits, licenses or other authorization that may be required by jurisdictions that have powers, duties or functions in relation to an assessment of the project's environmental effects.

PART F

Potential Effects of the Project

19 A description of any changes that, as a result of the carrying out of the project, may be caused to the following components of the environment that are within the legislative authority of Parliament:

- (a) fish and fish habitat, as defined in subsection 2(1) of the *Fisheries Act*;
- (b) aquatic species, as defined in subsection 2(1) of the *Species at Risk Act* (marine plants); and
- (c) migratory birds, as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*.

20 A description of any changes to the environment that, as a result of the carrying out of the project, may occur on federal lands, in a province other than the province in which the project is proposed to be carried out or outside of Canada.

21 With respect to the Indigenous peoples of Canada, the description of the impact — that, as a result of the carrying out of the project, may occur in Canada and result from any change to the environment — on physical and cultural heritage, the current use of lands and resources for traditional purposes and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, based on information that is available to the public or derived from any engagement undertaken with Indigenous peoples of Canada.

22 A description of any change that, as a result of the carrying out of the project, may occur in Canada to the health, social or economic conditions of Indigenous peoples of Canada, based on information that is available to the public or derived from any engagement undertaken with Indigenous peoples of Canada.

23 An estimate of any greenhouse gas emissions associated with the project.

24 A description of any waste and emissions that are likely to be generated — in the air, in or on water and in or on land — during any phase of the project and a description of the plan to manage them.

PART G

Summary

25 A plain-language summary of the information contained in parts A to F in English and in French.

Appendix II: Indigenous Groups Early Engagement Activities Log

Community	Engagement ⁹
Alexander First Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with the band’s leadership at the Project’s site • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • December 7, 2020 introduction conference call. No issues raised • December 11, 2020 Alexander First Nation provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band’s initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • January 25, 2021 held introductory virtual meeting. VCS sent previous engagement communication with AFN, as per AFN’s IRC office request. • February 17, 2021 further discussion with AFN’s leadership on project opportunities and application status
Alexis Nakota Sioux First Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band’s leadership at the Project’s site • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • February 27, 2020 phone call and email to arrange a meeting and further discuss the project (as per band’s request to IAAC) • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Athabasca Chipewyan First Nation	<ul style="list-style-type: none"> • June 12, 2019 in-person meeting at project’s site with band’s leadership as part of ongoing relationship. Provided status and overview of project • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress. ACFN requested Project description information. VCS forwarded both Summary and full IPD documents. • February 5, 2021 Email discussions regarding Project application and consultation protocol.
Beaver Lake Cree Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call and follow-up email to introduce the company and VCS-H Project and schedule a face-to-face meeting with band’s leadership at the Project’s site • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required

⁹ Due to COVID-19 restrictions, limited manpower capacity and Indigenous consultation pauses, there was a gap in the consultation timeline.

	<ul style="list-style-type: none"> • November 21, 2019 teleconference to introduce VCS and VCS-H project and expansion. No concerns raised. • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Blood Tribe	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress. Blood Tribe FN requested Project description information. VCS forwarded both Summary and full IPD documents. A virtual meeting was scheduled on February 3rd, 2021 • February 3, 2021 had video conference. Discussed VCS-H Project and the Expansion Application
Buffalo Lake Métis Settlement	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress • February 4, 2021 had video conference. Discussed VCS-H Project and the Expansion Application
Chipewyan Prairie Dene First Nation	<ul style="list-style-type: none"> • June 12, 2019 in-person meeting at project's site with band's leadership as part of ongoing relationship. Provided status and overview of project • August 22, 2019 in person meeting in Edmonton - introduced the VCS-H Expansion Project as part of ongoing relationship discussions • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • October 18, 2019 email communication regarding consultation protocol and to arrange a subsequent teleconference
Cold Lake First Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • December 9, 2020 Cold Lake First Nation provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • January 26, 2021 sent follow-up email to arrange a virtual meeting
Descendants of Michel First Nation	<ul style="list-style-type: none"> • February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • December 8, 2020 Descendants of Michel FN Association provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description

	<ul style="list-style-type: none"> January 22, 2021 had introductory virtual meeting to update Descendants of Michel FN on project application status and better understand their concerns. Preliminary concern is effect on environment and pristine reclamation. Requested to maintain the dialog.
Elizabeth Métis Settlement	<ul style="list-style-type: none"> February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity February 24, 2020 Elizabeth Metis email to arrange a meeting and requested shape files (VCS sent the files on the same day) February 27, 2020 VCS followed up on possible date for a teleconference March 5, 2020 VCS followed up on teleconference dates January 28, 2021 VCS sent a request for a virtual meeting to update on project's application progress February 3, 2021 had video conference. Discussed VCS-H Project and the Expansion Application. No concerns, just information gathering at this point to present to Council.
Enoch Cree Nation #440	<ul style="list-style-type: none"> June 17, 2019 Initial phone call and follow-up email to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required November 26, 2019 Enoch Cree commented they would like to conduct a Traditional Land Use Study and be involved in all archeological work February 4, 2020 face-to-face meeting at Enoch Cree's administration building to introduce VCS and VCS-H Project and Expansion March 19, 2020 VCS responded to Enoch Cree's letter dated Feb 10, 2020 (to AER)- Preliminary comments Regarding the VCS-H Expansion Project PTOR January 28, 2021 VCS sent a request for a virtual meeting to update on project's application progress
Ermineskin Cree Nation	<ul style="list-style-type: none"> June 17, 2019 Initial phone call and follow-up email to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity October 21, 2019 email correspondence to set up consultation procedures and further teleconference discussions November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required December 4, 2020 email correspondence to schedule to meet via videoconference, as referred by IAAC December 9, 2020 videoconference – provided update on project and Expansion and discussed consultation protocol. Primary project consideration stated were river, water contamination, animals, possible archaeological and burial sites. Requested capacity funding for map review and site assessment January 28, 2021 VCS sent a request for a virtual meeting to update on project's application progress
Fishing Lake Métis Settlement	<ul style="list-style-type: none"> February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity March 2, 2020 sent shapefiles, as per Fishing Lake's request

	<ul style="list-style-type: none"> January 13, 2021 IAAC informed VCS that Fishing Lake Metis Settlement stated that the Project does not fall within their traditional use areas and that they can be removed from the consultation list
Foothills Ojibway First Nation	<ul style="list-style-type: none"> February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity February 28, 2020 sent copies of notification letter and brochure to Chief O'Chiese of O'Chiese First Nation, due to understanding that Foothills Ojibway First nation is mostly represented by O'Chiese First Nation January 28, 2021 VCS sent virtual meeting request to Chief O'Chiese to update on project application's progress
Fort McMurray #468 First Nation	<ul style="list-style-type: none"> June 12, 2019 in-person meeting at project's site with band's leadership as part of ongoing relationship. Provided status and overview of project August 21, 2019 in person meeting in Banff – introduced the VCS-H Expansion Project as part of ongoing relationship discussions October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required. Provided further clarification on consultation related questions on the next day.
Friends of Michel Society (Michel First Nation)	<ul style="list-style-type: none"> February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity December 9, 2020 Michael First Nation provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description January 26, 2021 sent follow-up email to arrange a virtual meeting February 2, 2021 had a video conference. Discussed VCS-H Project and the Expansion application. Michel FN inquired about the infrastructure that VCS is planning to use to capture sour gas. VCS sent a subsequent email with an explanation.
Gunn Métis Local 55	<ul style="list-style-type: none"> October 11, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required December 9, 2020 Gunn Métis provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues. January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description January 26, 2021 sent follow-up email to arrange a virtual meeting
Kehewin Cree Nation	<ul style="list-style-type: none"> June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site February 21, 2020 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity January 27, 2021 VCS requested a virtual meeting to provide update on project application progress

