Part A

Project Introduction
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A. PROJECT INTRODUCTION

A.1 The Project

Laricina Energy Ltd. (Laricina) Germain Project Expansion (Project) is located within the Municipal District of Opportunity No. 17 (MD Opportunity) in Townships 84 and 85, Range 22, West of the 4th Meridian (W4M), approximately 50 kilometres (km) northeast of Wabasca-Desmarais, Alberta (Figure A.1.1-1). Laricina’s total land base in the Germain area consists of 70 sections. Laricina plans to produce bitumen from the Grand Rapids Formation and holds rights in the Grand Rapids Formation in 63 (gross) sections which contain an estimated 2.4 billion barrels of bitumen in place. The technologies Laricina plans to use at Germain include Steam Assisted Gravity Drainage (SAGD) and Solvent Cyclic-Steam Assisted Gravity Drainage (SC-SAGD). The Germain development is a four phase project, with Phase 1 being the approved Germain Commercial Demonstration Project (Figure A.1.1-2). In this application, Laricina is applying for Phases 2, 3, and 4.

Laricina received approval for the Germain Commercial Demonstration Project (Phase 1) in October 2010 (ERCB Approvals 11509A & 11509B; EPEA Approval 242701-00-01). Laricina is currently constructing the Phase 1 Project, which is expected to be fully operational by the end of 2012. The approved Phase 1 Project is located in Sections 3 and 4, Township 85, Range 22 W4M, on Laricina’s Oil Sands Leases No. 7400060004 and 7400060005. The components of Phase 1 are presented in Table A.1.1-1.

<table>
<thead>
<tr>
<th>Table A.1.1-1 Germain Commercial Demonstration Project – Phase 1 Components</th>
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</thead>
<tbody>
<tr>
<td>Central Processing Facility (CPF) (16 ha; 2:1 SOR, SC-SAGD)</td>
</tr>
<tr>
<td>1 well pad (10 ha; 10 wellpairs)</td>
</tr>
<tr>
<td>Access road (0.2 km, 1.3 ha)</td>
</tr>
<tr>
<td>Surface pipelines (0.4 km, 2 ha)</td>
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<tr>
<td>Water source, water disposal, and observation wells (18 ha)</td>
</tr>
<tr>
<td>Soil storage and laydown area (15 ha)</td>
</tr>
<tr>
<td>1 borrow pit (6 ha)</td>
</tr>
<tr>
<td>Access road from Chip Lake Road to disposal well, including 9 borrow pits (132 ha)</td>
</tr>
<tr>
<td>Campsite (3 ha)</td>
</tr>
<tr>
<td>Miscellaneous (3 ha)</td>
</tr>
</tbody>
</table>

With this application, Laricina is proposing the Germain Project Expansion (Project) which will increase production from the Germain leases by 23,848 m³/day (150,000 bbls/d), from the currently approved production level of 795 m³/day (5,000 bbls/d) for a total of 24,643 m³/day (155,000 bbls/d). The proposed Project will integrate Phase 1 with three additional phases of development. Phase 2 will consist of a CPF, infrastructure and well pads and will increase production by 4,770 m³/day (30,000 bbls/d). Phases 3 and 4 will each consist of a CPF, infrastructure and well pads, and each will increase production by 9,539 m³/day (60,000 bbls/d). Laricina plans to utilize either SC-SAGD or SAGD technology in Phase 2 of the Project. This application presents two facility designs to facilitate flexibility for steam requirements for Phase 2. The first facility design is based on SC-SAGD with an SOR of 2.2 (SC-SAGD-2.2) and the second facility design is based on adding steam capacity to allow for operations based on an
SOR of 3.3 (SC-SAGD-3.3) should Laricina choose to employ SAGD technology. Laricina is requesting approval for Phase 2 based on the environmentally conservative SC-SAGD-3.3 case to allow flexibility to build either an SC-SAGD facility based on SOR of 2.2 or to build a SAGD facility based on an SOR of 3.3. Laricina plans to utilize SC-SAGD with an SOR of 2.2 in Phases 3 and 4 of the Project.

The proposed Project will consist of three CPFs, well pads to sustain production levels, access roads, pipelines, and associated infrastructure (e.g., source and disposal wells). Pending approvals, construction of Phase 2 will initially require 60 well pairs on six pads for Phase 2 SC-SAGD-3.3 operations or 38 well pairs on four well pads for Phase 2 SC-SAGD-2.2 operations, and will commence in 2013. Construction of the Phase 3 CPF and initial development of nine well pads, with the drilling of 100 SC-SAGD well pairs, will commence in 2016, while construction of the Phase 4 CPF and initial development of five well pads, with the drilling of 100 SC-SAGD well pairs, will commence in 2020. The initial development required by each of the expansion phases to reach full production (23,848 m³/day or 150,000 bbls/d) is shown on Figure A.1.1-3. As production begins to decline, additional well pairs will be drilled to maintain production levels for the life of the Project (Figure A.1.1-4 and Figure A.1.1-5).

The components of the proposed Project and their spatial requirements are summarized in Table A.1.1-2.

<table>
<thead>
<tr>
<th>Table A.1.1-2 Project Components</th>
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<tbody>
<tr>
<td><strong>Project Components</strong></td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
</tr>
<tr>
<td>CPF (54 ha; 3.3:1 SOR, SAGD)</td>
</tr>
<tr>
<td>5 single well pads (8 ha each; 10 well pairs each)</td>
</tr>
<tr>
<td>1 double well pad (12 ha each; 20 well pairs each)</td>
</tr>
<tr>
<td>Surface pipeline corridor (5.2 km, 21 ha)</td>
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<tr>
<td>Access corridor (5.3 km, 11 ha)</td>
</tr>
<tr>
<td>Pipeline tankage (25 ha)</td>
</tr>
<tr>
<td>2 borrow pits (91 ha)</td>
</tr>
<tr>
<td>2 water disposal wells (3 ha)</td>
</tr>
<tr>
<td>3 water monitoring wells (2 ha)</td>
</tr>
<tr>
<td>6 observation wells (4 ha)</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
</tr>
<tr>
<td>CPF (98 ha; 2.2:1 SOR, SC-SAGD)</td>
</tr>
<tr>
<td>8 single well pads (8 ha each; 10 well pairs each)</td>
</tr>
<tr>
<td>1 double well pad (12 ha each; 20 well pairs each)</td>
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<tr>
<td>Surface pipeline corridor (4.6 km, 18 ha)</td>
</tr>
<tr>
<td>Access corridor (9.4 km, 19 ha)</td>
</tr>
<tr>
<td>1 borrow pit (119 ha)</td>
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<tr>
<td>Project Components</td>
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<tr>
<td>--------------------</td>
</tr>
<tr>
<td>12 water source wells (10 ha)</td>
</tr>
<tr>
<td>4 water disposal wells (3 ha)</td>
</tr>
<tr>
<td>1 observation wells (1 ha)</td>
</tr>
<tr>
<td>Campsite (52 ha)</td>
</tr>
<tr>
<td>CPF (94 ha; 2.2:1 SOR, SC-SAGD)</td>
</tr>
<tr>
<td>5 double well pads (12 ha each; 20 well pairs each)</td>
</tr>
<tr>
<td>Surface pipeline corridor (6.3 km, 26 ha)</td>
</tr>
<tr>
<td>Access corridor (1.2 km, 2 ha)</td>
</tr>
<tr>
<td>1 borrow pit (10 ha)</td>
</tr>
<tr>
<td>19 single well pads (8 ha each; 10 well pairs each)</td>
</tr>
<tr>
<td>35 double well pads (12 ha each; 20 well pairs each)</td>
</tr>
<tr>
<td>Surface pipeline corridor (37.4 km, 150 ha)</td>
</tr>
<tr>
<td>Access corridor (6.2 km, 12 ha)</td>
</tr>
<tr>
<td>2 borrow pits (65 ha)</td>
</tr>
</tbody>
</table>

**TOTAL FOOTPRINT** 1,650

The estimated gross footprint will be 1,650 ha and with progressive reclamation the active footprint at any given time will be considerably less.

A number of the components constructed and used for operating the Phase 1 Project will be used for the proposed Project (e.g., main roads, fuel gas pipelines, source and disposal wells and associated pipelines). However, the current Germain construction camp, capable of housing 350 to 500 workers, will not be able to support the additional workforce required to build Phases 3 and 4, therefore Laricina is proposing the construction of additional camp to the northeast of the Phase 3 and 4 CPFs at SE12-85-22 W4M.

Natural gas will be the fuel source for the proposed Project and will be supplied by the TransCanada pipeline system. Electrical power for the facility will be provided through an ATCO system substation located approximately 3 km north of the CPFs.

Water for steam generation will be sourced from existing and proposed wells completed in the lower and/or middle sand of the Grand Rapids Formation. Steady-state water requirements will be 1,010 m³/d for the SAGD case (SC-SAGD-3.3) and 574 m³/d for the SC-SAGD-2.2 case for Phase 2, and 1,130 m³/d for each of Phase 3 and Phase 4. The waste water disposal zone will be the Grosmont A unit of the Grosmont Formation with estimated disposal rates of 2,609 m³/d for Phase 2 SC-SAGD-3.3 and 1,626 m³/d for Phase 2 SC-SAGD-2.2, and 3,234 m³/d for each of Phase 3 and Phase 4.
Laricina intends to ship its dilbit product by pipeline with some provision to truck until such time as the diluent and dilbit transportation pipelines are built. Laricina still plans to construct truck racks at each of the three CPFs in the event of a pipeline interruption.

During operation of the proposed Project, Laricina will take measures to mitigate the environmental impact that may occur as a result of development. Laricina will fully engage in stakeholder consultation and comply with all regulatory requirements. A safe and healthy working environment will be key to Laricina’s operation of the Project.

A.2 The Proponent

Laricina Energy Ltd. is a privately held, Calgary-based company that is creating value by developing Canada’s oil sands using innovative in-situ technologies (SAGD and SC-SAGD).

Laricina has a portfolio of targeted oil sands assets containing a variety of reservoir environments and geological character. These assets range from the familiar oil sands of the McMurray Formation to the less developed Grand Rapids, and Grosmont Formations and Winterburn carbonate formations, all of which offer significant resource potential. Laricina’s diverse portfolio of oil sands assets are at varied stages of development.

