

**FINAL TERMS OF REFERENCE
ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT**

FOR THE

**DEVON ARL CORPORATION (DEVON)
(FORMERLY REFERRED TO AS DEVON CANADA
CORPORATION)**

JACKFISH 2 SAGD PROJECT

150 km South of Fort McMurray & 15 Southeast of Conklin, Alberta

ISSUED BY: Alberta Environment

DATE: May 12, 2006

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APPENDIX

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to identify for Devon ARL Corporation, formerly referred to as Devon Canada Corporation (Devon), and for the public, the information required by government agencies for an Environmental Impact Assessment (EIA) report. Devon will prepare and submit an EIA report that examines the environmental effects of the construction, operation and reclamation of its proposed Jackfish 2 SAGD Project (the Project). Devon is proposing a steam assisted gravity drainage (SAGD) thermal recovery heavy oil project with a nominal capacity of up to 35,000 barrels per day of bitumen production. This Project will be located in Township 75 and 76, Range 7, W4M, approximately 150 km south of Fort McMurray and 15 km southeast of the community of Conklin.

1.2 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under the *Alberta Environmental Protection and Enhancement Act* (EPEA) and Regulations, the *Oil Sands Conservation Act* (OSCA) and Regulations, and the *Canadian Environmental Assessment Act* (CEAA) and Regulations. The EIA report will:

- a) assist the public and government to understand the environmental consequences of the Project's development, operation and reclamation;
- b) assist Devon in its decision-making process;
- c) present impact predictions in terms of magnitude, frequency, duration, seasonal timing, reversibility and geographic extent;
- d) discuss measures to prevent or mitigate impacts and monitor environmental protection measures;
- e) identify residual impacts and their significance including cumulative and regional development considerations;
- f) discuss proposed mitigation measures, protection plans, monitoring or research programs and other follow-up actions related to proposed activities, environmental performance objectives and anticipated regulatory requirements;
- g) include a glossary of terms to assist the reader in understanding the material presented;
- h) include tables that cross-reference the report (subsections) to the EIA Terms of Reference and to any current applications submitted pursuant to the EPEA and *Water Act* (WA); and
- i) form part of Devon's Application to the Alberta Energy and Utilities Board (EUB). A summary of the EIA report should also be included as part of the EUB Application.

1.3 PUBLIC CONSULTATION

The preparation of the EIA report will include a public consultation program documenting the results of these consultations (see Section 8.0) and providing environmental information to address the issues raised. The public consultation program is to communicate with those members of the public who may be affected by the Project and to provide them with an opportunity to participate in the Environmental Assessment process.

1.4 PROPONENT'S SUBMISSION

Devon is responsible for the preparation of the EIA report and related applications. The final submission will be based upon these Terms of Reference and issues raised during the public consultation process.

2.0 PROJECT OVERVIEW

2.1 THE PROPONENT

Provide:

- a) the name of the proponent;
- b) the name of the legal entity that will develop, manage and operate the Project;
- c) details on the proponent;
- d) a brief history of Devon's operations including existing activities; and
- e) an overview of the proposed Project.

2.2 THE PROJECT AREA AND EIA STUDY AREA(S)

The Project Area includes all lands subject to direct disturbance from the Project and associated infrastructure, including access and utility corridors. For the Project Area, provide:

- a) the legal land description;
- b) the boundaries of the proposed development area;
- c) a map that identifies the locations of all proposed development activities; and
- d) a map showing the area proposed to be disturbed in relation to existing topographic features, township grids, wetlands, watercourses and waterbodies.

Study Areas for the EIA report include the Project Area and other areas based on individual environmental components where an effect from the proposed development can reasonably be expected. For the Study Areas, provide:

- a) the rationale used to define Local and Regional Study Areas (see also Section 4.2), considering the location and range of probable project and cumulative effects including those related to regional or cumulative effects consistent with regional environmental monitoring and management activities where possible; and
- b) illustrate boundaries and identify Local and Regional Study Areas chosen to assess impacts on maps of appropriate scale.

2.3 PROJECT COMPONENTS AND DEVELOPMENT SCHEDULE

Provide a development plan and overview of the Project components proposed to be approved, including:

- a) the phases of development;
- b) bitumen/heavy oil recovery and field maintenance operations;
- c) processing facilities;
- d) buildings;
- e) transportation infrastructure; and
- f) utilities.

Provide an outline and/or drawings of the Project components and activities including:

- a) temporary structures;
- b) processing/treatment facilities;
- c) buildings and infrastructure (roads, pipelines and utilities);
- d) transportation and access routes;
- e) storage areas and bitumen extraction operations;
- f) containment structures such as berms and retention ponds;
- g) lime sludge pond(s);
- h) water source wells and intakes;
- g) locations of borrow pits and salvaged soil stockpiles;
- h) aggregate resources and other road construction material required and on-site availability;
- i) types and amounts of waste materials, waste storage area and disposal sites;
- j) activities associated with development of the area, operations, reclamation and development closure; and
- k) proposed method of product transportation to markets.

Provide a development schedule outlining the proposed phasing and sequencing of components, including:

- a) pre-construction;
- b) construction;
- c) operation;
- d) decommissioning;
- e) progressive and final reclamation and closure;
- f) a detailed schedule for any reclamation and related activities envisaged during the first decade of operations; and
- g) timing of key construction, operational and reclamation activities and the expected duration of each for the life of the Project.

2.4 PROJECT NEED AND ALTERNATIVES CONSIDERED

Discuss the need for the Project and alternatives considered and:

- a) identify and compare any alternative technologies, operational practices, mitigation, and management options for the Project and indicate their potential environmental effects and impacts;
- b) discuss reasons for not selecting any identified alternatives;
- c) discuss contingency plans if major project components for any process or during any phase prove to be unfeasible;
- d) discuss the implications of a delay in proceeding with the Project, or any phase of the Project; and
- e) identify potential cooperative development opportunities for the Project.

2.5 REGULATORY APPROVAL

Provide the following:

- a) identify the environmental and other specific regulatory approvals and legislation that are applicable to the Project at the municipal, provincial and federal government levels;
- b) identify government policies, resource management, planning or study initiatives pertinent to the Project and discuss their implications; and
- c) identify and delineate major components of the whole Project and identify those being applied for and constructed within the duration of approvals under the:
 - i) *Environmental Protection and Enhancement Act* (EPEA);
 - ii) *Water Act* (WA);
 - iii) *Public Lands Act* (PLA);
 - iv) *Canada Fisheries Act*; and
 - v) *Navigable Waters Protection Act*.

2.6 EIA SUMMARY

Provide a summary of the EIA report, including:

- a) the baseline conditions in the Study Area(s) (baseline includes existing and approved facilities and activities in the Study Area);
- b) activities and components of the Project that are anticipated to influence environmental conditions;
- c) anticipated environmental impacts of the technologies and operational practices considered in the design of the Project;
- d) anticipated environmental conditions with the Project and anticipated effects of existing, approved and announced Projects in the region, with emphasis on regional and cumulative considerations;
- e) proposed mitigation measures and management plans;
- f) any residual effects and their implications for the future management of regional cumulative effects;
- g) a list and discussion of key environmental issues, and issues which are important for the achievement of sustainable environmental and resource management;
- h) a list of issues that were raised during public consultation and the response to these issues;
- i) a list of issues related to Aboriginal people;
- j) differentiate between emerging issues (with ongoing uncertainties), issues with quantifiable and significant environmental effects, and issues which can be resolved through available technology and with existing management approaches;
- k) reclamation and closure plans;
- l) historical resources and traditional use in the Study Areas;
- m) public health and safety issues related to the Project;
- n) the socio-economic impacts of the Project; and
- o) the public consultation undertaken.

3.0 PROJECT DESCRIPTION AND MANAGEMENT PLAN INFORMATION REQUIREMENTS

Describe activities and components of the Project and relevant management plans. Provide sufficient scope and detail in the project description information to allow quantitative assessment of the environmental consequences. If the scope of information varies among components or phases of the Project, provide rationale demonstrating that the information is sufficient for assessment purposes.

Technical information required in this section may also be required under the EUB technical information requirements or information requirements for an EPEA Approval Application or a WA Application. Information required in this section may be provided in other parts of Devon's submission(s) provided that the location of the information is referenced in the EIA report. Devon should ensure consistency in the information provided, whenever it is discussed in more than one section of the submission.