Kelly Lake First Nation	<ul style="list-style-type: none"> • January 13, 2021 included into the consultation list, as per IAAC’s advice. Expressed interest in a meeting with VCS • January 26, 2021 VCS sent a request for a virtual introductory meeting and to discuss the project. KLFN forwarded their LOC sent to IAAC on January 25, 2021 • February 4, 2021 had video conference. Discussed VCS-H Project and the Expansion Application.
Kikino Métis Settlement	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • December 9, 2020 Kikino Métis Settlement provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band’s initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • February 2, 2021 had a video conference. Discussed VCS-H Project and the Expansion application. Initial concern is the environmental protection of the North Saskatchewan river (secondary water source for Kikino)
Louis Bull Tribe	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call and follow-up email to introduce the company and VCS-H Project and schedule a face-to-face meeting with band’s leadership at the Project’s site • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • November 20, 2019 Louis Bull Tribe commented that need more information about the project. Primary concern was the protection of North Saskatchewan river in the event of an accident • November 21, 2019 teleconference to introduce VCS and VCS-H Project and expansion. Requested commitment to protect the river. Would like to be on the notification list in the event of incidents • December 2019 teleconference and subsequent in person meeting on Dec 19, 2019 to discuss Project and Expansion, as part of ongoing business discussions. No major concerns raised • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress. Virtual meeting was scheduled for February 5th, 2021.
Métis Nation of Alberta – Region 4	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • October and November 2019 email communications to arrange a teleconference • November 25, 2019 teleconference to introduce VCS and VCS-H project and expansion. Discussed consultation protocol. No concerns raised. • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Montana First Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band’s leadership at the Project’s site • October 10, 2019 sent notification letter and brochure to update on Project status and company’s intention to file a regulatory amendment for expansion of the Project’s capacity • October 29, 2019 email correspondence to arrange a teleconference and further discuss the Project

	<ul style="list-style-type: none"> • October 30, 2019 teleconference to introduce VCS and VCS-H project and expansion. No concerns raised. No observable impacts on traditional land. MFN would like to be kept up to date on project progress and informed on opportunities for equity investment and contractual work/ bidding. • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
O'Chiese First Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Papaschase First Nation	<ul style="list-style-type: none"> • January 13, 2021 included into the consultation list, as per IAAC's advice • January 26, 2021 VCS sent a request for a virtual introductory meeting and to discuss the project
Paul First Nation	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • December 2020 Paul First Nation provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • January 26, 2021 sent follow-up email to arrange a virtual meeting
Piikani First Nation	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Saddle Lake Cree Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • October and November 2019 phone calls and subsequent email follow-ups to set up a teleconference call to discuss the project • February 25, 2020 phone call and email to arrange a meeting and further discuss the project (as per band's request to IAAC) • March 6, 2020 teleconference to discuss the project. No concerns raised • March 10, 2020 follow-up to arrange a teleconference for further discussions • March 19, 2020 left a phone message to set up a date for a teleconference for further discussions. • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress

Samson Cree Nation	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • November 19, 2019 Samson Cree provided their consultation procedures • December 4, 2020 emailed shape files (as per band's request to IAAC) • December 9, 2020 Samson Cree Nation provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • January 26, 2021 sent follow up email to arrange a virtual meeting
Siksika Nation	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Stoney Nakoda Nation	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • November 15, 2019 Stoney Nakoda provided comments that more time is needed to evaluate any site-specific concern. Consultation protocol and forms were provided as well. • November 25, 2019 sent filled consultation forms and project map to Stoney Nakoda • December 9, 2020 Stoney Nakoda Nations provided comments to the Initial Project Description. Primary issues and concerns listed in the Summary of Issues • January 19, 2021 VCS requested to arrange a discussion to better understand the band's initial concerns, as outlined in the documents submitted to IAAC regarding the Initial Project Description • January 26, 2021 sent follow up email to arrange a virtual meeting. Stoney Nakoda FNs consultant phoned back requesting a capacity funding for introductory meeting, per their consultation protocol
Tsuuti'na Nation	<ul style="list-style-type: none"> • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required • January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
Whitefish Lake First Nation #128	<ul style="list-style-type: none"> • June 17, 2019 Initial phone call and email to introduce the company and VCS-H Project and schedule a face-to-face meeting with band's leadership at the Project's site • October 10, 2019 sent notification letter and brochure to update on Project status and company's intention to file a regulatory amendment for expansion of the Project's capacity • November 14, 2019 sent a follow-up email if any questions, feedback or additional explanation is required



	<ul style="list-style-type: none">• January 27, 2021 VCS requested a virtual meeting to provide update on project application progress
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Appendix III: Summary of Issues and VCS Responses

Summary of Issues	VCS Response
Accidents and Malfunctions	
Clarity on potential pathways to groundwater contamination, such as overland flow and for accidental release of deleterious substances, and means to protect surface waters and near- surface potable groundwater aquifers from wastewater injection.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 23.1 of the Tailored Environmental Impact Statement Guidelines. ¹⁰ The issue is discussed in Section 19 of the Detailed Project Description.
Clarity on guidelines that will be followed in the event of accidental spills of fuels, hydrocarbons, chemicals, and waste products.	This issue will be addressed in the Impact Statement, to follow requirements in Section 23.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.
Potential effects to the environment, including water resources, wildlife, vegetation, and aquatic life, from accidents and malfunctions, such as spills from the storm water holding ponds, fuels, hydrocarbons, chemicals and waste products, failure of the water treatment system, explosion or fire from natural gas systems and hydrogen manufacturing units, failure of transport and storage structures for bitumen product, or incidents associated with other project components or activities, and means to mitigate or monitor effects.	This issue will be addressed in the Impact Statement, to follow requirements in Section 23.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.
Potential effects to water quality and wildlife health due to accidental release of propylene glycol during hydrotesting.	This issue will be addressed in the Impact Statement, to follow requirements in Section 23.1 of the Tailored Environmental Impact Statement Guidelines.
Acoustic Environment	
Potential effects, including an assessment of cumulative effects, to human health and well- being due to increased noise levels from project activities such as machinery use, blasting, drilling activities, and increased traffic, including timing of activities and proposed mitigation and monitoring plans.	This issue will be addressed in the Impact Statement, to follow requirements in Section 16 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Section 14 and Appendix IV in the A2 section of the Detailed Project Description.