Laricina is a responsible energy company that will contribute supply to the growing demand for crude oil through in-situ oil sands development with an exceptionally experienced technical team.

A.3 Project Alternatives

Laricina has investigated development alternatives for its Germain lease block beyond its initial 795 m³/day (5,000 bbls/d) Commercial Demonstration Project (Phase 1) with the main objective to realize the potential value of its oil sands reserves, with consideration to continue to supply the marketplace with a reliable source of bitumen production over the long term and to continue a positive economic contribution to the local, provincial and national economies. The principles followed include, but are not necessarily limited to the following:

1. **Upfront Learnings:** Establish a plan that facilitates learning on initial smaller phases that provide for optimization of recovery factors, cost minimization and technological advancement. Deriving learnings from initial smaller phases allows the optionality to implement learnings on subsequent larger phases, while preserving the flexibility to more efficiently optimize phases already on-stream.

2. **Scalability:** Economies of scale will be realized at Germain as larger future phases are brought on stream. The dual effect of economies of scale and accumulated learnings on previous phases will allow for accretive returns as the Project progresses.

3. **Risk Mitigation:** Optimizing on standard phase sizes allows for more controlled risk management for capital availability, labour sourcing, project execution and managing timelines; smaller project phases are inefficient and too large of phases may become difficult to finance and execute.
4. **Cost Containment:** Oil sands cost inflation is best contained through a phased approach to development and in sizes of development in increments of 30,000 bbls/d due to standard equipment sizing, module size, transportation and logistics of equipment. Smaller and larger phases were reviewed to reach the full Project Expansion but were not optimal for cost containment.

5. **Stakeholder Concerns:** A staged approach to development allows for stakeholder concerns to be more efficiently addressed upfront and incorporated into subsequent phases.

6. **Infrastructure:** A significant amount of infrastructure for the initial phase of development is already in place and will be integrated into subsequent phases which are effective and cost efficient. Additional infrastructure will be developed in stages as required so as to minimize the overall land disturbance that otherwise would be required if the full 23,848 m³/day (150,000 bbls/d) Project Expansion was developed in one phase.

7. **Continuous Economic Benefits and Long Term Sustainable Commodity Development:** Building in phases provides the existing workforce continuous employment and the opportunity to reside and commute to work without being relocated. Additionally local businesses benefit from a steady economic development plan and can build their required business capabilities over time without large capital outlays which otherwise may not be feasible to meet the vendor requirements of a large project plan.

Laricina has systematically approached the issue of how best to optimize stakeholder value. A phased approach is believed to be consistent with the staged, responsible development of the oil sands resource, while permitting on-going optimization and maximizing value for all stakeholders.

### A.4 Approvals

Laricina is currently constructing Phase 1 of the overall Germain project development, *i.e.*, the Germain Commercial Demonstration Project, and expects to commence operations by 2012 (Figure A.1.1-2). This phase has a design capacity of 795 m³/d (5,000 bbls/d) of bitumen production. Laricina plans to expand the productive capacity of operations by an additional 23,848 m³/d (150,000 bbls/d) of bitumen production, leading to an overall production capacity of 24,643 m³/d (155,000 bbls/d) of bitumen production.

Laricina plans to employ SAGD and SC-SAGD bitumen extraction and procession technologies. The expansion will employ “more of the same” technology. The existing infrastructure, both internal and external, will be used and expanded as required.

### A.4.1 Name of the Applicant

The name of the applicant for the Project is Laricina Energy Ltd.

The address of the applicant is:
Laricina Energy Ltd.
East Tower, 5th Ave Place
Suite 800, 425 - 1st Street SW
Calgary, Alberta T2P 3L8

Correspondence concerning this application should be directed to the above address to the attention of:

Name: Deepa Thomas, B.Sc., Manager – Regulatory and Environmental Performance
Phone: (403) 718-8810
Fax: (403) 263-0767
E-mail: DThomas@laricinaenergy.com

A.4.2 Existing Operations and Approvals
Laricina began construction of the Phase 1 Project in 2011. Laricina holds the following approvals for the Phase 1 Project:

- Germain Commercial Demonstration Project EPEA Approval - No’s. 242701-00-00 & 242701-00-01
- ERCB Scheme Approval – No. 11509A

Laricina holds numerous Alberta Sustainable Resource Development (SRD) and MD Opportunity approvals for the existing project. These are described further in Section D.13 of the Application.

A.4.3 Expansion Activities and Approvals/Amendments

**Energy Resources Conservation Board**

Laricina plans to maintain the ERCB facility license for the Phase 1 CPF, and to apply for individual facility licenses for each of the proposed CPFs. The Phase 1 CPF will maintain its currently approved production capacity of 795 m³/d (5,000 bbls/d). Laricina is applying to amend the Phase 1 approval to increase production capacity to 23,848 by 4,770 m³/day (30,000 bbls/d) for Phase 2 and by 9,539 m³/day (60,000 bbls/d) for each of the Phases 3 and Phase 4 for a total production capacity of 24,643 m³/day (155,000 bbls/d). The sulphur emissions at each of the three additional facilities are expected to be below one tonne per day. Sulphur control (as per ERCB Interim Directive 2001-3) will occur if any of the facilities exceeds one tonne per day.

Laricina has an approved Project Area for the Phase 1 Project which is shown on Figure A.1.1-2. Laricina is applying for approval of additional Project Area required to supply bitumen for the life of the Project. Laricina is confident that sufficient bitumen exists in this area to sustain the Project for an estimated 30 years.

Laricina is seeking the following from the ERCB:
LARICINA ENERGY LTD.
Part A: Project Introduction
Germain Project Expansion

- scheme approval of the proposed Project and approval of each of the proposed facilities, pursuant to Section 10 and 11 of the *Oil Sands Conservation Act*, respectively, and Section 3 and 33 of the *Oil Sands Conservation Regulations*;
- approval of the requested Project Area required to provide bitumen for the life of the Project; and
- approval to construct and operate additional distribution and gathering pipeline systems within the Project Area, pursuant to Section 4 of the *Pipeline Act*.

**Alberta Environment**

Laricina plans to amend the Phase 1 Project EPEA Approval to include the proposed Germain Project Expansion, which includes all components specified in Table A.1.1-2, encompassing approximately 1,650 hectares over the life of the Project. The legal location of the Project is provided in Table A.4.3-1.

| Table A.4.3-1 Location of Phase 1 and Proposed Project |
|-------------------------|---------|------------|----------------------|
| Stage                  | Township | Range | Meridian | Section or Portions of |
| Phase 1                | 85       | 22    | W4M      | W ½ 3, E ½ 4, SW 4 |
|                        | 84       | 22    | W4M      | NW 34, N ½ 33        |
| Expansion              | 85       | 22    | W4M      | 1, 2, 3, 4, 5, 6, N ½ 8, W ½ 9, NE 9, 10, 11, 12, SW 14, SE 15, SE 16, E ½ 17 |
|                        | 84       | 22    | W4M      | N ½ 7, SE 7, NE 8, W ½ 8, W ½ 13, E ½ 14, E ½ 15, SW 15, S ½ 16, S ½ 17, S ½ 18, N ½ 19, N ½ 20, 21, 22, SW 24, N ½ 24, S ½ 25, N ½ 26, 27, 28, 29, E ½ 30, SW 30, N ½ 31, 32, 33, 34, 35, W ½ 36, NE 36 |

Laricina will amend the pending Phase 1 *Water Act* Licence for the additional water required for the proposed Project.

Laricina is seeking approval, pursuant to Part 2, Division 2 and Section 66 of the Alberta *Environmental Enhancement and Protection Act*, to construct, operate and reclaim the various components of the proposed Project.

In support of this Application, Laricina submits the Environmental Impact Assessment Report (Report) to the Director for his review, pursuant to Section 50 of the *Environmental Protection and Enhancement Act*, and for a decision, in due course, by the Director that the Report is complete, pursuant to Section 53 of the *Environmental Protection and Enhancement Act*. 
A.4.4 Additional Approvals Associated with the Application

Laricina will file separate applications for other aspects of the proposed Project under the appropriate statutes. The provincial application and approval requirements applicable to this Project will be submitted separately and will include, but is not limited to, the following:

Surface rights dispositions pursuant to the *Public Lands Act*:

- Mineral Surface Lease (MSL) for CPF site;
- MSL for new well pads, observation wells, disposal wells, source water wells;
- Pipeline Agreement (PLA) for pipelines connecting the source and disposal wells to the CPF site; and
- Electrical distribution line.

Well licences as required under the *Oil and Gas Conservation Act*:

- Class III License for Injection Pursuant to ERCB Directive 051: Injection and Disposal Wells – Well Classifications, completions, Logging and Testing Requirement;
- Class 1B Disposal Well Licenses (ERCB Directive 051 and ERCB Directive 065);
- Clearance to construct the Project facilities in accordance with the Historical Resources Act; and
- A Development Permit issued from the Regional Municipality of Opportunity pursuant to Part 17 of the Municipal Government Act.

Laricina is not aware of any federal permit applications or approvals that are required for the proposed Project. In the event approval from federal agencies is subsequently required, Laricina will make separate application directly to the appropriate regulatory authorities.

A.4.5 EIA Report and Application Guide and Description

The Environmental Impact Assessment (EIA) Report and Integrated Application for approval to the ERCB and AENV has been integrated in accordance with the guidelines to facilitate an efficient review of the application by the regulatory review agencies and the public. This EIA Report and Application for the Project is presented in three volumes that consist of the following components:
In accordance with the “Guide to Content of Industrial Approval Applications”, Alberta Environment, 1999, the EPEA approval application has been provided as a separate stand-alone volume separate from the EIA Report and Integrated Application. The EPEA approval applications are included in one binder consisting of the following components:

**EPEA Application**
- EPEA Application
- Appendix A – Terms of Reference and Concordance Table
- Appendix B – Existing Approvals
- Appendix C – Stakeholder Consultation
- Appendix D – Soil Data
- Appendix E – Conservation and Reclamation Plan
A.5 Regional Setting

The proposed Project is located approximately 50 km northeast of Wabasca-Desmarais within Townships 84 & 85, Range 22 W4M (Figures A.1.1-1, A.1.1-3, A.1.1-4, and A.1.1-5). There are no permanent dwellings located in the vicinity of the Project.