3.1 SITE DEVELOPMENT

Describe the thermal recovery and other related processes, process facilities and waste management components of the Project, and:

- a) provide a map showing any existing infrastructure (e.g., roads) and the location of the proposed central and field facilities;
- b) locate the buildings, road access, pipeline routes, water pipelines, utility corridors and waste disposal sites associated with the Project;
- c) show all existing leases and clearings, including exploration clearings, and illustrate how Devon intends to use these areas for project development;
- d) describe the process and criteria used to select all sites for facilities and infrastructure, including uncertainties and alternatives;
- e) list the facilities for which locations will be determined later;
- f) describe the planned accommodation for the workforce during construction and operations;
- g) provide a description and schedule of land clearing required for:
 - i) central plant facilities,
 - ii) field facilities,
 - iii) well pads,
 - iv) access roads,
 - v) pipelines,
 - vi) borrow areas, and
 - vi) utilities and other site preparation activities,
- h) indicate the amount of surface disturbance from plant, field and infrastructure-related activities including:
 - i) how surface disturbance (extent and duration) will be minimized,
 - ii) opportunities to undertake progressive reclamation to offset new disturbance,
 - iii) whether the timber is merchantable and if so, indicate anticipated volumes from clearing activities,
 - iv) how visual aesthetics will be managed,

- i) opportunities to integrate the proposed Project with other resource development activities (minerals and forestry); and
- j) any restrictions, and where appropriate, measures taken to control access to project areas while ensuring continued access to adjacent wildland areas.

3.2 INFRASTRUCTURE AND TRANSPORTATION

Describe and locate on maps of appropriate scales the infrastructure and transportation (access) requirements for the Project and how it relates to local communities, and:

- a) discuss the amount and source of energy required for the Project;
- b) discuss the options considered for supplying the thermal energy and electric power required for the Project and their environmental implications;
- c) describe road access to and within the Project Area and identify needs to upgrade existing roads or construct new roads;
- d) describe any crossings of watercourses or waterbodies required (with appropriate maps and diagrams):
 - i) include timing,
 - ii) construction standards or methods, and
 - iii) environmental protection plans;
- e) discuss the route or site selection criteria for any linear or other infrastructure development or modification and provide the rationale for selecting the proposed alignment and design;
- f) discuss the need for access management during and after project operations;
- g) provide the results of consultation with Alberta Transportation and discussions with other industry operators;
- h) describe access corridors needed and/or planned by other resource stakeholders including Forest Management Areas or Quota holders. Describe how their needs are accommodated to reduce overall environmental impact from resource development. Describe the steps taken to integrate their needs into the location and design of the access infrastructure;
- i) describe the anticipated changes to traffic (e.g., type, volume) on local highways during the construction and operation of the Project. Discuss any Project and cumulative effects expected on the primary and secondary highway systems, particularly Highway 881. Consider other existing and planned operations in the region;
- j) identify the type and location of road construction and restoration materials, the volume of material needed and the availability of materials in the area. Discuss how the Project will affect Alberta Transportation's aggregate reserves that may be located on Devon leases and reserves in the region. Provide a plan of how these potentially affected reserves will be salvaged and stockpiled with input provided by Alberta Transportation and Sustainable Resource Development;
- k) outline design features to prevent spills, contingencies for spill response and environmental risks associated with spills; and
- l) discuss secondary effects that may result from linear development such as increased hunter, angler and other recreational access and facilitated predator movement.

3.3 AIR EMISSIONS MANAGEMENT

Develop an emissions profile (type, rate and source) for each component of the Project including point sources, fugitive emissions, construction and vehicle emissions. Consider both normal

operating conditions and upset conditions. Include definitions for these conditions. Discuss the following:

- a) the emission control technologies proposed for the Project in the context of available technologies including:
 - i) the control technologies used to minimize air emissions such as sulphur dioxide (SO₂), hydrogen sulphide (H₂S), oxides of nitrogen (NO_x), volatile organic compounds (VOC) and particulate matter,
 - ii) any potential odorous or visual emissions from the proposed facilities,
 - iii) any *National Pollutant Release Inventory* (NPRI), *Priority Substances List* (PSL1 and PSL2) and/or *Accelerated Reduction/Elimination of Toxics* (ARET) substances relevant to the Project,
 - iv) use of low NO_x technology for turbines and boilers. The applicability of *Canadian Council of Ministers of the Environment (CCME) National Emissions Guidelines for Stationary Combustion Turbines* and *CCME National Emissions Guideline for Commercial/Industrial Boilers and Heaters*,
 - v) applicability of sulphur recovery, acid gas re-injection, flue gas desulphurization or other technologies to reduce sulphur emissions and applicability of EUB sulphur recovery guidelines (*Interim Directive ID 2001-03*),
 - vi) gas collection, conservation and applicability of technology for vapour recovery for the Project at well pads and central facilities, including the recovery of diluent,
 - vii) control technologies for minimization of venting and flaring, and
 - viii) fugitive emissions control program to detect, measure and control emissions and odours from equipment leaks and the applicability of the *CCME Code of Practice for Measurement and Control of Fugitive VOC Emissions from Equipment Leaks* and the *CCME Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Above Ground Storage Tanks*;
- b) emergency flaring scenarios (frequency and duration) and proposed measures to ensure flaring events are minimized;
- c) the systems used to monitor and quantify air emissions;
- d) the use of alternative fuels in this project. Provide emission profiles for each fuel under consideration;
- e) the amount and nature of any acidifying emissions, as well as deposition areas and deposition rates to soils, vegetation, and waterbodies as well as programs Devon may implement to monitor the effects of this deposition;
- f) monitoring programs that may be implemented to assess air quality and the effectiveness of mitigation during project development and operation, and discuss how these monitoring programs are compatible with those in use by regional multi-stakeholder air initiatives;
- g) estimates of the incremental loading of greenhouse gases to the atmosphere as a result of the Project including:
 - i) the expected annual and total greenhouse gas (GHG) emissions over the construction, operation and decommissioning phases of Project; and
 - ii) the Project's marginal contribution to total provincial and national GHG emissions on an annual basis;

- h) describe emission estimates relative to total provincial and national emissions. Discuss a greenhouse gas management plan for the Project including:
 - i) internal energy efficiency designs for the Project,
 - ii) any plans for the use of offsets (nationally or internationally),
 - iii) the expected results of implementing plans,
 - iv) the intensity of GHG emissions per unit of product produced and discuss how it compares with similar projects and technology performance,
 - v) how the project design and GHG management plans have taken into account the need for continuous improvement with respect to GHG emissions and their consideration of the national *Climate Change Plan for Canada* and *Alberta's Climate Change Action Plan*; and
 - vi) Devon's overall GHG management plans, any plans for the use of offsets (nationally or internationally), and the expected results of implementing the plans.
- g) identify other emission reduction processes or programs.

3.4 WATER SUPPLY, WATER MANAGEMENT AND WASTEWATER MANAGEMENT

3.4.1 *Water Supply*

Describe the water supply requirements for the Project including:

- a) the annual and seasonal water balance prior to the project development and the expected water balance during project operations. Discuss assumptions made or methods chosen to arrive at the water balances;
- b) the process, potable and non-potable water requirements and sources for construction, start-up, normal and emergency operating situations, decommissioning and reclamation. Include a description of the criteria for selecting the preferred source(s). Identify the volume of water to be withdrawn from each source, considering plans for wastewater reuse, and the locations of any water well;
- c) the variability in the amount of water required on an annual and seasonal basis as the Project is implemented and the expected cumulative effects on water losses/gains due to the project operations. Show the location of sources/intakes and associated infrastructure (pipelines);
- d) contingency plans for water supply, including the potential effects of extended periods of drought on the proposed water supply; and
- e) options for using saline groundwater including the criteria used to assess the feasibility of its use.

3.4.2 *Water Management*

Provide a Water Management Plan for construction, operation and reclamation phases including:

- a) factors considered in the design of water management systems, such as:
 - i) site drainage, dewatering and anticipated annual runoff volumes,
 - ii) road and well pad run-off,
 - iii) containment,
 - iv) erosion/sediment control,
 - v) slumping areas,
 - vi) groundwater protection,
 - vii) groundwater seepage,

- viii) potable water,
- ix) produced water, and
- x) flood protection;
- b) measures for ensuring efficient use of water including alternatives to reduce freshwater consumption such as the displacement of freshwater with saline sources, water use minimization, recycle of produced water, conservation and synergies with other developers and/or earlier project phases;
- c) permanent or temporary alterations or realignments of watercourses, wetlands (including bogs and fens) and other waterbodies; and
- d) potential downstream impact if water is removed from local surface waterbodies.

3.4.3 Wastewater Management

Provide a Wastewater Management Plan to address site runoff, groundwater protection, deep well disposal and wastewater discharge, including:

- a) source, quantity and composition of each wastewater stream from the existing and proposed facilities;
- b) NPRI, PSL1, PSL2, or ARET substances relevant to the Project;
- c) design of facilities that will handle, treat, store and release each wastewater stream;
- d) type and quantity of chemicals used in water and wastewater treatment;
- e) options considered for treatment, wastewater management strategies and reasons (including water quality and environmental considerations) for selecting the preferred options (consider the *Industrial Release Limits Policy* when determining whether either technology or water quality standards will define acceptable release limits);
- f) the discharge of aqueous contaminants (quantity, quality and timing) beyond plant site boundaries and the potential environmental effects of such releases;
- g) aquifers for the disposal of wastewaters, including:
 - i) formation characterization,
 - ii) local and regional hydrodynamic flow regime,
 - iii) water quality,
 - iv) chemical compatibility,
 - v) containment potential within the disposal zones, and
 - vi) injection capacity;
- h) the chemical composition of disposal waters;
- i) wastewater disposal alternatives;
- j) current and proposed monitoring programs;
- k) potable water and sewage treatment systems that will be installed as components of the Project for both the construction and operation stages; and
- l) the principles that have been incorporated into the project design for pollution prevention, waste minimization and recycling.

