FINAL TERMS OF REFERENCE, JULY 2007

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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

FOR THE

NORTH AMERICAN OIL SANDS CORPORATION

KAI KOS DEHSEH SAGD PROJECT

Conklin, Alberta

Issued by: Alberta Environment

Date: July 27, 2007

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to identify for North American Oil Sands Corporation (North American) and the public the information required by government agencies for an Environmental Impact Assessment (EIA) report. North American will prepare and submit an EIA report that examines the environmental and socio-economic effects of the construction, operation and reclamation of its proposed Kai Kos Dehseh1 project (the Project).

North American is an oil sands company operating in northeastern Alberta. North American is a working interest owner and operator of approximately 12 townships of oil sands leases between Lac La Biche and Fort McMurray. North American's goal is to develop the Kai Kos Dehseh Project, producing up to 35,000 cubic metres (220,000 barrels) per day of bitumen through steam assisted gravity drainage (SAGD) technology. The operating areas are within the Regional Municipalities of Wood Buffalo and Lakeland County, centred about 30 km northwest of the community of Conklin, between Highways 63 and 881.

North American has already applied and is awaiting approval for the Leismer Demonstration Project, which will produce 1,600 cubic metres (10,000 barrels) per day of bitumen. The Kai Kos Dehseh Project will include expansion of the Leismer Demonstration Project with development of the Leismer and Corner operating hubs, thereby increasing production by approximately 11,000 cubic metres (70,000 barrels) per day of bitumen. These operating hubs will include central processing facilities, SAGD wells and additional infrastructure. The Leismer hubs will be located adjacent to North American's Leismer Demonstration Project located in Section 2, Township 79, Range 10, W4M. The Corner operating hubs will be located in Section 31, Township 80, Range 8, W4M. Following these developments, North American expects to expand the Project with a series of added hubs in the Hangingstone, Corner and Thornbury areas for an additional 22,000 cubic metres (140,000 barrels) per day of bitumen.

The EIA will address the full capacity of the lease area. By addressing the full capacity of the lease in the regional EIA, North American will assess all phases of the development. This will allow the public and North American to examine the effects of the overall Kai Kos Dehseh Project.

1.2 Scope of Environmental Impact Assessment Report

North American will prepare the EIA report 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, and any other federal legislation which may apply. The EIA report will:

a) assist the public and government in understanding the environmental and socio-economic consequences of the Project development, operation and reclamation and will assist North American in its decision-making process;

b) include a discussion on the 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

1 *Kai Kos Dehseh* is a Chipewyan Dene phrase which identifies the general area in which North American Oil Sands is operating. Translated it means Red Willow River which is the Chipewyan Dene name for the Christina River.

iii) identify residual environmental impacts and their significance, including cumulative and regional development considerations;

c) 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;

d) include tables that cross-reference the report (subsections) to the EIA Terms of Reference;

e) include a glossary of terms and list of abbreviations to assist the reader in understanding the material presented; and

f) as appropriate for the various types of impacts, discuss impact predictions in terms of magnitude, frequency, duration, seasonal timing, reversibility, and geographic extent.

The EIA report will form part of North American's Application to the Alberta Energy and Utilities Board (EUB) and Alberta Environment (AENV) for construction and operation of the Project. A summary of the EIA report will also be included as part of the 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. The results of these consultations will be documented as part of the EIA report (see Section 9.0). To meet the public consultation requirements North American must, at a minimum, 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

North American is responsible for the preparation of the EIA report and related applications. The 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 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 North American's operations including existing facilities;

e) an overview of the previous (if applicable) and recent EIAs and the associated developments completed by North American and other lease holders in the Conklin area; and

f) an overview of the proposed Project.

2.2 Project Area and EIA Study Area

The Project Area includes all lands subject to direct disturbance from the Project including the initial commercial phases at Leismer and Corner and the subsequent facilities at Hangingstone, Thornbury and South Leismer and associated infrastructure, including access and utility corridors. For the Project Area, provide:

a) the legal land description;

b) the boundaries;

c) a map that identifies the locations of all proposed development activities; and

d) a map and photomosaic 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 should include the Project Area and other areas based on individual environmental components where an effect from the proposed development can reasonably be expected. Provide:

a) the Local and Regional Study Areas chosen to assess the impacts of the Project and provide maps of appropriate scale to illustrate boundaries; and

b) the rationale used to define Local and Regional Study Areas (see Section 4.2), considering the location and range of probable Project and cumulative effects.

2.3 Project Components and Development Schedule

Provide a development plan and 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) field maintenance operations;

d) processing/treating facilities;

e) quantification and characterization of wastes produced;

f) identification of waste storage sites and disposal sites;

g) buildings;

h) storage areas;

i) containment structures such as berms and retention ponds;

j) locations of borrow pits and salvaged soil stockpiles;

k) temporary structures;

l) infrastructure (roads, pipelines and utilities);

m) transportation and access routes;

n) lime sludge pond(s);

o) water source wells and intakes;

p) aggregate resources and road construction, identifying the material required and on-site availability; and

q) proposed method of product transportation to market.

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

a) pre-construction;

b) construction;

c) operation;

d) decommissioning;

e) reclamation and closure;

f) timing of key construction, operational and reclamation activities and the expected duration of each for the life of the Project;

g) detailed schedule for any reclamation and related activities envisaged during the first decade of operations; and

h) the key factors controlling the schedule and uncertainties.

2.4 Project Need and Alternatives

Discuss the need for the Project and the alternatives to the Project, including the alternative of not proceeding with the Project. Include the following:

a) an analysis of the alternative means of carrying out the Project that are technically and economically feasible and indicate their potential environmental effects and impacts. Include rationale for selecting the proposed option;

b) how a balance between environmental, resource recovery or conservation and economic goals has been achieved through planning and preliminary design, highlighting any areas where planning focused on one goal in exclusion of others;

c) contingency plans, if selected major Project components or methods during any phase proved to be unfeasible or do not perform as expected;

d) the environmental performance of the technology selected and a comparison to the alternative technologies considered; and

e) the implications of a delay in proceeding with the Project, or any phase of 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 Project and identify those being applied for and constructed within the duration of approvals under the:

   i) *Environmental Protection and Enhancement Act* (EPEA),
   ii) *Oil Sands Conservation Act*,
   iii) *Water Act* (WA),
   iv) *Public Lands Act* (PLA),
   v) *Canada Fisheries Act*, and
   vi) *Navigable Waters Protection Act*; and

d) a summary of the regional, provincial or national objectives, standards or guidelines, which have been used by North American to assist in the evaluation of any predicted environmental impacts.

2.6 EIA Summary

A summary of the results of the EIA report will be provided which includes:

a) project components and development activities which have the potential to affect the environment;

b) existing conditions in the Study Areas, 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 and their implications for future management of regional cumulative effects.

3.0 PROJECT DESCRIPTION

Describe the components, infrastructure and activities 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, North American shall provide a rationale demonstrating that the information is sufficient for EIA purposes.

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 North American's submission(s) provided that the location of the information is appropriately referenced in the EIA report. North American 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 hubs and field facilities;

b) show all existing leases and clearings including exploration clearings and illustrate how North American 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 a description and schedule(s) of land clearing required for:

   i) steam generation facilities,
   ii) central processing facilities,
   iii) well pads,
   iv) access roads,
   v) borrow areas,
   vi) pipelines, and
   vii) utilities and other site preparation activities;

h) indicate the amount of surface disturbance from plant, field and infrastructure-related activities; discussing:

   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, and
   iv) how visual aesthetics will be managed, where required;

i) discuss opportunities to integrate the Project with other resource development activities (mineral and forestry); and

j) identify 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 they relate 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,
   iii) construction standards or methods, and
   iv) environmental protection plans;

e) describe existing and planned activities as they relate to boating and vessel navigational use of watercourses and waterbodies within the Local 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 during and after project operations;

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, and those under consideration by the Regional Issues Working Group. 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;

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 and other regional roads. 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 North American 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 Alberta Sustainable Resource Development;

l) discuss how the Project design will minimize the amount of disturbance;

m) outline design features to prevent spills, contingencies for spill response and environmental risks associated with spills; and

n) 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) 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 to soils, vegetation and waterbodies, as well as programs North American may implement to monitor the effects of this deposition;

c) any odorous or visual emissions from the proposed facilities;

d) emergency flaring scenarios (e.g., frequency and duration) and proposed measures to ensure flaring events are minimized;

e) the systems used to monitor and quantify air emissions; and

f) the use of alternative fuels in this project, if applicable. Provide emission profiles for each fuel under consideration.

3.3.1 *Emission Control Technologies*

Discuss the following:

a) the emission control technologies proposed for the Project within the following context:
   i) minimizing air emissions such as sulphur dioxide (SO_2), hydrogen sulphide (H_2S), 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 Heate*rs, and applicable provincial guidelines,
   iii) applicability of sulphur recovery, acid gas re-injection, 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,
   v) control technologies for minimization of venting and flaring, and
   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*, the CCME *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Above Ground Storage Tanks*, and applicable provincial guidance documents; and

b) monitoring programs North American 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.

3.3.2 *Greenhouse Gas Emissions*

Provide the following:

a) expected annual and total greenhouse gas (GHG) emissions as a result of the Project;

b) the Project's 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 *Albertans and Climate Change: Taking Action*; and

e) North American's overall GHG management plans, including 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) compliance with the *Water Conservation and Allocation Guideline 2006 for Oilfield Injection*;

b) the annual and seasonal water balance(s), if applicable, for each project phase and overall;

c) assumptions made or methods chosen to arrive at the water balance(s), 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 (e.g. pipelines);

d) the process, non-saline and saline water requirements and sources for construction, startup, normal and emergency operating situations, decommissioning and reclamation;

e) 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 while considering plans for wastewater reuse, and the locations of any water wells;

f) contingency plans for water supply, including the potential effects of extended periods of drought on the proposed water supply; and

g) 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, 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) non-saline 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 use of saline waters, recycle of produced water, water use minimization, 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, 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 each wastewater stream;

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 (including water quality and environmental considerations) 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) local and regional 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) non-saline 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's 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 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*;

c) describe the proposed storage and handling methods and disposal for each waste stream. Consider both central plant and field operations;

d) 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*;

e) discuss the strategy for on-site waste disposal versus off-site waste disposal, including but not limited to the following:

   i) 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,
   iii) on- and off-site waste treatment and storage areas, and
   iv) potential effects on the environment;

f) describe plans for waste minimization, recycling, and management over the life of the Project; and

g) 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 PSL1, PSL2,
   iii) ARET,
   iv) those defined as dangerous goods pursuant to the federal *Transportation of Dangerous Goods Act*,
   v) on the 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, of how these items will be stored and managed to ensure adequate protection of both the environment and 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)

Provide a conceptual reclamation and closure plan considering 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 appropriate natural subregion (Lower Boreal Highland Natural Subregion or the Central Mixed wood 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, and a soil material balance;

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 with information required for inclusion into the Forest Management Agreement (FMA) Detailed Forest 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.

Discuss the conceptual 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) how North American 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) integration of surface and near-surface drainage within the development area;

f) resemblance to the pre-disturbed landscape. Identify the post-disturbance land capability on a map;

g) project planning and development;

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 North American'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 waste tracking, process inputs and outputs. Present conceptual contingency plans that consider the environmental effects of serious malfunctions or accidents; the key elements of the operating plans and performance standards to be developed prior to the commissioning of the Project, 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;

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) proposed monitoring, including:
   i) monitoring done independently by North American,
   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) an emergency response system to deal with emergency situations and minimizing 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;

e) a fire control plan:
   i) highlighting measures taken to ensure continued access for fire fighters to adjacent wildland areas,
   ii) highlighting forest fire prevention measures, and
   iii) using the "FireSmart" Wildfire Assessment System to assess areas adjacent to proposed facilities and identify mitigative measures;

f) how regional environmental management initiatives will be incorporated into the management practices; and

g) 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 North American 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 adaptive management plans that will 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 in Cooperative Efforts

Demonstrate and document North American's current and planned 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 on-going initiatives and any potential co-operative ventures that North American is participating in with oil and gas and resource users (e.g., minerals and forestry). Include:

a) regional air monitoring networks and studies, health studies, biomonitoring and research, aquatics monitoring, wetlands management, end land use planning and socio-economic studies;

b) potential cooperative ventures that North American 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 North American 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 North American 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 Scenarios

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 or Planned Development Case, which includes , existing, planned and approved projects or activities, and the Application case.

Note: For the purposes of defining assessment scenarios, "approved" means approved by the applicable 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's Application and EIA report.

4.2 Study Areas

The EIA Study Area shall include the Project Area and associated infrastructure, as well as, the spatial and temporal areas of individual environmental components outside the boundaries where

an effect can be reasonably expected. The EIA Study Area includes both Regional and Local Study Areas.

Illustrate boundaries and identify the Local and Regional 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.

4.3 Information Requirements for the Environmental Assessment

Discuss the methods, criteria and assumptions used in North American'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;

b) 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;

c) discuss how the EIA report ensures that the same level of information is provided for all phases of the Project;

d) quantify and assess impact significance where possible, taking into consideration spatial, temporal and cumulative aspects;

e) discuss the sources of information used in the assessment including a summary of previously conducted environmental baseline work related to North American'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;

f) 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;

g) 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

h) 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 become part of the 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. Discuss the key elements of such plans,

    iv) identify residual impacts and comment on their significance, and

    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.

4.4 Modelling

Document any assumptions, used in the EIA report, to obtain modelling predictions. Clearly identify the limitations of the model(s) and data used in modelling, including sources of error and relative accuracy. Discuss the applicability and reasons for using a particular model.

4.5 Cumulative Environmental Effects Assessment

Assessment of cumulative effects will be an integral component of the EIA report. North American 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 with due consideration for regional environmental monitoring and management activities and provide the rationale for assumptions used to define those boundaries for each environmental component examined;

b) describe the baseline state of the environment in the Regional Study Area (used for the cumulative effects assessment);

c) provide a discussion of historic 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 planned projects in the region;

e) demonstrate that relevant information or data used from previous oil sands and other development projects is appropriate for use in this EIA report;

f) consider and describe deficiencies or limitations in the existing database for relevant components of the environment;

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 relevant 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).

