

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

FOR THE

**CANADIAN NATURAL RESOURCES LIMITED
PRIMROSE EAST IN-SITU OIL SANDS PROJECT
Approximately 30 km North of Cold Lake, Alberta**

ISSUED BY: ALBERTA ENVIRONMENT

DATE: April 1, 2005

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to identify for Canadian Natural Resources Limited (CNRL) and appropriate stakeholders the information required by government agencies for an Environmental Impact Assessment (EIA) report. CNRL will prepare and submit an EIA report that examines the environmental and socio-economic effects of the construction, operation and reclamation of its proposed Project (the Project).

CNRL plans to expand its thermal oil sands operations through development of the 30,000 barrels per day Primrose East In-Situ Oil Sands Project. Primrose East will be located approximately 25 km from CNRL's existing Wolf Lake Central Processing Facility and 15 km from the existing Primrose South steam plant. The Primrose East development area is located entirely within the Cold Lake Air Weapons Range in Townships 67 & 68 and Ranges 2 & 3, W4M. The Primrose East Project will be integrated with the existing operations in the Primrose and Wolf Lake area. As a result the Project also includes the expansion of the Wolf Lake Central Processing Facility located in Section 8, Township 66, Range 5, W4M. The Wolf Lake expansion will include increasing the bitumen processing capacity from 80,000 to 120,000 barrels per day and increasing the produced water treating capacity from 40,000 cubic meters per day to 60,000 cubic meters per day.

The Project will have a production life of approximately 25 years. Pending regulatory approval, it is CNRL's intention to begin construction in the first quarter of 2007 with subsequent start-up expected in the first quarter of 2009.

1.2 Scope of Environmental Impact Assessment Report

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

- a) assist the public and government in understanding the environmental and socio-economic consequences of the Project's development, operation and reclamation plan and will assist CNRL in its decision-making process;
- b) address:
 - i. project impacts,
 - ii. mitigation options, and
 - iii. residual effects relevant to the assessment of the Project including, as appropriate, those related to other industrial operations;
- c) discuss possible measures, including established measures and possible improvements based on research and development to:
 - i. prevent or mitigate impacts,
 - ii. assist in the future monitoring of environmental protection measures, and
 - iii. identify residual environmental impacts and their significance including cumulative and regional development considerations. As appropriate for the various types of impacts, discussion of impact predictions should be presented in terms of magnitude, frequency, duration, seasonal timing, reversibility, and geographic extent;
- d) include tables that cross-reference the report (subsections) to the EIA Terms of Reference; and
- e) include a glossary of terms and list of abbreviations to assist the reader in understanding the material presented.

The EIA report will form part of CNRL's Application to the Alberta Energy and Utilities Board (EUB). A summary of the EIA report will 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 to assist with project scoping and issue identification, documenting the results of these consultations (see Section 9.0). 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

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

2.0 PROJECT OVERVIEW

2.1 The Proponent and Lease History

Provide:

- a) the name of the proponent;
- b) the name of the legal entity that will develop, manage and operate the Project;
- c) a corporate profile;
- d) a brief history of CNRL's operations including existing facilities;
- e) an overview of the recent EIAs and the associated developments completed by CNRL in the Primrose and Wolf Lake areas; and
- f) an overview of the proposed Project.

2.2 The Project Area and EIA Study Area

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. Provide:

- e) the rationale used to define Local and Regional Study Areas (see also Section 4.1), considering the location and range of probable project and cumulative effects, and the direction of regulatory guidelines; and
- f) an illustration of 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 description and/or figures of the project components and activities to be approved including:

- a) activities associated with development of the area, operations, reclamation and development closure;
- b) bitumen recovery;
- c) processing/treating facilities;
- d) quantify and characterize wastes produced;
- e) identify waste storage site and disposal sites;
- f) buildings;
- g) storage areas;
- h) containment structures such as berms and retention ponds;
- i) locations of borrow pits and salvaged soil stockpiles;
- j) temporary structures;
- k) infrastructure (roads, pipelines and utilities);
- l) transportation and access routes;
- m) aggregate resources and road construction, identify the material required and on-site availability; and
- n) proposed method of product transportation to market.

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

- o) pre-construction;
- p) construction;
- q) operation;
- r) decommissioning;
- s) reclamation and closure;
- t) timing of key construction, operational and reclamation activities and the expected duration of each for the life of the Project; and
- u) if appropriate a detailed schedule for any reclamation and related activities envisaged during the first decade of operations.

2.4 Project Need and Alternatives

Discuss the need for the Project and alternatives considered including the following:

- a) identify any alternative means of carrying out the Project and indicate their potential environmental effects and impacts;
- b) compare identified alternatives to the Project and their anticipated environmental effects;
- c) discuss reasons for not selecting any identified alternatives;
- 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 Review

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;
- 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*,
 - iii. *Public Lands Act (PLA)*,
 - iv. *Canada Fisheries Act*, and
 - v. *Navigable Waters Protection Act*; and
- d) a summary of the regional, provincial or national objectives, standards or guidelines which have been used by CNRL to assist in the evaluation of any predicted environmental impacts.

2.6 EIA Summary

Provide a summary of the results of the EIA report including:

- a) the project components and development activities which have the potential to affect the environment;
- b) existing conditions in the Study Area, including existing uses of lands, resources and other activities which have potential in combination with proposed development activities, to affect the environment;
- c) the anticipated environmental effects including cumulative considerations;
- d) proposed mitigation measures and appropriate monitoring plans; and
- e) any residual effects.

3.0 PROJECT DESCRIPTION

Describe all of the activities and components of the Project that are proposed for approval. The scope and detail of the project description information shall be sufficient to allow quantitative assessment of the environmental consequences. If the scope of information varies among components or phases of the Project, CNRL shall provide a rationale demonstrating that the information is sufficient for EIA purposes.

Describe the project components, infrastructure and activities. Discuss the alternatives considered, the alternative selection process, the potential effects that activities and infrastructures may have on the environment and the natural resources to be used for the Project.

Outline the management plans to minimize the discharge of pollutants, manage wastes, reclaim disturbed lands and waterbodies, optimize resource use, manage and monitor environmental effects.