3.5 HYDROCARBON, CHEMICAL AND WASTE MANAGEMENT

Estimate the quantity and composition of each waste stream. Classify each waste stream according to applicable provincial regulations and guidelines. Demonstrate that the plans are consistent with current industry practices, and:

- a) describe the composition and volume of specific waste streams generated by the Project, and identify how each stream will be managed. Demonstrate that the selected practices for the plant and field operations comply with provincial and federal regulations including EPEA's *Waste Control Regulation* and Alberta Environment's *Hazardous Waste Storage Guidelines*;
- b) provide a listing of chemical products to be used for the Project. Identify products containing substances that are:
 - i) *Canadian Environmental Protection Act (CEPA)* toxics,
 - ii) on the PSL 2 or ARET, and those defined as dangerous goods pursuant to the federal *Transportation of Dangerous Goods Act*. Classify the wastes generated and characterize each stream under the Alberta Environment *User's Guide for Waste Managers*,
 - iii) on the NPRI, and
 - iv) on Track 1 substances targeted under Environment Canada's *Toxic Substances Management Policy* for virtual elimination from the environment;
- c) describe, in general terms, how these products will be stored and managed. Discuss options for the substitution or replacement of these products and identify how future changes to this list of chemical products will be handled to ensure adequate protection to both the environment and to employee health and safety;
- d) identify the location, nature and amount of on-site hydrocarbon storage. Discuss containment and other environmental protection measures. Discuss how selected practices comply with provincial and federal regulations including the *EUB Guide 55 – Storage Requirements for Upstream Petroleum Industry*;
- e) identify the amount of drilling wastes produced by the Project. Determine the amount of surface disturbance caused by drilling waste disposal. Describe any mitigative options to reduce the disturbance. Describe how the disposal sites and sumps will be constructed in compliance with the *Oil and Gas Conservation Regulation*;
- f) discuss the strategy for onsite versus offsite waste disposal including:
 - i) locations of onsite waste disposal, including landfills, if applicable, and the general suitability of the site from a groundwater protection perspective (provide geotechnical information to support siting options),
 - ii) industrial landfills,
 - iii) on and offsite waste treatment and storage areas, and
 - iv) potential effects on the environment;
- g) describe plans for waste minimization, recycling and management over the life of the Project; and
- h) discuss methods and technologies to reduce waste quantities, and associated potential risks, to the lowest practical levels.

3.6 RECLAMATION/CLOSURE (SEE APPENDIX)

Provide a conceptual reclamation and closure plan for all phases of the Project with consideration of the following:

- a) reclamation requirements specified by relevant regulatory organizations and stakeholder preferences;
- b) pre-development information with respect to land capability, reclamation suitability, vegetation, commercial forest land base by commercialism class, forest productivity, old growth forests, recreation, wildlife, aquatic resources, aesthetics and land use resources;
- c) project development phasing;
- d) integration of operations, reclamation/closure planning and reclamation activities;
- e) reclamation sequencing for each phase of development;
- f) a revegetation plan for the disturbed terrestrial and aquatic areas, identifying the species types that will be used for seeding or planting, and the vegetation management practices. Include the rationale for selection based on the need for the development of self-sustaining biologically diverse ecosystems consistent with the Central Mixedwood Subregion of the Boreal Forest Natural Region with reference to the use of native vegetation species;
- g) soil and reclamation material salvage including criteria to be used in salvaging soil, soil storage areas and soil handling procedures;
- h) areas of soil replacement indicating depth, volume and type of reclamation material;
- i) soil-related constraints or limitations that may affect reclamation;
- j) re-establishment of self-sustaining topography, drainage and surface watercourses and vegetation communities representative of the surrounding area;
- k) pre-development and final closure site drainage plans;
- l) management of waste, wastewater, and other waters;
- m) restoration of pre-development traditional use with consideration for traditional vegetation, fish and wildlife species in the closure landscape;
- n) post-development land capability for all uses;
- o) post-development reforestation and forest productivity, with information required for inclusion into the FMA (Forest Management Agreement) Detailed Forest Management Plan;
- p) wetlands or other alternatives to reclaim the land;
- q) reporting of reclamation progress through development of the Project, relating reclamation progress to pre-development expectations; and
- r) a detailed monitoring plan (including soils, vegetation, wildlife and aquatic resources) with schedules, methodologies and limitations to measure and evaluate reclamation performance and success.

Discuss the closure landscape design with reference to the following:

- a) appropriate productivity equivalent to pre-development levels having regard for regulatory requirements and stakeholder end land use preferences;
- b) discussion on how Devon will incorporate into the reclamation plan, the issues raised by regional environmental monitoring and management activities;
- c) promotion of biodiversity;
- d) integration and interconnectivity to the surrounding landscapes;
- e) integrating surface and near-surface drainage within the development area;
- f) resemblance to the pre-disturbed landscape;
- g) aquatic components of the post-reclamation landscape including:
 - i) issues related to the design of a self-sustaining and productive aquatic ecosystem,

- ii) a hydrological analysis of the post-reclamation landscape including pre-development and final closure site drainage plans,
 - iii) contrasts of the pre-disturbed aquatic ecosystem to the post-reclamation situation, and
 - iv) a discussion of how the reclamation plan incorporates diversity, size and extent of wetlands into the final design;
- h) anticipated timeframes for completion of reclamation phases and release of lands back to the Crown, including an outline of the key milestone dates for reclamation and a discussion of how progress will be measured in the achievement of these targets. Discuss any constraints to reclamation such as timing of activities, availability of soil materials and influence of natural processes and cycles; and
- i) development of a conceptual ecological land classification (ELC) map for the post-reclamation landscape considering all potential land uses and how the landscape and soils have been designed to accommodate future land use.

3.7 ENVIRONMENTAL MANAGEMENT SYSTEMS AND CONTINGENCY PLANS

Summarize key elements of Devon's existing or proposed environment, health and safety management system and discuss how it will be integrated into the Project, including the following:

- a) plans for monitoring all inputs of the Project and associated facilities, including the key elements of the operating plans and performance standards to be developed prior to the commissioning of the plant, such as:
 - i) policies and corporate procedures,
 - ii) operator training,
 - iii) emergency reporting procedures for spill containment and management, and
 - iv) emergency response and safety procedures;
- b) plans to minimize the production or release into the environment of substances that may have an adverse effect, including:
 - i) modifying existing plans, or
 - ii) developing new conceptual contingency plans that consider environmental effects associated with operational upset conditions such as serious malfunctions or accidents that represent deviations from normal operating performance;
- c) review of monitoring information, including:
 - i) monitoring done independently by Devon,
 - ii) monitoring performed in conjunction with other stakeholders,
 - iii) publicly-available monitoring information, and
 - iv) new monitoring initiatives that may be required as a result of the Project;
- d) air emissions, water emissions, waste tracking, process inputs and outputs. Present conceptual contingency plans that consider the environmental effects of serious malfunctions or accidents;
- e) how regional environmental management initiatives will be incorporated into management practices;
- f) an emergency response system to deal with emergency situations and minimize adverse environmental effects. Discuss the emergency response plan's capability to deal with unpredicted negative impacts. Comment on contingency plans that have been or will be

developed to respond to unpredicted negative impacts that are realized during and after project development; and

- g) a fire control plan highlighting:
 - i) measures taken to ensure continued access for firefighters to adjacent wildland areas,
 - ii) forest fire prevention measures;
 - iii) measures for determining the clearing width of power line rights-of-way, and
 - iv) use of the *FireSmart Wildfire Assessment System* to assess areas adjacent to the proposed facilities to identify required mitigative measures.

3.8 ADAPTIVE PLANNING

Describe adaptive management plans that reduce the impact of the Project at the design stage. Describe how the adaptive management plans will be used throughout the life of the Project to site facilities and infrastructure associated with future phases of the Project.

3.9 PARTICIPATION AND MONITORING IN COOPERATIVE EFFORTS

Document Devon's current and planned involvement in regional cooperative efforts to address environmental and socio-economic issues associated with oil sands development during the life of the Project, including:

- a) regional air monitoring networks and studies, health studies, biomonitoring and research, aquatics monitoring, wetlands management, and land use planning and socio-economic studies;
- b) potential cooperative ventures that Devon has initiated, could initiate or could develop with other oil sands operators and other resource users (minerals and forestry) to minimize the environmental impact of the Project or the environmental impact of regional oil sands development;
- c) a description of how Devon will rely upon regional cooperative efforts to design and implement mitigation measures (to mitigate project specific effects and cumulative effects), monitoring programs (project specific monitoring and regional mentoring), and research programs;
- d) a description of how Devon will design and implement mitigation measures (to mitigate project specific effects and cumulative effects), monitoring programs (project specific monitoring and regional monitoring), and research programs outside of these initiatives where necessary; and
- e) the improvements in environmental performance achieved as a result of such ventures.