4.6 Climate, Air Quality and Noise

4.6.1 *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 North American's participation in any regional air monitoring forums.

4.6.2 *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 and upset conditions;

b) describe the selection criteria used to determine the Study Areas, including information sources and assessment methods;

c) provide 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) provide the 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 H+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 the CEMA *Particulate Matter and Ozone Management Framework*; and

h) compare predicted air quality concentrations with the appropriate air quality guidelines available.

4.6.3 *Impact Assessment*

Discuss current and approved emission sources and changes as a result of anticipated future development scenarios within the EIA Study Area(s) (CEA 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. Identify, describe and discuss the following:

a) the appropriate air quality parameters such as:, sulphur dioxide (SO_2), hydrogen sulphide (H_2S), total hydrocarbons (THC), oxides of nitrogen (NO_x),volatile organic compounds (VOC), individual hydrocarbons of concern in the THC and VOC mixtures, particulates (road dust, PM_{10} and $PM_{2.5}$), ozone (O_3), 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, 99.9^{th} percentile for hourly predictions and 98^{th} percentile for 24-hour $PM_{2.5}$ predictions;

c) the formation of secondary pollutants such as ground-level ozone (O_3), 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) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;

f) interactive effects that may occur as a result of co-exposure of a receptor to the emissions and discuss limitations in the present understanding of this subject;

g) 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;

h) the effect of 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*, and *EUB Guide 38*, include the following:

   i) potentially-affected people and wildlife,
   ii) characterization of noise sources, and noise resulting from the development,
   iii) the implications of any increased noise levels, and
   iv) proposed mitigation measures; and

m) regional air monitoring underway in the area and describe North American's participation in regional forums.

4.6.4 *Climate Change*

Provide the following:

a) in accordance with the guideline document *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*, 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) 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.

4.7 Aquatic Resources

4.7.1 *Hydrogeology*

4.7.1.1. Baseline Information

Provide the following:

a) an overview of the existing geologic and hydrogeologic setting in the Study Areas from the ground surface down to and including the bitumen producing zones and disposal zones;

b) presentation of the geologic setting should describe depth, thickness and spatial extent of lithology, stratigraphic units and structural features including water table and potentiometric surfaces; and

c) presentation of the hydrogeologic setting including:

i) the spatial distribution of aquifers and aquitards, their properties and the hydraulic connections between hydrostratigraphic units (include 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 (where applicable, field verification surveys will be completed),

vi) the recharge potential for Quaternary aquifers,

vii) the potential hydraulic connection between bitumen production zones, disposal formations and other aquifers,

viii) confirmation that the disposal zones currently used for deep disposal of wastes and wastewater will be sufficient for the life of the Project. Provide descriptions of wastewater disposal formations including containment, water quality, and the chemical compatibility with the wastewater, and

ix) the locations of major facilities associated with the Project including facilities for waste storage, treatment and disposal (e.g., deep well disposal), and the site-specific aquifer and shallow groundwater beneath these proposed facilities.

4.7.1.2. Methodology

Provide the following:

a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;

b) structure contour maps, geologic cross-sections and isopach maps to describe specific geology in the Local and Regional Study Areas;

c) 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;

d) details on the observation well network used to calibrate hydrogeological modelling efforts used in this assessment; and

e) demonstration of how, or if, figures, maps, diagrams, interpretations and concepts developed from previous work and submitted in the EIA report have been modified by the incorporation of any subsequent new data.

4.7.1.3. Impact Assessment

Discuss the following:

a) the components and activities of the Project which have the potential to affect groundwater resource quantity and quality within the Study Areas during project development, operation and reclamation; and

b) 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) potential conflicts with other groundwater users and proposed resolutions to these conflicts,
    iii) changes in groundwater quality,
    iv) potential implications of seasonal variations,
    v) the suitability of on-site waste disposal and supporting geotechnical information, and
    vi) groundwater withdrawal for project operations.

4.7.1.4. Mitigation

Discuss conceptual plans and implementation program to manage and protect groundwater resources including, but not limited to:

a) monitoring programs for groundwater quality and quantity;
b) 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
c) North American's involvement in regional groundwater initiatives in the in-situ oil sands.

4.7.2 *Hydrology*

4.7.2.1. Baseline Information

a) Describe baseline hydrological conditions in the Study Areas;
b) Provide local and regional surface flow baseline data, including low, average and peak flows and seasonal variations for key watercourses, and low, average and peak levels and seasonal variations for key waterbodies; and
c) Describe and map drainage patterns in the Study Areas.

4.7.2.2. Methodology

Provide:

a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;
b) the criteria used to identify key creeks, lakes and waterbodies to be monitored;
c) maps of the drainage patterns in the Study Areas; and
d) a topographic map of the Local Study Area with an appropriate contour interval.

4.7.2.3. Impact Assessment

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,
    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 project and cumulative effects 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, and

iv) discuss the potential for short and long term changes in the connection between surface water, groundwater, production zones and disposal zones;

b) discuss changes to watershed(s), including surface and near-surface drainage conditions, potential flow changes, 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 local creek channels due to existing or proposed project activities;

e) discuss changes in sediment concentrations in receiving waters caused by construction, operation, and reclamation phases of the Project; and

f) discuss any surface water users who have existing approvals, permits or licenses including the impact on these users due to the Project. Identify any potential water use conflicts and potential solutions.

4.7.2.4. Mitigation

a) Describe surface water management plans, mitigation measures and monitoring programs, including participation in regional initiatives, for the start-up, operations, and reclamation phases;

b) discuss how potential impacts of temporary and permanent roads and well pads on open-water hydrology (including peatland/wetland types) will be minimized, mitigated and monitored;

c) discuss plans to return disturbed areas to a self-sustaining habitat, if applicable;

d) discuss remedial measures to alleviate any anticipated erosion;

e) describe mitigation measures to reduce sediment loadings; and

f) describe any monitoring programs that may be considered to assess the impacts of potential changes to surface water on aquatic resources, wildlife and vegetation.

4.7.3 *Surface Water Quality*

4.7.3.1. Baseline Information

Provide:

a) a summary of the baseline water quality of watercourses and waterbodies in the Study Areas, including consideration of all appropriate water quality parameters, their seasonal variations and relationships to flow and other controlling factors;

b) the identity of waterbodies that are sensitive to acid deposition; and

c) an inventory of surface water users in the area.

4.7.3.2. Methodology

Provide:

a) the selection criteria used to determine the Study Areas, including information sources and assessment methods, considering the current framework for the management of acid deposition; and

b) a comparison of existing and predicted water quality, using as appropriate, the *Surface Water Quality Guidelines for Use in Alberta* (November 1999) or the *Canadian Water Quality Guidelines*.

4.7.3.3. Impact Assessment

a) Identify project components that may affect surface water quality during all stages of the Project; and

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 and identify any parameters that are inconsistent 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) assess the potential project-related and cumulative impacts of acidifying and other air emissions on surface water quality,

   iv) distinguish between natural variability and project-related impacts to water quality including the potential effects of seasonal variations and weather extremes on surface water quality,

   v) discuss seasonal variation and potential effects on surface water quality. Describe the cumulative effects of regional activities on surface water quality in the Study Areas;

c) discuss 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

d) discuss the effect of water quality in surface waterbodies due to the change in surface runoff or groundwater discharge.

4.7.3.4. Mitigation

a) Discuss the proposed mitigation measures to be considered, during construction, operation and reclamation phases of the Project, to maintain surface water quality;

b) 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; and

c) identify any cooperative monitoring and assessment initiative(s) such as with regional stakeholders that North American may consider joining.

4.7.4 *Aquatic Biological Resources*

4.7.4.1. Baseline Information

a) Describe the existing fish and other aquatic resources (e.g., benthic invertebrate and aquatic vegetation) in the waters found in the Local and Regional Study Areas and in other fish-bearing waters likely to be impacted by the Project:

   i) identify species composition, distribution, relative abundance, movements and general life history parameters,

   ii) identify critical or sensitive areas such as spawning, rearing, and over-wintering habitats. Discuss seasonal habitat use including migration and spawning routes,

   iii) identify key indicator species and provide the rationale and selection criteria used,

   iv) describe and map, as appropriate, the fish habitat and aquatic resources of the lakes, rivers and other waters within the Local Study Area, and

   v) 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 Local Study Area;

b) for water course crossings, describe the fish species present and life stages of concern; and

c) discuss the use of the fish resources as existing or potential Aboriginal, sport or commercial fisheries.

4.7.4.2. Methodology

Provide:

a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;

b) the criteria and selection process for key indicator species; and

c) a description of the timing, techniques, and the design of the inventory sampling used to determine the abundance, distribution and habitat use of aquatic biological resources.

4.7.4.3. Impact Assessment

Discuss:

a) 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). Consider 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;

b) potential impacts on riparian areas that could impact aquatic biological resources and productivity;

c) how potential changes to groundwater and surface water may affect fisheries and aquatic resources, under normal and drought conditions;

d) the potential effects of watercourse crossings on fish, fish habitat, and aquatic communities including habitat losses, and their potential for habitat fragmentation;

e) the significance of residual environmental effects in the context of local and regional fisheries; and

f) 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.

4.7.4.4. Mitigation

a) Discuss, as applicable, the design, construction and operational factors to be incorporated into the Project for the protection of fish resources;

b) 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;

c) for potential watercourse crossings, discuss the short and long term monitoring of fish, fish habitat and habitat fragmentation, including mitigation measures incorporated in the design of proposed watercourse crossings;

d) describe any mitigation strategies that might be planned to minimize the effects of improved access, increased workforce and increased fishing pressure on the fish resource;

e) as appropriate, discuss any cooperative mitigation strategies that might be planned or continued with other oil sands and industrial operators; and

f) as applicable, discuss any monitoring programs that have been initiated by North American 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.

4.8 Terrestrial Resources

4.8.1 *Geology, Soils, Terrain*

4.8.1.1. Baseline Information

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

a) a general description of the surficial geology, including surface topography and bedrock;
b) a detailed description of regional soils;
c) a detailed description of the soil types and their distribution in the Project Area and Local Study Area;
d) the sensitivity of the local and regional soil types to potential acid deposition;
e) the pre- and post-disturbance land capability classes for soils in the Local Study Area;
f) the availability and suitability of soils within the Project Area for reclamation;
g) a reclamation balance for topsoils and subsoils in all phases of the Project; and
h) identification and location of erosion sensitive soils.

4.8.1.2. Methodology

Provide the following:

a) the rationale 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 accepted soil sensitivity analyses and modelled predictions of acid deposition patterns;
c) the distribution of soil types in the Local and Regional Study Areas using appropriate soil survey intensity 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) a description of the suitability and availability of soils within the Project for reclamation using *Soil Quality Criteria Relative to Disturbance and Reclamation* (Alberta Agriculture, 1987);
e) an inventory of the pre- and post-disturbance land capability classes for soils in the Local Study Area by using the *Land Capability Classification System for Forest Ecosystems in the Oil Sands, Third Edition* (Leskiw, 2006); and
f) an ecological context of the soil resources by supplying a soil survey report and maps following S*oil Survey Handbook*, Vol. 1 (Agriculture Canada, 1987) at an appropriate level of detail to determine the effect of the Project on soil types and quality on the Regional Study Area.

4.8.1.3. Impact Assessment

Discuss the following:

a) the significance of any changes for the Local and Regional landscapes, biodiversity, productivity, ecological integrity, aesthetics and future use resulting from disturbance during construction, operation and reclamation;
b) the significance of predicted impacts by acidifying emissions on 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) any constraints or limitations to achieving vegetation/habitat restoration based on anticipated soil conditions (e.g. compaction, contaminants, soil moisture, nutrient depletion, erosion, etc.);

d) the impact of the Project development on soil types and reclamation suitability and the approximate volume of soil materials for reclamation;

e) the potential for soil erosion from the disturbance, construction, operation and reclamation of the Project;

f) the anticipated changes (type and extent) to the pre-disturbance topography, elevations and drainage patterns within the Project Area resulting from disturbance during construction, operation and reclamation;

g) the potential for changes in the ground surface during operations (e.g., temperature, ground heave and ground subsidence). Summarize applicable experience with temperature changes, 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;

h) the impacts to land capability in the Local Study Area due to the Project; and

i) any other issues that will affect soil capability and quality of the Study Areas and the reclaimed landscape.

4.8.1.4. Mitigation

Provide the following:

a) possible mitigative measures to minimize surficial disturbance;

b) possible mitigative actions to address potential effects of acid deposition;

c) actions to mitigate effects of any constraint or limitation to habitat restoration such as compaction, contaminants, soil moisture, erosion, nutrient regime, etc.;

d) possible measures to mitigate changes to ground surface (temperature, heave and subsidence) during operations;

e) possible mitigative actions to address impacts to land capability; and

f) any other measures to reduce or eliminate the potential impacts that the Project may have on soil capability and/or quality.

4.8.2 *Terrestrial Vegetation, Wetlands and Forest Resources*

4.8.2.1. Baseline Information

a) Describe vegetation communities in the Study Areas, using, as appropriate, the *Alberta Vegetation Inventory* (AVI) Standard AVI 2.1 and *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996);

b) describe peatlands and wetlands in the Study Areas according to the *Alberta Wetland Inventory Standards Manual* (AWI) Version 1.0;

c) identify and discuss 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;

d) identify and discuss the ecosites considering their potential to support rare plant species, plants for traditional or medicinal purposes, old growth forests or other communities of limited distribution. Consider their importance for local and regional habitat, sustained forest growth, rare plant habitat and hydrologic regime;

e) identify and verify the presence of species of rare plants and the ecosite phases where they are found, using reliable survey methods;

f) where landscape units are identified as rare, or where a significant percentage of landscape units within the LSA may be removed by the Project, describe their regional significance; and

g) discuss the rarity or abundance of wetlands in the Local Study Area.