Technical information required in this Section may also be required specifically for federal and provincial government approvals (see Appendix). Information required in this Section may be provided in other parts of CNRL's submission(s) provided that the location of the information is appropriately referenced in the EIA report. CNRL 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 process, process facilities (including environmental abatement processes and equipment), and waste management components of the Project, and:

- a) provide a map showing the location of all existing infrastructure (e.g., roads) and the location of the proposed central and field facilities;
- b) show all existing leases and clearings including exploration clearings and illustrate how CNRL intends to use these areas for project development to minimize additional disturbances;

- c) locate the buildings, road access, pipeline routes, water source wells, water pipelines, utility corridors, lime sludge ponds, retention ponds and waste storage/disposal sites associated with the Project;
- d) describe the process and criteria used to select the sites for facilities and infrastructure for the Project including uncertainties and alternatives, if any, associated with the selection;
- e) list the facilities whose location will be determined later;
- f) describe the planned accommodation for the workforce during construction and operations;
- g) provide schedule for clearing land required for:
 - i. steam generation facilities,
 - ii. central processing facilities,
 - iii. well pads,
 - iv. access roads,
 - v. pipelines, and
 - vi. utilities and other site preparation activities;
- h) indicate the amount of surface disturbance from plant, field and infrastructure-related activities; discuss:
 - i. how surface disturbance (extent and duration) will be minimized,
 - ii. whether the timber is merchantable and if so, indicate anticipated volumes from clearing activities, and
 - iii. how visual aesthetics will be managed, where required; and
- i) discuss opportunities to integrate the proposed Project with other resource development activities (mineral and forestry).

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 or activities, 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, or activities that may be undertaken in, watercourses or waterbodies that will be required for the Project. Include:
 - i. appropriate maps and diagrams,
 - ii. timing, and
 - iii. construction standards or methods.
- e) describe existing and planned activities as they relate to boating and vessel navigational use of watercourses and waterbodies within the Study Area. Include implications on navigational safety and how this will be mitigated;
- f) 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;
- g) discuss the need for access management;
- h) provide the results of consultation with Alberta Transportation and discussions with other industry operators;
- i) describe access corridors needed and/or planned by other resource stakeholders including Forest Management Areas or Quota holders. Describe how needs of resource stakeholders will also accommodate the requirements of the Department of National Defence within the Cold Lake Air Weapons Range. Describe how these 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;

- j) 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. Consider other existing and planned operations in the region;
- k) 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 aggregate reserves that may be located on CNRL 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;
- l) discuss how the project design will minimize the amount of disturbance; and
- m) outline design features to prevent spills, contingencies for spill response and environmental risks associated with spills.

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) any National Pollutant Release Inventory (NPRI), Priority Substance List (PSL1), PSL2 and/or Accelerated Reduction/Elimination of Toxics (ARET) substances relevant to the Project;
- b) the amount and nature of any acidifying emissions, probable deposition patterns and rates, and programs CNRL may implement to monitor the effects of this deposition;
- c) any odorous or visual emissions from the proposed facilities;
- d) emergency flaring scenarios and proposed measures to ensure flaring events are minimized; and
- e) the use of alternative fuels in this project. Provide emission profiles for each fuel under consideration.

3.3.1 Emission Control Technologies

- a) discuss the emission control technologies proposed for the Project with the following context:
 - i. minimizing air emissions such as sulphur dioxide (SO₂), hydrogen sulphide (H₂S), oxides of nitrogen (NO_x), volatile organic compounds (VOC) and particulate matter,
 - ii. 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*,
 - iii. 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),
 - iv. gas collection, conservation and applicability of technology for vapour recovery for the Project at well pads and central facilities,
 - v. control technologies for minimization of venting and flaring,
 - vi. 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*; and
- b) discuss monitoring programs CNRL will implement to assess the air quality and the effectiveness of mitigation during the Project's development and operation. Discuss how

these monitoring programs are compatible with those in use by regional multi-stakeholder air initiatives (e.g., LICA).

3.3.2 Greenhouse Gas Emissions

Provide the following:

- a) the expected annual and total greenhouse gas (GHG) emissions over the construction, operation and decommissioning phases of the Project;
- b) the Project's marginal contribution to total provincial and national GHG emissions on an annual basis;
- c) the intensity of GHG emissions per unit of product produced and discuss how it compares with similar projects and technology performance;
- d) 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
- e) CNRL's overall GHG management plans, any plans for the use of offsets, (nationally or internationally) and the expected results of implementing the plans.

3.4 Water Supply, Water Management and Wastewater Management

3.4.1 Water Supply

Describe the water supply requirements for the Project, including, but not limited to, the following:

- a) the annual and seasonal water balance(s) for each project phase and overall. Discuss assumptions made or methods chosen to arrive at the water balance(s);
- b) the process, potable and non-potable water requirements and sources for construction, start-up, normal and emergency operating situations, decommissioning and reclamation. Provide an evaluation of alternative water sources and include a description of the criteria and rationale for selecting the preferred source(s) and identify the volume of water to be withdrawn from each source;
- c) the variability in the amount of water required on an annual and seasonal basis as the Project is implemented. Show the location of sources/intakes and associated infrastructure (pipelines); and
- d) contingency plans for water supply, including the potential effects of extended periods of drought on the proposed water supply.

3.4.2 Water Management

Provide a Water Management Plan for construction, operation and reclamation phases, including, but not limited to, the following:

- a) factors considered in the design of water management systems, such as:
 - i. site drainage 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, recycle of produced water, and conservation;
- c) permanent or temporary alterations or realignments of watercourses, wetlands 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, but not limited to, the following:

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

3.5 Hydrocarbon, Chemical and Waste Management

3.5.1 Management of Waste Streams

Provide the following:

- a) estimate of the quantity and composition of each waste stream. Classify each waste stream according to applicable provincial regulations and guidelines. Demonstrate that plans are consistent with current industry practices;
- b) describe the proposed storage and handling methods and disposal for each waste stream. Consider both central plant and field operations;
- c) identify the amount of drilling wastes produced by the Project, the options considered for disposal and the option(s) chosen;
 - i. determine the amount of surface disturbance caused by drilling waste disposal and describe any mitigative options to reduce the disturbance, and
 - ii. describe how the disposal sites and sumps will be constructed to be in compliance with the Oil and Gas Conservation Regulation;

- d) discuss the strategy for on-site waste disposal versus off-site waste disposal, including but not limited to the following:
 - i. identify the location of on-site waste disposal, including landfills, if applicable, and the general suitability of the site(s) from a groundwater protection perspective (provide geotechnical information to support siting options);
 - ii. industrial landfills; and
 - iii. on- and off-site waste treatment and storage areas;
- e) describe plans for waste minimization, recycling, and management over the life of the Project; and
- f) discuss methods and technologies to reduce waste quantities and associated potential risks, to the lowest practical levels.