4.0 ENVIRONMENTAL ASSESSMENT

4.1 ASSESSMENT SCENARIOS

Define assessment scenarios including:

- a) a Baseline Case, which includes existing environmental conditions, existing and approved projects or activities;
- b) an Application Case, which includes the Baseline Case plus the Project; and
- c) a Cumulative Effects Assessment (CEA), which includes past studies, existing and anticipated future environmental conditions, existing projects or activities, plus other or planned projects or activities.

Note: For the purposes of defining assessment scenarios, “approved” means approved by any federal, provincial or municipal regulatory authority. “Planned” is considered any project or activity that has been publicly disclosed during the time period ending six months prior to the submission of the Project Application and EIA report.

4.2 ASSESSMENT REQUIREMENTS

Discuss the methods, criteria and assumptions used in Devon’s Environmental Assessment process and:

- a) provide information on the environmental resources and resource uses that could be affected by the construction, operation and reclamation of the Project. Provide a sufficient base for the prediction of positive and negative impacts and the extent to which negative impacts may be mitigated by planning, project design, construction techniques, operational practices and reclamation techniques. Discuss how the EIA report ensures that the same level of information is provided for all phases of the Project;
- b) quantify and assess impact significance where possible, taking into consideration spatial, temporal and cumulative aspects. Discuss the sources of information used in the assessment including a summary of previously conducted environmental baseline work related to Devon’s operations. Information sources will include literature and previous baseline reports and environmental studies, operating experience from current oil sands operations, industry study groups, traditional knowledge, and government sources. Identify any limitations or deficiencies that the information may place on the analysis or conclusions in the EIA report. Discuss how these limitations or deficiencies will be addressed within the current EIA report;
- c) describe the stakeholder consultation process (including, but not limited to, the public, Aboriginal people, industry and regulatory representatives) used to select and rationalize the Key Indicator Resources (KIRs). Where required, undertake studies and investigations to obtain additional information for establishing a sound baseline in the Study Area(s). From a broad-based examination of all ecosystem components including previous environmental baseline work, describe and rationalize the selection of key components and indicators examined; and
- d) for each environmental parameter:
 - i) describe baseline conditions (includes existing and approved facilities and activities). Comment on whether the available data are sufficient to assess impacts and mitigation measures. Identify environmental disturbance from previous activities that have now become part of baseline conditions,
 - ii) describe the nature and significance of the environmental effects and impacts associated with the development activities. Discuss the impacts of both the baseline case, as well as, the application case,
 - iii) present plans to minimize, mitigate or eliminate negative effects and impacts and discuss the key elements of such plans,
 - iv) identify residual impacts and comment on their significance,
 - v) present a plan to identify possible effects and impacts, monitor environmental impacts and manage environmental changes to demonstrate the Project is operating in an environmentally sound manner. Identify any follow-up programs necessary to verify the accuracy of the environmental assessment and to determine the effectiveness of any measures taken to mitigate any adverse environmental effects,

- vi) present a plan that addresses the adverse impacts associated with the Project that may require joint resolution by government, industry and the community,
- vii) describe how this plan will be implemented and how it will incorporate the participation of government, industry and the community, and
- viii) summarize the mitigation measures, which Devon is committed to implement in the Project.

4.3 MODELLING

Document any assumptions used to obtain modelling predictions submitted as part of the EIA report. Clearly identify the limitations of the model(s) including sources of error and relative accuracy.

4.4 EIA STUDY AREAS

The EIA Study Area shall include the PDA and associated infrastructure, as well as, the spatial and temporal areas of individual environmental components outside the project boundaries where an effect can be reasonably expected. The EIA Study Area includes both Regional and Local Study Areas.

Illustrate boundaries and identify the Study Area(s) chosen to assess impacts. Define temporal and spatial boundaries for the Study Areas. Maps of these areas shall include township and range lines for easy identification and comparisons with other information within the EIA report. Describe the rationale and assumptions used in establishing the EIA Study Area boundaries, including those related to cumulative effects.

4.5 BIODIVERSITY AND FRAGMENTATION

4.5.1 Biodiversity

Using the definition for biodiversity provided in the *Canadian Biodiversity Strategy (1995)*, determine the suite of target elements that will be used to assess biodiversity in terrestrial and aquatic ecosystems, that will be used to characterize the existing ecosystems and that will be used to represent broad taxonomic assemblages and:

- a) describe the process and rationale used to select biotic target elements for biodiversity;
- b) determine the presence and abundance of species in each ecosite phase or ecological type, within selected taxonomic groups. Provide species lists and summaries of observed and estimated species richness and evenness for each ecosite phase;
- c) ensure that baseline vegetation information collected in each terrestrial and aquatic community is accompanied by sufficient plots in each ecosite phase to provide statistically sound data using a suitable proportional sampling method;
- d) provide a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites;
- e) rank each ecological unit for biodiversity potential by combining measures of species richness, overlap in species lists, significance of individual species or associations, uniqueness and other appropriate measures. Provide the rationale and techniques for the ranking system chosen for this section;
- f) discuss the contribution of the Project to any anticipated changes in regional biodiversity, including measures to minimize such changes;
- g) identify and describe Devon's participation in regional programs that will allow for the collection and submission of baseline information in a timely manner;

- h) determine the variety, distribution, and abundance of non-biotic systems including, but not limited to, landforms and waterbodies, at the local, regional and landscape levels of analysis;
- i) discuss how changes in biodiversity could potentially impact local and regional ecosystems; and
- j) discuss biodiversity monitoring programs and management thresholds that Devon will implement either individually or in cooperation with other operators or regional initiatives.

4.5.2 **Fragmentation**

Determine the current and proposed level of habitat fragmentation for the Study Area. Describe the techniques used in the fragmentation analysis. Describe the principle factors contributing to fragmentation. Identify and evaluate the extent of potential effects from fragmentation (e.g., potential introduction of non-native plant species on native species composition and any changes to plant communities).

4.6 **CUMULATIVE ENVIRONMENTAL EFFECTS**

Assessment of cumulative effects will be an integral component of the EIA report. Devon will conduct a cumulative environmental effects assessment of the Project based on the EUB/AENV/NRCB Information Letter *Cumulative Effects Assessment in Environmental Impact Assessment Reports under the Alberta Environmental Protection and Enhancement Act (June 2000)*. This will include a comprehensive summary of all proposed monitoring, research and other strategies or plans to minimize, mitigate and manage any potential adverse effects. The identification and assessment of the likely cumulative environmental effects of the Project will:

- a) define the spatial and temporal Study Area boundaries with due consideration for RSDS recommendations, and provide the rationale for assumptions used to define those boundaries for each environmental component examined;
- b) describe the current (baseline) state of the environment in the Regional Study Area (used for the cumulative effects assessment);
- c) provide a discussion of historical developments and activities that have created the current conditions, clearly describing the state of the environment that will be affected by the proposed development, the potential interactions of stresses created by the Project and other stresses and, if possible, predict the cumulative consequences of these combined effects;
- d) assess the incremental consequences that are likely to result from the Project in combination with other existing, approved and proposed (projects that have been advanced to the public disclosure stage) or reasonably foreseeable activities in the region;
- e) demonstrate that any information or data used from previous oil sands and other development projects is appropriate for use in this EIA report;
- f) consider and describe any deficiencies or limitations in the existing database for all relevant components of the environment (and provide Supplemental Information where required);
- g) explain the approach and methods used to identify and assess cumulative impacts, including cooperative opportunities and initiatives undertaken to further the collective understanding of cumulative impacts, and provide a record of all assumptions, confidence in data and analysis to support conclusions; and
- h) discuss any deviations from the EUB/AENV/NRCB Information Letter *Cumulative Effects Assessment in Environmental Impact Assessment Reports under the Alberta Environmental Protection and Enhancement Act (June 2000)*.

4.7 CLIMATE, AIR QUALITY AND NOISE

Discuss climatic and air quality conditions considering existing and approved emission sources (baseline case) alone and in combination with the Project's proposed emissions (application case).

With respect to the collection of baseline information, provide the following:

- a) baseline climatic conditions, including the type and frequency of meteorological conditions, that may impact ambient air quality; and
- b) any regional air monitoring underway in the area and Devon's participation in any regional forums.