¹⁰ <https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act.html> (modified 2020-11-27, retrieved 2021-01-11)

Alternative Means of Carrying Out the Project	
Clarity on alternative means of carrying out the Project, including any technologies and processes considered, justification for selection(s), including how greenhouse gas emissions were considered for selection(s).	This issue will be addressed in the Impact Statement, to follow requirements in Section 4.4 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 12 of the Detailed Project Description.
Atmospheric Environment	
Clarity on if the Canadian Ambient Air Quality Standards and objectives will be used to undertake an assessment of existing baseline and predicted future air quality application cases.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.
Potential effects and cumulative effects to the biological environment from settled air contaminants due to metals and polycyclic aromatic compound emissions, and nitrous oxides and sulfur oxides emissions.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.
Potential effects and cumulative effects to air quality and the health and well-being of local residents due to increased fugitive dust emissions and concentrations of particulate matter in the atmosphere from earth moving and project operations, and means to mitigate and monitor effects.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.
Potential effects to air quality due to emissions of criteria air contaminants (e.g. sulfur oxides, nitrous oxides, volatile organic compounds, and particulate matter) from petroleum and chemical storage, handling, processing, and wastewater treatment options.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.
Potential effects to air quality, including cumulative effects, due to emissions of criteria air contaminants (e.g., nitrous oxides, fine particulate matter, volatile organic compounds, sulfur dioxide, polycyclic aromatic compounds, and metals) from the combustion of diesel fuel in equipment, the processing of bitumen, and other relevant operations.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.
Potential effects to air quality outside of immediate region due to long-range transportation, and means to mitigate and monitor effects.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.

<p>Sources of air emissions affecting air quality throughout all phases of the Project, including nitrogen oxides, carbon monoxide, sulphur oxides, particulates, and volatile organic compounds.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.1 of the Tailored Environmental Impact Statement Guidelines. This issue is discussed in Appendix IV in the A1 section of the Detailed Project Description.</p>
<p>Climate Change and Greenhouse Gas Emissions</p>	
<p>Assessment of greenhouse gas emissions and contribution to climate change as per the Strategic Assessment of Climate Change¹¹, and description of how the Project aligns with the Government of Canada's long-term goal to achieve net-zero emissions by 2050.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 15.5 and 24 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Sections 7 and 23 of the Detailed Project Description.</p>
<p>Assessment of how Project fits under Alberta's 100 MT cap and Canada's goal to exceed 2030 greenhouse gas emission reduction targets.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 7 of the Detailed Project Description.</p>
<p>Clarity on the scope of activities included in the annual estimate of greenhouse gas emissions, an estimate of greenhouse gas emissions for each Project phase, and information on the methodology, data, emissions factors, and assumptions used to quantify greenhouse gas estimates.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 23 of the Detailed Project Description.</p>
<p>Clarity on the specific technologies and practices under consideration to reduce greenhouse gas emissions, including best available technologies and best environmental practices.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Sections 7 and 12 of the Detailed Project Description.</p>
<p>Effects on carbon sinks (e.g., forests, wetlands) that absorb carbon dioxide from the atmosphere, and the quantification of impacted land areas (e.g., forests, cropland, grassland, wetlands, and built up land).</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 23 of the Detailed Project Description.</p>
<p>Clarity on estimation for avoided greenhouse gas emissions, as per the criteria found in Section 3.1.1 of the Strategic Assessment of Climate Change.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 23 of the Detailed Project Description.</p>

¹¹ Government of Canada. 2020. Strategic Assessment of Climate Change, Revised October 2020. Available at <https://www.strategicassessmentclimatechange.ca/>

Cumulative Effects	
Potential for cumulative effects with existing and future projects and activities in the region, including to air and water quality and quantity (e.g., water withdrawals from the North Saskatchewan River), due to the large scale of industrial development in the Alberta Industrial Heartland.	This issue will be addressed in the Impact Statement, to follow requirements in Section 22 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 5 of the Detailed Project Description.
Social and Economic Conditions	
Potential effects on the crude oil and refined products market, including energy commodity prices, economic and financial indicators, energy security, investment trends and competitiveness issues.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 7 of the Detailed Project Description.
Potential effects to access and use of resources, such as education, information and services, and additional detail on plans to implement local employment and policies and planning, and increasing training, employment and retention of women and other under-represented groups.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 7 of the Detailed Project Description.
Effects of the Environment on the Project	
Potential effects of climate change on the Project that could lead to accidents and malfunctions or changes in baseline conditions, including clarity on measures or design features to increase the resilience of the Project to climate change.	This issue will be addressed in the Impact Statement, to follow requirements in Section 23.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 of the Detailed Project Description.
Federal Lands	
Effects assessments for air quality and associated impacts, noise, and health should include Elk Island National Park.	This issue will be addressed in the Impact Statement, to follow requirements in Section 14 of the Tailored Environmental Impact Statement Guidelines.
Fish and Fish Habitat	
Potential to cause harmful alteration, disruption, or destruction of fish habitat, or death of fish, and means to mitigate, offset, and monitor effects, including consideration of potential cumulative effects.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.
Clarity on methods to compare predicted and actual effects to fish and fish habitat and methods to avoid and mitigate effects to fish and fish habitat, and death of fish.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.

Offsetting plan for any harmful alteration, disruption, destruction to fish and fish habitat, or death of fish, including proposed monitoring to verify offsetting success.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.
Potential effects on life processes of fish in waterbodies with water withdrawal and/or water drawdown, or erosion and sedimentation.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.1 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 of the Detailed Project Description.
Potential effects to fish species of Indigenous cultural importance and clarity on measures to protect fish and fish habitat in the North Saskatchewan River through all Project phases.	This issue will be addressed in the Impact Statement, to follow requirements in Section 19.1 of the Tailored Environmental Impact Statement Guidelines.
Follow-up and Monitoring Programs	
Clarity on reclamation of land for the use of future generations.	This issue will be addressed in the Impact Statement, to follow requirements in Section 26 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 9 of the Detailed Project Description.
Human Health and Well-Being	
Clarity on the potential for emissions or the release of contaminants of potential concern, clarity on potential human receptors, and existing pathways for human exposure to contaminants of potential concern, and clarity on potential noise emissions that reach nearby human receptors.	This issue will be addressed in the Impact Statement, to follow requirements in Section 16 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 15 and Section A3 in Appendix IV of the Detailed Project Description.
Recommendation to conduct a Human Health Risk Assessment that contains all relevant contaminants and exposure pathways, and locations of human receptors relative to the Project.	This issue will be addressed in the Impact Statement, to follow requirements in Section 16 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 15 and Section A3 in Appendix IV of the Detailed Project Description.
Potential effects on local and regional drinking water sources, their proximity to the Project site, and location of drinking water treatment facilities, including consideration of accidents and malfunctions.	This issue will be addressed in the Impact Statement, to follow requirements in Section 16 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 15 and Section A3 in Appendix IV of the Detailed Project Description.