4.8.2.2. Methodology

Provide:

a) a map of vegetation-related information, including vegetation communities, peatlands and wetlands in the Study Areas. Map the Project development footprint at an appropriate scale. Discuss any shortfalls in using AVI and AWI for mapping the Local Study Area;

b) a discussion of the adequacy of the Study Areas, information sources and assessment methods for a cumulative effects assessment, including how baseline information was collected to enable a detailed ELC of the Local Study Area to be completed; and

c) the selection criteria used to determine the Study Areas, including information sources and assessment methods.

4.8.2.3. Impact Assessment

a) Identify the amount of vegetation and wetlands to be disturbed during each stage of the Project;

b) discuss any potential effects the Project may have on rare plants and areas with high rare plant potential habitat;

c) 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 for timber harvesting and other land uses;

d) 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),

   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,

   iii) predict the anticipated effect of the Project on wetlands, and

   iv) discuss the impact of any loss of peatlands or surface wetlands, as well as how this will affect land use, fragmentation and biodiversity;

e) identify and evaluate the extent of potential effects of the Project, such as ecosystem fragmentation and introduction of non-native plant species on native species composition and changes to plant communities;

f) 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 Local Study Area. Provide Timber Productivity Ratings for the Local Study Area lands, including identification of productive forested, non-productive forested and non-forested lands;

g) determine how the project disturbance impacts Annual Allowable Cuts and quotas within the Forest Management Agreement. Discuss opportunities to integrate this project with other resource development activities such as logging; and

h) comment on the significance of the residual effects on vegetation resources, peatlands and wetlands, and their implications for other environmental resources.

4.8.2.4. Mitigation

Provide:

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 existing cutblocks. Identify any setbacks proposed around environmentally sensitive areas such as surface waterbodies, riparian areas and peatlands/wetlands;

c) a discussion of measures and techniques that will be used to minimize the impact of peatland and wetland loss;

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.

4.8.3 *Wildlife*

4.8.3.1. Baseline Information

Identify and describe:

a) existing wildlife resources (amphibians, reptiles, birds and terrestrial and aquatic mammals), their use and potential use of habitats in the Study Areas;

b) wildlife species composition, distribution, relative abundance, seasonal movements, movement corridors, habitat requirements, key habitat areas, and general life history in the Study Areas; and

c) include current field data for all key indicator species and 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 2005*, or update) and COSEWIC (endangered, threatened, and special concern species in the *Canadian Species at Risk Act (SARA)*).

4.8.3.2. Methodology

Provide:

a) the selection criteria used to determine the Study Areas, including information sources and assessment methods;

b) key indicator species including 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 and validated by comparing model predictions with wildlife data from the Study Area(s). Describe data and data sources that were used to evaluate wildlife models.

4.8.3.3. Impact Assessment

Discuss:

a) the anticipated changes to wildlife in the Study Areas;

b) the potential adverse impacts on wildlife populations (including indicator species and sensitive species), 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;

c) the spatial and temporal changes to habitat (type, quality, quantity, diversity and distribution) and to wildlife distribution, relative abundance, movements, habitat availability including:
    i) anticipated effects on wildlife as a result of changes to air, water, including both acute and chronic effects on animal health, and
    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;
d) the mapped changes in habitat distribution and fragmentation anticipated from the project and other planned activities, and their implications; and
e) residual impacts to wildlife and wildlife habitat and discuss their significance in the context of local and regional wildlife populations.

4.8.3.4. Mitigation

Discuss:

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 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 predicted wildlife impacts from the Project and the effectiveness of mitigation strategies and habitat enhancement measures, giving special attention to sensitive species in the Local Study Area;
b) the potential to return the Project Area to pre-disturbance wildlife habitat/population conditions;
c) the use setbacks to provide for the protection of riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using the habitat; and
d) measures that will be taken to prevent habituation of wildlife, the potential for human-wildlife encounters and consequent destruction of wildlife (e.g., black bears), including any staff training programs, garbage containment or regular follow-up.

4.9 Biodiversity and Fragmentation

4.9.1 *Baseline Information*

Provide the following:

a) within selected taxonomic groups, discuss the presence and abundance of species in each ecosite phase or ecological type;
b) species lists and summaries of observed and estimated species richness and evenness for each ecosite phase or ecological type;
c) a ranking of each ecological unit for biodiversity potential;
d) a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites;

e) 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 biodiversity analysis; and

f) the current level of habitat fragmentation in the Study Areas.

4.9.2 *Methodology*

Provide and discuss the following:

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

b) the process and rationale used to select biotic target elements for biodiversity;

c) the collection of baseline information in each terrestrial and aquatic community using a suitable proportional sampling method to provide sufficient plots in each ecosite phase and statistically sound data;

d) the combination of measures of species richness, overlap in species lists, significance of individual species or associations, uniqueness and other appropriate measures to rank ecological units for biodiversity potential. Provide the rationale and techniques for the chosen ranking system;

e) North American's participation in regional programs that will allow for the collection and submission of baseline information in a timely manner; and

f) the techniques used in the fragmentation analysis.

4.9.3 *Impact Assessment*

Discuss:

a) the contribution of the Project to any anticipated changes in regional biodiversity;

b) how changes in biodiversity could potentially impact local and regional ecosystems; and

c) the anticipated level of habitat fragmentation in the Study Areas as a result of the Project, the principle factors contributing to fragmentation and 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).

4.9.4 *Mitigation*

Discuss:

a) measures to minimize changes in regional biodiversity resulting from the Project; and

b) biodiversity monitoring programs and management thresholds that North American will implement either individually or in cooperation with other operators or regional initiatives.

4.10 Land And Resource Use

4.10.1 *Baseline Information*

Describe the following:

a) the existing recreational, commercial, residential, institutional, industrial, tourism, cultural/historical, trapping, hunting, traditional land uses and other outdoor recreational activities in the Study Areas;

b) unique sites or special features in the Study Areas, such as Natural Areas, Environmentally Significant Areas archaeological sites or Heritage Rivers. Indicate the location and significance of other protected areas, if present; and

c) the quantity and quality of aggregate resources in the Study Areas.

4.10.2 *Methodology*

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) outline the process for addressing the needs of other users in the Study Areas; and

d) discuss the implications of those land and resource use policies for the Project, including any constraints to development.

4.10.3 *Impact Assessment*

Discuss the following:

a) the potential impact of the Project on the identified land uses and public access during and after development activities;

b) the aesthetic characteristics of the facilities with respect to the existing landscape;

c) any impacts of the Project on special features in the Study Area;

d) the impact of development and reclamation on commercial forest harvesting in the Project Area; and

e) the impact of the development on aggregate resources in the Study Areas.

4.10.4 *Mitigation*

a) Identify measures to mitigate the potential land use impacts resulting from the Project;

b) discuss how regional environmental management initiatives will be incorporated into North American's land use plan;

c) discuss how reclamation will restore existing land use potentials considering any recommendations of the *Oil Sands Mining End Land Use Committee* and the Cumulative Environmental Management Association, Reclamation Working Group that are applicable to in-situ oil sands operations;

d) discuss opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fire hazard; and

e) discuss mitigative measures to conserve aggregate resources.

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, specifically:

a) identify and discuss the data and methods North American used to assess 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 and chronic adverse effects on human health;

c) identify the human health impact of the potential contamination of country foods and natural food sources taking into consideration all project activities;

d) provide the information on compounds released from the project found in samples of selected species of vegetation;

e) provide results of modelling of compounds released from the Project and found in wildlife known to be consumed by humans based on chemical data from soil, vegetation, water and other available samples;

f) 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;

g) 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;

h) assess cumulative health effects to receptors, including First Nations and Aboriginal receptors, that are likely to result from the Project in combination with other existing, approved, and planned projects;

i) identify, as appropriate, 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;

j) identify and discuss potential health and safety impacts due to higher regional traffic volumes and the increased risk of accidental leaks and spills;

k) document health and safety concerns raised by stakeholders during consultation on the Project;

l) provide a summary of North American'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;

m) describe how local residents will be contacted during an emergency and the type of information that will be communicated to them;

n) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations and municipal emergency response agencies; and

o) 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.

6.0 TRADITIONAL ECOLOGICAL KNOWLEDGE AND TRADITIONAL USE

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

a) results of consultation with Aboriginal communities to identify the extent of traditional use of the Study Area(s);

b) the traditional land uses including fishing, hunting, trapping and plant harvesting (nutritional and medicinal) and cultural use in the Study Area(s);

c) the vegetation and wildlife used for nutritional and medicinal purposes, and any potential effects the Project may have;

d) cabin sites, spiritual sites and graves;

e) the project and cumulative impact of development on these uses and identify possible mitigation strategies; and

f) a description of how TEK was incorporated into the technical components of the EIA report.

7.0 HISTORIC RESOURCES

Describe those aspects of the Project that may have implications for historic resources and provide the following:

a) a general overview of the results of any previous historic resource studies that have been conducted in the Local Study Area, including archaeological resources, palaeontological resources, historic period sites, and any other historic resources as defined within the *Historical Resources Act*, including Aboriginal traditional use sites that may be considered to be historic resources under the *Historical Resources Act*;

b) details of the consultation with the Historic Resources Management Branch of Alberta Tourism, Parks, Recreation and Culture, First Nations and any other Aboriginal communities with respect to historic resources;

c) the final report discussing the results of the Historic Resources Impact Assessment (HRIA) to the Historic Resources Management Branch, and any other interested parties, prior to or at the same time as the submission of the EIA report to Alberta Environment. The EIA is to include a summary of the results of the HRIA;

d) documentation of the participation of local Aboriginal peoples in the field component of the consultation program, and any concerns that local First Nations and other Aboriginal communities have relative to project impacts on historic resources;

e) documentation of any stakeholder concerns with respect to the development of the Project based on the historic significance of the Local Study Area; and

f) an outline of the historic resources management program and schedule of field investigations that may be required to further assess and mitigate the effects of the Project on historic resources.

8.0 SOCIO-ECONOMIC FACTORS

8.1 Baseline Information

Describe the baseline socio-economic conditions and trends for the region and for the communities impacted by the Project.

8.2 Methodology

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

8.3 Impact Assessment

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

a) identify any concerns related to socio-economic conditions that have been raised by the local municipality or any other stakeholder in the region;

b) provide information on the socio-economic impacts of the Project on the Regional Study Area and Alberta, related to:

i) local employment and training,
ii) local business opportunities,
iii) population changes,
iv) demands on local services and infrastructure,
v) effects on traffic and traffic safety,
vi) regional and provincial economic benefits,
vii) housing and availability of affordable housing,

viii) effects on medical facilities and health services,
ix) effects on trapping, hunting and fishing,
x) effects on recreational activities, and
xi) effects on First Nations and Métis (e.g., traditional land use and cultural well being);

c) provide an analysis of the significance of the socio-economic impacts;

d) 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;

e) describe the overall engineering and contracting plan for the project;

f) provide a summary of any discussions that have taken place with the Municipality concerning potential housing shortages;

g) discuss the location of proposed construction camps, the number of workers they are intended to house and outline what services will be provided in the camp (e.g., security, recreation and leisure, medical);

h) 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;

i) discuss North American's policies and programs respecting the use of regional and Alberta goods and services; and

j) provide an estimated breakdown of Alberta, other Canadian and non-Canadian industrial benefits for engineering and project management, equipment and materials, construction labour and total overall project.

8.4 Mitigation

Provide the following information on:

a) current plans and strategies to mitigate the socio-economic impacts of the Project, including work undertaken with industry partners, local municipalities and other regional stakeholders; and

b) North American's current and ongoing plans to work with First Nations 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.

9.0 PUBLIC CONSULTATION

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

a) describe the consultative process and show how public input was obtained and addressed;

b) provide documentation individual participation and attendance at each meeting, including records of specific comments or issues raised by individuals present at the meetings;

c) describe and document concerns, issues, and opportunities raised by the public, North American's analysis of those concerns and issues, and the actions taken to address those concerns and issues;

d) describe how the resolution of the concerns and issues was incorporated into the Project development, impact mitigation and proposed monitoring; and

e) provide 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.

Consultation will include discussions with the following:

a) Alberta provincial representatives;
b) Federal government representatives;
c) Municipal government representatives;
d) Residents in surrounding areas as identified during the consultation process;
e) First Nations and Métis organizations;
f) commercial, industrial, recreational and traditional users; and
g) 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.

AIR QUALITY ASSESSMENT

Provide via modelling maximum groundlevel concentration locations of nitrogen dioxide (NO2) and sulphur dioxide (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 RECLAMATION PLAN

The reclamation plan in the Application will address the following:

a) provide 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 adequate sampling intensity 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 predevelopment conditions;

d) provide details on area of soil replacement indicating techniques, timing, depth, volume and type of reclamation material;

e) discuss the potential to retain coarse woody debris for use in reclamation and to reduce the need for slash burning after clearing;

f) provide information about the reclaimed topography for well pads, roads, and facilities. Identify contouring objectives, drainage restoration (surface and near-surface flow) and erosion control;

g) discuss the methods that may be used to deal with potential soil compaction and contamination problems in the Project Areas;

h) 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;

i) 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 North American 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; and

j) provide appropriately scaled maps of the area highlighting (where possible) the preceding points.

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 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 (2006)* is required;

c) North American's plan to meet the objectives of the *Water Conservation and Allocation Policy* strategy to improve the water use efficiency and productivity;

d) the design details of facilities that will handle, treat and store wastewater streams and runoff and include appropriate annual volumes;

e) the type and quantity of any chemicals used in water/wastewater treatment; and

f) design details for the non-saline 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) water quality monitoring program for metals and other relevant substances.