3.5.2 Hydrocarbons and Chemical Products

Provide the following:

- a) a listing of chemical products to be used for the Project. Identify any products that may contain substances that are:
 - i. Canadian Environmental Protection Act (CEPA) toxics;
 - ii. on the Priority Substances List (PSL1), PSL2;
 - iii. Accelerated Reduction/Elimination of Toxics (ARET);
 - iv. those defined as dangerous goods pursuant to the federal *Transportation of Dangerous Goods Act*.
 - v. on the National Pollutant Release Inventory (NPRI) list; and
 - vi. Track 1 substances targeted under Environment Canada's Toxic Substances Management Policy for virtual elimination from the environment;
- b) the wastes generated and characterize each stream in accordance with Alberta Environment's *User's Guide for Waste Managers*;
- c) a description, in general terms, how these items will be stored and managed to ensure adequate protection to both the environment and to employee health and safety; and
- d) the location, nature and amount of on-site hydrocarbon storage. Discuss containment and other environmental protection measures. Demonstrate how selected practices comply with the provincial and federal regulations including EUB Guide 55 – Storage Requirements for Upstream Petroleum Industry.

3.6 Reclamation/Closure (See Appendix for Additional Requirements)

Provide a conceptual reclamation and closure plan for the Project with consideration to the following:

- a) reclamation requirements specified by relevant regulatory organizations and stakeholder preferences;
- b) pre-development information with respect to land capability, vegetation, commercial forest land base by commercialism class, forest productivity, recreation, wildlife, aquatic resources, aesthetics and land use resources;
- c) project development phasing;
- d) opportunities for integration of operations, reclamation/closure planning and reclamation activities;
- e) reclamation sequencing for each phase of development;
- f) revegetation 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, soil storage areas and soil handling procedures;

- h) areas of soil replacement indicating depth, volume and type of reclamation material;
- i) any soil-related constraints or limitations that may affect reclamation;
- j) pre-development and final reclaimed site drainage plans;
- k) re-establishment of self-sustaining topography, drainage and surface watercourses and vegetation communities representative of the surrounding area;
- l) management of waste, wastewater, and other waters;
- m) restoration of pre-development traditional use with consideration for traditional vegetation and wildlife species in the closure landscape;
- n) post-development capability for all uses;
- o) post-development reforestation and forest productivity; and
- p) wetlands or other alternatives to reclaim the land.

Discuss the conceptual closure landscape design with reference to the following:

- q) appropriate productivity equivalent to pre-development levels;
- r) biodiversity;
- s) integration and interconnectivity to the surrounding landscapes;
- t) integrating surface and near-surface drainage within the development area;
- u) incorporating into project planning and development;
- v) resemblance to the pre-disturbed landscape;
- w) 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
- x) 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 CNRL's existing or proposed environment, health and safety management system and discuss how it will be integrated into the Project, addressing the following:

- a) plans for monitoring air emissions, wastewater releases, and waste tracking for the Project and associated facilities;
- b) 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 and air emission reporting, response and monitoring procedures, and
 - iv. emergency response, public notification protocol and safety procedures;
- c) plans to minimize the production or release into the environment of substances that may have an adverse effect, including the modification of existing plans;
- d) proposed monitoring, including:
 - i. monitoring done independently by CNRL,
 - 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;
- e) an emergency response system to deal with emergency situations and minimize adverse environmental effects, while protecting the safety of personnel. Comment on contingency

- plans that have been or will be developed to respond to operational upsets or unpredicted environmental impacts that are realized during and after project development; and
- f) a fire control plan highlighting:
 - i. measures taken to ensure continued access for fire fighters to adjacent wildland areas;
 - ii. forest fire prevention measures; and
 - iii. using the “FireSmart” Wildfire Assessment System to assess areas adjacent to proposed facilities and identify mitigative measures;
 - g) describe CNRL’s participation in the Lakeland Industry and Community Association (LICA), and the mechanisms to incorporate the outputs from this and other relevant regional initiatives into management practices; and
 - h) 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 CNRL 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.

3.8 Adaptive Planning

Describe the flexibility built into the plant design and layout to accommodate future modifications required by any change in emission standards limits and guidelines. Discuss any follow-up programs and adaptive management considerations.

3.9 Participation in Co-operative Efforts

Demonstrate and document CNRL’s involvement in regional co-operative efforts to address environmental and socio-economic issues associated with oil and gas development during the life of the Project. Include initiatives such as:

- a) the Lakeland Industry and Community Association;
- b) potential co-operative ventures that CNRL is participating in with oil and gas and resource users (e.g., minerals and forestry);
- c) regional air monitoring networks and studies;
- d) The Cold Lake-Beaver River Water Management Plan; and
- e) The Northeast Co-operative Weed Management Group.

4.0 ENVIRONMENTAL ASSESSMENT

Define assessment scenarios including:

- a) a Baseline Case, which includes existing environmental conditions, and 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) Case, which includes past studies, existing and anticipated future environmental conditions, existing and approved projects or activities, plus other or planned projects.

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 prior to the issuance of the terms of reference or up to six months prior to the submission of the Project Application and EIA report, whichever is submitted sooner.

4.1 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 PDA boundaries where an effect can be reasonably expected. The EIA Study Area includes both Regional and Local Study Area.

Illustrate boundaries and identify the Study Areas 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 Study Area boundaries, including those related to cumulative effects.

4.2 Information Requirements for the Environmental Assessment

The EIA report will include the following environmental information for the three assessment scenarios:

- a) from a broad-based examination of all ecosystem components including previous environmental baseline work, describe and rationalize the selection of environmental attributes, parameters, or properties examined;
- b) for each selected environmental attribute, parameter, or property:
 - i. describe existing conditions. Comment on whether the available data are sufficient to assess impacts and mitigative measures. Identify environmental disturbance from previous, current and approved activities that have become part of the baseline conditions,
 - ii. describe the nature and significance of the environmental effects and impacts associated with the development activities,
 - iii. present plans to minimize, mitigate, or eliminate negative effects and impacts. Discuss the key elements of such plans,
 - iv. present a plan to manage environmental changes and identify any follow-up programs necessary to verify the accuracy of the environmental assessment and to determine the effectiveness of measures taken to mitigate adverse environmental effects, and
 - v. identify residual impacts and comment on their significance;
- c) discuss the sources of information used in the assessment including a summary of previously conducted environmental assessments related to CNRL's operations:
 - i. information sources will include literature and previous EIA reports and environmental studies, operating experience from current oil sands operations, industry study groups, traditional knowledge and government sources, and
 - ii. 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 EIA report;
- d) identify where deficiencies in information exist and describe CNRL's plan, including rationale, for providing the necessary information. Where required, undertake studies and investigations to obtain additional information to address the information deficiencies;
- e) 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. Impact significance will be quantified where possible and assessed including consideration of spatial, temporal and cumulative aspects; and
- f) if applicable, present a plan that addresses the adverse impacts associated with the Project that may require joint resolution by government, industry and the community. Describe how this plan will be implemented and how it will incorporate the participation of government, industry and the community.