Indigenous Consultation and Engagement	
Need for ongoing meaningful and collaborative proponent engagement and Crown consultation with all Indigenous communities identified on the Agency’s consultation list throughout all Project phases.	This issue will be addressed in the Impact Statement, to follow requirements in Section 6 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 4 of the Detailed Project Description.
Need for consultation and engagement with Indigenous communities that respect Indigenous cultures, traditions, customary laws and protocols.	This issue will be addressed in the Impact Statement, to follow requirements in Section 6 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 4 of the Detailed Project Description.
Indigenous Knowledge	
Potential effects to Indigenous knowledge, language, and culture, and clarity on support for cultural initiatives related to their preservation, recording, and retention.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Indigenous Peoples' Use of Lands and Resources for Traditional Purposes	
Potential effects to wildlife and birds including ducks, geese and ungulates, and the quality of harvested traditional vegetation, aquatic and wildlife resources.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Potential effects and cumulative effects on current use in the area, access to preferred locations for harvesting, and impacts to the ability of Indigenous peoples to engage in and transmit cultural language, traditions, and practices.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Potential effects of increased fragmentation and loss of land and quality resources for use in traditional practices.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Support for study and understanding of the baseline, cumulative, and project-specific effects to traditional land use and rights.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.

Indigenous Peoples' Health and Well-being	
Potential effects and cumulative effects to Indigenous peoples' health through consumption or use of country foods (including duck eggs and fish) and medicinal plants exposed to contaminants from the Project in water, air, or soil.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.
Potential effects to Indigenous health and the use and enjoyment of traditional lands and waters, through reduced air quality or other direct exposure to contaminants.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.
Potential effects to Indigenous health and well-being due to influx of workers and resulting pressures on services and housing and the potential for race or gender-based discrimination or violence.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.
Indigenous Peoples' Rights	
Potential impacts and cumulative impacts to Aboriginal or Treaty rights, including the opportunity to jointly develop the assessment of rights.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 4 of the Detailed Project Description.
Concern that the benefits to Indigenous groups are identified without consideration of impacts to rights.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 12 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 4 of the Detailed Project Description.
Indigenous Peoples' Social and Economic Conditions	
Clarity on potential job and training opportunities for Indigenous peoples, including women and youth.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 17, 18 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.
Clarity on plans, processes, and reporting regarding engagement with and inclusion of Indigenous groups and businesses in economic and business opportunities.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 18 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.

Potential effects to social cohesion and community values, including through deterrence of traditional harvesting activities in the area, including focus on the differential effects to women, elders, and young people.	This issue will be addressed in the Impact Statement, to follow requirements in Sections 17, 18 and 19 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 22 of the Detailed Project Description.
Indigenous Peoples' Spiritual, Physical, and Cultural Heritage	
Clarity on if an archaeological or historic resource impact assessment has been completed and how Indigenous peoples have been, or will be engaged or informed.	This issue will be addressed in the Impact Statement, to follow requirements in Section 17.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Potential effects to structures, sites, or things of historical, archaeological, and paleontological significance to Indigenous peoples, and subsequent effects on Indigenous knowledge transmission.	This issue will be addressed in the Impact Statement, to follow requirements in Section 17.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Potential effects on Indigenous peoples' experience of the cultural landscape, in particular the North Saskatchewan River Valley, affecting cultural identity and transmission to future generations.	This issue will be addressed in the Impact Statement, to follow requirements in Section 17.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Support for study and understanding of physical and cultural heritage (e.g., ceremonial sites, burial sites, cultural landscapes) and sharing of information on any new findings.	This issue will be addressed in the Impact Statement, to follow requirements in Section 17.5 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 21 of the Detailed Project Description.
Migratory Birds and their Habitat	
Potential effects and cumulative effects to migratory birds due to the removal of nesting, foraging, staging, and overwintering habitat, including nesting areas and riparian habitat in the North Saskatchewan River valley.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.
Potential mortality of migratory birds due to contact with harmful substances that could result from accidental oil or chemical spills, and collisions with vehicles or project infrastructure, including consideration of cumulative effects.	This issue will be addressed in the Impact Statement, to follow requirements in Section 15.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.

<p>Potential effects and cumulative effects to migratory birds from sensory disturbance (i.e., noise, vibrations, light) and the presence of workers, such as avoidance of habitats adjacent to the site and disorientation or attraction to the Project area, resulting in injury or death. Include details on the amount, duration, frequency, and timing of sensory disturbances.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.</p>
<p>Navigation</p>	
<p>Clarity on potential effects to navigation, including construction details and methodology for works within a waterway, existing waterway infrastructure used in the Project, timing and quantity of water withdrawal and effects to navigation, and contribution to cumulative effects.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 17.3 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 9 of the Detailed Project Description.</p>
<p>Species at Risk, Terrestrial Wildlife, and their Habitat</p>	
<p>Potential effects and cumulative effects to wildlife and other species at risk due to loss of habitat and negative effects from potential changes in air, vegetation, water and soil quality, including from accidents or malfunctions.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 15.3 and 15.4 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.</p>
<p>Clarity on the pathways of effects to wildlife and habitat, including duration, scale, and location of activities, and baseline conditions, taking into consideration behavioural adaptability, presence, species limiting factors and population resilience.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.3 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.</p>
<p>Potential effects to species at risk, culturally significant species, terrestrial and aquatic wildlife and their habitat, including travel corridors, related to effects to the North Saskatchewan River and Astotin Creek.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 15.4 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 19 and Appendix IV in the A5 section of the Detailed Project Description.</p>
<p>Vulnerable Population Groups (Gender Based Analysis Plus)</p>	
<p>Inclusion of disaggregated baseline data to understand how the Project could potentially impact different population subgroups in different ways, including potential social, economic and health effects and community well-being.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines.</p>

<p>Potential effects on diverse groups of people and across Project phases, including clarity on efforts to narrow gender gaps and other disparities, as demonstrated through gender based analysis plus assessment and means of mitigation.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines.</p>
<p>Clarity on potential issues of gender based violence, such as sexual harassment, violence against women, human trafficking, and means to avoid or mitigate potential issues, including any policies or information on external interactions with Indigenous peoples in or around the Project, including potential for differential effects on women.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines.</p>
<p>Clarity on policies to reduce discrimination against Indigenous people identifying as Lesbian, Gay, Bisexual, Transgender, Queer, Questioning, Intersex, Asexual, Two-Spirit, etc. (LGBTQIA2S+) and to support such individuals in accessing and retaining employment, training, and career development.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines.</p>
<p>Need for identification and confirmation of potential effects with potentially impacted communities and Indigenous groups, including identification and avoidance or mitigation of adverse effects to vulnerable subgroups.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Sections 17 and 18 of the Tailored Environmental Impact Statement Guidelines.</p>
<p>Water – Groundwater and Surface Water</p>	
<p>Potential effects and cumulative effects, to groundwater recharge and discharge quantities, groundwater quality and levels, and groundwater-surface water interactions due to landscape alterations, drilling and usage of a deep groundwater disposal well for wastewater, the Project's groundwater management system, and wastewater streams for all project conditions (i.e. normal, start-up, worst-case, and upset conditions).</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 of the Detailed Project Description.</p>
<p>Potential effects on the deposition of particulate matter, and the introduction of high concentrations of erosion sediment, hydrocarbons, and other contaminants to surrounding waters from the operation of heavy equipment, bitumen processing, and land clearing.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 of the Detailed Project Description.</p>