The Project is located in the watershed of the Wabasca River and lies within the Central Mixedwood Subregion of the Boreal Forest Natural Region of northern Alberta. This low-relief plain is relatively poorly drained, and organic soils are dominant in the region. The largest of all subregions in Alberta, the Central Mixedwood is characterized by a mosaic of aspen, mixedwood and white spruce forests on uplands and coniferous swamps, bogs and fens in lowlands. This area is characterized by jack pine on dry and/or sandy sites and by black spruce and tamarack on wet sites. White spruce, aspen, balsam poplar, white birch and balsam fir occur in admixtures or separately on the more mesic sites. Fens and bogs are also typical of the Central Mixedwood Subregion. Luvisolic soils are typical of uplands while Organic soils are dominant in wet, poorly drained areas. Several large mammals could occur in the area, including woodland caribou, moose, grey wolf, black bear, mule deer and white-tailed deer. Other mammal species potentially occurring in the area include coyote, lynx, fisher, ermine, least weasel, marten, little brown and big brown bats, red backed vole and red squirrel.

All of the lands within the Project area are Crown land administered by Alberta Sustainable Resource Development (ASRD) in Fort McMurray. These lands are within the Athabasca Oil Sands Designated Area and Caribou Range Restricted Area 000129 (Wabasca-Dunkirk). The Project lies within the Municipal District of Opportunity’s “Resources (land-use) District” with oil sands development being a discretionary use within this land use district.

There are three active Registered Fur Management Areas held over the Project Area. The legal description of Project Area lands held under the various TPA’s are as follows:

- TPA # 2583, August Beaver all Project Area found within 085-12W4M
- TPA #763, Francis Auger 7-8, 15-22, 27-24-084-22W4M
- TPA #1425, Raymond D Auger 13-14, 23-26, 35-26-084-22W4M

The primary land use within the Project area and near vicinity is oil sands development; however, petroleum and natural gas development, forestry, and trapping also occur in the area. These are described in greater detail in Section D.13 of the Application.

A.5.1 Regional Initiatives

Laricina’s regional initiatives revolve around consultation and stakeholder involvement. Under these initiatives, socio-economic issues are being addressed, specifically in regard to business opportunities, capacity building, and Laricina’s Trapper Compensation Program. The Project stakeholders in the region have been identified and a comprehensive list has been compiled. The stakeholder consultation is described in more detail in Part F. Laricina recognizes the need for regional cooperation among the wide variety of stakeholder groups to ensure successful and sustainable oil sands development. Laricina has already developed a relationship with the
Bigstone Cree Nation, Métis Local #90 and the Bigstone Trappers, of which some participated in the wildlife, vegetation and soils, and Traditional Land Use Assessments field studies during 2009 and 2010. Additionally, a significant portion of the exploration and development programs have been awarded to local businesses. Laricina will continue to build and maintain good working relationships with all regional stakeholder groups and individuals that have an interest in the oil sands development area as the Project progresses.

Laricina opened an office in the community of Wabasca-Desmarais in March 2008. The office provides a permanent workspace for the Community Relations Coordinator. The office has been well received by the community as it enables direct access to Laricina and readily facilitates addressing any questions or concerns.

A.6 Project Schedule

The schedule below illustrates timelines for main activities associated with the Germain Project Expansion (Table A.6-1). Detailed engineering for Phase 2 will commence in Q1 2012 which will be followed by equipment ordering, shop fabrication, earthworks and field construction lasting through the summer of Q1 2014. Commissioning and start-up of Phase 2 will take place in Q4 of 2014. Detailed engineering of Phase 3 will commence in Q2 2015 with construction starting in Q1 2016 and commissioning and start-up in Q4 of 2018. Detailed engineering of Phase 4 will commence in Q2 2018 with construction starting in Q3 of 2018 and commissioning and start-up in Q3 of 2021.

Figure A.1.1-4 illustrates the overall development plan and well pad placement which will be constructed and commissioned as indicated in Table A.6-1.
Laricina has adopted a phased approach which facilitates efficient development of its oil sands resources. This approach mitigates the risk of both time delays and cost pressures associated with traditional large scale oil sands projects. However, there are other risk variables that could impact the proposed timeline. These variables include regulatory approval, financing, market conditions and production results from the Phase 1 Project.

### A.7 Stakeholder Consultation Summary

#### A.7.1 Stakeholder Consultation Philosophy

Laricina is committed to open and transparent communication with our stakeholders and the nearby communities. Laricina, since its initial presence in the Wabasca area in 2006, has developed and maintained an effective public consultation program in the Wabasca area since 2006 with all relevant stakeholders including the Bigstone Cree Nation (BAN), the Métis Local 90, the MD of Opportunity #17 and the newly designated Peerless Trout First Nation. Laricina’s consultation program relies primarily on face-to-face consultation, such as group and individual meetings, to communicate to the community regarding Laricina’s operations in the area. Laricina’s consultation program was developed in cooperation with the BCN’s Government and Industry Relations (GIR) Office. The program represents preferred methods of consultation which are consistent with the Laricina principle that personal contact is the most effective and preferred method of consultation with individuals and groups alike.

Locally acceptable engagement methods include:

- Workshops;
- Project-specific local open house;
- Small group meetings;
- Informal and formal presentations;
A presence in the community resulting in informal meetings (Laricina maintains an office and staff in Wabasca-Desmarais);
Tours;
Field studies (e.g., traditional land use assessment); and
Follow up on questions, concerns and ideas.

Laricina intends to maintain and enhance its consultation program as long as it has interests in the Wabasca-Desmarais area. It will design and implement future public involvement initiatives that will make every reasonable effort to utilize communication and consultation methods best suited to the needs of its neighbours.

A.7.2 Consultation Activities

A.7.2.1 Aboriginal Communities
Laricina has consulted with the following Aboriginal communities:
  - Bigstone Cree Nation
  - Peerless-Trout First Nations
  - Métis Local 90

Laricina representatives have participated in workshops, community events, informal and formal presentations and have further augmented the personal contact approach with written communication including, but not limited to, company newsletters, annual reports, project description brochures and notification letters.

A.7.2.3 Trappers
Laricina has consulted with the following trappers who have interests on the Germain leases: Bert Alook, Francis Auger, Raymond D. Auger, August Beaver, Martin Beaver, Raymond Peters.

Laricina representatives have participated in workshops, community events, informal and formal presentations and have further augmented the personal contact approach with written communication including, but not limited to, company newsletters, annual reports, project description brochures and notification letters.

A.7.2.4 Other Stakeholders
Laricina has consulted with the other stakeholders through a number of communication methods, including community events, discussions through organized meetings, and consultation by correspondence (i.e., telephone, email, information letter). Laricina is committed to providing the stakeholders with timely, accurate information in a manner that is conducive to understanding throughout the project approval process and life of the Project.
A.7.3 Issues Raised

Through the consultation activities that Laricina has undertaken, three primary concerns have been consistently raised:

- **Economic Opportunities** - members of the communities have expressed concerns about work opportunities with Laricina. Bigstone Cree Nation (BCN) members also identified the need for providing more work opportunities for single person company or operation.

- **Access** - BCN trappers have raised concerns regarding access to their traplines being impacted by the Project during construction, as well as, increase in the number of non-Aboriginal hunters resulting from Laricina’s road development.

- **Environmental** - members of the community identified concerns with respect to the use of solvent in the recovery process, the potential for ground to collapse and for contamination of surface water due to deep well wastewater disposal.

The above are three examples of the most common concerns related to the Project. The specific issue and Laricina’s response to each concern are cited in Part F of the Stakeholder Consultation Section of the Project Application.

A.7.4 Traditional Knowledge and Traditional Land Use

Laricina has actively engaged traditional knowledge holders, through interviews and site visits, to identify traditional land use activities and knowledge within the area of Laricina’s development activities. A description of this information is provided in Appendix 7 of the EIA Report and Application.

A.8 Summary of Environmental, Historical Resources and Socio-Economic Impact Assessment

A.8.1 Air Quality

The potential effects of the Project on air quality at nearby receptors are discussed in Section D.1 and Consultants Report #1 (CR #1).

The LSA and RSA were chosen based on the location of major regional industrial emission sources and the expected spread of project concentration and deposition contours. For the Project, maximum concentrations are expected to occur within 5 km of the main emission sources and decrease with increasing distance beyond this point. The LSA is a 30 km by 30 km square centred approximately on Laricina’s proposed facilities. The RSA is about 85 km by 100 km.

Natural gas will be the prime fuel source for the Project. Some produced gas from the reservoir will be recovered and burned with the natural gas. Continuous emission sources at the proposed Phase 2 facility include six steam generators based on the more conservative SC-SAGD-3.3 facility design, a propane vapourizer, a diluent injection heater, and continuous purge and pilot stream, through both the low- and high-pressure flare stacks. Intermittent sources that were conservatively modelled as continuous sources include the two steam-generator air make-up
units, furnaces used for building heating, and the glycol heater. The standby generator is an intermittent source and was not modelled in continuous operation, as its frequency of engagement is much less than other intermittent sources. Phases 3 and 4 consist of the same emission source types as Phase 2, except that there are eight steam generators and four steam-generator air make-up units in each of the two phases. Flare stacks are essentially used for emergency only.

The Project may potentially affect a number of valued environmental components (VECs) related to air quality, including:

- NOx, SO2, H2S, CO, PM2.5 specific VOCs and PAHs;
- Potential Acid Input (PAI) and eutrophication (nitrogen deposition);
- GHG Emissions;
- odour and visible plumes; and
- O3.

In accordance with recent modelling practice, the CALMET and CALPUFF models were used in the air quality assessment as recommended models by AENV (2009). Results of the air quality modelling indicate that there are no exceedances of the AENV Alberta ambient air quality objectives (AAAQOs) for sulphur dioxide, nitrogen oxides and carbon monoxide predicted at any locations for the three assessment scenarios. Particulate matter (PM2.5) concentrations are negligible in the Application Case at the RSA MPOI for hourly and 24-hour averaging periods, while the predicted increase in 2nd highest 24-hour concentration from Baseline to Application scenarios at each of the special receptors is no more than 10%.