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 Cumulative Environmental Effects Assessment

Assessment of cumulative effects will be an integral component of the EIA report. CNRL 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 summary of all proposed monitoring, research and other strategies or plans to minimize, mitigate and manage 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, 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) and the activities that have created the current conditions;
- c) assess the incremental consequences that are likely to result from the Project in combination with other existing, approved and planned projects in the region;
- d) demonstrate that relevant information or data used from previous oil sands and other development projects is appropriate for use in this EIA report;
- e) consider and describe deficiencies or limitations in the existing database for relevant components of the environment; and
- f) 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 relevant assumptions, confidence in data and analysis to support conclusions.

4.5 Climate, Air Quality and Noise

4.5.1 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) identify any regional air monitoring underway in the area and CNRL's participation in any regional forums.

4.5.2 Methodology

Provide the following:

- a) describe air quality in the Study Areas and any anticipated environmental changes for air quality. Review emission sources identified in Section 3.3 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) discuss the meteorological data model input set used to run the model and provide a rationale for the choice of data set;

- e) complete the air dispersion modelling 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 acid deposition management framework for the Study Areas;
- g) identify the 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) compare predicted air quality concentrations with the appropriate air quality guidelines available.

4.5.3 Impact Assessment

Identify, describe and discuss the following:

- a) the appropriate air quality parameters including, but not limited to, sulphur dioxide (SO₂), hydrogen sulphide (H₂S), Total Reduced Sulphur Compounds (TRS), total hydrocarbons (THC), oxides of nitrogen (NO_x), volatile organic compounds (VOC), individual hydrocarbons of concern in the THC and VOC mixtures, particulates matter (PM₁₀ and PM_{2.5}), ozone (O₃), trace metals (including arsenic) and visibility;
- b) 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) the formation of secondary pollutants such as ground-level ozone (O₃), secondary particulate matter, and acid deposition;
- d) any expected changes to particulate deposition or acidic deposition patterns;
- e) the potential for reduced air quality (including odours and visibility) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;
- f) air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, vegetation resources, water quality and soil conservation;
- g) the cumulative effects on the air quality of the Study Areas and include any related emission increases from adjacent operations and publicly disclosed projects in the area;
- h) the use of alternative fuels on the air quality in the Study Areas, if applicable;
- i) how air quality impacts resulting from the Project will be mitigated;
- j) ambient air quality monitoring that will be conducted during construction and operation of the Project;
- k) components of the Project that have the potential to affect noise levels and discuss the implications and measures to mitigate; and
- l) the results of a noise assessment based on operations, as specified by EUB ID 99-08, Noise Control Directive, include the following:
 - i. potentially-affected people and wildlife,
 - ii. an estimate of the noise resulting from the development,
 - iii. the implications of any increased noise levels, and
 - iv. proposed mitigation measures.

4.5.4 Climate Change

Provide the following:

- a) review and discuss existing studies and information on 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) identify 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) comment on the adaptability of the Project in the event the region's climate changes. Discuss any follow-up programs and adaptive management considerations.

4.6 Land Use, Access to Public Lands and Aggregate Resource Conservation

4.6.1 Collection of Baseline Information

Provide the following:

- a) an overview of the Department of National Defence guidelines that CNRL must consider for any development within the Cold Lake Air Weapons Range. These guidelines are applicable for all phases of the Project (construction, operation and reclamation);
- b) the existing recreational, commercial, residential, institutional, industrial and traditional land uses, in the local and regional Study Areas;
- c) an identification of unique sites or special features in the Study Areas, such as Natural Areas or Environmentally Significant Areas. Discuss any impacts of the Project on these features. Indicate the location and values of other protected areas, if present; and
- d) discuss the quantity and quality of aggregate resources in the Study Areas.

4.6.2 Methodology

Provide the following:

- a) identify any land use policies and resource management initiatives that pertain to the Study Areas;
- b) discuss how the proposed development will be consistent with the intent of the guidelines and objectives of these initiatives;
- c) discuss the implications of those land and resource use policies for the Project, including any constraints to development; and
- d) outline the process for addressing the needs of other users in the Local Study Area.

4.6.3 Impact Assessment

Discuss the following:

- a) the potential impact of the Project on the identified land uses;
- b) describe the impact of development and reclamation on commercial forest harvesting in the Project Area. Include opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fire hazard;
- c) describe the impact of the development on aggregate resources in the Study Area; and
- d) discuss the implications of the Project for regional recreation activities, public access and other land uses during and after the development activities. Identify anticipated impacts on public access for land use in the region.

4.6.4 Mitigation

Discuss the following:

- a) identify measures to mitigate the potential land use impacts resulting from the Project; and
- b) mitigative measures to conserve aggregate resources.

4.7 Terrestrial and Aquatic Ecosystems

Describe ecosystem characteristics in the Study Areas. Explain the significance of any anticipated environmental changes for ecosystem integrity. Include the sustainability of biodiversity, critical wildlife sites and fisheries habitat, wildlife corridors, habitat quality, and productivity and potential changes to fish and wildlife populations. Discuss the existing use of plants and animals in traditional lifestyles, recreational pursuits and industrial activities and, if appropriate, provide the locations of these sites.

4.7.1 Biodiversity

Using the definition for biodiversity provided in the Canadian Biodiversity Strategy (1995), determine and describe the metrics that will be used to assess biodiversity in terrestrial and aquatic ecosystems in order to characterize the existing ecosystems and probable effects of project development.

4.7.1.1 Collection of Baseline Information

Provide the following:

- a) within selected taxonomic groups, discuss the regional presence and abundance of species in each ecosite phase or ecological type; and
- b) species lists and summaries of observed and estimated species richness and evenness.

4.7.1.2 Methodology

Provide and discuss the following:

- a) baseline information collected in each terrestrial and aquatic community, accompanied by sufficient plots in each ecosite phase to provide statistically sound data using a suitable proportional sampling method;
- b) the selection process and rationale used to select biotic and abiotic biodiversity indicators;
- c) the rank of each ecological unit for biodiversity potential by combining measures of species richness, overlap in species lists, importance of individual species or associations, uniqueness and other appropriate measures. Describe the techniques used in the ranking process; and
- d) the techniques used in the fragmentation analysis.

4.7.1.3 Impact Assessment

Discuss the following:

- a) the contribution of the Project to any anticipated changes in regional biodiversity;
- b) the implications of the Project's incremental contribution to habitat fragmentation on biodiversity with regard to regional levels of habitat fragmentation; and
- c) the comparison of pre- and post-topography, soil and parent material conditions and their contribution to biodiversity.