ACRONYMS and GLOSSARY

Glossary

Abiotic	Non-living factors that influence an ecosystem, such as climate, geology and soil characteristics.
Aboriginal People	The descendents of the original inhabitants of Canada. Pursuant to the Canadian Constitution Act, 1982, and Schedule B of the Canada Act, 1982, (Chapter 11, Section 35) Aboriginal peoples includes the Indian, Inuit and Métis peoples of Canada. The Constitution does not define membership in individual groups.
Abundance	Reference to the relative number of individuals of a species/community.
Acid Anion	Negatively charged ion that does not react with hydrogen ion in the pH range of most natural waters.
Acid Cation	Hydrogen ion or metal ion that can hydrolyze water to produce hydrogen ions (e.g., ionic forms of aluminum, manganese and iron).
Acid Neutralizing Capacity (ANC)	The equivalent capacity of a solution to neutralize strong acids. Acid Neutralizing Capacity can be calculated as the difference between non-marine base cations and strong anions. This is the principal variable used to quantify the acid-base status of surface waters. Acidification is often quantified by decreases in ANC, and susceptibility of surface waters to acidic deposition impacts is often evaluated on the basis of ANC.
Acidic	A solution that has an excess of hydrogen ions (H+; i.e., a pH of less than 7).
Acidification	The decrease of acid neutralizing capacity in water, or base saturation in soil, caused by natural or anthropogenic processes. Acidification is exhibited as the lowering of pH, a process that can adversely affect aquatic life.
Activity Area	An area in which a specialized cultural function was done, such as hide scraping, tool manufacture, food preparation and other activities.
Acute	A stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96 hours or less is typically considered acute. When referring to aquatic toxicology or human health, an acute effect is not always measured in terms of lethality.
Acute Exposure	Chemical exposures that are very short in duration, single exposure events that occur as a result of an accident, or exposures that do not typically occur on a regular basis. Health Canada defines an acute exposure as one that occurs over a period of no longer than 14 days. The term can also be applied to the effects that are associated with short duration exposures (i.e., acute effects), or generally used to describe the adverse effects resulting from these exposures (i.e., acute toxicity).

Additivity	Each substance contributes to the same toxic effect in the same organ by the same mechanism, with the observed toxicity equal to that expected by adding the toxicities of the individual agents.
Admixing	The dilution of topsoil with subsoil, spoil or waste material, with the result that topsoil quality is reduced. Admixing can result in adverse changes in topsoil texture, poor soil aggregation and structure, loss of organic matter and decrease in friability.
Adsorption	The surface retention of solid, liquid or gas particles by a solid or a liquid.
Adverse Effect	An undesirable or harmful effect to an organism (human, animal or plant), indicated by some result such as mortality, growth inhibition, reproductive abnormalities, altered food consumption, altered body and organ weights, altered enzyme concentrations, visible pathological changes or carcinogenic effects.
Aeolian	Sedimentary deposits arranged by wind, such as sand and other loose substrates in dunes.
Aesthetic Objective (AO)	Aesthetic objective for drinking water (includes parameters such as odour, taste and turbidity).
Agglomeration	A technique that combines small particles to form larger particles.
Agitation Tank	A vessel in which slurry material is maintained in suspension by using an impeller or by re-circulating the material with pumps.
Ah Horizon	In soils, an A horizon of organic matter accumulation containing less than 17 percent carbon.
Air Cooler	A device that lowers temperature using atmospheric air as the coolant.
Airshed	The geographic area requiring unified management to achieve air pollution control.
Alberta Ambient Air Quality Objectives (AAAQO)	Alberta Ambient Air Quality Objective levels are established for several air compounds under Section 14 of the Environmental Protection and Enhancement Act (EPEA). The AAAQOs form an integral part of the management of air quality in the province, and are used for reporting the state of the environment, establishing approval conditions, evaluating proposed facilities with air emissions, assessing compliance near major air emission sources and guiding monitoring programs.

Alberta Energy and Utilities Board (EUB)	An independent, quasi-judicial agency of the Government of Alberta, the EUB was created in February 1995 by the amalgamation of the Energy Resources Conservation Board and the Public Utilities Board. The purpose of the EUB is to ensure that the discovery, development, and delivery of Alberta's resources take place in a manner that is fair, responsible and in the public interest.
Alberta Environment (AENV)	Provincial ministry that looks after the following: establishes policies, legislation, plans, guidelines and standards for environmental management and protection; allocates resources through approvals, dispositions and licenses, and enforces those decisions; ensure water infrastructure and equipment are maintained and operated effectively; and prevents, reduces and mitigates floods, droughts, emergency spills and other pollution-related incidents.
Alberta Surface Water Quality Guidelines (ASWQG)	Numerical concentrations or narrative statements established to support and protect the designated uses of water. These are minimum levels of quality, developed for Alberta watersheds, below which no waterbody is permitted to deteriorate. These guidelines were established as minimum levels that would allow for the most sensitive use. These concentrations represent a goal to be achieved or surpassed.
Alberta Sustainable Resource Development (ASRD)	Provincial ministry that looks after the following: forest protection; forest land and resource development; fish and wildlife management; range land management and land use disposition management.
Alberta Vegetation Inventory (AVI)	A GIS mapping system and digital forest inventory. It includes tree species, height, canopy closure, stand age, site conditions. and non-commercial vegetated and non-vegetated cover types.
Aldehyde	Hydrocarbon chain compound associated with a –C-H=O single carbon bond to other chain-like hydrocarbons (e.g., aldehyde H-CHO).
Alkalinity	A measure of water's capacity to neutralize an acid. It indicates the presence of carbonates, bicarbonates and hydroxides, and less significantly, borates, silicates, phosphates and organic substances. Alkalinity is expressed as an equivalent of calcium carbonate. Its composition is affected by pH, mineral composition, temperature and ionic strength. However, alkalinity is normally interpreted as a function of carbonates, bicarbonates and hydroxides. The sum of these three components is called total alkalinity.
Alkane	Hydrocarbon chain compound with fully saturated carbon-to-carbon bonds (e.g., methane, ethane).
Alkene	Hydrocarbon chain compound with unsaturated (double) carbon-to-carbon bonds (e.g., ethylene).
Alluvial	Soil or earth material which has been deposited by running water, as in a riverbed, floodplain, or delta.

Alluvial Deposit	Eroded soil deposited by flowing water.
Alluvium	Sediment deposited in land environments by streams.
Ambient	The conditions surrounding an organism or area.
Ambient Air	The air in the surrounding atmosphere.
Ambient Noise	The pre-existing sound environment of a location, before the introduction of, or in absence of, noise from a specific source which also affects the sound environment of that location.
Amine	One of a class of organic compounds that can be derived from ammonia by replacing one or more hydrogens with organic radicals.
Amine Regeneration Unit	Equipment that removes absorbed acid gases from amine to reusable condition for acid gas absorption.
Ammonia	A pungent, colourless, gaseous, alkaline compound of nitrogen and hydrogen that is soluble in water, lighter than air, and can easily be condensed to a liquid by cold and pressure.
Amphibian	Any of the class of cold-blooded vertebrates such as frogs, toads, and salamanders intermediate between fishes and reptiles; they have gilled aquatic larva and air-breathing adults.
Anion	A negatively charged ion.
Annulus	The space around a pipe in a wellbore, the outer wall of which might be the wall of either the borehole or the casing.
Anoxia	Little to no dissolved oxygen in the water sample. Waters with <2 mg/L of dissolved oxygen experience anoxia.
Antagonism	Two substances interact such that the effect of one substance is counteracted by the other. For example, antidotes are antagonistic to the poisons they are used to treat.
Anthropogenic	Man-made or related to human activities.
Antiscalant	An additive that prevents the buildup of scale, such as from calcium or iron.
Application Case	The Environmental Impact Assessment (EIA) case including the project that is the subject of the application, existing environmental conditions, and existing and approved projects or activities.
Aquiclude	An impermeable stratum or material that acts as a barrier to the flow of groundwater.

Aquifer	A permeable body of rock or soil that stores and transmits groundwater in sufficient quantity to supply wells. An aquifer is only a relative term determined largely by economics and is best illustrated by extreme examples. An aquifer in an arid prairie area required to supply water to a single farm may be adequate if it can supply 1 m^3/day. This would not be considered an aquifer by any industry looking for cooling water in volumes of 10,000 m^3/day. The term aquifer is also used to indicate the water-bearing material in any area from which water is most easily extracted.
Aquifer Depressurization	The process of reducing the natural hydrostatic pressure in an aquifer.
Aquifer Test	A method of obtaining quantitative information on the hydraulic characteristics of an aquifer by removing water from the aquifer in a controlled manner and measuring the groundwater surface or piezometric response. Often referred to as a “pumping test” or “drawdown test”.
Aquitard	A material of intermediate permeability between an aquifer and an aquiclude. An aquitard allows some measure of leakage between the aquifers it separates.
Arboreal	Living on trees, as in arboreal lichens such as old man’s beard.
Archaeology	The scientific study of the unwritten portion of man’s historic and prehistoric past.
Armoured Habitat	Cobble and boulder habitat.
Armouring	Protecting a channel from erosion by covering with protective material.
Aromatic	Organic compounds containing a ring structure composed of six carbon atoms. Benzene is the simplest of these molecules, which are composed of a single ring with no branch chains.
Artifact	Any portable object modified or manufactured by man.
Artifact Find	A site with five or fewer artifacts.
Artifact Scatter	A site with six or more artifacts.
Aspect	Compass orientation of a slope as an inclined element of the ground surface.
Assay	A qualitative or quantitative determination of the components of a material such as ore.

Assemblage	A collection of cultural materials from a sampling area or unit such as a site, pit or level.
Assessment	Determine or estimate the size, quality, or extent of a resource or impact.
Associated Gas	Free natural gas in immediate contact, but not in solution, with crude oil in the reservoir.
Association	Archaeological materials are said to be associated when they are found in close proximity in an undisturbed context.
At Risk	Any species known to be “At Risk” after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta.
Atmospheric Distillation	Distillation conducted at atmospheric pressure. Distillation is the process of producing a gas or vapour from a liquid by heating the liquid in a vessel and collecting and condensing the vapours into liquids.
Attenuation	The process by which a compound is reduced in concentration over time, through adsorption, degradation, dilution and/or transformation.
Attenuation (Noise)	A reduction in sound level that occurs with sound propagation over distance by means of physical dissipation or absorption mechanisms, or a reduction in sound level that occurs by means of noise control measures applied to a sound source.
Atterberg Limits	A geometric and decimal grade scale for classifying particles in sediments based on the unit value of 2 mm and involving a fixed ration of 10 for each successive grade. Subdivisions are geometric means of the limits of each grade.
Auxiliary Utilities	Supplementary utilities, such as diesel fuel, nitrogen, plant air and steam.
Available Drawdown	The vertical distance that the equipotential surface of an aquifer can be lowered; in confined aquifers, this is to the top of the aquifer; in unconfined aquifers, this is to the bottom of the aquifer.
Average Depth	Average depth of pools, riffles and runs, based on measurements taken across one to three transects within the surveyed stream section.
Average Wetted Wet Width	Average width of the water surface based on measurements taken across three to six transects.
Awl	A pointed tool for making holes as in wood or leather.
Background	An area not influenced by chemicals released from the site under evaluation.

Background Concentration (Environmental)	The concentration of a chemical in a defined control area during a fixed period before, during or after data gathering.
Backwater	Discrete, localized area exhibiting reverse flow direction and, generally lower stream velocity than main current. Substrate similar to adjacent channel with more fines.
Bankfull Depth	The maximum depth of a channel within a rifle segment when flowing at a bank-full discharge.
Barrels Per Day (bbl/d)	A unit of measure for oil production and processing operations.
Barrels Per Stream Day (bpsd)	A unit of measure for oil production and processing operations.
Basal Aquifer	A water-bearing strata located at the lowest portion of a stratigraphical unit.
Basal Thinning	The intentional removal of small longitudinal flakes from the base of a chipped stone projectile point or knife to facilitate hafting (fitting to a shaft or handle).
Base Cation	An alkali or alkaline earth metal cation (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}).
Baseline	A surveyed or predicted condition that serves as a reference point to which later surveys are coordinated or correlated.
Baseline Case	The EIA assessment case that includes existing environmental conditions as well as existing and approved projects or activities.
Baseline Data (also Environmental Setting Data)	A quantitative level or value from which other data and observations of a comparable nature are referenced. Information accumulated concerning the state of a system, process or activity before the initiation of actions that may result in changes.
Basic Sound Level	The allowable sound level at a residential location, as defined by the current EUB Directive, with the inclusion of industrial presence based upon dwelling unit density and proximity to transportation noise sources.
Basin	A geographic area drained by a single major stream; consists of a drainage system comprised of streams and often natural or man-made lakes.
Bathymetry	Measurement of the depth of an ocean or large waterbody.
Beaver River Sandstone	A light gray, medium to fine-grained quartz sandstone cemented in a silica matrix.
Bed Slope	The inclination of the river channel bottom.

Bedrock	The body of rock that underlies gravel, soil or other surficial material.
Before Present (B.P.)	1,000 B.P. = 1,000 years before 2000 A.D., or approximately 1,000 A.D.
Benthic Invertebrates	Invertebrate organisms living at, in or in association with the bottom (benthic) substrate of lakes, ponds and streams. Examples of benthic invertebrates include some aquatic insect species (such as caddisfly larvae) that spend at least part of their lifestages dwelling on bottom sediments in the waterbody. These organisms play several important roles in the aquatic community. They are involved in the mineralization and recycling of organic matter produced in the water above, or brought in from external sources, and they are important second and third links in the trophic sequence of aquatic communities. Many benthic invertebrates are major food sources for fish.
Benzene	A colourless, liquid, flammable, aromatic hydrocarbon that boils at 80.1ºC and freezes at 5.4ºC to 5.5ºC. It is used to manufacture styrene and phenol.
Berm	A mound or wall of earth.
Bile	An alkaline secretion of the vertebrate liver. Bile, which is temporarily stored in the gall bladder, is composed of organic salts, excretion products and bile pigments. It primarily functions to emulsify fats in the small intestine.
Bioaccumulation	When an organism stores within its body a higher concentration of a substance than is found in the environment. This is not necessarily harmful. For example, freshwater fish must bioaccumulate salt to survive in intertidal waters. Many toxicants, such as arsenic, are not included among the dangerous bioaccumulative substances because they can be handled and excreted by aquatic organisms.
Bioavailability / Bioavailable	The amount of chemical that enters the general circulation of the body following administration or exposure.
Biochemical Oxygen Demand (BOD)	An empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of wastewaters, effluents and polluted waters.
Bioconcentration	A process where there is a net accumulation of a chemical directly from an exposure medium into an organism.
Biodegrade	Capable of being decomposed by biological agents.
Biodiversity	The variety of a plant and animal life in a particular habitat (e.g., plant community or a country). It includes all levels of organization, from genes to landscapes, and the ecological processes through which these levels are connected.