<p>Potential effects on surface water quality of nearby waterbodies and watercourses, including the North Saskatchewan River and Astotin Creek watersheds, including consideration of interaction with groundwater in contact with process-affected waters.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 of the Detailed Project Description.</p>
<p>Potential effects to surface water quantity from river withdrawal, altered surface flows, and removal of wetlands.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.2 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 of the Detailed Project Description.</p>
<p>Wetlands</p>	
<p>Potential release of air contaminants that may lead to acidification of waterbodies and subsequent effects on aquatic and terrestrial wildlife and vegetation.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.3 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Section 14 and Appendix IV in the A1 and A8 Section of the Detailed Project Description.</p>
<p>Potential effects and cumulative effects on wetland function, direct loss of wetlands, quality of wetland habitat, and residual effects, including consideration of ecological functions of wetlands and any resultant effects to migratory birds, species at risk, and other wildlife, given that the Project overlaps with Astotin Creek and several open water, fen, marsh, and swamp wetlands.</p>	<p>This issue will be addressed in the Impact Statement, to follow requirements in Section 14.3 of the Tailored Environmental Impact Statement Guidelines. The issue is discussed in Sections 14 and 19 and Appendix IV in the A8 Section of the Detailed Project Description.</p>

Appendix IV: Proposed Approach and Scope for an Integrated Environmental Impact Assessment/Impact Statement

A1. Air Quality Assessment:

The Air Quality assessment will involve the preparation of an air dispersion modelling study of emissions from the proposed Expansion that meet the requirements of the Air Quality Model Guideline issued by Alberta Environment and Parks (AEP). The air quality assessment will include the modelling of maximum continuous emissions of various chemicals from the Project, as well as an assessment of non-routine process upset release / emergency flaring scenarios that may arise from the Project.

A1.1 Proposed Study Area

We propose to use the same 120 by 120 km dispersion model study area used in the June 2016 amendment application. This study area meets all requirements of the Air Quality Model Guideline and will provide results that can be compared directly with Original Application and 2016 Amendment.

A1.2 Modelling Approach

CALMET and CALPUFF models will be used and these models have been used in previous modeling projects in the Fort Saskatchewan and Heartland regions and are recommended by AEP. It is proposed that the most recent version of the software be used for this assessment.

Modelling scenarios will include:

- Project-Only Case – assessment of the Project only at operating conditions that would result in maximum air emissions;
- Baseline Case – assessment of existing and approved industrial sources within the study area plus appropriate ambient background concentrations;
- Application Case – assessment of the Project together with existing and approved industrial sources within the study area plus ambient background concentrations (Project-Only Case + Baseline Case);
- Planned Case – assessment of the Application Case plus all known planned developments in the study area that are not yet approved; and
- Up to three process upset release scenarios that may arise from non-routine events and operations at the Plant.

Sources from the Project will be separated into their own CALPUFF input file and modelled on their own. Similarly, each nearby industrial facility will be separately modelled. This will help reduce modelling time and the results for each of these individual modelling files will then be combined and processed using post-processing programs in CALPUFF.

Data will be generated for all averaging periods required for comparison against the Alberta Ambient Air Quality Objectives (AAAQO), including the recently updated objective for PM_{2.5} and the planned objectives for NO₂, and applicable standards from other jurisdictions. Predictions for PM_{2.5}, SO₂ and NO₂ will also be compared to the Canadian Ambient Air Quality Standards (CAAQS; CCME 2012). We recommend comparing to the most stringent standards of each, some of which may not come into effect until 2025.

A1.4 Regional Background Ambient Air Quality

Air quality information collected by the Fort Air Partnership (FAP) air quality monitoring network over the five most recent calendar years will be summarized. The air quality measurements from the stations nearest to the Plant will be analysed, as they are all located within about 15 km of the Plant. For reference, the 2016 Amendment considered the four stations selected in the Previous Amendment (BA Energy 2014a) were analyzed in this air quality assessment: Bruderheim, Elk Island and Lamont. Fort Saskatchewan will be used for CO only.

Data collected from these stations will be reviewed and curate a set of reliable and acceptable values for ambient background concentrations around the Plant that will account for non-industrial emission sources including the Edmonton Capital Region, naturally occurring sources, and distant industrial sources beyond the study area. These ambient background concentrations will be added to model predictions.

A1.5 Project Emissions

The chemicals that will be modelled in the assessment will be those expected in an upgrader in an industrialized area where PM_{2.5} and ozone are issues. These chemicals are expected to be emitted from stack sources as well as fugitive sources. As such we expect the following will be assessed:

- criteria contaminants including NO_x, SO₂, CO, PM_{2.5};
- specific VOCs such as BTEX to be determined and specific PAHs;
- odorous chemicals such as reduced sulphur compounds;
- acid deposition (PAI), depending on the magnitude of acid forming emissions;
- nitrogen deposition and NO₂ fumigation as it may affect local agriculture; and
- ozone.

Greenhouse Gas (GHG) emissions from the facility will also be calculated and compared to provincial and national totals. The GHG emission intensity, defined as the amount of GHG emissions generated per barrel of synthetic crude oil and/or diesel fuel will also be calculated and compared to industrial peers. Typically, the GHG analyses in EIAs are confined within the property boundary or fenceline of the project. However, it is amenable to expanding the GHG analysis beyond the Project's fenceline in order to capture the efficiencies inherent in the transportation and downstream processing of the higher-value crude blend produced by the Project.

Water vapour emissions will also be estimated for the visibility assessment.

The effects of Project emissions on climate change and the effects of climate change on the Project will be documented. The effects of Project water vapour emissions on visibility will be modelled.

Combustion-related emissions will be reviewed for compliance with relevant standards and guidelines, such as, but not limited to, *CCME National Emission Guidelines for Commercial/Industrial Boilers and Heaters* (1998), the *Federal Multi-sector Air Pollutants Regulations* (2016), and/or any other operating guidelines VCS wishes to achieve.

A2. Noise Impact Assessment:

The Assessment will focus on assessing the noise impacts of the Project, relative to the existing environmental noise climate in the area. The noise levels will be assessed relative to the AER Directive 038, the Alberta Utility Guideline (AUG) Rule 012, the NCIA regional/noise management plan, and the Health Canada noise guidelines.

The noise assessment scope would be as follows:

- Field study in the study area to review locations of area residential receptors, industrial noise sources, etc.
- Update previously generated noise model of VCS-H facility with proposed additional equipment

- Obtain the most recent NCIA regional noise model output
- Run noise modeling results and add in with NCIA regional noise model output to assess noise levels and compliance with the AER Directive 038, the NCIA regional noise management plan and (if required) the AUG Rule 012.
- Calculate appropriate noise assessment with respect to the Federal requirements. Specifically, the Health Canada document "Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise" (January 2017).
- Provide results in the form of a written noise impact assessment as per the requirements of the AER Directive 038, the NCIA regional/noise management plan, the AUG Rule 012, and the Health Canada noise document.