Modelling results for potential acid input (PAI) indicates that the project does not contribute to an area above the Clean Air Strategic Alliance (CASA) critical load and monitoring load. The Project contribution to regional nitrogen deposition levels is under the threshold. There were also no predicted exceedances of AAAQOs of any chemicals of potential concern (COPC) at the maximum point of impingement (MPOI), community and receptor locations near the project, and in most cases the concentration at the RSA MPOIs are many orders of magnitude below the AAAQOs. Odour threshold exceedances are only predicted for hydrogen sulphide with the frequency of these exceedances being 0.34%, with increases being due to Project operations.

Dispersion modelling of the emergency flaring scenario resulted in SO2 and NO2 below the AAAQO. The worst case upset scenario for the Project is not expected to contribute significantly to ground-level SO2 and NO2 concentrations.

With mitigation, the effects of the Project on air quality VECs are considered to have a low impact rating.

Laricina will utilize the following mitigation measures to reduce potential impacts of the Project on air quality:
• There will be no continuous flaring other than pilot and purge gas. The emergency flare system will include liquid knockout facilities, pilot/purge gas, continuous monitoring, and burner management.
• Vapour recovery systems will be installed.
• Laricina will minimize NOx emissions, through the following measures:
  • the selection of low NOx emissions technology, as required by the CCME National Emission Guideline for Commercial / Industrial Boilers and Heaters;
  • considering NOx emissions in future facility upgrades; and
  • energy conservation initiatives.
• Laricina will manage VOC emissions through the following measures:
  • the use of process designs that reduce VOC emissions;
  • plant-wide fugitive emissions identification and control, using the protocol recommended by the CCME guideline “Environmental Code of Practice for the Measurement and Control of Fugitive Emissions from EquipmentLeaks” (CCME 1993);
  • a vapour recovery unit (VRU) to condense and recover emissions; and
  • floating roofs on storage tanks that contain hydrocarbons.
• Laricina will review the potential for fugitive H2S release as detailed facility design proceeds and will strive to eliminate odour occurrences outside the facility footprint; and
• Laricina will install sulphur recovery equipment to remove 70% of inlet sulphur.

In order to verify that the mitigation measures have been effective, Laricina will conduct the following source monitoring:

• Produced gas will be tested for H2S content, and SO2 emissions will be estimated from the produced gas flow rate.
• Produced gas composition and fuel use will be monitored to determine GHG emissions.
• NOx emissions from each of the Project steam boilers will be tested within six months of project start-up, and thereafter surveyed annually.
• Installation of one continuous emission monitor (CEM), measuring NOx, in one steam generator stack, in each of Phases 3 and 4.

A.8.2 Aquatic Resources
The potential effects of the Project on aquatic resources are discussed in Section D.2 and Consultants Report #2 (CR #2).

The aquatics LSA encompasses portions of the Wood Buffalo River watershed located approximately 40 km upstream of its confluence with the Wabasca River. The Wood Buffalo River watershed within the LSA contains a number of unnamed tributaries and one unnamed lake. The RSA includes the LSA and the main stem of the Wood Buffalo River from the LSA to its confluence with the Wabasca River.
A number of potential aquatic resources VECs were identified as they relate to potential fish and fish habitat effects:

- changes in surface water quality;
- changes in fish health and fish tissue; and
- alteration of fish resources and aquatic habitat.

With strict implementation of the proposed mitigation measures, potential impacts to aquatic resources through changes in surface water quality are predicted to be Low Impact in the LSA and in the RSA; and the surface water flow rates are predicted to be Low Impact.

Improved access and increased workforce in the area as a result of the Project could increase fishing pressure and fish harvest in local fish-bearing waterbodies and watercourses.

While many fish populations in the region are sensitive to angling pressure, and while the workforce may potentially catch additional fish, it is expected that with mitigation these effects of increased angling on LSA fish populations will be Low Impact.

With implementation of the mitigation measures to address potential sedimentation of surface waters, changes in flow, and any releases of process-affected water and accidental spills of contaminants to surface waters, potential impacts to aquatic resources are predicted to have a low impact rating.

Laricina will utilize the following measures to mitigate potential impacts to aquatic resources:

- The requirement for earthworks contractors to submit a sediment control plan;
- Sediment control measures such as those described in the Alberta Code of Practice for Watercourse Crossings (AENV 2000) and associated guidelines will be implemented for earthworks which take place within or in close proximity to watercourses. These measures may include, as required: the use of cutoff trenches, silt fences, flow barriers, temporary and/or permanent sediment control ponds and/or traps, and ditches to minimize or eliminate sediment transport from exposed soil areas into receiving watercourses and waterbodies;
- Whenever possible, surface disturbance activities in close proximity to watercourses will be carried out during periods of relatively low surface runoff in late fall, winter and early spring (from October to April). A 30 m buffer (vegetation) strip will be left between disturbance sites and watercourses except at stream crossings and diversions;
- The time interval between clearing/grubbing and subsequent earthworks will be minimized, particularly at or in the vicinity of watercourses or in areas susceptible to erosion;
- Where relevant, slope grading and stabilization techniques will be adopted. Slopes will be contoured to produce moderate slope angles to reduce erosion risk. Other stabilization techniques used to control erosion may include: ditching above the cutslope to channel surface runoff away from the cutslope, leaving buffer (vegetation) strips between the disturbance area and a watercourse, placing large rock rip rap to stabilize slopes;
• Where required, surface runoff collection and treatment systems will be used to direct surface runoff from both disturbed areas and constructed areas (well pads and roads) into settling impoundments/sumps for removal of settleable solids;

• Progressive disturbance and reclamation will be undertaken to reduce the amount of disturbed area at any given time. During reclamation, permanent plant cover and re-vegetation will be established. Soil erosion will be reduced by minimizing the time that reclaimed surfaces are left bare; and

• Interim erosion/sediment control measures will be utilized until long-term protection can be effectively implemented.

• Idol Creek flows will be re-routed around the wellpad that is planned to be part of Phase 2 in order to maintain connectivity between upper and lower Idol Creek;

• Whenever possible, instream construction activities will be carried out during periods of relatively low surface runoff in late fall, winter and early spring (from October to April); and

• All watercourse crossings will be designed and constructed in compliance with the Alberta Code of Practice for Watercourse Crossings (AENV 2000) and associated guidelines. For watercourse crossings these requirements include: aquatic and biological assessments; watercourse crossing design and construction; post-construction clean-up and reclamation; contingency measures; and watercourse crossing site monitoring. Implementation of appropriate mitigation measures means that all stream crossings constructed and operated for the Project will meet regulatory requirements for the protection of fish resources and aquatic habitat and will subsequently mitigate against effects on surface water quality. There are no fish resources present in the channelized portions of Idol Creek.

• Storm-water retention pond water will always be tested prior to discharge, will be released at a controlled rate, and will only be released in accordance with the terms and conditions of the operating approval.

• Management and disposal of all drilling waste will be in accordance with all regulations and will be implemented under the Project’s waste management plan.

• Diverting runoff from disturbed areas into the natural environment, away from the existing stream networks and phasing reclamation activities such that they commence before the entire Project is developed.

• Raising awareness among the Project workers of the existing ASRD regulations for the species found in the LSA lakes;

• Educating the Project workforce on the benefits of the practice of catch-and-release angling; and

• Discouraging fishing by Project employees within the LSA.

A.8.3 Groundwater

The potential effects of the Project on groundwater are discussed in Part D.3 and Consultants Report #3 (CR #3).
The hydrogeology LSA includes a buffer around the proposed Project footprint (Figure C.2.4-1). The LSA is intended to include the extent of the Project related impacts beyond which the potential effects of the Project are expected to be non-detectable.

The hydrogeology regional study area (HRSA) defined for the hydrogeology assessment extends between Townships 81 and 87 and Range 25 W4M east to the Athabasca River (Figure C.2.4-2). The HRSA boundaries were selected based on major hydrologic-hydrogeologic features, such as the Athabasca River, which is a regional groundwater discharge feature and was selected as the eastern boundary. The western boundary is approximately aligned with the God’s Valley Quaternary Channel, Wabasca River and North Wabasca Lake. The HRSA also includes sufficient distance where measurable effects associated with the Project are not anticipated, but where residual effects from the Project have potential to interact cumulatively with the residual effects of other projects.

Groundwater VECs for the Project are those environmental attributes associated with the proposed project development, which have been identified to be of concern either by directly-affected stakeholders, government or the professional community. The Project VECs and potential impacts of the project include:

- Effects of the groundwater withdrawals on water quantity;
- Effects of surface facilities on water quality;
- Effects of production and injection wells on water quality;
- Effects of SAGD operations on water quality; and
- Effects of disposal wells on water quality.

Regional aquifers include potential buried channel deposits of the God’s Valley and Wabasca Channel, the Cretaceous Viking and Grand Rapids lower, middle and upper sands and the Upper Devonian Winterburn-Wabamun, Grosmont and Beaverhill-Cooking Lake aquifers or aquifer systems (Bachu et al. 1993). Within the HRSA the permeable portions of the undifferentiated glacial drift are interpreted as forming only localized aquifers. The Base of Groundwater Protection is established at an elevation of 335.2 masl at the Project (ERCB 2011) and the Grand Rapids Formation is identified as the deepest protected unit. Thus key units from a hydrogeological point of view that underlie the Project are the Quaternary glacial drift, Viking Formation and Grand Rapids sands. Other units will be considered in less detail as they are either below the Base of Groundwater Protection or do not underlie the Project.

Groundwater production within the HRSA is primarily industrial; however, there are a few groundwater diversions for domestic use. All domestic use within the HRSA is from Quaternary sources; whereas industrial production is mainly from Grand Rapids sands. Substantial production from wells completed in the Grand Rapids Formation is occurring at the CNRL Britnell (mainly in 81-22-W4M) and Cenovus Pelican Lake (Townships 82 and 83, Ranges 18 to 22-W4M) projects. A lesser amount of production from the lower Grand Rapids is occurring at the Laricina Saleski project to the east in Township 85, Ranges 19 and 20 W4M. Only three wells are identified within the HLSA and two of these are camp wells owned by Laricina. The other is a domestic well which is approximately 5 km to the south of the proposed Project.
The Grosmont Formation appears to have good potential for the production of saline water, which would require extensive treatment prior to use. Shallower aquifers are either non-saline or not expected to have adequate production. Laricina will continue to evaluate supplementing water production with groundwater from the Grosmont; however in the interim the lower Grand Rapids will be used to provide water to support the Project.