Biodiversity Ranking	The relative contribution of an ecosite phase/wetlands type to the overall biological diversity of an area.
Biogenic	Essential to the maintenance of life.
Biogenic Emission	Emissions resulting from biological activity.
Biological Indicators	Any biological parameter used to indicate the response of individuals, populations or ecosystems to environmental stress. For example, growth is a biological indicator.
Biomarker	A chemical, physiological or pathological measurement of exposure or effect in an individual organism from the laboratory or the field. Examples include contaminants in liver enzymes, bile and sex steroids.
Biome	A major community of plants and animals such as the boreal forest or tundra biome.
Bioremediation	The process of applying corrective action to unbalanced biological systems.
Biotic	The living organisms in an ecosystem.
Biotic Gradient	The scale or continuum moving from having little living material to a very productive site.
Bi-Polar	The technique of resting a core, or lithic implement on an anvil and striking the core with a percussor. Contrary to popular belief, bulbs of force are not present on both ends of bi-polar flakes or blades. This technique causes the cone of force to be shattered or severed.
Bitumen	A highly viscous, tarry, black hydrocarbon material having an API gravity of about 9 (specific gravity about 1.0). It is a complex mixture of organic compounds. Carbon accounts for 80% to 85% of the elemental composition of bitumen, hydrogen 10%, sulphur 5%, and nitrogen, oxygen and trace elements form the remainder.
Bitumen Froth	Air-entrained bitumen with a froth-like appearance that is the product of the primary extraction step in the warm or hot water extraction process.
Bitumen Grade	The amount of bitumen in oil sands usually expressed as a percentage.
Blowdown	The act of emptying or depressurizing material in a vessel.
Bog	Ombrotrophic, acidic, peat-forming wetlands that receives its surface moisture from precipitation. Characterized by a level, raised or sloping peat surface with hollows and hummocks.

Boiler Feed Water	Water that meets required purity specifications and is used in the heat recovery steam generator to produce steam.
Bonferroni Confidence Intervals	A simple statistical method that adjusts for multiple comparisons while assuring that an overall confidence coefficient is maintained.
Borden Block	Map units of 10' latitude by 10' longitude used to facilitate site designation.
Borden System	A grid system based on National Topographic Series maps, which form a grid covering the whole of Canada. Each square on the grid is numbered with a code such as DgRn. The number following the code (23:) denotes the number of the archeological site in the area. Artifacts recovered at the dig are then sequentially numbered after the colon. This enables archaeologist to identify the origin of an artifact by just looking at its number.
Borehole	A hole drilled into the ground using a drilling rig, with the hole to be used to determine the surficial geological stratigraphy.
Bottom Sediments	Substrates that lie at the bottom of a body of water. For example, the soft mud, silt, sand, gravel, rock and organic litter that make up a river bottom.
Bottom-Feeding Fish	Fish that feed on the substrates and/or organisms associated with the river bottom.
Bottoms	The substance left after distilling off all but the heaviest components from crude oil in petroleum refinery operations. Also known as residue.
Boundary Condition	A specified value of hydraulic head (specified head cell), specified groundwater inflow or outflow (zero hydraulic gradient, groundwater recharge or well), or a specified relationship between hydraulic head and groundwater flow (general head boundary, recharge-seepage face or river). Boundary conditions are required at the boundaries of the model domain.
Brackish Water	Water with total dissolved solids concentration ranging from 1,000 g/m^3 to 10,000 g/m^3.
Brine	Water that contains high concentrations of soluble salts with a mineralization greater than 100,000 mg/L total dissolved solids.
Broadcast Seeding	A method of sowing seed using a machine with a rotating fan-like distributor.
Brown Water	Freshwaters containing elevated amounts of humic materials, which impart a yellow-brown colour to the water. Dissolved organic carbon concentrations in brown water lakes and streams usually range from 10 to 40 mg/L.

Brucisolic Soil	An order of soils whose horizons are developed sufficiently to exclude the soils from the Regosolic order, but that lack the degrees or kinds of horizon development specified for soils of the other orders. These soils, which occur under a wide variety of climatic and vegetative conditions, all have Bm or Btj horizons.
Buffer Zones	A transition zone between areas managed for different objectives.
Bush Economy	Representing some of the value of a traditional life, considering hunting, trapping, berry collection and other activities.
Butane	An alkane of which there are two isomers, n- and iso-butane. It occurs in natural gas, petroleum and is also produced by cracking heavier petroleum fractions.
C Horizon	A mineral horizon comparatively unaffected by pedogenic processes operative in the A and B horizons except for the process of gleying (Cg) or the accumulation of calcium carbonate (Cca) or other salts (Csa). A naturally calcareous horizon is designated Ck.
Calendar day	Stream day multiplied by a service factor for planned and unplanned downtime.
CALGRID	An Eulerian photochemical transport and dispersion model that includes modules for horizontal and vertical advection/diffusion, dry deposition and a detailed photochemical mechanism.
CALMET	A meteorological model that includes a diagnostic wind field generator containing objective analysis and parameterized treatments of slope flow, kinematic terrain effects, terrain blocking effects with a divergence minimization procedure, and a micrometeorological model for overland and overwater boundary layers.
CALPUFF	A non-steady Lagrangian Gaussian Puff Model containing modules for complex terrain effects, overwater transport interaction effects, building downwash, wet and dry removal, and simple chemical transformation.
Canadian Water Quality Guidelines (CWQG)	Numerical concentrations or narrative statements recommended to support and maintain a designated water use in Canada. The guidelines contain recommendations for chemical, physical, radiological and biological parameters necessary to protect and enhance designated uses of water.
Cancer	A disease characterized by the rapid and uncontrolled growth of aberrant cells into malignant tumours.
Canopy	An overhanging cover, shelter or shade. The tallest layer of vegetation in an area.

Capability (land)	An evaluation of land performance that focuses on the degree and nature of limitation imposed by the physical characteristics of the land unit on a certain use, assuming a management system.
Carcinogen	An agent that is reactive or toxic enough to act directly to cause cancer.
Cardinal Directions	North, south, east and west.
Carrying Capacity (K)	The maximum population size that can be supported by the available resources.
Catalyst	A substance that reduces the peak activation energy required for a chemical reaction, such as by allowing the reaction to occur at a lower temperature.
Catalytic Cracking	The conversion of high-boiling hydrocarbons into lower-boiling types by a catalyst.
Cation	A positively charged ion.
Centre Reject	A non-bituminous baring material found within a central zone of the oil sands ore body.
Ceramics	Clay artifacts, such as vessels, that have been intentionally fired.
Cervid	Of the family Cervidae, which includes elk, deer, moose and caribou.
Chalcedony	A cryptocrystalline variety of quartz composed predominantly of silica and having the near luster of paraffin wax. May be transparent or translucent and of various tints.
Channel	The bed of a stream or river.
Channel Cover	The vegetation that projects over the channel width of a stream and material that is in the stream. It is recorded as the percent of the channel width covered within a 50 m section of the stream at each site. Channel cover is arbitrarily divided into three levels: Crown: vegetation >1 m above the water surface; Overhanging: vegetation <1 m above the water surface; and Instream: material (debris, stumps, fallen trees) in the stream that can provide cover for fish.
Channel Unit	Distinct channel sections with specific characteristics of water depth, velocity and cover for fish.
Chert	A fine-grained siliceous rock. Impure variety of chalcedony that is generally light-coloured.

Chironomids	A taxonomic family of invertebrates consisting of flies referred to as non-biting midges. The larval stage is aquatic and is included in the benthic invertebrate community.
Chi-Square Analysis	A statistical test to determine if the patterns exhibited by data could have been produced by chance.
Chlorophyll *a*	One of the green pigments in plants. It is a photo-sensitive pigment that is essential for the conversion of inorganic carbon (e.g., carbon dioxide) and water into organic carbon (e.g., sugar). The concentration of chlorophyll *a* in water is an indicator of algal concentration.
Chronic	The development of adverse effects after extended exposure to a given substance. In chronic toxicity tests, the measurement of a chronic effect can be reduced growth, reduced reproduction or other non-lethal effects, in addition to lethality. Chronic should be considered a relative term depending on the life span of the organism.
Chronic Exposure	Exposures occurring over a relatively long duration of time (Health Canada considers periods of human exposure greater than three months to be chronic while the U.S. EPA only considers human exposures greater than seven years to be chronic).
Chronic Toxicity	The development of adverse effects after an extended exposure to relatively small quantities of a chemical.
Chronic Toxicity Unit (TU_c)	Measurement of long-duration toxicity that produces an adverse effect on organisms.
Class Area (CA)	The total area of each patch type, or of the total undisturbed landscape area (in hectares). This provides a direct summary of area for comparison of losses due to disturbances, that either decreases the total amount of undisturbed land, or which changes patch types from one type to another.
Clearcut Modifier (CC)	An AVI stand condition modifier presents additional information about the condition of the stand. A clearcut modifier (CC) indicates a result from timber harvesting, either clear or selective harvesting, depending on extent (AEP, 1991).
Climax	The culminating stage in plant succession for a given site where the vegetation has reached a stable condition.
Climax Community	The culminating stage in plant succession for a given site where the vegetation has reached a stable condition.
Climax Forest	A community of plants that will eventually grow and remain dominant in an area.

Cline	A gradual change in a feature across the distributional range of a species or population.
Closed-Circuit Operation	A process in which potentially contaminated water is not discharged into a receiving stream but is reused. Any water lost during the process through evaporation or binding with some material is replaced by make-up water.
Closed-Loop Recycling	Recycling or reusing wastewater for non-potable purposes in an enclosed process.
Closure	The point after shutdown of operations when regulatory certification is received and the area is returned to the Crown.
Coefficient of Variation	Standardized index of the variability of a value relative to the mean value.
Cofferdam	A temporary dam-like structure constructed around an excavation to exclude water.
Cogeneration	The co-production of electricity and steam. A gas-fired combustion turbine is used to produce electricity, with the hot exhaust from the combustion turbine being used to produce steam.
Coke	A high-carbon material resembling fine ground-up asphalt material. It is a by-product produced by delayed or fluid coking.
Coker	Vessel in which bitumen is cracked into its fractions and coke withdrawn to start the conversion process of bitumen to upgrade crude oil.
Colluvial	A heterogeneous mixture of material that as a result of gravitational action has moved down a slope and settled at its base.
Community	Plant or animal species living in close association or interacting as a unit.
Compaction	The process of pore space reduction in soil or sediments from heavier overlying material weighing the soil down.
Compensation (Fisheries)	The replacement of natural habitat, increase in the productivity of existing habitat or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitat for Canada's fisheries resources.
Complex	A consistently recurring assemblage of artifacts or traits which may be indicative of a specific set of activities, or a common cultural tradition.
Complex Stand	A stand (group of trees) composed of stems with a high variation in height. The canopy does not exhibit distinct layers.

Concentration	Quantifiable amount of a chemical in environmental media.
Concentration Ratio (CR)	A method of risk characterization that is used for locally acting chemicals. The CR is the mathematical relationship between a chemical air concentration and the respective reference concentration. Concentration ratios are named as such, because the potential for adverse effects is dependent on the concentration of the chemical present in ambient air, rather than on total internal dose received by the receptor (as is the case when assessing exposure ratios).
Conceptual Model	A model developed at an early stage of the risk assessment process that describes a series of working hypotheses of how the chemicals of concern may affect potentially exposed populations. The model identifies the populations potentially at risk along with the relevant exposure pathways and scenarios.
Concordance Table	A table that serves as a cross-reference between regulated requirements and location of documented compliance.
Condition Factor	A measure of the relative "fitness" of an individual or population of fishes by examining the mathematical relationship between growth in length relative to growth in weight. In populations where increases in length are matched by increases in weight, the growth is said to be isometric. Allometric growth, the most common situation in wild populations, occurs when increases in either length or weight are disproportionate.
Conditioning Drums	Large, inclined cylindrical tumblers that rotate slowly, used for preparing (conditioning) oil sands for primary extraction by mixing it with hot water and steam.
Conductivity	A measure of a waterbody's capacity to conduct an electrical current. It is the reciprocal of resistance. Conductivity measurements provides limnologists with an estimation of the total concentration of dissolved ionic matter in the water and a quick check of the alteration of total water quality due to the addition of pollutants to the water.
Cone of Depression	An inverted cone depression in groundwater surface surrounding a pumped well or dewatered/depressurized excavation.
Configuration	The location and arrangement of landscape elements.
Confined Aquifer	A body of groundwater surrounded by impermeable strata. In confined aquifers the pressure of the water is usually higher than that of the atmosphere and the water in well stands above the top of the aquifer. The water in a confined aquifer is called confined or artesian water.
Conifers	White spruce, black spruce, balsam fir, jack pine and tamarack.