As the noise document from Health Canada is relatively new compared with other regulations, it is also worth noting that these new criteria rather are recommendations than specific requirements as stated clearly at the beginning of the document.

A3. Human Health Risk Assessment:

A3.1 HHRA Objective

The primary objective of the HHRA will be to evaluate the potential human health risks that would be posed by emissions from the VCS-H Expansion Project. Like other HHRAs completed in the Industrial Heartland, the assessment will focus on the extent that chemical emissions may influence the receiving environment (e.g., soil, food, water, and air quality) and how this will ultimately affect human health. The HHRA will consider all routes of exposure relevant to an agricultural exposure scenario. This will include air inhalation, dust inhalation, skin contact with soil, inadvertent ingestion of soil, consumption of locally grown crops and livestock, ingestion of water and possibly consumption of fish from the North Saskatchewan River.

The objective of the HHRA will be met by estimating the risks to public health resulting from both acute (i.e., short-term) and chronic (i.e., long-term) exposure to the Project emissions, considered on an incremental and cumulative basis.

A3.2 Methods

The assessment will be based on established methods published or endorsed by Alberta Health, Health Canada, Environment Canada, the Canadian Council of Ministers of the Environment and the United States Environmental Protection Agency. This approach is widely accepted and has been used successfully throughout Alberta's Industrial Heartland.

The HHRA will involve four steps or stages:

1. Problem Formulation, which includes the identification of the chemicals of potential concern (COPC), relevant exposure pathways, and the receptors of concern;
2. Exposure Assessment, which involves the quantification of the estimated rates of exposure for the COPC;
3. Toxicity Assessment, with the identification of health-based exposure limits and/or dose-response information for the COPC; and,
4. Risk Characterization, which involves the assessment of health risks based on the Exposure and Toxicity Assessments.

The HHRA is linked to the results of a number of disciplines, including air quality (primarily), surface water quality, groundwater quality (potentially), and vegetation. As such, there will be ongoing coordination with these disciplines to ensure that all relevant information is incorporated into the HHRA.

The HHRA will follow both provincial guidance (Alberta Health's 2011 Guidance on Human Health Risk Assessment for Environmental Impact Assessment in Alberta) and federal guidance (Health Canada's 2016 Guidance for Evaluating Human Health Impacts in Environmental Assessment: Air Quality) on how to assess health impacts through the EIA process for provincial and federal reviews.

A4. Socioeconomic Impact Assessment:

A4.1 Approach

The SEIA will follow the EIA approach of assessing environmental effects by describing and estimating the human environment with and without the Project, and under a cumulative development scenario.

The SEIA will address key socio-economic issues raised by the regulator and by regional stakeholders, including:

- effect of the Project on the Alberta economy, as well as fiscal contributions to the Provincial (taxes and royalties) and Federal (taxes) governments;
- employment effects;
- population effects, including potential use of camp-based commuting workforces
- effects of industry expansion and population growth on infrastructure and service levels in the region, including:
 - o housing;
- health, education, social and recreation services;
- emergency and police services;
- municipal, transportation and, if necessary, other infrastructure;
- municipal fiscal capacity; and
- others, as required;
- the socio-economic impact of the Project on Indigenous communities.

In addition to the above-listed standard elements of the ToR, a discussion will be included of the unique technology and processes being contemplated by VCS and position the Project in the broader context of improving oil sands economics in Alberta.

A4.2 Analysis of Project in Economic and Fiscal Terms

Methods will include:

- gathering and analyzing industrial development plans in the study area to show the role of the Project in the region's economy and workforce;
- gathering and analyzing selected municipal financial indicators to show the implications of the Project's municipal taxes on the host municipality;
- discussions regarding detailed project budget, work force estimates, and project execution methodologies for both construction and operations phases;
- discussions about onsite or near-site construction camps, expected host communities for permanent operations workers, and worker transportation options, in the context of workforce recruitment and effects mitigation;

- analyzing the project information, including the breakdown of local, Albertan, other Canadian, and foreign content of expenditures on labour, engineering, and equipment and materials, for both the construction and operations phases;
- estimating direct, indirect, and induced income and employment effects using provincial input-output model methodology, for both the construction and operations phases; and
- determine the Project effect on federal and provincial taxes as well as production royalties over the life of the Project.

A4.3 Labour Force Analysis

The labour force information of other projects to be considered in the Cumulative Effects Assessment will be reviewed and both the Project and cumulative labour force demands will be placed in the context of the existing labour force and expected competition from other, similar projects in the region and Alberta.

A4.4 Analysis of Population Effects

The labour force information of other projects will be reviewed in the discussion of cumulative effects; the potential effect on population associated with these projects will be discussed and placed in the context of the region's population and labour force.

A4.5 Analysis of Impacts on Service Providers and Infrastructure

Informed by population change estimates, effects by the various issue areas to service providers and infrastructure will be assessed in the context of the regional setting. Selected indicators will be used to assess change in service demand/supply, including for key social and municipal infrastructure.

Discussions will be held with selected service and infrastructure providers regarding current and anticipated future demands. The analysis will focus on both Project-related and cumulative activity-related effects and will consider key planning documents of relevance to the study area.

A4.6 Effects on Indigenous Communities

The SEIA will draw on information contained in the resource use and traditional land use sections of the EIA to provide a high-level discussion of the potential socio-economic effects of construction and operation of the Project on traditional land use and culture. The discussion will also be informed by consultations undertaken by VCS representatives with First Nations and Métis communities.

A4.7 Mitigation

Using the results of the analysis of population effects and effects on service providers and infrastructure and VCS activities in the community, mitigation measures will be proposed. Examples might include participation in regional coordination initiatives, Indigenous capacity building agreements, consultation and impact benefit agreements, commercial and other relationships with local communities, community investment, and others.

The study will explore other mitigation, or construction and operations phase activities that can alleviate Project effects. Examples include the use of construction camps, worker commuting systems (bus or plane), use of Living-Out allowances, and other actions.

A5. Wildlife Impact Assessment:

A5.1 Objectives

The wildlife assessment will be undertaken to meet the requirements outlined in the standardized Terms of Reference as well as the Guide to Preparing Environmental Impact Assessment Reports in Alberta (2013).

A5.2 Proposed Study Areas

It is expected that the Wildlife LSA will include all of the lease area plus a 250 m buffer zone to account for the potential effects of Project development on wildlife and wildlife habitat located immediately adjacent to the Project footprint.

The regional study area (RSA) is proposed to include area within a 4 km radius from the LSA boundary. This area (50 km²) reflects the average of two winter home ranges of moose (approximately 25 km²) in Alberta and will be used to assess potential regional effects on wider- ranging mammal species such as moose and deer. However, it should be noted that the RSA is largely made up of cultivated fields and industrial facilities with some forested areas associated with the North Saskatchewan River valley which may be refined further to reflect terrain and air shed characteristics.