A numerical groundwater flow model was prepared to complete the assessment of potential impacts due to groundwater production from the lower Grand Rapids. The model predicted a maximum drawdown at the Germain Project of just over 1 m, with no observable change to other users. For the Application Case the maximum drawdown in the lower Grand Rapids within the HLSA was 14 m. The reduction in groundwater level within the lower Grand Rapids as a result of the Project production is calculated as 12% near the Germain source wells. Potential effects of withdrawal on groundwater quantity in the lower Grand Rapids Formation are rated as low.

For the Planned Development Case the predicted maximum drawdown within the HLSA was found to occur at the cessation of Project pumping, as in the application simulation. The maximum drawdown was not found to have increased due to cumulative effects of planned projects; however the drawdown in the area of Cenovus persists for a longer duration due to the extended pumping period. Cumulative effects are related to effects of groundwater withdrawals on groundwater quantity (water levels) in the Grand Rapids are rated as low.

In consideration of the facility design and material handling methods (Part B), the surface facilities should have no effects on groundwater quality under normal operating conditions. The undifferentiated drift in the area of the proposed plant sites for Phases 2 to 4 is 70 m or greater in thickness and expected to be composed predominantly of clay and clay till. Groundwater flow rates are expected to be generally slow within the undifferentiated drift deposits, i.e. millimetres to centimetres per year. Upset conditions, specifically spills or leaks of fluids, may allow small amounts of fluids to seep into the shallow groundwater. A groundwater monitoring network has been established and monitoring will be conducted throughout the life of the Project. In the event that an impact on groundwater quality is detected, a groundwater response plan will be implemented. The response plan will be effective at avoiding a significant effect on groundwater quality, preventing impacted groundwater from reaching surface water bodies and restoring groundwater quality. The mitigation measures to be implemented should be effective in preventing or minimizing any fluids from adversely affecting the shallow groundwater, and application case effects are rated as low.

For production and injection wells, industry best practices and regulatory requirements will be utilized with respect to their construction, operating pressures and operational monitoring. As a result of these measures, casing failure and leakage into a non-saline aquifer during operations should not occur. Therefore it is determined that there is no potential Project impact on groundwater quality in non-saline aquifers.

The groundwater that underlies the bitumen zone within the upper Grand Rapids Formation is non-saline and therefore bitumen production presents a direct risk to the groundwater quality within this aquifer. Laricina plans to utilize primarily SC-SAGD technology, but may utilize SAGD during Phase 2. 2-D model simulation results indicated that in the case of SC-SAGD
processes, the concentrations of dissolved hydrocarbons (related to bitumen and solvent) would increase within the groundwater over a distance of approximately 20 m outside the steam chamber (about 50 m from the horizontal well pairs) at the end of seven years. The half life for dissolved hydrocarbon parameters is 4.8 years or less (AENV 2009a). Potential Project effects related to SAGD and/or SC-SAGD operation on groundwater quality within the upper Grand Rapids are rated as moderate.

Considering the presence of thick low permeability materials that underlie potential shallow drift aquifers, surface water bodies and wetlands and form an effective hydraulic barrier above the Grand Rapids Formation, no impacts are expected to shallow drift aquifers, surface water bodies and wetlands due to SAGD or SC-SAGD operations in the upper Grand Rapids.

Based on the characteristics of the cap rock, operational factors and continuous monitoring, failure of the cap rock is considered unlikely and there is no potential Project impact on groundwater quality in non-saline aquifers.

Disposal wells will be used to dispose of sludge from the hot lime softener, blowdown from the once-through steam generators and neutralized regen waste from the weak acid cation softeners. Concerns regarding disposal wells relate to the containment potential, chemical compatibility and injection capacity of the selected disposal zone. The Grosmont A unit of the Grosmont Formation, which has been proved as an effective disposal zone for other projects in the region, has been identified as the disposal zone for the Project. Based on the characteristics of this disposal zone and industry best practices and regulatory requirements associated with the disposal wells, no impact is anticipated to groundwater quality of non-saline groundwater resources or surface water bodies and wetlands.

In order to reduce the potential impact to groundwater resources Laricina will:

- Develop a spill response plan to mitigate effects in the event of upset conditions;
- Develop a groundwater monitoring program to enable early detection of any effects to groundwater quality;
- Implement a Groundwater Response Plan in the case that monitoring identifies a change in groundwater quality; and
- In the event of a change in water levels implement mitigative actions such as reducing pumping rates in one or more of the water source wells, adding more source wells to modify the drawdown distribution, completing water source wells in other aquifer units or utilizing alternative water sources.

In order to monitor the effectiveness of the mitigation measures Laricina will:

- Monitor water quality in non-saline aquifer units (i.e. shallow drift aquifers, Viking Aquifer and upper Grand Rapids Aquifer) in locations near well pads;
- Monitor water levels in the water source and observation well completed within the Grand Rapids Formation; and
• Monitor wellhead injection pressure and injection rate at each disposal well in accordance with the terms of the disposal well licence.

A.8.4 Historical Resources

The potential effects of the Project on Historical Resources are discussed in Section D.4 and Consultants Report #4 (CR #4).

A model of archaeological potential was developed in order to determine the relative ranking of terrain features in terms of the potential to identify pre-contact archaeological sites. Overall the historic resource potential of the area is low within the LSA. No pre-contact period archaeological sites have been identified during field studies and no sites are on record within the RSA.

To date there are no known sites, so there is no need to mitigate potential impacts to historical resources:

• No historical resource sites have been identified on the Phase 1 or 2 sites;
• It is not expected that any sites will be found on Phases 3 or 4 based on the model and previous field results;
• Laricina is applying to ACCS for clearance to develop new facilities for the entire project (Phases 2 to 4).

A.8.5 Human and Wildlife Health

The potential effects of the Project on human and wildlife health are discussed in Section D.5 and Consultants Report #5 (CR #5).

The Human Health Risk Assessment (HHRA) describes the nature and significance of potential short-term (i.e., acute) and long-term (i.e., chronic) health risks to humans associated with exposure to the COPCs emitted or released from the Project. The HHRA examines the potential health risks attributable to the Project in combination with existing and planned emission sources in the region. The screening level wildlife risk assessment (SLWRA) addresses the same components with respect to effects on wildlife.

The COPCs for the Project were identified through the development of a comprehensive inventory of chemicals that could be emitted or released by the Project and to which people or wildlife might be exposed. The COPCs that were included in the HHRA and the SLWRA include:

• Criteria air contaminants (CAC);
• Carcinogenic polycyclic aromatic carbons (PAHs);
• Petroleum hydrocarbon (PHC) fractions;
• Volatile organic compounds (VOCs); and
• Total reduced sulphur (TRS) compounds.
The HHRA was structured to characterize the potential health risks to area residents who reside in the area over the long-term. In the SLWRA, the potential risks to wildlife species were not assessed for individual species, but instead, predicted COPC concentrations were compared to toxicity data and generic soil and water quality guidelines considered protective of all wildlife species.

The following exposure pathways were included, as applicable, in the HHRA:

- Inhalation of air;
- Inhalation of dust;
- Ingestion of soil (inadvertent);
- Ingestion of water;
- Ingestion of local above-ground plants (including fruit and vegetables);
- Ingestion of local below-ground plants (root vegetables);
- Ingestion of local fish;
- Ingestion of local wild game;
- Dermal contact with water; and
- Dermal contact with soil.

In the SLWRA the ingestion and inhalation exposure pathways were assessed.

The chemical emissions from the Project are not expected to result in adverse health effects in the region. For most of the COPCs, the magnitude of the differences in predicted health risks between the Baseline and Application Cases is negligible. The key findings of the HHRA are as follows:

- Acute Inhalation Assessment - With the exception of the MPOI and SO2, all acute RQ values were less than 1, suggesting adverse health effects attributable to air emissions on an acute basis are not expected. The maximum predicted hourly SO2 concentrations at the LSA and RSA MPOI are within the range of concentrations where modest, transient changes in lung function indices may occur. All changes in airway resistance are fully reversible and strictly sub-clinical in nature, with no evidence of wheezing, shortness of breath or other clinical signs. In addition, the probability of exceeding the WHO 10-min SO2 exposure limit of 500 µg/m³ at the LSA or RSA MPOI is less than 0.1%. Finally, the maximum concentrations of SO2 in the Application Case are predicted to occur within close proximity to the Project boundary.

- Chronic Inhalation Assessment - The MPOI locations were not evaluated on a chronic basis since it is intended to reflect worst-case exposure to a hypothetical transient person who might be in the area when worst case emissions and meteorological conditions are occurring.

- Chronic Multiple Pathway Assessment - The potential long-term health risks associated with exposure to the COPCs via multiple pathways of exposure were evaluated for resident, cabin and worker groups in the area. In all instances, potential risks were
The results of the SLWRA indicate that the overall risks posed to wildlife health will be negligible. Therefore, no impacts to wildlife populations are expected based on estimated wildlife exposures to predicted maximum acute and chronic air concentrations and predicted maximum soil and surface water concentrations.

Mitigation of potential health effects due to the Project relies on appropriate mitigation of impacts to Air Quality (Section A.8.1), Surface Water Quality (Section A.8.2), and Groundwater (Section A.8.3).

Laricina currently monitors air and surface water quality in the area. If any issues arise from existing monitoring programs or concerns raised from local stakeholders, Laricina will initiate the appropriate mitigation measures to ensure operations do not pose additional risk to human or wildlife health.

A.8.6 Hydrology

The potential effects of the Project on hydrology are discussed in Section D.6 and Consultants Report #6 (CR #6).

The Project lies within the drainage area of the Wabasca River. The LSA is drained by tributaries of the Wood Buffalo River, a tributary of Wabasca River.

The LSA used for the hydrology assessment is defined as the Project footprint and surrounding areas which may be affected by direct runoff from the Project. The RSA is composed of the LSA and the downstream Wood Buffalo River channel extending to the Wabasca River.