Connate Water	Water entrapped in the interstices of a sedimentary rock at the time the rock was deposited.
Connectivity	A measure of how connected or spatially continuous a corridor or matrix is.
Conservative Approach	Approach taken to incorporate protective assumptions to ensure that risk will not be underestimated.
Consolidation	The gradual reduction in volume of a soil or semi-solid mass.
Contaminant Body Burdens	The total concentration of a contaminant found in either whole-body or individual tissue samples.
Contaminants	Any chemical compound added to a receiving environment in excess of natural concentrations. Contaminants include chemicals or effects not generally regarded as "toxic," such as nutrients, colour and salts.
Contouring	Process of shaping the land surface to fit the form of the surrounding land.
Control	A toxicity test that duplicates all the conditions of exposure treatments but contains no test material. The control is used to determine basic test conditions in the absence of toxicity (e.g., health of test organisms, quality of dilution water).
Convective Meteorological Conditions	A condition where turbulence is enhanced due to strong solar heating (e.g., such as during a hot summer afternoon).
Convergence Tolerance	The permissible difference between computed hydraulic heads for successive computer calculations when calculating the hydraulic heads using a numerical groundwater flow model. The convergence tolerance is set to a small value to give an acceptable mass balance error.
Core	A blocky nucleus of stone from which flakes or blades have been removed.
Core Reduction / Rejuvenation (trimming flakes)	Intentional flake wastage in the process of further flake removal. Flakes exhibit the remnants of past platforms and are removed by percussion or pressure techniques. They can be further separated into transverse or lateral trimming flakes depending on their point of impact.
Corridor	A travel route allowing animals to migrate from one faunal region to another.
Corrosion	Any of a variety of complex chemical or electrochemical processes by which metal is destroyed through reaction with its environment.
Corrosion Scale Inhibitors	Substances that prevent the buildup of metal oxides produced by corrosion.

Cortex	Fresh surface of a nodule that has been altered by weathering.
Cratering	The act of creating depressions, or craters in the snow when foraging for food. Usually done by elk or other ungulates.
Craton	A portion of a continent that has not been subjected to major deformation for a prolonged time, typically since Precambrian or early Paleozic time.
Creek	A branch or small tributary of a river.
Critical Load	A quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge. For waterbody acidification, the critical load represents an estimate of the amount of acidic deposition below which significant adverse changes are not expected to occur in a lake's ecosystem.
Crop Tree Regeneration	The renewal of a forest or stand of trees by natural or artificial means, usually white spruce, jack pine or aspen.
Cubic metres per day (m^3/d)	A measure of oil production or processing rate.
Cubic metres per second (m^3/s)	The standard measure of water flow in rivers (i.e., the volume of water in cubic metres that passes a given point in one second).
Culture	The sum of man's non-biological behavioural traits: learned, patterned and adaptive.
Cumulative Environmental Management Association (CEMA)	An association of oil sands industry, other industry, regional community representatives, regulatory agencies and other stakeholders designed to develop systems to manage cumulative effects associated with developments in the Oil Sands Region.
Cutline	A cleared right-of-way, often used in forestry or seismic work.
Cyclo-	Hydrocarbon ring or cyclic compound of saturated or unsaturated carbon-to-carbon bonds (e.g., cyclohexane, C_6H_{12}).
Cyclofeeder	A vertical, open-topped cylindrical vessel with a conical bottom. Cyclofeeders are used to mix oil sands with warm water, forming a slurry that can be pumped via a pipeline to Extraction. Warm water is introduced through horizontal ports at the bottom of the vessel's vertical portion to produce a vortex inside the vessel, into which incoming oil sands falls. The energy imparted to the oil sands forms a slurry that is withdrawn at the bottom of the cone.

Darcy's Law	A law describing the rate of flow of water through porous media. (Named for Henry Darcy of Paris who formulated it in 1856 from extensive work on the flow of water through sand filter beds).
Deaerator	A device in which oxygen, carbon dioxide and other non-condensable gases are removed from boiler feed water, steam condensate or a process stream.
Debitage	Waste by-products from tool manufacture.
Decommissioning	The act of taking a processing plant or facility out of service and isolating equipment to prepare for routine maintenance work, suspending or abandoning.
Demineralizer	Equipment in which mineral constituents are removed from water.
Dendritic Drainage Pattern	A stream system that branches irregularly in all directions with the tributaries joining with the main stream at all angles.
Department of Fisheries and Oceans (DFO) (now Fisheries and Oceans Canada)	Responsible for policies and programs in support of Canada's economic, ecological and scientific interests in oceans and inland waters; for the conservation and sustainable utilization of Canada's fisheries resources in marine and inland waters; for leading and facilitating federal policies and program on oceans; and for safe effective and environmentally sound marine services responsive to the needs of Canadians in a global economy.
Deposit	Material left in a new position by a natural transporting agent such as water, wind, ice or gravity, or by the activity of man.
Depositional	Gentle slope with fines.
Depressurization	The process of reducing the pressure in an aquifer, by withdrawing water from it.
Depuration	Loss of accumulated chemical residues from an organism placed in clean water or clean solution.
Desulphurization	A process in which sulphur compounds are removed from a gas or liquid hydrocarbon stream. See also "Flue Gas Desulphurization".
Detection Limit (DL)	The lowest concentration at which individual measurement results for a specific analyte are statistically different from a blank (that may be zero) with a specified confidence level for a given method and representative matrix.
Deterministic	Risk approach using a single number from each parameter set in the risk calculation and producing a single value of risk.

Detoxification	To decrease the toxicity of a compound. Bacteria decrease the toxicity of resin and fatty acids in mill effluent by metabolizing or breaking down these compounds; enzymes like the EROD or P4501A proteins begin the process of breaking down and metabolizing many "oily" compounds by adding an oxygen atom.
Detrended Correspondence Analysis (DCA)	An ordination technique used to visually determine species and site relationships.
Development Area	Any area altered to an unnatural state. This represents all land and water areas included within activities associated with the development of oil sands leases.
Devonian	A period of the Paleozoic era thought to have covered the span of time between 400 and 345 million years ago; also, the corresponding system of rocks.
Dewatering	Removal of groundwater from a geological formation using wells or drainage ditch systems.
Diagenesis	Process involving physical and chemical changes in groundwater (e.g., includes solution of soluble minerals, cation exchange between groundwater and rock, ions diffusion).
Diameter at Breast Height (DBH)	The diameter of a tree 1.5 m above the ground on the uphill side of the tree.
Diatom	The common name for algae composing the class Bacillariophyceae. It is noted for the symmetry and sculpturing of the siliceous cell walls.
Diatomaceous Earth	A yellow, white or light grey, siliceous, porous deposit made of the opaline shells of diatoms. It is used as a filter aid, paint filler, adsorbent, abrasive and thermal insulator.
Digital Elevation Model (DEM)	A three-dimensional grid representing the height of a landscape above a given datum.
Diluent	A light liquid hydrocarbon added to bitumen to lower viscosity and density.
Discharge	In a stream or river, the volume of water that flows past a given point in a unit of time (e.g., m^3/s).
Disclimax	A type of climax community that is maintained by either continuous or intermittent disturbance to a severity that the natural climax vegetation is altered.
Dispersal Routes	The travel route of an animal from its birth site or breeding site.

Dissolved Organic Carbon (DOC)	The dissolved portion of organic carbon water; made up of humic substances and partly degraded plant and animal materials.
Dissolved Oxygen (DO)	Measurement of the concentration of dissolved (gaseous) oxygen in the water, usually expressed in milligrams per litre (mg/L).
Distillation	The process of producing a gas or vapour from a liquid by heating the liquid in a vessel and collecting and condensing the vapours into liquids.
Disturbance (Historic)	A cultural deposit is said to be disturbed when the original sequence of deposition has been altered. Examples of agents of disturbance include erosion, plant or animal activity, cultivation and excavation.
Disturbance (Terrestrial)	A force that causes significant change in structure and/or composition of a habitat.
Disturbance Area (DA)	The area of disturbance (hectares) in a fragmentation and heterogeneity analysis.
Disturbance Coefficient	The effectiveness of the habitat within the disturbance zone of influence in fulfilling the requirements of a species.
Disturbance Zone of Influence	The maximum distance to which a disturbance (e.g., traffic noise) is felt by a species.
Diversity	The variety, distribution and abundance of different plant and animal communities and species within an area.
Dose	A measure of integral exposure. Examples include: (1) the amount of chemical ingested; (2) the amount of a chemical taken up; and (3) the product of ambient exposure concentration and the duration of exposure.
Dose Rate	Dose per unit time, for example in mg/day, sometimes also called dosage. Dose rates are often expressed on a per-unit-body-weight basis, yielding units such as mg/kg body weight/day expressed as averages over some period, for example a lifetime.
Dose Response	The quantitative relationship between exposure of an organism to a chemical and the extent of the adverse effect resulting from that exposure.
Dose Response Principle	The fundamental principle in toxicology, based on the assumption that the response of a specific organism to a chemical is directly related to the amount of chemical that is received by the organism.
Drainage Basin	A region of land that eventually contributes water to a river or lake.
Drake	A male duck.

Drawdown	Lowering of water level caused by pumping. It is measured for a given quantity of water pumped during a specified period, or after the pumping level has become constant.
Drawdown Cone	A conical groundwater surface created in an unconfined aquifer due to pumping, or an imaginary conical surface indicating pressure relief in a confined aquifer due to pumping.
Drift Density	The number of organisms per m^3 of stream water.
Drift Deposits	Any sediment laid down by, or in association with, the activity of glaciers and ice sheets.
Drill / Perforator	A pointed, edge-retouched tool which is rotated on the long axis for the purpose of drilling usually into wood or bone.
Drill Stem Tester (DST)	A device used in a borehole to measure hydraulic properties of a tested interval and/or to collect fluid samples.
Dry Landscape Reclamation	A reclamation approach that involves dewatering or incorporation of fine tailings into a solid deposit capable of being reclaimed as a land surface or a wetlands.
Echolocation	High frequency sounds (25 kHz to 120 kHz) produced by bats that are beyond the range of human hearing (20 Hz to 25 kHz). These sounds are produced with great intensity. Echoes resulting from sound returning from objects in the bat's environment provide information to the bat.
Ecodistricts	Landscape units that represent similar geology, landform and vegetation characteristics that best reflect overall patterns of landscape features.
Ecofact	Nonartifactual evidence from the past that has cultural relevance; e.g., pollen.
Ecological Land Classification (ELC)	A means of classifying landscapes by integrating landforms, soils and vegetation components in a hierarchical manner.
Ecoregion	Ecological regions that have broad similarities with respect to soil, terrain and dominant vegetation.
Ecosection	Clearly recognizable landforms such as river valleys and wetlands at a broad level of generalization.

Ecosite	Ecological units that develop under similar environmental influences (climate, moisture and nutrient regime). Ecosites are groups of one or more ecosite phases that occur within the same portion of the moisture/nutrient grid. Ecosite is a functional unit defined by the moisture and nutrient regime. It is not tied to specific landforms or plant communities, but is based on the combined interaction of biophysical factors that together dictate the availability of moisture and nutrients for plant growth.
Ecosite Phase	A subdivision of the ecosite based on the dominant tree species in the canopy. On some sites where the tree canopy is lacking, the tallest structural vegetation layer determines the ecosite phase.
Ecosystem	An integrated and stable association of living and non-living resources functioning within a defined physical location. A community of organisms and its environment functioning as an ecological unit. For the purposes of assessment, the ecosystem must be defined according to a particular unit and scale.
Ecotone	The transition of physical and biological characteristics, from one community to the next.
Edaphic	Referring to the soil. The influence of the soil on plant growth is referred to as an edaphic factor.
Edge	Where different plant communities meet in space on a landscape; and where plant communities meet a disturbance. An outer band of a patch that usually has an environment significantly different from the interior of the patch.
Edge Effect	An ecological effect associated with patch edges. An outer band of a plant community that usually has an environment significantly different from the interior of the plant community.
Edge Species	A species found only or primarily near the perimeter of a patch.
Effective Porosity	The percentage of the total volume of a given mass of soil or rock that consists of interconnected voids.
Effects Assessment	The process of determining the amount (concentration or dose) of a chemical to which a receptor may be exposed without the development of adverse effects.
Effluent	Stream of water discharging from a source.
Electrofishing	A 'live' fish capture technique in which negative (anode) and positive (cathode) electrodes are placed in the water and an electrical current is passed between the electrodes. Fish are attracted (galvano-taxis) to the anode and become stunned (galvano-narcosis) by the current, allowing fish to be collected, measured and released.

Elevation	Measurement of the height of the land above sea level.
Endangered	A species facing immediate extinction or extirpation.
Endogamy	Marriage within one's own tribe or similar unit.
Entrenchment Ratio	The ratio of the width of the flood-prone area to the surface width of the bankfull channel which is used to describe the degree of vertical containment of a river channel.
Environmental Impact Assessment (EIA)	A review of the effects that a proposed development will have on the local and regional environment.
Environmental Media	One of the major categories of material found in the physical environment that surrounds or contacts organisms (e.g., surface water, groundwater, soil, food or air) and through which chemicals can move and reach the organism.
Environmental Protection and Enhancement Act **(EPEA) (Alberta)**	The purpose of the act is to support and promote the protection, enhancement and wise use of the environment.
Environmental Setting	A quantitative level or value from which other data and observations of a comparable nature are referenced. Information accumulated concerning the state of a system, process or activity before the initiation of actions that may result in changes.
Eolian	A designation of rocks and soils whose constituents have been carried and laid down by atmospheric currents.
Ephemeral	A phenomenon or feature that lasts only a short time (e.g., an ephemeral stream is only present for short periods during the year).
Epilimnion	A freshwater zone of relatively warm water in which mixing occurs as a result of wind action and convection currents.
Epilyxic	A plant that typically grows on decaying wood.
Epiphyseal Plate	The area where the metacarpal and phalange meet in an animal's foot.
Epiphyte	A plant, such as lichens or orchids, that grows on another plant but depends on it only for physical support, not for nutrients.
Episodic Acidification	Also referred to as a spring acid pulse, this natural phenomena occurs commonly in surface waters and is usually a response to snowmelt or rainfall. Industrial sources can contribute to this depression of pH and increase the recovery period.