4.7.1.4 Mitigation

Identify and discuss possible measures to minimize any change in regional biodiversity.

4.7.2 Geology, Soils, Terrain

4.7.2.1 Collection of Baseline Information

Provide the following:

- a) describe the bedrock and surficial geology, soils and terrain in the Study Areas. Where appropriate, use maps of suitable scale, cross-sections and figures to illustrate these features;
- b) describe the overburden geology and mineralogy; and
- c) describe and map the soil types and their distribution in the Local Study Areas. The soil survey maps should show approximate soil inspection and sampling locations corresponding

to appropriate survey intensities in the Study Areas. The soil survey report should include necessary landscape and soil characteristics for land capability rating.

4.7.2.2 *Methodology*

Provide the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) the sensitivity and buffering capacity of the local and regional soil types to potential acid deposition from the proposed development using modeled predictions of acid deposition patterns to assess the potential acidification impact on soils in the Local and Regional Study Areas;
- c) the distribution of soil types in the proposed Project Areas using appropriate soil survey and classification procedures as outlined in the Soil Survey Handbook, Vol. 1 (Agriculture Canada, 1987) and The Canadian System of Soil Classification (Agriculture and Agri-Food Canada, 1999);
- d) describe the suitability and availability of soils within the Project for reclamation using Soil Quality Criteria Relative to Disturbance and Reclamation (Alberta Agriculture, 1987);
- e) provide an inventory of the pre- and post-disturbance land capability classes for soils in the Local Study Area by using the Land Capability Classification for Forest Ecosystems in the Oil Sands Region (Leskiw, 1998); and
- f) provide an ecological context of the soil resource by supplying a soil survey report and maps following Soil Survey Handbook, Vol. 1 (Agriculture Canada, 1987) to include:
 - i. SIL (survey Intensity Level) 1 for the development footprint areas;
 - ii. SIL 2 for other areas in the Local Study Area including potential wellpad sites and future phases; and
 - iii. appropriate level of detail to determine the effect of the Project on soil types and quality, with some emphasis on potential acidification, on the Regional Study Area.

4.7.2.3 *Impact Assessment & Mitigation*

Discuss the following:

- a) the significance of any changes for the regional landscape, biodiversity, productivity, ecological integrity, aesthetics and the future use of the regional landscape area;
- b) the predicted cumulative impact of acidifying emissions to local and regional soils resulting from the Project, with reference to local studies, current guidelines and management objectives for acidifying emissions consistent with the latest acid deposition management framework;
- c) the implications of environmental effects on ecosystem sustainability and regional management, including:
 - i. any constraints or limitations to achieving vegetation restoration based on anticipated soil conditions,
 - ii. an assessment of soil types for reclamation suitability and the approximate volume of suitable soil materials for reclamation,
 - iii. the potential for soil erosion and measures to minimize the effects of any such erosion, and
 - iv. any other issues that will affect the soil capability of the Study Areas or the reclaimed landscape and the mitigation measures proposed;
- d) an estimate of the effects of surface disturbance on geological features and soils, including:
 - i. the type and extent of changes to the pre-disturbance topography; and
 - ii. an assessment and maps of the pre- and post-disturbance land capability and resiliency of the Project Area and a description of the impacts to land capability resulting from the Project;

- e) the environmental effects of proposed drilling methods and summarize waste treatment methods consistent with EUB G50 guidelines, locations, area required and environmental impacts of drilling over the life of the Project;
- f) the potential for casing failures, including assessment of impacts and possible remediation options. Identify measures to reduce the environmental risks from casing failures (e.g., monitoring); and
- g) 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.

4.7.3 Vegetation

4.7.3.1 Collection of Baseline Information

Identify and discuss the following:

- a) ecosite phases based on their potential to support rare plant species, plants for traditional or medicinal purposes, old growth forests or other communities of limited distribution;
- b) the relative abundance of species of rare plants and the ecosite phases where they are found, using reliable survey methods;
- c) the distribution and relative abundance of peatlands and wetlands in the Local Study Area; and
- d) the importance of peatlands and wetlands species, and landscape units for local and regional habitat, sustained forest growth, the hydrologic regime and water quality.

4.7.3.2 Methodology

Provide the following:

- a) describe and map vegetation communities in the EIA Study Areas, using, as appropriate, the Alberta Vegetation Inventory (AVI) Standard AVI 2.1, *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald, 1996) and the Alberta Wetland Inventory Standards Manual (AWI) Version 1.0. Map the project development footprint at a scale of 1:20,000;
- b) the selection criteria used to determine the Study Areas, including information sources and assessment methods. Address the adequacy of these factors for a cumulative effects assessment; and
- c) a description of how baseline information was collected to enable a detailed ELC of the Local Study Area to be completed.

4.7.3.3 Impact Assessment

- a) discuss any potential effects the Project may have on rare plants 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;
- b) produce an ELC map that shows pre-disturbance and reclaimed land surfaces. Comment on the importance of size, distribution and variety of these landscape units from both a local and regional perspective;
- c) discuss temporary (including the 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;
- d) predict the anticipated effect of the Project on wetlands in conjunction with other project-induced variations in hydrology;
 - i. identify the amount of vegetation and wetlands to be disturbed during each stage of the Project; and
 - ii. discuss the impact of any loss of peatlands or surface wetlands, as well as how this will affect land use, fragmentation and biodiversity;
 - e) determine the amount of commercial and non-commercial forest land base that will be disturbed by the Project. Compare the pre-disturbance and reclaimed 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;
 - f) determine how the project disturbance impacts Annual Allowable Cuts and quotas within the L51 Timber Management Unit. Discuss opportunities to integrate this project with other resource development activities such as logging;
 - g) provide a timber harvest/salvage plan, and tracking mechanism to ensure the appropriate utilization of the timber volumes, by species to salvage per year, or periodically as the Project progresses;
 - h) discuss the significance of the changes to vegetation for:
 - i. the availability of plants for traditional and medicinal purposes,
 - ii. ecosystem fragmentation, and
 - iii. introduction of non-native plant species on native species composition and potential plant changes to communities; and
 - i) comment on the significance of the residual effects on vegetation resources, peatlands and wetlands, and their implications for other environmental resources.

4.7.3.4 *Mitigation*

Provide the following:

- a) a detailed mitigation strategy that will minimize project impacts in the Study Areas;
- b) a plan to mitigate the adverse effects of site clearing on rare plants and plant communities;
- c) an identification of any setbacks proposed around environmentally sensitive areas such as surface waterbodies, riparian areas and peatlands/wetlands. Also discuss the measures and techniques that will be used to minimize the potential impacts on wetlands;
- d) 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; and
- e) 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.