Three VECs related to hydrology have the potential to be impacted by the Project including:

- runoff volumes and streamflows;
- water levels and surface areas; and
- channel morphology and sediment concentrations

The effect of the development on water levels and corresponding surface areas was found to be small. Peak water levels and surface areas in streams are not anticipated to change.

Channel morphology and sediment concentrations largely will not change due to the Project because changes to the flow regime. A small portion of the Idol Creek channel will be disturbed by the construction of two well pads and by surface pipeline corridor crossing. A ditch will be constructed around the corner of the well pads to convey water to the downstream channel and a clearspan structure will be used for crossing Idol Creek.
Environmental effects on hydrology were assessed after accounting for relevant mitigation measures. The effects on hydrology were reversible over the long term and, with mitigation, the effect of the Project on the VECs has a Low impact rating.

Laricina will undertake the following mitigation measures to reduce potential hydrological impacts from the Project:

- Water will not be transferred from one watershed to another along ditches and road right-of-ways.
- Appropriate drainage culverts will be provided at crossings of any significant drainage courses to maintain existing drainage patterns.
- Sediment control will be utilised for construction activity where runoff may potentially flow directly into streams with defined channels.
- Runoff from well pads will be controlled and will not be directed toward streams with defined channels.
- Run-on from upstream of well pads and plant sites will be directed around the disturbances and back into their original pathways.
- Surface disturbances will be reclaimed after they are no longer required.
- Runoff from the plant sites will be collected in stormwater runoff ponds. If this water meets the specified water quality standards it will be discharged onto the natural landscape.

In order to verify that the mitigation measures have been effective, Laricina will:

- Carry out routine visual inspections to ensure that access corridor drainage culverts are working as intended to maintain the natural surface drainage patterns.
- Carry out sediment monitoring during the construction of stream channel crossings to ensure that sediment from construction sites does not adversely impact the downstream channels.
- Record water volumes pumped from the plant site runoff ponds into the natural environment.
- Record the volume of any runoff water used for process water.

A.8.7 Noise

The potential effects of the Project on noise levels at nearby receptors are discussed in Section D.7 and Consultants Report #7 (CR #7).

The ERCB Directive 038 specifies that noise impact assessments are to be carried out to evaluate project impacts on the nearest dwelling. The Directive further specifies that, in the event the nearest dwelling is greater than a 1.5 km distance from the Project, new facilities must meet a permissible sound night time level of 40 dBA 1.5 km from the facility fence-line. No dwellings lie within 1.5 km of the proposed facilities; therefore theoretical receptors have been used.
The results of the noise modeling indicated night-time noise levels below the ERCB Directive 038 permissible sound levels of 45 dBA at the nearby theoretical 1,500 m receptors. Further, the dBC – dBA sound levels indicated minimal likelihood of low frequency tonal components.

Although results of the noise modeling indicated that no specific additional noise mitigation measures are required for project equipment Laricina will utilize the following mitigation measures, where possible, to reduce the potential impacts associated with noise from the Project:

- Construction activity will be conducted between the hours of 07:00 and 22:00.
- Internal combustion engines will be fitted with appropriate muffler systems.
- Respond to any noise related issues raised by stakeholders.

**A.8.8 Socio-Economic**

The potential effects of the Project on socio-economic resources are discussed in Section D.8 and Consultants Report #8 (CR #8).

The socio-economic impact assessment (SEIA) addresses the human environment with and without the Project. The key socio-economic issues considered in the analysis fall into the following categories:

- Employment effects;
- Regional and provincial economic benefits;
- Population effects;
- Effects on regional infrastructure and services;
- Traditional land use effects; and
- Transportation effects.

The focus of the analysis of employment, income, population, and infrastructure effects is on the MD of Opportunity 17, especially Wabasca-Desmarais. Transportation issues are analyzed with special attention to the corridor along Highway 63 between the Project and the City of Edmonton and effects on police, emergency, and health services focus on the Urban Services Area of the Regional Municipality of Wood Buffalo (Fort McMurray).

The Project will require an estimated 4,560 person years of on-site employment and 465 person years of off-site employment for construction of the Project. The proposed Project is expected to require 140 operations staff plus 220 person years of ongoing drilling employment and 22 person years of off-site operations employment for the period of 2022 to 2045. An estimated 85% of these full-time positions are expected to be direct employees of Laricina, with the balance consisting of contractors. The period of 2013 to 2025 contains the most activity leading to socio-economic effects. All together, and under the assumed schedule, the construction of the plants, field facilities, and the drilling of wells will create close to 5,170 person years of employment over the nine-year construction period, with a peak of nearly 800 in 2018.
The company will continue to promote employment, contractor and supply opportunities for local, and especially aboriginal, contractors through efforts such as:

- Continue to implement the policy of buying or hiring local first, subject to quality and price considerations;
- Continue to work with local educators to inform young people of the potential career opportunities with Laricina and the process through which they can begin careers in the oil and gas sector; and

Economic benefits of the Project will include:

- Construction capital expenditures estimated at approximately $4.5 billion;
- Sustaining capital and ongoing drilling expenditures will average approximately $308 million per year;
- Operations costs of the Project (excluding gas and electrical costs) are estimated to average $345 million per year;
- Property taxes to the MD of Opportunity 17;
- Oil sands royalties to the provincial government; and
- Corporate taxes to the provincial and federal government.

Through operations of its Saleski Pilot CPF and the construction of its Germain Phase 1 Project, Laricina has developed a number of relationships with contractors in the regional area. Laricina intends to continue working with locally and regionally based contractors to increase the share of local contractors in Project work.

The Project’s population effect and the associated effect on service providers in the RSA are expected to be small. The Project will use on-site operations and construction camps and institute worker commute systems, using private vehicles, busses, and a fly-in/fly-out program utilizing a Wabasca area airport.

Laricina is committed to hiring locally whenever possible and to fully use available local and provincial workforce. The residency patterns of the current Laricina workforce and the inclusion of a permanent on-site operations camp suggests that the majority of operations workers will live outside the MD of Opportunity 17 region. The same holds for the temporary construction workforce.

Laricina will utilize the following mitigation measures in order to reduce potential impacts to socio-economic resources:

- Utilize a camp to house construction and operations personnel with security personnel, emergency medical technicians and paramedics, and an emergency conveyance vehicle.
- Continue to implement the policy of buying or hiring local first, subject to quality and price considerations.
• Continue to work with local educators to inform young people of the potential career opportunities with Laricina and the process through which they can begin careers in the oil and gas sector.

• Continue to engage local stakeholders, via the Laricina field office, on such things as adjusting main elements of Laricina’s socio-economic enhancement and mitigation strategies.

• Consult with BCN to, whenever possible, understand and mitigate, emerging issues;

• Employ progressive reclamation whenever practical.

• Implement an access management program, including facilitation of access across the Project area by trappers to their traplines and compensation to trappers directly affected by the Project.

• Support the collection of traditional ecological knowledge on medicinal plants, wildlife and spiritual and cultural sites on Laricina leases prior to their development.

• Support Métis and Cree cultural retention programs, including language programming, and an oral history project.

• Provide aboriginal culture training to Laricina employees and contractors.

• Implement explicit and enforced camp, workplace, and flight policies with regards to the use of alcohol, drugs, and illegal activities.

• Implementation of an emergency response plan, including integrated incident/crisis management teams, full time certified emergency responders, and auxiliary emergency response teams.

• Cooperation with other service providers and members of industry in the RSA to assist in addressing effects that are mostly outside its direct control by entering into mutual aid agreements where appropriate.

• Continue to engage regional social service providers, including representatives of the M.D. of Opportunity 17 and the BCN, to identify potential issues and strategies to address these issues.

• Continued financial support of local literacy programs.

• Utilization of a fly-in, fly-out transportation model for construction and operations staff.

• Scheduling oversized loads and ensuring that Project related vehicles travelling the ALPAC road follow the established protocol of using a radio to communicate with other drivers to minimize incidents at narrow bridge crossings and low-visibility points along the road.

Laricina will continue with periodic consultations with its main stakeholders. These consultations will include discussions about Project impacts. No formal monitoring program beyond these periodic stakeholder engagements is proposed.

A.8.9 Soil Resources

The potential effects of the Project on soil resources are discussed in Section D.9 and Consultants Report #9 (CR #9).
Project activities that have the potential to impact soil quality, quantity and biodiversity include:

- soil salvage and handling;
- soil stockpiling;
- construction of infrastructure;
- operational activities; and
- reclamation activities.

Baseline soil data was collected in order to determine the potential environmental effects that the Project may have on soil resources, and to assist in preparation of a conceptual Conservation and Reclamation Plan with appropriate site mitigation and monitoring activities designed to achieve reclamation success.

Soil survey guidelines were based on accepted methodologies used in Canada for baseline soil survey (MSWG 1981). A survey intensity level (SIL) 2 was completed over the majority of the LSA, with one inspection point for every 5 to 15 ha, and a SIL 1 for the Initial Development footprint with one inspection for every 1 ha. A total of 898 inspection points were recorded in the LSA. Samples of one or more soil horizons were collected from 70 inspection points and analyzed for the specific chemical parameters required to determine reclamation suitability.

Baseline soil characteristics were identified for each map unit and include:

- thickness of soil layers;
- forest soil capability classification;
- reclamation suitability;
- baseline erosion risk; and
- soil sensitivity to acidification.

The main goal for the reclamation program is to achieve forested land capability equivalent to pre-disturbance conditions. By undertaking the practices and procedures discussed in the conservation and reclamation plan (Part E) the impacts to the soil resource are expected to have a low impact rating.