With respect to the methodology, provide the following:

- a) description of air quality in the Study Areas and any anticipated environmental changes for air quality. Review emission sources identified and model normal, worst case and upset conditions;
- b) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- c) justification of models used, model assumptions, and any model shortcomings or constraints on findings;
- d) the meteorological data model input set used to run the model and provide a rationale for the choice of data set;
- e) air dispersion modelling completed in accordance with Alberta Environment's *Air Quality Model Guideline*;
- f) for acid deposition modelling, provide deposition data from maximum levels to areas with 0.17/keq/ha/yr Potential Acid Input (PAI). Justify the selection of the models used and identify any model shortcomings or constraints of findings; include analysis of PAI deposition levels consistent with the most recent CEMA acid deposition management framework for the Study Areas;
- g) regional, provincial and national objectives for air quality that were used to evaluate the significance of emission levels and ground-level concentrations, including the Canada Wide Standard for particulate matter and ozone; and
- h) a comparison of predicted air quality concentrations with the appropriate air quality guidelines available.

4.7.1 *Impact Assessment*

Identify, describe and discuss the following:

Review current and approved emission sources and discuss changes as a result of anticipated future development scenarios within the EIA Study Area(s) (cumulative effects assessment case). Consider emission point sources as well as fugitive emissions. Identify components of the Project that will affect air quality from local and regional perspectives and:

- a) discuss appropriate air quality parameters such as: sulphur dioxide (SO₂), hydrogen sulphide (H₂S), total hydrocarbons (THC), oxides of nitrogen (NO_x), volatile organic compounds (VOCs), individual hydrocarbons of concern in the THC and VOC mixtures, representative heavy metals, visibility and particulates (road dust, PM₁₀ and PM_{2.5});
- b) provide estimates of ground-level concentrations of the appropriate air quality parameters; include frequency distributions for air quality predictions in communities and sensitive

- receptors; maximums for all predictions, 99.9th percentile for hourly predictions and 98th percentile for 24-hour PM_{2.5} predictions;
- c) discuss the formation of secondary pollutants such as ground-level ozone, secondary particulate matter and acid deposition;
 - d) discuss any expected changes to particulate deposition or acidic deposition patterns;
 - e) identify the potential for reduced air quality (including odours) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health. Discuss consideration of interactive effects that may occur as a result of co-exposure of a receptor to various emissions and discuss limitations in the present understanding of this subject;
 - f) describe Project-related and cumulative air quality impacts and their implications for other environmental resources, including habitat diversity and quantity, vegetation resources, water quality and soil conservation;
 - g) discuss the use of alternative fuels on the air quality in the Study Areas, if applicable;
 - h) describe how air quality impacts resulting from the Project will be mitigated. Identify ambient air quality monitoring that will be conducted during construction and operation of the Project. Identify components of the Project that have the potential for creating increased noise levels and discuss the implications and measures to mitigate. Assess the cumulative effects on the air quality of the Study Area, and include any emissions from current operations and disclosed Projects in the Study Area;
 - i) discuss noise according to the requirements and procedures outlined in *EUB ID 99-8* and *EUB Guide 38*. Provide the following:
 - i) quantification of existing and baseline conditions,
 - ii) potentially affected people and wildlife,
 - iii) characterization of noise sources, and noise resulting from the development,
 - iv) implications of any increased noise levels,
 - iii) environmental noise propagation modelling and impact assessment, and
 - iv) any proposed mitigation measures;
 - j) discuss interactive effects that may occur as a result of co-exposure of a receptor to all emissions and discuss limitations in the present understanding of this subject; and
 - k) discuss regional air monitoring underway in the area and describe Devon's participation in regional forums.

4.7.2 Climate Change

Discuss the following:

- a) in accordance with the guideline document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners (November 2003)*, review and discuss climate change and the local and/or regional, inter-provincial/territorial changes to environmental conditions resulting from climate conditions, including trends and projections where available;
- b) stages or elements of the Project that are sensitive to changes or variability in climate parameters. Discuss what impacts the change to climate parameters may have on elements of the Project that are sensitive to climate parameters; and
- c) the adaptability of the Project in the event the region's climate changes. Discuss any follow-up programs and adaptive management considerations.

4.8 SURFACE WATER AND HYDROGEOLOGY

4.8.1 *Hydrogeology*

Provide an overview of the existing geologic and hydrogeologic setting in the Project and Study Areas from the ground surface down to and including the bitumen producing zones and disposal zones. Document any new hydrogeological investigations, including methodology and results, undertaken as part of the EIA Study. Provide details on the observation well network used to calibrate any modelling efforts used in this assessment. If figures, maps, diagrams, interpretations and concepts developed from previous work are submitted in the EIA report, demonstrate how, or if, they have been modified by the incorporation of any subsequent new data and:

- a) present Regional and primary development area (PDA) specific geology using structure contour maps, geologic cross-sections and isopach maps to illustrate depth, thickness and spatial extent of lithology, stratigraphic units and structural features including water table and potentiometric surfaces;
- b) present Regional and PDA-specific hydrogeology describing:
 - i) the spatial distribution of aquifers and aquitards, their properties and the hydraulic connections between hydrostratigraphic units (include local and regional hydrostratigraphic cross sections),
 - ii) the hydraulic head, hydraulic gradients and groundwater flow directions and velocities,
 - iii) the chemistry of groundwater including background concentrations of major ions, metals and hydrocarbon indicators,
 - iv) the potential discharge zones, potential recharge zones and sources, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock aquifer interaction,
 - v) all water well development and groundwater use, including an inventory of all groundwater users (field verified survey),
 - vi) the recharge potential for Quaternary aquifers,
 - vii) the potential hydraulic connection between bitumen production zones, disposal formations and other aquifers,
 - viii) the locations of major facilities associated with the Project including facilities for waste storage, treatment and disposal (e.g., deep well disposal),
 - ix) confirmation that the disposal zones currently used for deep disposal of wastes (e.g., lime sludges) and wastewater will be sufficient for the Project. Provide descriptions of the disposal formations including containment, water quality, and the chemical compatibility with the wastewater,
 - x) the site-specific aquifer, shallow groundwater and geotechnical conditions beneath these proposed facilities. Identify the components and activities of the Project which have the potential to affect groundwater resource quantity and quality within the Study Areas during project development, operation and reclamation;
- c) describe the nature and significance of the potential project effects on groundwater with respect to:
 - i) inter-relationship between groundwater and surface water in terms of surface water quantity and quality,
 - ii) implications on terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands,
 - iii) changes in groundwater quality,
 - iv) conflicts with other groundwater users, and proposed resolutions to these conflicts, and
 - v) potential implications of seasonal variations,
 - vi) the suitability of on-site waste disposal and supporting geotechnical information, and
 - vii) groundwater withdrawal for project operations.

- d) describe programs to manage and protect groundwater resources including, but not limited to:
 - i) monitoring programs for groundwater quality and quantity,
 - ii) response/mitigation plans that may be considered in the event that adverse effects on non-saline groundwater, other groundwater users and/or surface effects related to groundwater pumping or steam/waste injection are detected, and
 - iii) Devon's involvement in regional groundwater initiatives in the in-situ oil sands area south of Fort McMurray.

Discuss the cumulative effects of groundwater withdrawal by the Project and other groundwater users with respect to the Study Areas and the PDA.

4.8.2 *Surface Hydrology*

Describe the surface hydrology in the Study Areas, including existing flow regimes of streams in the PDA and:

- a) provide the criteria used to identify key creeks, lakes and waterbodies to be monitored;
- b) provide available local and regional surface flow baseline data, including seasonal variation, low, average and peak flows for key creeks, river locations, and low, average and peak levels for key lakes:
 - i) describe and map the drainage patterns in the Study Areas, and
 - ii) provide a topographic map of the Local Study Area with appropriate contour intervals;
- c) identify the extent of changes that will result from disturbances to groundwater and surface water movement:
 - i) include changes to the quantity of surface flow, water levels and channel regime in local watercourses (during minimum, average and peak flows) and water levels in local waterbodies,
 - ii) assess the potential impact of any alterations in flow on the local and regional hydrology and identify all temporary and permanent alterations, channel realignments, disturbances and surface water withdrawals, their magnitude, duration, frequency, and proposed mitigation measures,
 - iii) discuss both the project and cumulative effect of these changes on hydrology (e.g., timing, volume, peak and minimum flow rates, river regime and lake levels), including the significance of effects for downstream watercourses,
 - iv) discuss the potential for connection between surface water, groundwater, production zones and disposal zones,
 - v) identify any potential erosion problems in the local creek channels due to existing or proposed project activities, and
 - vi) discuss remedial measures to alleviate the anticipated erosion;
- d) discuss changes to watershed(s), including surface and near-surface drainage conditions, potential flow impediment, and potential changes in open water surface areas caused by construction of access roads, drilling and well pads, and other facilities;
- e) discuss how potential impacts of temporary and permanent roads and well pads on peatland/wetland types will be minimized, mitigated and monitored. Discuss plans to return disturbed areas to a self-sustaining habitat considering previous capability, biodiversity and land uses;
- f) discuss changes in sediment concentrations in receiving waters caused by construction and describe mitigation measures to reduce sediment loadings;
- g) if any surface water withdrawals are considered, describe the effects of withdrawal, including cumulative effects. Identify any users who have existing approvals, permits or licenses and impact on users due to the Project. Identify any potential water use conflicts and potential solutions;

- h) describe water management plans, mitigation measures and monitoring programs, including participation in regional initiatives, for surface water recommended for the start-up, operations, and reclamation phases; and
- i) identify and discuss any monitoring programs that may be considered to assess the impacts of potential changes to surface water on aquatic resources, wildlife and vegetation.