4.7.4 **Wildlife**

4.7.4.1 *Collection of Baseline Information*

Identify and describe the following:

- a) existing wildlife resources (amphibians, reptiles, birds and terrestrial and aquatic mammals), their use and potential use of habitats in the Study Areas; and
- b) wildlife species composition, distribution, relative abundance, key habitat areas, seasonal movements and movement corridors, habitat requirements, and general life history for all species of concern, including those listed by Alberta (at risk, may be at risk, and sensitive list

species in the *General Status of Alberta Wild Species 2000*, or update) and federal *Species at Risk Act* (endangered, threatened, and special concern species).

4.7.4.2 *Methodology*

Provide the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) key indicator species and provide rationale and selection criteria;
- c) current field data to establish baseline conditions, using recognized sampling protocols; and
- d) if habitat models are used to evaluate impacts, models will be modified/calibrated by comparing model predictions with wildlife data from the Study Areas.

4.7.4.3 *Impact Assessment*

Discuss the following:

- a) the potential 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 reproductive potential and recruitment for regional wildlife populations over the life of the Project;
- b) the spatial and temporal changes to habitat (type, quality, quantity, diversity and distribution) and to wildlife indicator species distribution, relative abundance, movements, habitat availability include:
 - 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 effects and hunting pressure) during operations and after project closure, and
 - iii. anticipated effects of habitat fragmentation the implications to wildlife by mapping the changes anticipated by the Project and other planned activities on a local and regional scale;
- c) the potential to return the area to pre-disturbed wildlife habitat/population conditions; and
- d) residual impacts to wildlife and wildlife habitat and discuss their significance in the context of local and regional wildlife populations.

4.7.4.4 *Mitigation*

Discuss the following:

- a) a strategy and mitigation plan to minimize impacts on wildlife habitat and populations through the life of the Project and to return productive wildlife habitat to the area, considering:
 - i. habitat enhancement measures in adjacent undisturbed lands within the leases, 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/population 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 predicted wildlife impacts from the Project and the effectiveness of mitigation strategies and habitat enhancement measures;
- b) how CNRL will use setbacks to ensure the protection and maintenance of riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using the habitat; and

- c) the measures that 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.

4.7.5 Hydrogeology

4.7.5.1 Collection of Baseline Information

Provide the following:

- a) a description of the geologic and hydrogeologic setting in the Project and Study Areas from the ground surface down to and including oil producing zones and disposal zones;
- b) descriptions of the lithology, stratigraphy, structural continuity, thickness, hydraulic properties and groundwater quality of the geologic units in the Project and Study Areas;
- c) descriptions of major aquifers, aquitards and aquicludes, their spatial distribution and groundwater flow directions and velocities; include Quaternary deposits and bedrock formations down to the Precambrian including the bitumen-producing zones and the disposal zones; include hydraulic head data, hydraulic gradient data and descriptions of the hydraulic connections between hydrostratigraphic units; include groundwater chemistry data such as baseline concentrations of major ions, metals (including arsenic) and hydrocarbon indicators;
- d) include with c) maps and cross-sections that include the water table and piezometric surfaces based on identifiable groundwater systems and accurate data sources, such as monitoring wells;
- e) describe known and potential recharge and discharge areas, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock groundwater interaction; discuss the recharge potential for Quaternary aquifers;
- f) describe groundwater availability and use within the Study Areas, including a field -verified water well survey of users;
- g) confirm the disposal zones currently used at the existing projects for deep disposal of wastes (e.g., lime sludges) and wastewater will be sufficient for the new Project. Provide descriptions of the disposal formations including containment, water quality, and the chemical compatibility with the wastewater;
- h) documentation of any new hydrogeologic investigations, including methodology and results, undertaken since the Primrose and Wolf Lake Expansion (2000) EIA and any investigations undertaken as part of the current EIA study. For figures, maps, diagrams, interpretations and concepts developed from previous work that are submitted in the EIA report, demonstrate how, or if, they have been modified by the incorporation of any subsequent new data; and
- i) locations of major facilities associated with the Project including facilities for wastewater treatment waste disposal; describe site-specific aquifer and shallow groundwater conditions beneath these proposed facilities.

4.7.5.2 Methodology

Provide the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods; and
- b) justification of hydrogeological models used for the impact assessment and the cumulative effects assessment, including the results of the sensitivity analysis and discussions of model/modelling assumptions, constraints on the results and how limitations were addressed.

4.7.5.3 *Impact Assessment*

Discuss the following:

- a) the components and activities of the Project which have the potential to affect groundwater resource quantity and quality with the Project and Study Areas during project construction, operation and closure;
- b) the suitability of on-site waste disposal and supporting geotechnical information;
- c) the potential for hydraulic connection between geological zones affected by the Project (e.g., disposal zones, bitumen-production zones, groundwater production zones) as well as the land surface;
- d) the potential for changes in the groundwater regime and the effects of these changes, including:
 - i. potential or expected changes in groundwater quality for any aquifer resulting from project operations,
 - ii. the effects from the Project and cumulative effects on local and regional groundwater regimes, including vertical gradients and aquifer recharge rates and changes resulting from any proposed diversions,
 - iii. potential conflicts with other groundwater users and proposed resolutions to these conflicts,
 - iv. the potential impact of decreased recharge to aquifers under prolonged drought conditions and the potential impacts of groundwater withdrawal due to project activities under drought conditions, and
 - v. the effect of groundwater withdrawal and its implications for other environmental resources, including habitat diversity and quantity, surface water quality and quantity, vegetation, wetlands and soil saturation.

4.7.5.4 *Mitigation*

Discuss the following:

- a) a conceptual plan and implementation program for the protection of groundwater resources, including the following:
 - i. the early detection of potential contamination and remediation planning. Surrogate parameters to be used as indicators of potential aquifer contamination could include, but not limited to, total phenols, dissolved organic carbon, total extractable hydrocarbons, chlorides, sulphides, benzene, toluene, ethylbenzene and xylenes (BTEX) and trace elements, including arsenic,
 - ii. groundwater remediation options in the event that adverse effects are detected, and
 - iii. monitoring the sustainability of groundwater production.

4.7.6 Hydrology

4.7.6.1 *Collection of Baseline Information*

Provide the following:

- a) describe baseline hydrological conditions in the Study Areas;
- b) available local and regional surface flow baseline data, including low, average and peak flows for key creeks, river locations, and low, average and peak levels for key lakes;
- c) describe and map the drainage patterns in the Study Areas; and
- d) provide a topographic map of the Local Study Area with an appropriate contour interval.