A5.3.1 Wildlife Diversity and Reporting

To meet current environmental effects assessment requirements, there is a need to conduct an assessment of potential Project effects on natural biodiversity, both at the local (Project effects) and regional (cumulative effects) levels. Biodiversity reflects the number and composition of all living things and ecosystems in which they occur and is an important indicator of overall environmental health. A fundamental requirement of a biodiversity assessment is the need to quantitatively predict changes in natural biodiversity (from existing or baseline conditions) during Project development and following Project reclamation. In the case of wildlife biodiversity, total species richness and breeding bird diversity will be used as indicators to assess Project-related effects on habitat fragmentation and changes in landscape composition and heterogeneity. The recommended approach for the Project would follow the approach used in recent wildlife assessments for similar projects, which involves analysis of landscape configuration (using GIS) and wildlife species diversity (using baseline data collected during the wildlife surveys).

A5.3.2 Wildlife Assessment and Reporting

The wildlife assessment will follow current practice in Alberta and Canada with respect to the selection of Valued Environmental Components (VECs), selection of study boundaries, and identification of interactions between wildlife VECs and various Project components. The wildlife assessment is designed to ensure that all potential effects of the proposed Project relating to construction, operation and maintenance activities are identified and assessed in accordance with applicable provincial and federal acts, regulations and guidelines and that the final products are comprehensive and detailed enough to obtain the necessary regulatory approvals.

During and beyond its construction, operations, and reclamation phases, the Project will cause various modifications to terrain, vegetation, and drainage, all of which may have potential effects on wildlife. These effects include habitat loss and fragmentation, barriers to movement, increased risk of wildlife mortality, and effects on biodiversity. The assessment approach will follow current practice in Alberta with respect to the selection of Valued Environmental Components (VECs), selection of study boundaries, and identification of interactions between wildlife VECs and project components. The wildlife assessment is designed to ensure that all potential effects of the proposed project relating to construction, operation, and maintenance activities are identified and assessed in accordance with applicable provincial and federal acts, regulations, and guidelines and that the final product is sufficiently comprehensive and detailed to obtain the necessary regulatory approvals.

A6. Aquatic Resources Assessments:

A6.1 Objectives

The aquatic resources (hydrology, surface water quality and aquatic ecology) assessments will be undertaken in order to meet the requirements outlined in the standardized Terms of Reference as well as the Guide to Preparing Environmental Impact Assessment Reports in Alberta (2013).

This section outlines a scope of work for an integrated program of baseline studies and assessments for aquatic resources (hydrology, surface water quality, and aquatic ecology).

A6.2 Proposed Study Areas

Hydrology, surface water quality, and aquatic ecology will share a common study area. The study areas will be finalized till later stage, however, based on an initial review of existing information it is expected that the Local Study Area (LSA) will consist of:

- the Project Lease Area;
- Astotin Creek flowing downstream from south to north in and downstream of SW 03-054-21 W4M to its confluence with Beaverhill Creek; and
- Beaverhill Creek from its confluence with the unnamed creek to its confluence with the North Saskatchewan River (NSR).

It is expected that the Regional Study Area (RSA) for these three components will consist of the LSA plus the NSR downstream from its confluence with Beaverhill Creek downstream to the vicinity of Smoky Lake.

The Air Quality Regional Study Area will be used as the basis for assessments of potential effects of acidifying emissions on surface water quality and aquatic biology.

A6.3 Data Analysis and Preparation of Baseline Case, Impact Assessment, and Reporting

The results for the aquatic resources components will be presented in two concise, clearly-written documents (one for hydrology and another for water quality and aquatic ecology) consisting of a description of the Baseline Case, Application Case, and Planned Development Case.

The existing datasets, information, and the results of the field programs will be integrated into a comprehensive description of the Baseline Case for surface aquatic resources in regard to the proposed Project. This description will include a summary of existing conditions, identification of environmental disturbances from previous activities that have become part of baseline conditions.

This will be followed by the effect assessment on an issue-by-issue basis, for the Application and Planned Development cases, organized as follows:

- assessment of the validity of the causal relationships linking Project activities to possible changes in hydrology, surface water quality, and aquatic ecology;
- specification of mitigation measures to be implemented to prevent or avoid potentially negative environmental consequences of Project activities. Mitigation plans, enhancement measures, and schedules to address applicable regional, provincial, and federal policies will be emphasized. A focused effort will be applied to the identification of mitigation measures that eliminate or limit residual effects. A summary of aquatic resources present in the LSA and RSA will also be used to categorize sensitive ecosystem components, to allow predevelopment planning initiatives to account for, and where possible avoid or enhance, these critical areas;

- analysis and classification of residual impacts after the application of mitigation measures, presented separately for hydrology, surface water quality, and aquatic ecology. This will include potential effects of the Project on surface aquatic resources from acidifying emissions; and
- preparation of a plan to monitor environmental effects and manage environmental change to demonstrate that the Project will be operated in an environmentally-sound manner.

A7. Soil and Terrain Assessments:

A7.1 Objectives

Objectives of the baseline soil survey and impact assessment are based on the standardized Terms of Reference as well as the Guide to Preparing Environmental Impact Assessment Reports in Alberta (2013).

The environmental issues with respect to soils and terrain are anticipated to occur in areas of direct disturbance to the soil and terrain as a result of Project development. Other environmental issues as a result of the cumulative effects of the Project within the Regional Study Area (RSA) will also be assessed. Potential impacts to soil and terrain include:

- Soil quality – changes to soil and physical parameters as a result of soil movement, storage and replacement over the life of the Project (erosion, compaction, admixing, contamination, and decrease in suitable quantity of materials).
- Land Capability – removal and eventual replacement of soil materials and landforms may result in decreased capability of the reclaimed lands to provide equivalent capability as baseline conditions.
- Alteration of Terrain – Project development will result in the alteration of various landforms in the study area. Issues of post reclamation landscapes and drainage will be addressed.
- Soil Biodiversity – development of the Project may reduce the diversity of various soil types and landforms within the Local Study Area (LSA) and/or RSA. In some instances certain landscapes may be considered uncommon within the study areas.
- Potential soil acidification as a result of emissions related to the Project, current developments and future developments. Evaluation of potential soil acidification is completed on a regional scale (assessment of RSA).

The effects assessment will include an assessment of a baseline case, application case, and cumulative effects assessment case. Each case assessment will evaluate potential impacts to soils and terrain as a result of the actual or projected activity in the Project study areas.

A7.2 Proposed Study Areas

The Soil and Terrain LSA will include lands within the lease boundary. This LSA will allow for the evaluation of soils and terrain that may be potentially impacted as a result of the development of the Project. Most of these impacts involve direct surface disturbance, which will occur during Project construction, operation and reclamation.

The Regional Study Area (RSA) will be defined as the LSA plus a buffer area that will be selected based on requirements from other terrestrial disciplines and will include consideration of the following terrestrial requirements:

- ecosite phase classification boundaries;
- unique changes in surficial geology and terrain indicative of potentially acid sensitive soils, from a regional scale (1:50,000 mapping detail); and

- land area covered by the Potential Acid Input (PAI) isopleths that are equivalent to the Alberta Monitoring load (0.17 Keq/ha/yr). The size and distribution of the RSA will be determined upon completion of PAI modelling.