4.8.3 *Surface Water Quality*

Describe the baseline water quality of watercourses and waterbodies in the Study Areas before and after project development and operation. The description of water quality will consider all appropriate water quality parameters, their seasonal variations and relationships to flow and other controlling factors, and a summary of existing water quality data, and:

- a) identify components within each phase of the Project that may influence or impact surface water quality;
- b) describe the potential impacts of the Project on surface water quality within the Study Areas:
 - i) discuss any changes in water quality resulting from the Project that may indicate a potential adverse effect or non-compliance with the *Surface Water Quality Guidelines for Use in Alberta* (November 1999) or the *Canadian Water Quality Guidelines*,
 - ii) discuss the significance of any impacts on water quality and implications to aquatic resources (e.g., biota, biodiversity and habitat),
 - iii) identify waterbodies that are sensitive to acid deposition. Assess the potential project related and cumulative impacts of acidifying and other air emissions on surface water quality;
 - iv) the distinction between natural variation and project-related impacts to water quality; and
 - v) discuss the effect of water quality in surface waterbodies due to the change in surface runoff or groundwater discharge;
- c) describe the proposed mitigation measures to be considered, during the construction, operation and reclamation phases of the Project, to maintain surface water quality. For any monitoring implemented for the Project, justify the selection of monitoring locations, and the integration of these sites into an overall aquatic assessment and monitoring program. Describe how the methods are in accordance to Alberta Environment standards for surface water quality monitoring. Identify any cooperative monitoring and assessment initiative(s), such as with regional stakeholders, that Devon may consider joining; and
- d) discuss the potential effects of seasonal variations and weather extremes on surface water quality. Describe the cumulative effects of regional activities on surface water quality in the Study Areas.

4.8.4 *Aquatic Resources*

Describe the existing fish and other aquatic resources (e.g., benthic invertebrate and aquatic vegetation) in the waters found in the Study Area and in other fish-bearing water likely to be impacted by the Project. Identify species composition, distribution, relative abundance, movements and general life history parameters, and:

- a) discuss the use of the fish resources as existing or potential Aboriginal, sport or commercial fisheries;
- b) describe and map, as appropriate, the fish habitat and aquatic resources of the lakes, rivers and other waters likely to be affected by the Project, and:
 - i) describe the timing, techniques, and the design of the inventory sampling used to determine the abundance, distribution, and habitat use of aquatic biological resources;
 - ii) identify key indicator species and provide the rationale and selection criteria used,
 - iii) identify critical or sensitive areas such as spawning, rearing, and over-wintering habitats. Discuss seasonal habitat use including migration and spawning routes,

- iv) describe the existing baseline information, any deficiencies in information, how these deficiencies will be addressed and, as applicable, any studies proposed to evaluate and monitor the status of the fish and aquatic resources in the Study Areas,
 - v) describe the potential for adverse impacts on the lakes and streams in the area (e.g., stream alterations and changes to substrate conditions, water quality and quantity affecting fish, fish habitat, and other aquatic resources in the Study Areas),
 - vi) consider fish tainting, survival of eggs and fry, chronic or acute health effects, and increased stress on fish populations from release of contaminants, sedimentation, flow alterations, temperature and habitat changes, and
 - vii) potential impacts on riparian areas that could impact aquatic biological resources and productivity;
- c) describe how potential changes to groundwater and surface water may affect fisheries and aquatic resources, under optimal, normal and drought conditions;
 - d) describe for potential watercourse crossings:
 - i) fish species present and life stages of concern;
 - ii) proposed use of culverts, their projected longevity, and their potential for habitat fragmentation; and
 - iii) longterm culvert monitoring and replacement program to ensure fish passage;
 - e) discuss, as applicable, the design, construction and operational factors to be incorporated into the Project for the protection of fish resources. Identify residual impacts on fish, fish habitat, and aquatic communities and discuss their significance in the context of local and regional fisheries. Indicate how environmental protection plans address applicable provincial and federal policies on fish habitat including the development of a “No Net Loss” fish habitat objective;
 - f) discuss the potential for increased fishing pressures in the region that could arise from the increased workforce and improved access as a result of the Project. Identify the implications for the fish resource and describe any mitigation strategies that might be planned to minimize these effects;
 - g) discuss, as appropriate, any cooperative mitigation strategies that might be planned or continued with other oil sands and industrial operators;
 - h) assess potential cumulative effects of the Project in combination with other proposed developments in the area on the fish and fish habitat resources of the Study Area; and
 - i) identify and discuss, as applicable, any monitoring programs that have been initiated by Devon or conducted in cooperation with stakeholders to assess fisheries impacts from the Project. Provide details of any programs and discuss how they would contribute to an overall understanding of Project impacts on fish resources.

4.9 TERRESTRIAL

4.9.1 *Geology, Terrain and Soils*

Describe the Local Study Area and Regional Study Area geological, terrain and soils conditions, including:

- a) surficial geology including surface topography of the Study Area and the bedrock;
- b) regional soils (include maps);
- c) soil types and their distribution in the Project footprint and Local Study Area using appropriate survey intensity levels (include maps);
- d) sensitivity of the soil types to acid deposition in both the regional and local study areas (include maps). Use modeled predictions of acid deposition patterns from the Project to assess the potential acidification impact on soils in the Local and Regional Study Areas.

- Discuss the potential cumulative effects of acid deposition as related to this project and suggest possible mitigative actions;
- e) a pre- and post-disturbance land capability assessment of the Local Study Area and describe the impacts to land capability due to the Project. Identify the distribution of pre- and post-disturbance land capability on a map and indicate the areas and locations of soil types and land capability classes that will be disturbed. Suggest ways in which surficial disturbances can be minimized;
 - f) availability and suitability of soils within the Project Area for reclamation and provide a soil balance for all phases of the Project;
 - g) an assessment of the anticipated changes (type and extent) to baseline topography, elevations and drainage patterns within the Project Area resulting from disturbance during construction, operation and reclamation;
 - k) all baseline biophysical information presented in a manner that enables a detailed ELC of the Project Area to be completed to the boreal ecosite classification. Describe the impact of the Project on each ELC unit based upon the key characteristics of the soil;
 - l) identification and location of erosion sensitive soils and discuss potential effects of the Project on these soils including mitigative actions;
 - m) any project activity and other related issues that could affect soil quality in the Study Areas (e.g. compaction, contaminants, soil moisture or other constraints or limitations to achieving vegetation restoration based on anticipated soil conditions);
 - n) environmental effects of proposed drilling methods on the surface landscape, surficial and bedrock geology. Identify environmental impacts of drilling over the life of the Project. Consider the potential for new or additional technology to increase resource recovery at later stages of the field development and to affect the number of wells required; discuss the potential environmental effects of casing failures. Identify measures to reduce the environmental risks from casing failures. Describe methods of detecting casing failures and propose an action plan in the event of a casing failure; and
 - o) discuss the potential for changes in the ground surface during operations (e.g., ground heave and ground subsidence). Summarize applicable experience with surface heaving and subsidence and the factors involved in their occurrence. Describe the environmental implications of any terrain changes during the steaming and recovery operations. Identify any activities that may cause soil contamination and describe mitigative actions.

4.9.2 *Vegetation and Forest Resources*

Map and describe vegetation communities for each landscape unit in the Project Area using the Alberta Vegetation Inventory Standards Manual (AVI) Version 2.1 and according to *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald), and:

- a) map and describe peatlands and wetlands affected by the Project according to the Alberta *Wetlands Inventory Standards Manual* (AWI) Version 1.0;
- b) discuss any shortfalls in using AVI and AWI for mapping the Project Area;
- c) address the adequacy of the Study Area, information sources and assessment methods for a cumulative effects assessment, including how baseline information was collected to enable a detailed ELC of the Project Area to be completed;
- d) identify the rare or endangered species, as listed by the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC) and the *Alberta Natural Heritage Information Centre* (ANHIC), for each landscape unit;