Equivalent Land Capability	The ability of land to support various land uses after reclamation is similar to the ability that existed prior to any activity on the land, but the ability to support individual land uses will not necessarily be equal after reclamation.
EROD (7-ethoxyresorufin 0-de ethylase)	Used to measure fish exposure to chemicals, particularly polycyclic aromatic hydrocarbons (PAHs). It is a biomarker that measures the activity of an enzyme that metabolizes PAHs.
Erosion	The process by which material, such as rock or soil, is worn away or removed by wind or water.
Escarpment	A cliff or steep slope at the edge of an upland area. The steep face of a river valley.
Eskers	Long, narrow bodies of sand and gravel deposited by a subglacial stream running between ice walls or in an ice tunnel, left behind after melting of the ice of a retreating glacier.
Eutrophic	The nutrient-rich status (amount of nitrogen, phosphorus and potassium) of an ecosystem.
Evaporation	The process by which water is changed from a liquid to a vapour.
Evaporation, Lake	Evaporation that occurs from a lake surface.
Evaporation, Potential	The maximum amount of water that can be evaporated from a surface (e.g., ground, vegetation).
Evapotranspiration	A measure of the ability of the atmosphere to remove water from a location through the processes of evaporation and water loss from plants (transpiration).
Evapotranspiration, Areal	Evapotranspiration that occurs over a given area.
Evapotranspiration, Potential	The maximum quantity of water capable of being evaporated from the soil and transpired from the vegetation of a specified region in a given time interval under existing climatic conditions.
Evenness	The relative abundance of species; measured using the Shannon Weiner Index.
Exotic/Alien	Any species that has been introduced as a result of human activities.
Exposure	The contact reaction between a chemical and a biological system, or organism. Estimated dose of chemical that is received by a particular receptor via a specific exposure pathway (e.g., ingestion, inhalation); expressed as the amount of chemical received, per body weight, per unit time (i.e., mg/kg/day).

Exposure Assessment	The process of estimating the amount (concentration or dose) of a chemical that is taken up by a receptor from the environment.
Exposure Concentration	The concentration of a chemical in its transport or carrier medium at the point of contact.
Exposure Limit or Toxicity Reference Value	For a non-carcinogenic chemical, the maximum acceptable dose (per unit body weight and unit of time) of a chemical that a specified receptor can be exposed to, without the development of adverse effects. For a carcinogenic chemical, the maximum acceptable dose of a chemical to which a receptor can be exposed to, assuming a specified risk (e.g., 1 in 100,000). May be expressed as a Reference Dose (RfD) for non-carcinogenic (threshold-response) chemicals or as a Risk Specific Dose (RsD) for carcinogenic (non-threshold response) chemicals. Also referred to as a toxicity reference value.
Exposure Pathway or Route	The route by which a receptor comes into contact with a chemical or physical agent. Examples of exposure pathways include: the ingestion of water, food and soil; the inhalation of air and dust; and dermal absorption.
Exposure Ratio (ER) or Hazard Quotient (HQ)	A comparison between total exposure from all predicted routes of exposure and the exposure limits for chemicals of concern. This comparison is calculated by dividing the predicted exposure by the exposure limit. Also referred to as hazard quotient (HQ).
Exposure Scenario	A set of facts, assumptions and inferences about how exposure takes place, which helps the risk assessor evaluate, estimate and quantify exposures.
Extinct	A species that no longer exists.
Extirpated	A species no longer existing in the wild in Canada, but exists elsewhere in the world.
Facies	A distinctive group of characteristics that distinguish one group from another within a stratigraphic unit; e.g. contrasting river-channel facies and overbank-flood-plain facies in alluvial valley fills.
Fate	In the context of the study of contaminants, fate refers to the chemical form of a contaminant when it enters the environment and the compartment of the ecosystem in which that chemical is primarily concentrated (e.g., water or sediments). Fate also includes transport of the chemical within the ecosystem (via water, air or mobile biota) and the potential for food chain accumulation.
Fauna	An association of animals living in a particular place or at a particular time.
Faunal Remains	Bones and other animal parts found in archaeological sites.

Feature	A non-portable product of human workmanship (e.g., includes hearths, structural remains, clusters of associated objects).
Fecundity	The most common measure of reproductive potential in fishes. It is the number of eggs in the ovary of a female fish. It is most commonly measured in gravid (pregnant) fish. Fecundity increases with the size of the female.
Female Composite Receptor	Used for assessing and characterizing the risk to carcinogenic chemicals. For carcinogens, since it is the incremental lifetime cancer risk that is important, all lifestages are considered. Thus, the risk to the female composite receptor represents the sum total of the risk at each individual lifestage. The lifestages assessed included: the infant (zero to <six months), toddler (six months to five years), child (five to <12 years), adolescent (12 to <20 years) and adult (20 to <70 years) receptors.
Fen	Minerotropic peat-forming wetlands that receive surface moisture from precipitation and groundwater. Fens are less acidic than bogs, deriving most of their water from groundwater rich in calcium and magnesium.
Field Facilities	The surface equipment and pipelines required to deliver steam to the wells and transport fluids to the central plant.
Filterable Residue	Materials in water that pass through a standard-size filter (often 0.45 µm). This is a measure of the "total dissolved solids" (TDS), i.e., chemicals that are dissolved in the water or that are in a particulate form smaller than the filter size. These chemicals are usually salts, such as sodium ions and potassium ions.
Filter-Feeders	Organisms that feed by straining small organisms or organic particles from the water column.
Fine Tailings	A suspension of fine silts, clays, residual bitumen and water that forms in the course of bitumen extraction from oil sands using the hot water extraction process. This material segregates from coarse sand tailings during placement in tailings ponds and accumulates in a layer, referred to as fine tailings, that dewaters very slowly. The top of the fine tailings deposit is typically about 85% water, 13% fine minerals and 2% bitumen by weight.
Fines	Silt and clay particles.
Fish Health Parameters	Parameters used to indicate the health of an individual fish. May include, for example, short-term response indicators such as changes in liver mixed function oxidase activity and the levels of plasma glucose, protein and lactic acid. Longer-term indicators include internal and external examination of exposed fish, changes in organ characteristics, hematocrit and hemoglobin levels. May also include challenge tests such as disease resistance and swimming stamina.

Fish Tainting	Abnormal odour and/or flavour detected in the edible fish tissue.
Fisheries Act	Federal legislation that protects fish habitat from being altered, disrupted or destroyed by chemical, physical or biological means. Destruction of the habitat could potentially undermine the economic, employment and other benefits that flow from Canada's fisheries resources. Department of Fisheries and Oceans (DFO). 1986. The Department of Fisheries and Oceans Policy for the Management of Fish Habitat. Presented to Parliament by the Minister of Fisheries and Oceans. October 7, 1986.
Flake	A fragment removed from a core of cryptocrystalline or fine-grained rock by percussion or pressure. The flake may be used as a tool itself if suitable for a particular task or may be formed into a specific tool by further flaking. A typical flake will display a platform or striking surface, bulb of percussion and rings of force radiating from the platform.
Flarks	Wet, elongate, depressions in patterned peatlands that develop perpendicular to the direction of dominant water flow.
Flint	A microcrystalline silicate rock similar to chert.
Flocculant	A reagent added to a dispersion of solids in a liquid to bring together the fine particles to form flocs.
Flocs	Small masses formed in a fluid through coagulation, agglomeration or biochemical reaction of fine suspended particles.
Floodplain	The lowland that borders a stream or river, usually dry but subject to flooding.
Floodplain Fringe	The portion of the floodplain outside the floodway which is covered by floodwaters during the 100-year recurrence interval flood. It is generally associated with shallow, standing or slowly moving water rather than deep, rapidly flowing water.
Flowline	These are generally small fibreglass or metal pipe that transport production from individual wells to a central processing facility and/or storage location - often <2-inch pipe (whereas pipelines are generally larger diameter lines carrying separated production fluids).
Flue Gas Desulphurization (FGD)	A process involving removal of a substantial portion of sulphur dioxide from the combustion gas (flue gas) formed from burning petroleum coke. Desulphurization is accomplished by contacting the combustion gases with a solution of limestone. Gypsum ($CaSO_4$) is formed as a by-product of this process.
Fluid Catalytic Cracking	An oil refining process in which the gas-oil is cracked by a catalyst bed fluidized by steam and the oil vapours produced by cracking.

Fluvial	Relating to a stream or river.
Fluvial Processes	Natural processes involving the formation and evolution of stream and river channels and their floodplains.
Food Chain Transfer	A process by which materials accumulate in the tissues of lower trophic level organisms and are passed on to higher trophic level organisms by dietary uptake.
Footprint	The area occupied by surface facilities associated with the proposed Husky Tucker development, resulting in surface disturbance. This term can apply to a central plant, well pads, roads, pipelines and other corridors..
Forage Area	The area used by animals for hunting or gathering food.
Forage Fish	Small fish that provide food for larger fish (e.g., longnose sucker, fathead minnow).
Forb	Broad-leaved herb, as distinguished from grasses.
Forest	A collection of stands of trees that occur in similar space and time.
Forest Cover Type	Primary stand groupings based on the percent composition of coniferous or deciduous species. Forest cover type can be deciduous, coniferous or mixedwood. Also, regenerating stands are included as a forest cover type.
Forest Fragmentation	The change in the forest landscape, from extensive and continuous forests.
Forest Landscape	Forested or formerly forested land not currently developed for non-forest use.
Forest Succession	The orderly process of change in a forest as one plant community or stand condition is replaced by another, evolving toward the climax type of vegetation.
Forested	Closed canopy with greater than 20% tree coverage.
Fork Length	The length of a fish measured from the most anterior portion of the head to the tip of the shortest rays in the caudal fin (i.e., to the fork in the tail).
Formation	A geologic unit of distinct rock types that is large enough in scale to be mappable over a region.
Fragmentation	The process of breaking into pieces or sections. For example, dividing contiguous tracts of land into smaller and less connected sections through site clearing (e.g., for roads).

FRAGSTATS	A spatial pattern analysis software program used to quantify the areal extent and spatial configuration of patches within a landscape. The analysis is done using categorical spatial data (e.g., plant communities).
Frazil Ice	Small, needle-like or thin, flat ice crystals suspended in water and formed when sub-freezing air cools the surface of the water to below the freezing point (supercooling). In rivers with turbulent flow, the supercooled water mixes into a thicker layer and frazil ice forms, suspended in the supercooled layer.
Freeze-Out	An increase in the concentrations of dissolved substances in surface waters during ice formation in the winter.
Frequency Analysis	A statistical procedure involved in interpreting the past record of a hydrological event to occurrences of that event in the future.
Fresh Water	Water with total dissolved solids concentration below 1,000 mg/L.
Froth	Air-entrained bitumen with a froth-like appearance that is the product of the primary extraction step in the hot water extraction process.
Fuel Gas	Gas used as fuel for the various pieces of equipment. Fuel gas can be purchased gas or a mixture of purchased gas and treated produced gas.
Fugitive Emissions	Substances emitted from any source except those from stacks and vents. Typical sources include gaseous leakage from valves, flanges, drains, volatilization from ponds and lagoons, and open doors and windows. Typical particulate sources include bulk storage areas, open conveyors, construction areas or plant roads.
Furbearer	Mammals that have traditionally been trapped or hunted for their fur.
Gasification	A process whereby upgrader by-products are converted in a partial oxidization process to produce synthetic gas “syngas” for use as an alternate fuel to natural gas by other components of the project.
Gasifier	The process equipment used in gasification.
General Head Boundary	A boundary condition used to define a relationship between groundwater flow into/out of the model domain and the hydraulic head in a grid cell.
Generalist	Organism which can survive under a wide variety of conditions, and does not specialize to live under any particular set of circumstances.
Genetic Diversity	The range of possible genetic characteristics found within a species and amongst different species (e.g., variations in hair colour, eye colour, and height in humans).

Genotoxic	Adverse effects that occur at the molecular level, when a chemical interacts directly with genetic material such as DNA.
Geographic Information System (GIS)	Computer software designed to develop, manage, analyze and display spatially referenced data.
Geomorphic	The natural evolution of surface soils and landscape over long periods.
Geomorphical Processes	The origin and distribution of landforms, with the emphasis on the nature of erosional processes.
Geomorphology	The science of surface landforms and their interpretation on the basis of geology and climate. That branch of science that deals with the form of the earth, the general configurations of its surface and the changes that take place in the evolution of landforms. The term usually applies to the origins and dynamic morphology (changing structure and form) of the earth's land surfaces, but it can also include the morphology of the sea floor and the analysis of extraterrestrial terrains. Sometimes included in the field of physical geography, geomorphology is really the geological aspect of the visible landscape.
Glacial Till	Unsorted and unstratified glacial drift (generally unconsolidated) deposited directly by a glacier without subsequent reworking by water from the glacier. Consisting of a heterogeneous mixture of clay, silt, sand, gravel and boulders (i.e., drift) varying widely in size and shape.
Glaciofluvial (or Glacio-Fluvial)	Relating to a glacial stream or river, usually relating to material deposited by glacial runoff at the culmination of an ice age. Glaciofluvial deposits commonly contain rounded cobbles arranged in bedded layers.
Glaciolacustrine (or Glacio-Lacustrine)	Relating to the lakes that formed at the edge of glaciers as the glaciers receded. Glaciolacustrine sediments are commonly laminar deposits of fine sand, silt and clay.
Glauconitic	Containing glauconite, a blue-green or yellow-green mineral, typically found in shallow marine sedimentary rocks.
Gleysolic Soil	A great group of soils in the Gleysolic order. A Gleysol either has a thin (less than 8 cm) Ah horizon underlain by mottled grey or brownish grey material, or it has no Ah horizon.
Global Positioning System (GPS)	A system of satellites, computers and receivers that is able to determine the latitude and longitude of a receiver on Earth by calculating the time difference for signals from different satellites to reach the receiver.
Gonads	Organs responsible for producing haploid reproductive cells in multi-cellular cells in multi-cellular animals. In the male, these are the testes and in the female, the ovaries.