A7.3 Impact Assessment Report

The soils and terrain report for the EIA will include results of the soils and terrain baseline mapping and interpretations for both the RSA and LSA. The impact assessment for the Project will include three scenarios; a Baseline Case, Application Case and Planned Development (Cumulative Effects) Case. Environmental mitigation and monitoring activities and processes will be provided to minimize impacts to soil and terrain throughout the life of the Project and an impact assessment will be completed that summarizes residual impacts (if any) and Project significance on soils and terrain.

The baseline information and interpretations collected and mapped for the LSA and RSA (mapped for acid sensitivity) provides the current conditions within the soil and terrain study areas. This is considered the Baseline Case. A summary of existing conditions and mapped disturbances within the study areas will be described and considered as part of the baseline conditions for the Project assessment. The Baseline Case will be considered the benchmark data set from which the Application and Planned Development Cases are evaluated.

The Application Case assessment focuses on the soil resource within the LSA that will be affected by development of the Project. Environmental impacts to be discussed will focus on the description of potential environmental effects, mitigation, and residual effects that relate directly to the development, operation, and reclamation of the Project.

The Planned Development Case (PDC) assessment focuses on the cumulative effects. It is expected that the impact assessment detailed for the Application Case is the same as for the Cumulative Effects Case. Potential soil and terrain disturbances recorded or planned within the RSA are likely to have similar impacts as those discussed for the Application Scenario (i.e., erosion, soil admixing, and terrain impacts). As such, the two cases will be discussed in concert.

Activities that may impact the soil resource and associated terrain as a result of Project for the Application and PDC cases include:

- soil salvage and handling;
- soil stockpiling;
- development of Project infrastructure;
- operational activities – day to day operations that may result in effects to soil through accidental releases; and
- progressive reclamation.

Mitigative measures and monitoring activities will be recommended to minimize the potential effects of the Project on soil and terrain.

A8. Vegetation and Wetlands Assessments:

A8.1 Objectives

The assessment will be undertaken in order to meet the requirements outlined in the standardized Terms of Reference as well as the Guide to Preparing Environmental Impact Assessment Reports in Alberta (2013).

Potential effects with respect to vegetation, wetland resources and vegetation biodiversity are primarily related to clearing and grading for construction as well as operation of the Project. Potential effects include:

- loss of vegetation communities including communities of limited distribution;
- loss of vegetation species including rare plants, vegetation used for traditional use;
- the introduction and colonization of weeds and non-native invasive species;
- increased fragmentation and loss of upland, riparian and wetland habitats;
- sensitivities of peat wetlands and certain vascular and non-vascular species due to water fluctuations associated with pumping activities during construction and stormwater overflow to lowland communities during operations; and
- implications of vegetation changes for other environmental resources resulting in:
 - reduced terrestrial and aquatic habitat diversity and quantity;
 - changes in water quality and quantity;
 - increased erosion potential resulting from vegetation clearing; and
 - increased dust and air emissions resulting in potential soil acidification and other effects on vegetation.

A8.2 Proposed Study Area

It is expected that the Vegetation, and Wetlands LSA will include lands within the lease boundary. This LSA was selected to allow for the evaluation vegetation and wetlands that may be impacted as a result of the development of the Project. Most of these impacts involve direct surface disturbance, which will occur during Project construction, operation and reclamation.

Since ecological communities form the basis for ranges of wildlife species, the RSA boundary will be consistent with that used for the wildlife assessment. The RSA will include a buffer around the LSA.

The total area of the RSA will be selected to ensure that it captured the effects in the LSA as well as farthest measurable cumulative effects of the Project on vegetation and wetland resources. It will assess effects in the LSA while also identifying and quantifying environmental effects from other projects and land uses that potentially overlap with those of the Project.

Within the RSA, mapping will be conducted at a lower resolution than within the LSA and will utilize a coarser and more cost-effective dataset. Recent satellite imagery will be used to enhance recent disturbance within the RSA. The RSA map will serve as the basis for assessing cumulative effects. Available mapping (shapefiles) from the original EIA will also be utilized, if available.

Effects of Acidifying Emissions will be defined by the land area covered by the PAI isopleths that are equivalent to the Alberta Monitoring load (0.17 Keq/ha/yr). The size and distribution of the RSA will need to be determined upon completion of PAI modelling. If deposition modelling reveals PAI results that warrant a larger RSA, the RSA will be adjusted to reflect the appropriate PAI isopleths modelled for the Project.

A8.3 Impact Assessment Report

The development of the Project will result in both direct and indirect impacts to vegetation, wetlands, biodiversity, and habitat fragmentation. Direct effects result from clearing of vegetation resources during construction and operation leading to losses in area of ecosite phases and wetland types and changes in biodiversity. Indirect effects result from altered surface hydrology and groundwater levels, air emissions effects on soils and vegetation and habitat fragmentation.

The assessment will be based on three scenarios or cases: Baseline Case, Application Case and Planned Development Case (Cumulative Effects Assessment). Environmental effects on vegetation and wetlands, including biodiversity and fragmentation will be assessed after accounting for relevant mitigation measures. For the Project, mitigation measures are those proposed to be implemented during the construction, operation, and reclamation phases of the Project.

The baseline case includes existing environmental conditions, and existing and approved projects or activities. The Baseline Case will be considered the benchmark data set from which the Application and Planned Development Cases are evaluated.

The Application Case describes the Baseline Case in combination with potential residual and cumulative effects. Residual and cumulative effects will be described at both maximum disturbance (construction and operation) and after mitigation (closure).

A conservative maximum disturbance scenario will be used for the application case. Maximum disturbance assumes all construction and operation components of the Project are occurring concurrently, that is that all components of the Project are fully developed and operational at the same time (the entire Project footprint). Maximum disturbance scenario assumes no sequential reclamation within the Project footprint, and all Project phases are active until closure.

The Planned Development Case will consider the Baseline Case results (includes past studies; existing and anticipated future environmental conditions); the Application Case; and existing, planned and approved future projects or activities in the area.

A9. Conservation and Reclamation

A9.1 Objectives

The conceptual Conservation & Reclamation (C&R) Plan will utilize information obtained from other disciplines to develop a conservation and reclamation plan that meets the ToR, VCS' goals and objectives along with stakeholder requirements. The C&R Plan will include a soil handling plan to ensure that equivalent land capability is attained post reclamation.

The conceptual C&R plan submitted in the application outlines the expected processes (development, operations, and reclamation) that VCS will undertake to ensure the Project is developed responsibly and ensure equivalent capability and desired end land uses are achieved post reclamation.

A9.2 Conceptual C&R Plan

A C&R section will be provided for inclusion in the EIA and regulatory applications. The C&R plan will outline the expected processes (development, operations and reclamation) that VCS will undertake to ensure the Project (all components) is developed responsibly and to ensure equivalent capability and desired end land uses are achieved post reclamation.