Laricina will utilize the following measures to mitigate potential impacts to soil resources:

- Upland soils will be salvaged using best management practices. Supervision of soil salvage operations and placement of soil materials during reclamation will be done by a qualified individual.
- Organic soil material will be salvaged in select areas for later use in reclamation.
- Some organic soils will be left in place and padded over with clay fill. The final reclamation of these areas will require the fill material to be removed to expose the underlying organic material; no additional soil replacement is required in these areas.
- Topsoil and subsoil will be stored in a manner to minimize soil loss or degradation.
• Decompaction of the replaced soil profiles will be done to reduce potential compaction as a result of soil replacement.
• All reclaimed lands will be vegetated upon completion of soil placement to minimize soil loss via erosion (wind and water).
• Stockpiles will be constructed to minimize exposure to wind or water.
• Stockpiles will have relatively gentle slopes less than or equal to 3H:1V, and will be contoured with small ridges perpendicular to slope direction (Knapik 1999).
• Topsoil stockpiles utilized as long-term storage will be seeded with a non-invasive and weed free seed mix that establishes quickly.
• Reclaimed landscapes that have a high probability of erosion (i.e., steep side slopes) will be stabilized using soil stabilizers or other measures will be utilized (e.g. vegetation) to minimize the effect of water erosion.
• Project reclamation will aim to create soil landscape patterns similar to pre-disturbance conditions such that equivalent land capability is met.
• Recontouring of reclaimed landscapes to provide topography and surface forms that provide appropriate surface drainage, blend with the adjacent undisturbed terrain (i.e., drainage, aspect) and remain stable. In instances where the reclaimed landscape is expected to differ from the original terrain type (i.e., borrow pit), the landscape will be designed to ensure that end land use objectives are met.

In order to verify that the mitigation measures have been effective Laricina’s monitoring program will assess the following:

• direct supervision of soil salvage and replacement activities by a qualified individual;
• ensure appropriate drainage through monitoring of landscape characteristics and features;
• monitor potential soil erosion issues of stockpiled or recently replaced soil material;
• reclaimed areas for topsoil quality (i.e., admixing) and quantity (depths);
• assessment of vegetation communities to determine if the appropriate seral communities are established;
• monitoring of stockpiled soils and reclaimed areas will be conducted to ensure mitigative measures are effective; and
• post-reclamation monitoring will be completed to ensure appropriate site contouring, soil placement, vegetation establishment and productivity.

A.8.10 Vegetation, Wetlands and Rare Plants

The potential effects of the Project on vegetation, wetlands and rare plants are discussed in Section D.10 and Consultants Report #10 (CR #10).

The LSA is a 500 m buffer around the proposed Project footprint. The physical extent of the LSA is sufficient in size to capture potential project effects to valued environmental components (VECs) that will result from direct disturbance to vegetation inside the Project footprint and also,
changes to vegetation outside the Project footprint as a result of alterations to physical components such as water quantity (wetlands) and quality, and air quality.

A 5.5 km buffer around the LSA was selected for the vegetation RSA. The RSA was defined 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.

The assessment of Project effects on vegetation and wetland resources was based on six valued environmental components including:

- terrestrial and aquatic vegetation species and ecosite phases;
- old growth forests;
- forestry resources;
- vegetation used by Aboriginal groups (TEK vegetation) for medicine, food, technological and other purposes;
- wetland (bogs, fens, marshes, swamps, open water/ponds) classification and occurrences;
- rare plants and rare plant habitat potential;
- rare ecological communities, and ecological communities of limited distribution;
- non-native and invasive vegetation species (noxious and noxious prohibited species); and,
- biodiversity and fragmentation.

The potential Project effects to vegetation and wetland resources are related to clearing natural vegetation and soils for Project facilities and infrastructure. Clearing natural vegetation will impact vegetation indicators directly through the reduction of communities and indirectly through changes to undisturbed vegetation and wetland resources resulting from changes to hydrology and habitat fragmentation. Other indirect effects considered in the assessment are effects to vegetation resulting from predicted climate change, natural disturbance (fire) and PAI. The potential effects of the Project have been assessed relative to each of the VECs.

Environmental effects on terrestrial vegetation, wetland resources, old growth forests, non-native and invasive species, traditionally used plants, and biodiversity were assessed after accounting for relevant mitigation measures. In all components the effects were reversible over the long term and, with mitigation, the effect of the Project on the VECs has a Low impact rating.

In order to minimize the potential impacts to vegetation resources, Laricina will undertake the following:

- Develop revegetation plans that will promote the long term establishment of healthy ecosystems and ingress of native species.
- Preserve adjacent habitat by minimizing the area required for construction and operation of the Project.
- Stockpiled topsoil will be seeded with suitable species mix to ensure long term stability of the piles reducing erosion and the potential for weed establishment.
When available, coarse woody debris should be used to amend soils to provide mycorrhizal and microbial inoculum.

Re-vegetation will be conducted according to the reclamation guidelines prepared by the Oil Sands Vegetation Reclamation Committee (OSVRC, 1998), CEMA, or updates.

Reporting the findings of rare and unranked species to ACIMS for updating provincial All Element Lists.

Merchantable timber will be salvaged.

Select areas will be planted with pine and white and black spruce seedlings 2 to 4 years after seeding reclaimed lands.

Where possible, planting of aspen and white spruce will be used to increase the diversity of ecosite phases.

Drainage patterns will be maintained to preserve the integrity of wetland areas outside the Project footprint.

Culverts will be placed within wetlands that will be divided by roads to ensure that water flow to wetlands outside of the Project footprint will not be affected.

Remove fill material placed over organics to re-establish wetlands.

Reclaim borrow areas to wetlands, and where possible utilize opportunities to direct place peat materials to provide a propagule source for wetland vegetation.

Where suitable, introducing woody species typical of b1, b2, c1, d1, and g1 ecosite phases.

Minimize areas of bare ground during Project construction and operation.

Use a non-invasive seed-mix for erosion control, and use approved revegetation species that are compatible with the intended end land use.

Implement a weed control program during construction, operations and reclamation.

Equipment arriving from offsite should be cleaned to remove dirt and vegetative material before accessing the Project footprint.

Aboriginal groups will be invited to participate in designing mitigation measures which contribute to the sustainable management of TEK vegetation, and which compliment re-vegetation measures.

Where possible, critical medicinal use vegetation (Rank 1) which is limited in distribution and which has the potential to be adversely affected by the Project should be re-established elsewhere via transplant or propagules.

The Project proponent should work with Aboriginal groups, who are affected by the Project, to locate alternative areas where TEK vegetation is accessible.

Move well pad and ROWs away from rare plant community (SW 21-84-22-W4M), if possible, and stake a buffer to avoid impact from construction.

Place rare vascular species voucher specimens in a herbarium.

Mark of locations of rare plants that are adjacent to the Project Footprint area in order to mitigate accidental removal.
• Areas with high biodiversity should be identified and the surface soil should be considered for soil salvage and use in direct placement reclamation.

• An adaptive reclamation strategy should be implemented to take advantage of opportunities present on the post-development contoured lands for establishment of a variety of plant communities (ecosite phases).

• Use native shrubs (willow, berry species) and deciduous trees (aspen) where possible to provide structural diversity to the reclaimed stands as well as browse for wildlife.

• In areas where there is poor survival of seedlings, fill planting should be performed if target stocking densities are in jeopardy.

In order to verify that the mitigation measures have been effective Laricina will undertake the following activities:

• Monitor reclaimed sites to assess the development of healthy ecosystems that will support natural vegetation capable of ecological succession.

• Perform survival, growth and health assessments to monitor the success of revegetation efforts.

• Conduct a rare plant survey on any new development areas not included in this assessment.

• Monitor and maintain drainage control structures regularly to ensure water flow and flow patterns are maintained in wetlands adjacent to the Project footprint during the construction, operation, and closure phases of the Project.

• Roads removed at Project closure which may have had an effect on adjacent wetlands will be monitored to ensure restoration of water flow.

• Monitor reclaimed wetlands after closure to ensure healthy wetlands are being created.

• Perform survival, growth and health assessments to monitor the success of revegetation efforts.

• Ensure regular site inspections during the life of the Project (construction, operation and closure) to identify if invasive species are becoming established.

• Control any weed populations that are identified during monitoring.

• Assess the success of weed control activities.

• Follow-up with Aboriginal communities as recommended during the consultation process.

• Monitor staked rare plant locations periodically during construction to ensure they have been protected.

• Regeneration surveys will be utilized to monitor for health and survival of planted trees.

• Post reclamation surveys should be completed on sites reclaimed early in the life of the Project to assess success and allow for adaptive management of subsequent stages of reclamation.
A.8.11 Wildlife

The potential effects of the Project on wildlife are discussed in Part D.11 and Consultants Report #11 (CR #11).

The LSA used for the wildlife baseline data collection includes the Germain leases plus a 500 m buffer. The RSA was defined as the land within 5 km buffer around the LSA, which represents the approximate home range of a Canada lynx, was selected for the wildlife RSA. To assess effects on caribou, the caribou regional study area (CRSA) was extended to 30 km beyond the Project footprint. This distance was selected because it represents the approximate area of a female caribou home range.

The wildlife assessment focused on eleven species selected as VECs, including:

- amphibians - western toad;
- bird species – Canada Warbler, Rusty Blackbird, Olive-sided Flycatcher, Common Nighthawk and Yellow Rail; and
- mammals – moose, woodland caribou, beaver, Canada lynx and fisher.

An additional 38 special status species whose ranges overlap with the Project, and for which there was suitable habitat, were also considered.

Project development has the potential to interact with wildlife in different ways. The Project may alter wildlife habitat availability, movement, and wildlife mortality risk and health, all of which may affect the abundance of wildlife in the RSA and beyond. The following components were included in the assessment of the wildlife VECs:

- habitat availability;
- Movement;
- mortality risk and health; and
- abundance

Ecosite phases for the LSA were grouped into broader wildlife habitat classes based on their vegetation species composition, moisture regime, topographic position, and general value to wildlife. Because of the varying importance of young and mature/old forests for wildlife, stand age was also incorporated into the habitat classes.

Under baseline conditions, the LSA was dominated by black spruce bog (58%), with components of closed white spruce (16%) and shrubby wetland (17.6%). Black spruce bog in particular is expected to provide high suitability habitat for caribou, while shrubby wetlands dominated by willow are likely valuable to moose. These lowland habitats are expected to provide effective habitat for a number of special status species, including great grey owl, sandhill crane, northern hawk owl, sharp-tailed grouse, common yellowthroat, white-winged scoter and other waterbird species. White spruce stands may be used by Cape May warbler, Baltimore oriole, bay-breasted warbler, brown creeper and other listed songbirds. Other classes represented minor components
of the LSA including closed deciduous, closed upland shrub and grassland (i.e., regenerating disturbance), graminoid wetlands and waterbodies. The RSA was dominated by moderate-high biodiversity habitat composed primarily of black spruce bog, white spruce and graminoid wetlands. Disturbances (both anthropogenic and natural) represented a large proportion of the low biodiversity habitat. High biodiversity habitats in the RSA included waterbodies and mixedwood forest.