- e) discuss the ecosites in consideration of their potential to support rare plant species, plants for traditional and medicinal purposes, old growth forests and communities of restricted distribution. Consider their importance for local and regional habitat, sustained forest growth, rare plant habitat and the hydrologic regime;
- f) identify and verify the presence of species of rare plants and the ecosite phases where they are found, using reliable survey methods. Discuss any potential effects the Project may have on rare plants and areas with high rare plant potential habitat;
- g) discuss where landscape units are identified as rare, or where a significant percentage of a specific type may be removed by the Project, describe their regional significance;
- h) identify the amount of vegetation and wetlands to be disturbed during each stage of the Project;
- i) discuss temporary (include timeframe) and permanent changes to vegetation and wetland communities:
 - i) comment on the significance of the effects and their implications for other environmental resources (habitat diversity and quantity, water quality, erosion potential, soil conservation, recreation and other uses), and
 - ii) comment on the sensitivity to disturbance (including acid deposition), as well as the techniques used to estimate sensitivity to disturbance and reclamation, of each vegetation community and discuss permanent and temporary changes;
- j) identify and evaluate the extent of potential effects such as ecosystem fragmentation and introduction of non-native plant species on native species composition and changes to plant communities;
- k) produce an ELC map that shows the pre- and post-disturbed land surfaces. Comment on the importance of the size, distribution and variety of these landscape units for timber harvesting, agriculture, traditional gathering and other land uses from both a local and regional perspective;
- l) determine the rarity or abundance of wetlands in the Local Study Area;
- m) predict the anticipated effect of the Project on wetlands in conjunction with other project-induced variations in hydrology, habitat quality and wildlife populations;
- n) discuss the impact of any loss of peatlands or surface wetlands, as well as how this will affect land use, fragmentation and biodiversity. Discuss measures and techniques that will be used to minimize the impact;
- o) determine the amount of commercial and non-commercial forest land base that will be disturbed within the Project Area. Compare the pre- and post-disturbance percentages and distribution of all forested communities in the Project Area. Provide Timber Productivity Ratings for the Local Study Area lands, including identification of productive forested, non-productive forested and non-forested lands;
- p) determine how the project disturbance impacts Annual Allowable Cuts and quotas within the FMA. Discuss opportunities to integrate this project with other resource development activities such as logging;
- q) provide a detailed mitigation strategy that will minimize Project impacts in the Study Area;
- r) discuss plans to return disturbed areas to a self-sustaining habitat equivalent to pre-disturbance conditions, considering factors such as biological capability and diversity and end land use objectives;

- s) develop a plan to mitigate the adverse effects of site clearing on rare plants, existing cutblocks, runoff and water quality. Identify any setbacks proposed around environmentally-sensitive areas such as surface waterbodies, riparian areas and peatlands/wetlands;
- t) comment on the significance of the residual effects on vegetation resources, peatlands and wetlands, and their implications for other environmental resources; and
- u) in addition to equivalent land capability principle, discuss from an ecological perspective the expected timelines for establishment and recovery of vegetative communities and the expected differences in the resulting vegetative community structures.

4.10 WILDLIFE

Describe existing wildlife resources (amphibians, reptiles, birds and terrestrial and aquatic mammals), their use and potential use of habitats in the Study Area(s). Document the anticipated changes to wildlife in the Study Area(s). Specifically:

- a) discuss the selection criteria used to determine the Study Area(s), including information sources and assessment methods;
- b) discuss the criteria and selection process for wildlife indicator species used in the EIA report;
- c) identify wildlife species composition, distribution, relative abundance, seasonal movements, movement corridors, habitat requirements, key habitat areas, and general life history in the Study Area(s);
- d) include current field data, using recognized sampling protocols, for all key indicators and species of concern, including those listed by Alberta Fish and Wildlife (at risk, may be at risk and sensitive species in *the General Status of Alberta Wild Species 2000*) and COSEWIC (endangered, threatened, vulnerable in *Canadian Species at Risk 2002*);
- e) evaluate potential adverse impacts on wildlife populations, habitat use, habitat availability/quality and food supply during all phases of the Project. Consider habitat loss, abandonment, reduced effectiveness, fragmentation or alteration as it relates to reduced reproductive potential and recruitment for regional wildlife populations over the life of the Project. If habitat models are used to evaluate impacts, the models will be modified, calibrated and validated by comparing model predictions with wildlife data from the Project Area. Monitoring data from existing projects should be included to the extent it is available to the proponent;
- f) describe the spatial and temporal changes to habitat (type, quality, quantity, diversity and distribution) and to wildlife distribution, relative abundance, movements, habitat availability and the potential to return the area to pre-disturbed wildlife habitat/population conditions, including:
 - i) anticipated effects on wildlife as a result of changes to air, water, including both acute and chronic effects on animal health;
 - ii) anticipated effects on wildlife due to improved or altered access into the area; e.g., vehicle collisions with wildlife, obstructions to daily or seasonal movements, noise and hunting mortality during operations and after Project closure; and
 - iii) map the changes in habitat distribution and fragmentation anticipated from the Project and other planned activities, and assess the implications;
- g) discuss the use of setbacks to provide for the protection of riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using the habitat;

- h) indicate what measures will be taken to prevent habituation of wildlife and increasing the potential for human-wildlife encounters and consequent destruction of wildlife (e.g., black bears), including any staff training program, garbage containment or regular follow-up;
- i) provide a reliable impact assessment for wildlife indicators and listed wildlife species in the Study Area. Identify residual impacts to wildlife and wildlife habitat and discuss their significance in the context of local and regional wildlife populations;
- j) provide a strategy and mitigation plan to minimize impacts on habitat and wildlife populations through the life of the Project and to return productive wildlife habitat to the area, considering:
 - i) habitat enhancement measures and a schedule for the return of habitat capability to areas impacted by the Project;
 - ii) consistency of the plan with applicable regional, provincial and federal wildlife habitat objectives and policies;
 - iii) the need for access controls or other management strategies to protect wildlife during and after project operations; and
 - iv) monitoring programs to assess wildlife impacts from the Project and the effectiveness of mitigation strategies and habitat enhancement measures, giving special attention to sensitive species in the Study Area.

4.11 LAND USE

Identify the existing recreational, commercial, residential, institutional, oil and gas development, forestry, tourism, cultural/historical use, food collection, trapping, fishing, hunting and other outdoor recreational activities in local and regional settings. Identify the potential impact of the Project on these land uses and possible mitigation strategies. Identify any anticipated impacts related to changes in public access. Discuss the aesthetic characteristics of the facilities with respect to the existing landscape, and:

- a) identify any land use policies and resource management initiatives that pertain to the Study Area and discuss how the proposed development will be consistent with the intent of the guidelines and objectives of these initiatives. Discuss the implications of those land and resource use policies for the Project, including any constraints to development;
- b) identify unique sites or special features in the Study Area such as Natural Areas, Environmentally Significant Areas, archaeological sites or Heritage Rivers and:
 - i) discuss any impacts of the Project on these features,
 - ii) indicate the location and significance of the Caribou Protection Area, and
 - iii) outline the process for addressing other users such as trappers, recreational clubs and holders of FMAs and Timber Quotas;
- c) discuss implications of the Project individually and in combination (cumulative) with other (existing and planned) developments for regional recreational activities, public access and other land uses during and after development activities, including:
 - i) how regional environmental management initiatives from RSDS and CEMA will be incorporated into Devon's land use plan,
 - ii) identifying measures to mitigate impacts created on land use by the Project. Identify anticipated impacts on public access for land use in the region, and

- ii) discussing how reclamation will restore existing land use potentials considering any recommendations of the *Oil Sands Mining End Land Use Committee* and the *Reclamation Advisory Committee* that are applicable to in-situ oil sands operations.

5.0 TRADITIONAL ECOLOGICAL KNOWLEDGE

Provide detail on the consultation undertaken with Aboriginal communities with respect to traditional ecological knowledge and traditional land use, and:

- a) provide results of consultation with Aboriginal stakeholders to determine the extent of traditional land use of the Local Study Area. Discuss the vegetation and wildlife used for nutritional and medicinal purposes, and any potential effects the Project may have; and
- b) identify the traditional land uses including fishing, hunting, plant harvesting (nutritional or medicinal), and cultural use with specific regard given to local Aboriginal peoples. Identify cabin sites, spiritual sites and graves. Determine the project and cumulative impact of development on these uses and identify possible mitigation strategies.

6.0 HISTORICAL RESOURCES

Describe those aspects of the Project that may have implications for historical resources and traditional use and provide:

- a) details of consultation with Alberta Community Development and with Aboriginal communities;
- b) a Historical Resources Impact Assessment (HRIA) for the Project to Alberta Community Development, and any other interested parties, prior to or at the same time as the submission of the EIA report to Alberta Environment;
- c) a general overview of the results of any previous historical resource studies that have been conducted in the Study Area, including archaeological resources, palaeontological resources, historical period sites, and any other historical resources as defined within the *Historical Resources Act*;
- d) a summary of the results of the HRIA that is carried out with respect to the Project;
- e) an outline of the historical resources management program and schedule of field investigations that may be required to further assess and mitigate the potential effects of the Project on historical resources;
- f) documentation of any stakeholder concerns with respect to the development of the Project based on the historical significance of sites within the Local Study Area; and
- g) identification of the existing and historical land uses including oil sands development, tourism, forestry, fishing, hunting and outdoor recreation . Determine the impact of development on these uses and identify possible mitigation strategies.