4.7.6.2 *Impact Assessment*

Provide the following:

- a) describe the changes to groundwater and surface water movement as a result of the Project:
 - 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, and
- 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, or other disturbances;
 - b) 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;
 - c) if any surface water withdrawals are considered, assess the potential impact of withdrawals including cumulative effects with respect to their magnitude, duration and frequency;
 - d) identify any potential erosion problems in the local creek channels due to existing or proposed project activities;
 - e) discuss changes in sediment concentrations in receiving waters caused by construction and describe mitigation measures to reduce sediment loadings;
 - f) discuss the significance of any predicted impacts on vegetation, wildlife, and aquatic resources; and
 - g) discuss related monitoring programs.

4.7.6.3 *Mitigation*

If potential impacts are predicted:

- a) discuss how potential impacts of temporary and permanent roads and well pads on peatland/wetland types will be minimized and mitigated;
- b) describe measures to reduce impacts to waterbodies and wetlands;
- c) discuss remedial measures to alleviate any anticipated erosion; and
- d) discuss participation in regional initiatives.

4.7.7 Surface Water Quality

4.7.7.1 *Collection of Baseline Information*

Provide the following:

- a) a description of the baseline water quality of watercourses and waterbodies in the Study Areas; the description of water quality will consider all appropriate water quality parameters, their seasonal variations and relationships to flow and other controlling factors;
- b) identify waterbodies that are sensitive to acid deposition; and
- c) provide an inventory of all surface water users in the Study Areas.

4.7.7.2 *Methodology*

Provide the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) the current framework for the management of acid deposition; and
- c) a comparison of existing and predicted water quality, using as appropriate, the *Surface Water Quality Guidelines for Use in Alberta*, the *Canadian Water Quality Guidelines* and relevant United States Environmental Protection Agency Guidelines. Consider the recommended procedures described in the document entitled: “*Protocol to Develop Alberta Water Quality Guidelines for Protection of Freshwater Aquatic Life*”.

4.7.7.3 *Impact Assessment*

Discuss the following:

- a) identify project activities that may affect surface water quality during all stages of the Project, including site preparation, construction, operation, decommissioning and reclamation;

- b) describe the potential impacts of the Project on surface water quality within the Study Areas;
- c) discuss any changes in water quality resulting from the Project and identify any parameters that are inconsistent with *Surface Water Quality Guidelines for Use in Alberta* (November 1999) or *Canadian Water Quality Guidelines*;
- d) assess the potential project related and cumulative impacts of acid deposition on water quality;
- e) discuss the significance of any impacts on water quality and implications to aquatic resources (e.g., biota, biodiversity and habitat);
- f) the residual effects for each stage of the Project, including post-reclamation. Predict and describe water conditions and suitability for aquatic biota in constructed waterbodies; and
- g) discuss related monitoring programs.

4.7.7.4 *Mitigation*

Discuss the following:

- a) measures to reduce impacts to waterbodies and wetlands; and
- b) regional initiatives.

4.7.8 Aquatic Ecology

4.7.8.1 *Collection of Baseline Information*

Provide the following:

- a) historical and current studies on fish and other aquatic resources in the Local Study Area.;
- b) describe existing aquatic resources using recognized sampling protocols, e.g., fish and benthic invertebrates, their use and potential use of associated habitats in watercourses, wetlands and other waterbodies in the Study Areas;
- c) describe sensitive species listed by Alberta Environment (at risk, may be at risk, and sensitive list species in the *General Status of Alberta Wild Species 2000*, or update) and federal *Species at Risk Act* (endangered, threatened, and special concern species);
- d) describe and map, as appropriate, the fish habitat of the lakes, rivers and other waters likely to be affected by the Project:
 - i. identify key indicator species;
 - ii. identify critical or sensitive areas such as spawning, rearing, and over-wintering habitats.
- e) discuss seasonal habitat use including migration and spawning routes; and
- f) describe the existing baseline information, any deficiencies in information, how these deficiencies will be addressed and, as applicable, any studies proposed to evaluate the status of the fish and aquatic resources in the Study Areas.

4.7.8.2 *Methodology*

Provide the following:

- a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
- b) current field data should be gathered using recognized sampling protocols; and
- c) the criteria and selection process for key indicator species.

4.7.8.3 *Impact Assessment*

Discuss the following:

- a) the potential changes to aquatic resources in the Study Areas;
- b) the aquatic biological resources in waterbodies affected by the Project, including composition, distribution, relative abundance, critical or sensitive seasonal habitat use and movement patterns;

- c) the nature of the potential effects, their duration; whether they are site-specific, local or regional in spatial extent;
- d) the implications of any construction, operation and reclamation activities in the Study Areas for aquatic biological resources and habitat. Clarify how stream alterations, changes to substrate conditions, stream flow conditions and water quality may affect these resources and habitat;
- e) the survival of eggs and fry, chronic or acute health effects, changes in the invertebrate community and food base; and increased stress on fish populations from release of contaminants, sedimentation, flow variations and habitat changes;
- f) potential impacts on riparian areas in the Local Study Area that could affect aquatic biological resources and productivity;
- g) potential for increased fishing pressure and the potential impacts that could result from increased use of the area and increased access in the area;
- h) describe resource users potentially affected by changes to local or downstream water quality, or to aquatic or fisheries resources (e.g., recreational, First Nations, commercial fisheries);
- i) how potential changes to groundwater and surface water quantities and quality due to project activities may affect fisheries and aquatic resources under normal and drought conditions;
- j) residual impacts on aquatic resources and their significance in the context of local and regional aquatic resources, including fisheries; and
- k) discuss related monitoring programs.

4.7.8.4 *Mitigation*

Discuss the following:

- a) the implications of potential effects on fish productivity and the need for access controls or other management strategies to protect the resources. Discuss plans to offset any incremental loss in the productivity. Indicate how environmental protection and compensation plans for the Project will address applicable provincial and federal policies for fish habitat;
- b) if applicable, the mitigation measures and habitat enhancement techniques that will be implemented to prevent or minimize any anticipated adverse effects; and
- c) environmental management procedures should monitoring indicate that mitigation strategies are not effective.