With mitigation, the impact to habitat availability, wildlife movement, wildlife mortality risk and health and Wildlife Abundance was considered Low for all VECs except caribou. The impact to habitat availability, wildlife movement, wildlife mortality risk and health and Wildlife Abundance was considered moderate for caribou in both the Application Case and PDC.

Laricina will undertake the following mitigation measures in order to reduce the potential impacts to wildlife:

• Site preparation and construction will follow the “early-in, early-out” principle to minimize disturbance of wildlife. Site preparation and construction activities will be timed for fall and early winter to avoid disruption of nesting birds, in accordance with the Migratory Birds Convention Act (Regulation 12:1), and the sensitive calving period for caribou, which occurs between February 15 and July 15 (GOA 2011a).

• Laricina will engage provincial and federal regulators, as well as First Nations and traditional land-users, in discussion regarding approaches to further minimize effects on woodland caribou. Such approaches may include, among other options, monitoring, habitat management and participation in regional initiatives.

• Forest raptor and owl nests will be identified and activity will be minimized within 200 m of nests between February 15 and August 15 although the exact dates may vary by species (e.g., most owls initiate nesting activities before forest raptors). In the event that a northern goshawk nest is identified, a 500 m setback distance from medium and high intensity disturbances will be used between March 15 and August 31 (GOA 2011b). Low intensity disturbances during this period will be setback from goshawk nests by 200 m. High intensity disturbances will have a 500 m setback year-round. Site specific mitigation plans will be developed to facilitate development.

• ASRD will be contacted in the event that a hibernating black bear is disturbed during the course of vegetation clearing in winter.

• The Project footprint will avoid mature and old-growth forest as much as possible to minimize impacts on species dependent on this habitat, including woodland caribou and old-growth forest birds. To achieve this, pre-construction surveys will be undertaken to evaluate habitat conditions at proposed well pads and other facility locations and to identify opportunities to reduce impacts through final siting of these facilities. The Project footprint will be minimized to the extent possible. The use of directional drilling will reduce the number of well pads required.

• Riparian areas and waterbodies will be avoided to preserve habitat for amphibians, waterbirds and many other species, as well as to reduce the chance of contaminating
waterbodies. Treed buffers will be retained around watercourses and waterbodies according to timber harvesting guidelines (ASRD 2008).

- Laricina restricts and consistently monitors access into its site to reduce disturbance of wildlife and minimize the creation of packed snowmobile trails in winter. Laricina’s common operational practices includes, but is not be limited to, the following:
  - Laricina strictly restricts the recreational use of snowmobiles and ATVs in the LSA;
  - Laricina restricts hunting and or harassment of wildlife by workers in the LSA;
  - Laricina has zero tolerance policy which is strictly enforced on the use of firearms on any of Laricina’s leases;
  - Laricina has a manned gate that monitors activities and access on a 24 hour basis into Laricina’s leases and requires all individuals to check-in prior to entry; and,
  - Laricina consults with First Nation’s to maintain access to the LSA for traditional land uses.

- Laricina commits to joining the Oil Sands Developers Group (OSDG) which is an industry association representing companies actively engaged in the development of Canada’s Athabasca oil sands region. Laricina will participate on the environmental committee which is supportive of the regional biodiversity monitoring initiative.

- A Waste Management Plan will be implemented to minimize the attraction of bears and other predators to the area, which could increase mortality rates of bears and ungulates, as well as potentially endanger site personnel. Laricina will adhere to the Best Management Practices for Camps, Fences and Barriers as described in the Bear Smart: Best Management Practices for Camps (ASRD 2004), and ensure waste is stored in secure wildlife-proof containers.

- An Emergency Spill Response Plan will be implemented in the event of accidental spills. Environmental consequences of spills will be minimized by restricting fuel storage/filling to designated areas at least 100 m from waterbodies and watercourses.

- Enforcement of low speed limits (≤50 km/hr) along all access roads, and posting signs at wildlife crossings to minimize vehicle-wildlife collisions. Vehicles will yield to all wildlife crossing access roads.

- Above-ground pipelines have the potential to act as a barrier to wildlife movements, particularly ungulates. Recent work conducted by ASRD provides guidelines for wildlife crossings although these guidelines are subject to revision following further research. In 2011, the Canadian Association of Petroleum Producers (CAPP) proposed a series of standard mitigation for above-ground pipelines that Laricina has incorporated into their strategy. Laricina will employ the following mitigation strategies as appropriate:
  - Wildlife crossing structures will be used to facilitate wildlife movement through the LSA. Wildlife passes will employ 6:1 ramps to maintain line of sight for ungulates, a 10 m effective width, and will be naturalized by planting the crossing with vegetation that is compatible with adjacent forest cover.
  - Wildlife crossings will be placed in locations that maximize the chances of use by wildlife. Such locations include, but are not limited to, wildlife trails, riparian areas, high quality habitat (e.g., mature treed bog for caribou). Wildlife crossings will be placed at a frequency that ensures overall permeability of the LSA to wildlife.
- Pre-construction surveys will be conducted to identify important wildlife areas and trails, to facilitate the correct placement of wildlife crossings. These surveys were initiated in 2010 with the Wildlife Monitoring Program.
- Continuous segments of above-ground pipelines >1,000 m will have a minimum of three crossing structures/1,000 m. Continuous segments of above-ground pipelines between 500 and 1,000 m will have a minimum of two crossing structures. Crossing structures will not be used within 500 m of the CPF because caribou and other wildlife are anticipated to avoid these features.
- Wildlife crossings will be marked to prevent wildlife-vehicular collisions, and winter plowing or grading will be conducted in a manner that does not result in the creation of snow berm barriers at wildlife crossings.
- The wildlife crossing structures will be monitored using wildlife cameras and snow tracking following construction. Further mitigation will be considered if crossings are not being used by wildlife and the pipelines appear to be acting as barriers to movement.
- Laricina will provide the ACC with any pertinent data collected during the monitoring program.
- Reclamation of disturbed sites will be initiated as soon as the work areas are no longer required and will be carried out progressively over the lifespan of the Project. Laricina also commits to the rapid reclamation of induced access (winter roads and seismic lines) to offset some of the adverse effects of induced access on woodland caribou.

A wildlife monitoring program will be put in place during the operations and decommissioning phases of the Project to evaluate the effectiveness of wildlife mitigation and reclamation procedures. Laricina will work with ASRD to develop the details of such a monitoring program and to adaptively manage Project effects and mitigation measures.

A.8.12 Greenhouse Gas

The potential effects of the Project on greenhouse gas and climate change are discussed in Section D.12 and Consultants Report #1 (CR #1).

A greenhouse gas (GHG) is any gas that contributes to potential climate change. Common GHGs include carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). GHGs absorb heat radiated by the earth and subsequently warm the atmosphere, leading to what is commonly known as the greenhouse effect.

At full operation, the Germain Project (Phases 1 through 4) will be generating 4.7 MT/yr of CO₂e, with the proposed Project contributing 3.03 Mt/yr to that total. Based on an estimated project life for Phases 2, 3, and 4 of 35, 30.5, and 27.5 years, respectively, total GHG for the Project alone is an estimated 144 Mt of CO₂e. The maximum GHG for the Project at full build-out will not occur for 30 years. The maximum annual Project at full build-out contribution to the total 2009 provincial and national GHG emissions on an annual basis will be 2.02 % to the total provincial and 0.68 % to the total national GHG emissions.
The GHG emission intensity is defined as the mass of GHG emissions generated per barrel of bitumen produced on an annual average basis. At full build-out, and accounting for indirect emissions due to electricity use, the Project is expected to generate 4,419 kt of CO$_2$e while producing 150,000 bbl of bitumen per day, for a GHG emission intensity of 81 kg CO$_2$e per barrel of produced bitumen. For direct emissions only, the intensity is projected to be 50 kg CO$_2$e per barrel.

A.8.13 Land and Resource Use

The potential effects of the Project on land and resource use are discussed in Section D.13.

Laricina has identified other surface and subsurface land and resource users located within their lease area. Land and resource uses within the Laricina lease area include:

- Surface dispositions and subsurface leases associated with petroleum and natural gas development;
- Surface dispositions associated with development of forest resources;
- Surface dispositions associated with public utilities;
- Government holdings and miscellaneous dispositions;
- Surface dispositions associated with sand and gravel development; and
- Traditional use and trapping areas.

The Project will have a neutral or positive impact on land and resource use. Laricina has identified potential land and resource users within the LSA and through their ongoing Stakeholder Consultation Program will ensure adverse impacts to these users are avoided and positive impacts are enhanced. Laricina will work cooperatively and jointly with other land resource users to minimize and mitigate any land use conflicts.
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Part A: Project Introduction
Germain Project Expansion

FIGURES
Legend
- Community
- Bigstone Cree and Peerless Trout First Nation Reserves
- Indian Reserve
- Germain Leases
- Saleski Leases
- Primary Highway
- Secondary Highway
- Improved Road
- Railway

Laricina Energy Ltd.
Germain Project Expansion
Regional Location of the Germain Project Expansion
Laricina Energy Ltd.
Germain Project Expansion

Title: Full Project Development for Phases 2, 3 & 4 (150k bbls/d) on Satellite Image

Legend:
- Germain Leases
- Proposed ERCB Project Area
- Approved ERCB Project Area
- Phase 1 - 5K (Existing)
- Proposed Project Footprint
- Borrow Pit
- Access ROW
- Access/Pipeline ROW
- Buried Pipeline ROW
- Observation Well
- Water Monitoring Well
- Water Disposal Well
- Water Source Well
- Open Water
- Streams with Defined Channels
- Drainages without Defined Channels

Scale 1:100,000

Date of Image: July, 2010

DRAWN: PS
CHECKED: JD
DATE: Oct 31/11
PROJECT: 10-045

A.1.1-5