7.0 PUBLIC HEALTH AND SAFETY ISSUES

Describe those aspects of the Project that may have implications for public health and determine whether there may be implications for public health arising from the Project, and:

- a) identify and discuss the data and methods used by Devon to assess the impacts of the Project on human health and safety;

- b) assess the potential health implications of the compounds that will be released to the environment from the proposed operation in relation to exposure limits established to prevent acute or chronic adverse effects on human health;
- c) assess cumulative health effects to receptors, including First Nations and Aboriginal peoples, that are likely to result from the Project in combination with other existing, approved, and planned projects or reasonably-foreseeable activities in the region;
- d) discuss the potential to increase human exposure to contaminants from changes to water quality, air quality, and soil quality taking into consideration all project activities;
- e) identify the human health impact of potential contamination of country foods and natural food sources taking into consideration all project activities;
- f) during consultation on the project, document any health concerns identified by Aboriginal stakeholders due to the impacts of existing industrial development and of the Project specifically on their traditional lifestyle. Determine the impact of the Project on the health of Aboriginal stakeholders and identify possible mitigation strategies;
- g) provide information on samples of selected species of vegetation known to be consumed by humans;
- h) as appropriate, identify anticipated follow-up work, including regional cooperative studies. Identify how such work will be implemented and coordinated with ongoing air, soil and water quality initiatives;
- i) provide a summary of Devon's emergency response plan and discuss mitigation plans that will be implemented to ensure workforce and public safety during pre-construction, construction, operation and reclamation of the Project. Include prevention and safety measures for wildfire occurrences, accidental release or spill of chemicals to the environment and failures of structures retaining water or fluid wastes;
- j) describe how local residents will be contacted during an emergency and what type of information will be communicated to them;
- k) describe existing agreements with area municipalities or industry groups such as, safety co-operatives, emergency response associations and municipal emergency response agencies;
- l) identify and discuss potential health and safety impacts due to higher regional traffic volumes and the increased risk of accidental leaks and spills;
- m) document health and safety concerns raised by stakeholders during consultation on the Project; and
- n) describe and discuss the impacts of the proposed Project on potential shortages of affordable housing and the quality of health care services. Identify and discuss the mitigation plans that will be undertaken to address these issues. Provide a summary of any discussions that have taken place with the Municipality and the Regional Health Authority concerning potential housing shortages and health care services respectively.

8.0 SOCIO-ECONOMIC ASSESSMENT

Provide information on the socio-economic effects of the Project. Specifically:

- a) document baseline (existing) socio-economic conditions and trends for the region and for communities within the region;
- b) identify any concerns related to socio-economics that have been raised by the local municipality or any other stakeholder in the region;

- c) provide information on the socio-economic impacts of the Project and, where appropriate, discuss the mitigation plans related to:
 - i) local employment opportunities,
 - ii) local business opportunities,
 - iii) stresses placed on public services and infrastructure,
 - iv) traffic and traffic safety,
 - v) medical facilities and health services,
 - vi) regional and provincial economic benefits,
 - vii) housing and availability of affordable housing,
 - viii) effects on trapping, hunting and fishing;
 - ix) effects on recreational activities, and
 - x) effects on First Nations and Metis (e.g., traditional land use and culture);
- d) identify construction camp locations (if required), the number of workers it is intended to house and outline what services will be provided in the camp (e.g., security, recreation, and leisure, medical);
- e) describe Devon's policies and programs regarding the use of regional and Alberta goods and services;
- f) provide a summary of estimated industrial benefits including Alberta, other Canadian, and non-Canadian percentages of total project cost for engineering and project management, equipment and materials, construction labour and total overall project;
- g) provide a description of the overall engineering and contracting plan for the Project;
- h) discuss the timing of workforce requirements for construction and operation. Include a breakdown of the total number of jobs to be created along with a description of when peak activity periods will occur;
- i) outline current and ongoing plans to work with Aboriginal people and other local residents and local businesses with regard to employment, training needs and other economic development opportunities arising from the construction and operation of the Project;
- j) evaluate the need for additional public services and infrastructure. Take into consideration other projects that are reasonably anticipated during the life of the Project. This will include consideration of housing, transportation, education/training, health and social services, urban and regional recreation use, law enforcement and emergency preparedness. Discuss options for mitigating any impacts; and
- k) provide an analysis of the significance of the socio-economic impacts, discuss strategies to mitigate the impacts and document the work undertaken with other industry partners or regional stakeholders. Also, document any steps that have been undertaken by governments to identify and address socio-economic concerns.

9.0 PUBLIC CONSULTATION

Document the public consultation program implemented for the Project including methods, the type of information provided and the level and nature of Devon's response, and provide:

- a) a consultative process showing how public input was obtained and addressed;
- b) documentation of individual participation and attendance at each meeting, including recording of specific comments or issues raised by individuals present at the meetings;
- c) description and documentation of concerns and issues expressed by the public, Devon's analysis of those concerns and issues, and the actions taken to address those concerns and

- issues;
- d) how resolution of the concerns and issues was incorporated into the project development, impact mitigation and monitoring;
 - e) plans to maintain the public consultation process following completion of the EIA review to ensure that the public will have an appropriate forum for expressing their views on the ongoing development, operation and reclamation of the Project; and
 - f) documentation in the EIA report of the public consultation process, any concerns or suggestions made by the public and a discussion of how these concerns have been addressed. Consultation will include discussions with:
 - i) Alberta provincial representatives,
 - ii) federal government representatives,
 - iii) residents in surrounding areas as identified during the consultative process,
 - iv) First Nations and Metis organizations,
 - v) commercial, industrial, recreational and traditional users, and
 - vi) other potentially-affected parties.

APPENDIX

The following information is necessary to be submitted as part of the Application under the *Environmental Protection and Enhancement Act (EPEA)*. It may not be necessary to be considered as part of the EIA report completeness decision-making process under Section 53 of EPEA. Upon review of the information submitted, a final determination will be made if it is necessary for the following information to be considered as part of the EIA report completeness decision.

Air Quality Assessment

Provide via modelling maximum ground level concentration locations of NO₂ and SO₂ near the vicinity of the central processing facility, plant or project. Provide ground-level concentrations in 50 or 100 m increments extending out from the central processing facility to 2 or 5 km.

Conservation and Closure Plan

The reclamation and closure plan in the Application will address the following:

- a) a soil conservation and reclamation plan for progressive reclamation in the project areas. Outline the anticipated major timelines for reclamation activities with reference to the life span of the proposed project;
- b) provide an ecological context of the soil resource by supplying a soil survey report and maps following the *Soil Survey Handbook, Volume 1* (Agriculture Canada, 1987) to include Survey Intensity Level 1 (SIL) 1 for the development footprint;
- c) provide details about soil salvage indicating areas where salvage will occur (for the pads, transportation routes, and any other similar activities), the depth and volume of soil to be salvaged, soil storage locations and methods and relate the information to pre-development conditions;
- d) provide details on area of soil replacement indicating techniques, timing, depth, volume and type of reclamation material;
- e) provide information about the reclamation topography for well pads, roads, and facilities. Identify contouring objectives, drainage restoration (surface and near-surface flow) and erosion control;
- f) discuss the methods that may be used to deal with potential soil compaction and contamination problems in the Project Areas;
- g) provide appropriately scaled maps of the area highlighting (where possible) the preceding points;
- h) discuss the potential to retain coarse woody debris for use in reclamation and to reduce the need for slash burning after clearing;
- i) provide a timber salvage plan, highlighting end land users and identifying proposed volumes for removal by species and year for the Project. Provide a tracking mechanism to ensure the appropriate utilization of the timber volumes by species to salvage per year, or periodically as the Project progresses. Include opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fuel hazards; and
- j) provide a weed management plan including provisions such as those outlined in the *Guidelines for Weed Management in Forestry Operations* (Forest Management Division directive – 2001 – 06). This will detail how Devon will prevent the establishment and control the spread of restricted and noxious weeds (as listed in the Alberta Weed Control Act) within the Project Area.

Water Supply, Water Management and Wastewater Management

Provide the following information:

- a) how the water requirements for the Project will be met, including annual volumes from each source (for groundwater sources, consider Alberta Environment's *Groundwater Evaluation Guideline*);
- b) if non-saline water is being considered for steam generation, then a Tier 2 evaluation using the *Water Conservation and Allocation Guideline for Oilfield Injection (2005)* is required.
- c) design details of facilities that will handle, treat and store wastewater streams and runoff and include appropriate annual volumes;
- d) the type and quantity of any chemicals used in water/wastewater treatment; and
- e) design details for the potable water and sewage treatment systems for both the construction and operation stages.

Groundwater

Provide a detailed plan and implementation program for the protection of groundwater resources, addressing:

- a) a groundwater monitoring program for early detection of potential contamination and assistance in remediation planning;
- b) groundwater remediation options to be considered for implementation in the event that adverse effects are detected; and
- c) a program to monitor the sustainability of groundwater production.

Surface Water

Provide a detailed plan and implementation program for the protection of surface water addressing:

- a) a surface water monitoring program to assess the performance of water management systems; and
- b) a water quality monitoring program for relevant substances.