5.0 **PUBLIC HEALTH AND SAFETY**

Describe those aspects of the Project that may have implications for public health or the delivery of regional healthcare services. Determine whether there may be implications for public health arising from the Project. Discuss the following:

- a) the data and methods CNRL used to assess impacts of the Project on human health and safety;
- b) 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 and chronic adverse effects on human health;
- c) the human health impact of the potential contamination of country foods and natural food sources taking into consideration all project activities;
- d) the information on samples of selected species of vegetation known to be consumed by humans;
- e) the potential to increase human exposure to contaminants from changes to water quality, air quality and soil quality taking into consideration all project activities;
- f) the cumulative health effects that are likely to result from the Project in combination with other existing, approved and planned projects;

- g) document any health concerns identified by Aboriginal stakeholders due to impacts of the Project on their traditional lifestyle. Determine the impact of the Project on the health of Aboriginal stakeholders and identify possible mitigation strategies;
- h) the 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) the potential health and safety impacts due to higher regional traffic volumes and the increased risk of accidental leaks and spills;
- j) the health and safety concerns raised by stakeholders during consultation on the Project;
- k) a summary of CNRL's emergency response plan and discuss mitigation plans 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;
- l) how local residents will be contacted during an emergency and the type of information that will be communicated to them; and
- m) the existing agreements with area municipalities or industry groups such as safety co-operatives, emergency response associations and municipal emergency response agencies.

6.0 TRADITIONAL ECOLOGICAL KNOWLEDGE AND LAND USE

Provide details on the consultation undertaken with potentially affected Aboriginal communities with respect to traditional ecological knowledge and traditional land use:

- a) provide results of consultation with Aboriginal communities to identify the specific traditional land uses such as fishing, hunting, trapping and plant harvesting (nutritional and medicinal) in the Study Area(s). Determine their extent and location where possible. Identify cabin sites, spiritual sites and graves;
- b) determine the project and cumulative impact of development on these uses and identify possible mitigation strategies; and
- c) describe how Traditional Ecological Knowledge was incorporated into the technical components of the EIA report.

7.0 HISTORICAL RESOURCES

Provide details of the consultation with Alberta Community Development and Aboriginal communities with respect to Historical Resources. Include the Historical Resource Impact Assessment (HRIA) for the Project, and:

- a) provide a general overview of the results of any previous historical resource studies that have been conducted in the Study Areas, including archaeological resources, palaeontological resources, historical period sites, and any other historical resources as defined within the *Historical Resources Act*;
- b) summarize the results from the field program conducted to assess archaeological, palaeontological and historical significance of the Project;
- c) document any stakeholder concerns with respect to the development of the Project based on the historical significance of the Study Areas; and
- d) as appropriate, provide an outline of the program and schedule of field investigations that may be required to further assess and mitigate the effects of the Project on historical resources.

8.0 SOCIO-ECONOMIC FACTORS

8.1 Collection of Baseline Information

Provide the following:

- a) describe the baseline (existing) socio-economic conditions in the region; and
- b) the number and distribution of people who may be affected by the proposal.

8.2 Methodology

Describe the selection of the Study Areas, information sources and assessment methods.

8.3 Impact Assessment

Discuss the following:

- a) the social impacts of the Project on the Study Areas, communities of the region and on Alberta, including:
 - i. local employment and training,
 - ii. local procurement,
 - iii. population changes,
 - iv. demands on local and regional service infrastructure,
 - v. trapping, hunting and fishing,
 - vi. effects on First Nations and Métis (e.g., traditional land use and culture),
 - vii. regional and provincial economic benefits, and
 - viii. construction camps;
- b) describe the economic impacts of the Project on the Study Areas and on Alberta, having regard for capital, labour and other operating costs and revenue from services;
- c) discuss CNRL's policies and programs respecting the use of local, Alberta and Canadian goods and services. Provide an estimated breakdown of Alberta, other Canadian and non-Canadian industrial benefits from project management/engineering; equipment and materials; construction labour and total overall project;
- d) the employment and business development opportunities the Project may create for local communities and the region. Provide a breakdown of the type of employment and number of employees with respect for the construction and operational workforces. Identify the source of labour for the proposed Project; and
- e) impacts of the proposed Project on potential shortages of affordable housing and the quality of health care services. Identify and discuss the mitigation plans 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.

8.4 Mitigation

Discuss the following:

- a) outline plans to work with Aboriginal and other local residents and businesses with regards to employment, training needs, and other economic development opportunities arising from the construction and operation of the Project; and
- b) strategies to mitigate socio-economic concerns raised by Lakeland County, the Municipal District of Bonnyville No. 87 and other stakeholders in the region.

9.0 PUBLIC CONSULTATION REQUIREMENTS

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

- a) describe the consultative process and show how public input was obtained and addressed;
- b) document individual participation and attendance at each meeting and record specific comments or issues raised by individuals present at the meetings;
- c) describe and document the concerns, issues, and opportunities raised by the public, CNRL's analysis of those concerns and issues, and the actions taken to address those concerns and issues;
- d) describe how resolution of the concerns and issues was incorporated into the Project development, impact mitigation and proposed monitoring; and
- e) describe 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.

The EIA report will document the public consultation process, record any concerns or suggestions made by the public and will demonstrate how these concerns have been addressed. Consultation will include discussions with:

- f) Alberta provincial representatives,
- g) Saskatchewan provincial representatives,
- h) Federal government representatives,
- i) Department of National Defence,
- j) residents of Lakeland County and the Municipal District of Bonnyville No.87,
- k) First Nations and Métis organizations,
- l) Lakeland Industry and Community Association (LICA),
- m) commercial, industrial, recreational and traditional users, and
- n) other potentially-affected parties.

APPENDIX

The following information is necessary to be submitted as part of the Application under the Water Act (WA) or 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.

RECLAMATION PLAN

The reclamation plan in the Application shall include:

- 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) 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 predevelopment conditions;
- c) details on area of soil replacement indicating techniques, timing, depth, volume and type of reclamation material;
- d) information about the reclaimed topography for well pads, roads, and facilities. Identify contouring objectives, drainage restoration (surface and near-surface flow) and erosion control;
- e) the methods that may be used to deal with potential soil compaction and contamination problems in the Project Areas;
- f) the location and distribution of post-disturbance land capability on a map;
- g) a comparison of the pre-disturbance and post reclamation percentages and distribution of all forested communities in the Project Area. Provide a timber salvage plan, highlighting end users and identifying proposed volumes for removal by species and year for the term of the proposed expansion;
- h) appropriately scaled maps of the area highlighting (where possible) the preceding points; and
- i) provide an updated and detailed monitoring plan (including soils, vegetation, wildlife and aquatic resources) with schedules and methodologies to measure and evaluate reclamation performance and success.

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 non-saline groundwater sources, follow AENV's Groundwater Evaluation Guideline);
- b) the design details of facilities that will handle, treat and store wastewater streams and runoff and include appropriate annual volumes;
- c) the type and quantity of any chemicals used in water/wastewater treatment; and
- d) 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; and
- b) groundwater remediation options to be considered for implementation in the event that adverse effects are detected.

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) water quality monitoring program for metals and other relevant substances.