Gonad-Somatic Index (GSI)	The proportion of reproductive tissue in the body of a fish. It is calculated by dividing the total gonad weight by the total body weight and multiplying the result by 100. It is used as an index of the proportion of growth allocated to reproductive tissues in relation to somatic growth.
Gran Alkalinity	Alkalinity in a water sample measured by the gran method which does not rely on the presence of inflection points in the titration curve; therefore, it is particularly useful for waters with low alkalinity.
Granivore/granivorous	Animals that feed on seeds or grains.
Graver	A small pointed or chisel-like stone tool used for incising or engraving. Generally made by pressure flaking.
Grid Cell (Cell)	A small, regular-shaped subregion of a numerical groundwater flow model domain within which groundwater flow and hydraulic head are represented by simple mathematical equations. The mathematical equations for all grid cells in a model domain are solved at once using a computer to calculate the hydraulic heads and groundwater flows for the entire model domain.
Ground-Level Concentration (GLC)	The ambient concentration (mass per unit volume of air) of a substance predicted to occur at the ground surface. These concentrations are predicted using dispersion models, and are typically reported in micrograms per cubic metre [µg/m^3].
Groundtruth	Visiting sites to confirm the accuracy of remotely sensed information.
Groundwater	That part of the subsurface water that occurs beneath the water table, in soils and geologic formations that are fully saturated.
Groundwater Flow Model	A simplified representation of one or more groundwater flow systems. Numerical groundwater flow models are used to represent the groundwater flow systems in the Regional Study Area.
Groundwater Level	The level below which the rock and subsoil, to unknown depths, are saturated.
Groundwater Regime	Water below the land surface in a zone of saturation.
Groundwater Velocity	The speed at which groundwater advances through the ground; the average linear velocity of the groundwater.
Guild	A set of co-existing species that share a common resource.
Habitat	The place or environment where a plant or animal naturally or normally lives or occurs.
Habitat Alienation	The loss of habitat effectiveness as a result of sensory disturbances from human activities at disturbed sites.

Habitat Connectivity	Ability for populations to move between habitats. A loss of habitat connectivity may be caused by physical barriers, sensory disturbance, and/or changes in habitat.
Habitat Effectiveness	The physical characteristics associated with the suitability of a habitat and, the ability of a habitat to be used by wildlife. The effectiveness of a habitat can be decreased through visual, auditory, or olfactory disturbance even though the physical characteristics of the habitat remain unchanged.
Habitat Fragmentation	Occurs when extensive, continuous tracts of habitat are reduced by habitat loss to dispersed and usually smaller patches of habitat. Generally reduces the total amount of available habitat and reduces remaining habitat into smaller, more isolated patches.
Habitat Generalist	Wildlife species that can survive and reproduce in a variety of habitat types (e.g., red-backed vole).
Habitat Patches	Isolated patches of habitat.
Habitat Specialist	Wildlife species that is dependent on a few habitat types for survival and reproduction (e.g., Cape May warbler).
Habitat Suitability Index (HSI) Model	Analytical tools for determining the relative potential of an area to support individuals or populations of a wildlife species. They are frequently used to quantify potential habitat losses and gains for wildlife as a result of various land use activities.
Habitat Unit (HU)	Generally, used in Habitat Suitability Index models. A habitat is ranked in regards to its suitability for a particular wildlife species. This ranking is then multiplied by the area (ha) of the particular habitat type to give the number of habitat units (HU) available to the wildlife species in question.
Hardness	Calculated mainly from the calcium and magnesium concentrations in water; originally developed as a measure of the capacity of water to precipitate soap. The hardness of water is environmentally important since it is inversely related to the toxicity of some metals (e.g., copper, nickel, lead, cadmium, chromium, silver and zinc).
Hazard	A condition with the potential for causing an undesirable consequence.
Head	The energy, either kinetic or potential, possessed by each unit weight of a liquid; expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. It is used in various compound terms such as pressure head, velocity head and loss of head.

Headwater(s)	The source and upper reaches of a stream; also the upper reaches of a reservoir. The water upstream from a structure or point on a stream. The small streams that come together to form a river. Also may be thought of as any and all parts of a river basin except the mainstrem river and main tributaries.
Health Effect Endpoint	A measurable biological response which may compromise the health of a human receptor, which is used as a point of reference for assessing exposure to a particular chemical.
Hearth	A fireplace.
Hepatotoxicity	The quality or condition of being toxic or destructive to the liver.
Herb	Tender plant, lacking woody stems, usually small or low; it may be annual or perennial, broadleaf (forb) or graminoid (grass).
Heterogeneity	Consisting of parts that are unlike each other. For example, the variety and abundance of ecological units (e.g., ecosite phases and wetlands types) comprising a landscape mosaic.
Hexane	A water-insoluble, toxic, flammable, colourless liquid with a faint aroma. Forms include n-hexane, a straight-chain compound used as a solvent, paint diluent, alcohol denaturant and polymerization-reaction medium; isohexane, a mixture of hexane isomers used as a solvent and freezing-point depressant; and neohexane.
Histology/Histological	The microscopic study of tissues.
Historical Resources Impact Assessment (HRIA)	A review of the effects that a proposed development will have on the local and regional historic and prehistoric heritage of an area.
Historical/Heritage Resources	Works of nature or of man, valued for their palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest.
Home Range	The area within which an animal normally lives.
Horizontal Stand	A stand with a structure that influences polygons by having two or more significant and observable strata, but one that is too small to stratify due to minimum polygon size restrictions.
Human Health Risk Assessment	The process of defining and quantifying risks and determining the acceptability of those risks to human life.

Hydraulic Conductivity	The permeability of soil or rock to water. A coefficient "k" depends on the physical properties of formation and fluid. It describes the "ease" with which a fluid will flow through a porous material. "k" is the rate of flow per unit cross-sectional area under the influence of a unit gradient, and has the dimension of: $Length^3/Length^2$ x Time or Length/Time (e.g., m/s), but should not be confused with velocity.
Hydraulic Gradient	A measure of the force of moving groundwater through soil or rock. It is measured as the rate of change in total head per unit distance of flow in a given direction. Hydraulic gradient is commonly shown as being dimensionless, since its units are metres/metre.
Hydraulic Head	The elevation, with respect to a specified reference level, at which water stands in a piezometer (a pipe in the ground used to measure water elevations/or a small diameter observation well) connected to the point in question in the soil. Its definition can be extended to soil above the water table if the piezometer is replaced by a tensiometer (instrument used to measure moisture content of soil). The hydraulic head in systems under atmospheric pressure may be identified with a potential expressed in terms of the height of a water column. More specifically, it can be identified with the sum of gravitational and capillary potentials, and may be termed the hydraulic potential.
Hydraulic Structure	Any structure designed to handle water in any way. This includes retention, conveyance, control, regulation and dissipation of the energy of water.
Hydric	Water is removed so slowly that the water table is at or above the soil surface all year; has organic and gleyed mineral soils.
Hydrochemical Type	The definition of a chemical composition of groundwater based on cation and anion concentrations.
Hydrocracking	A catalytic, high-pressure petroleum refinery process that is flexible enough to produce either high-octane gasoline or aviation jet fuel. The two main reactions are adding hydrogen to petroleum-derived molecules too massive and complex for gasoline, and then cracking them to the required fuels. The catalyst is an acidic solid with a hydrogenating metallic component.
Hydrocyclone	A device for separating out sand from extraction tailings slurry by imparting a rotating (cyclone) action to the slurry. Water, fine tailings and residual bitumen report to the overflow of the device. Sand flows out the bottom of the device in a dense slurry.
Hydrogen	A colourless, odourless, tasteless gas, composed of diatomic molecules, used to manufacture ammonia and methanol, for hydrofining, for desulphurization of petroleum products, and to reduce metallic oxide ores.

Hydrogeological Window	The erosional, sedimentional or structural break in geological strata, which allows hydraulic connection between different aquifers.
Hydrogeology	The study of the factors that deal with subsurface water (groundwater) and the related geologic aspects of surface water. Groundwater as used here includes all water in the zone of saturation beneath the earth's surface, except water chemically combined in minerals.
Hydrograph	A graph showing water surface elevations or flow versus time.
Hydrolic Gradient	The scale from very dry to very wet. Exists along a shoreline from water to upland.
Hydrologic Simulation Program – Fortran (HSPF)	The Hydrologic Simulation Program – Fortran (HSPF) model is a comprehensive, conceptual, continuous watershed simulation model designed to simulate the water quantity and water quality processes that occur in a watershed. The model can reproduce spatial variability by dividing the basin in hydrologically homogeneous land segments and simulating runoff for each land segment independently, using segment-specific meteorologic input data and watershed parameters.
Hydrology	The science of waters of the earth, their occurrence, distribution, and circulation; their physical and chemical properties; and their reaction with the environment, including living beings.
Hydrometric Station	A station where measurement of hydrological parameters is performed.
Hydrostratigraphic Unit	A formation, part of a formation, or group of formations in which there are similar hydrologic characteristics allowing for grouping into aquifers or confining layers.
Hydrotransport	The transport of granular materials (e.g., oil sands ore or extraction tailings) by means of a water-based slurry in a pipeline.
Hydrotreating	A process in which a crude or synthetic oil or oil product is treated under pressure with the addition of hydrogen in the presence of a catalyst to reduce the sulphur and nitrogen content of the oil and otherwise improve the quality of the oil.
Hygric	Water is removed slowly enough to keep the soil wet for most of the growing season; permanent seepage and mottling are present and possibly weak gleying.
Hyper-Eutrophic	Trophic state classification for lakes characterized by high primary productivity and high nutrient inputs (particularly total phosphorus). Hyper-eutrophic lakes are characterized by abundant plant growth, algal blooms and oxygen depletion.

Hypolimnion	The deep, cold layer of a lake lying below the metalimnion (thermocline) during the time a lake is normally stratified.
Hypsometer	A device using trigonomic principles to measure height of trees or slope of land. Often called a clinometer or Suunto™.
In Situ	Also known as "in place". Refers to methods of extracting deep deposits of oil sands without removing the groundcover. The in-situ technology in oil sands uses underground wells to recover the resources with less impact to the land, air and water than the traditional oil sands methods.
Incremental Lifetime Cancer Risk	The risk associated with daily exposure to a carcinogenic chemical that is separate from the risk associated with assumed background exposures.
Indeterminate	A species for which there is sufficient scientific information to support states designation.
Induction	Response to a biologically active compound — involves new or increased gene expression resulting in enhanced synthesis of a protein. Such induction is commonly determined by measuring increases in protein levels and/or increases in the corresponding enzyme activity. For example, induction of EROD (7-ethoxyresorufin 0-de ethylase) would be determined by measuring increases in cytochrome P4501A protein levels and/or increases in EROD activity.
Inductively Coupled Plasma (Atomic Emission Spectroscopy) (ICP) (Metals)	This analytical method is an U.S. EPA designated method (Method 6010). The method determines elements within samples of groundwater, aqueous samples, leachates, industrial wastes, soils, sludges, sediments and other solid wastes. Samples require chemical digestion before analysis.
Infiltration	The movement of groundwater or hydrothermal water into rock or soil through joints and pores. Infiltration is the main factor in recharge of groundwater reserves.
Influent	An inflow, especially a tributary.
Infrastructure	Basic facilities, such as transportation, communications, power supplies and buildings, which enable an organization, project or community to function.
Inorganics	Chemical compounds that do not contain carbon.
Integrated Light Intensity	Summation of solar radiation since sunrise to the clock hour.
Integrated Resource Management (IRM)	A coordinated approach to land and resource management that encourages multiple-use practices.

Interim Maximum Acceptable Concentration (IMAC)	Interim maximum acceptable concentration of contaminants for drinking water quality.
Interior Species	A species located only or primarily away from the perimeter of a landscape element.
Interspersion	The percentage of map units containing categories different from the map unit surrounding it.
Interspersion and Juxtaposition Index (IJI)	A measure of the dispersion and interspersion of patches in the landscape. It is a true landscape-level index that is computed based on the probabilities of a patch belonging to a class and its neighbours belonging to another.
Intra-Orebody Aquifers	Isolated water-saturated sand bodies, typically a few metres thick and up to a few tens of metres long, occurring within the oil sands.
Invasive Species	A species that has moved into an ecosystem and reproduced so successfully that it has displaced the original structure of the community.
Inversion	A reversal of normal atmospheric conditions, when temperatures increase rather than decrease with height above the ground. During inversion conditions the vertical mixing of emissions are restricted.
Invertebrate Drift	Collectively, stream invertebrates (almost wholly the aquatic larval stages of insects) that voluntarily or accidentally leave the substrate to move or float with the current, as well as terrestrial invertebrates that drop into the stream. Also, any detrital material transported in the water current.
Ionic Load	The total mass of charged molecules (ions) dissolved in a volume of water.
Irritant Chemicals	Chemicals which cause irritation at the site of contact (e.g., skin, nasal). These chemicals produce local adverse effects, and do not produce effects in areas away from the site of contact. Examples of irritant chemicals include carbon disulphide, carbon monoxide, nitrogen dioxide, sulphur dioxide and carbonyl sulphide.
Isolated Find	The occurrence of a single artifact with no associated artifacts or features.
Isopach Map	A geological map of subsurface strata showing the various thicknesses of a given formation underlying an area.
Kames	A ridge of sand or gravel deposited in contact with glacial ice.
Karst	A topography formed over limestone, dolomite or gypsum and characterized by sinkholes, caves and underground drainage.
Ketone	Hydrocarbon chain compound associated with the > C=O two single carbon bonds to other chain-like hydrocarbons (e.g., acetone, CH_3-CO-CH_3).

Kettle	A small hollow or depression formed in glacial deposits when outwash was deposited around a residual block or ice that later melted.
Key Indicator Resources (KIRs)	Environmental attributes or components identified as a result of a social scoping exercise as having legal, scientific, cultural, economic or aesthetic value.
Keystone Species	A species that is of particular importance to community integrity and function, without which significant changes to the community would occur.
Kick Sampling	Sampling of the streambed using a small mesh net with a long handle. The net is placed against the streambed and the substrate is disturbed (kicked) upstream of the net to dislodge fish eggs which float down into the net.
Kjeldahl Method	A quantitative analysis of organic compounds to determine nitrogen content by interaction with concentrated sulphuric acid. Ammonia is distilled from the NH_4SO_4 formed.
Lacustrine	Relating to a lake.
Land Capability	The ability of the land to support a given land use, based on an evaluation of the physical, chemical and biological characteristics of the land, including topography, drainage, hydrology, soils and vegetation.
Land Classification	The classification of specific bodies of land according to their characteristics or their capabilities of use.
Landform	General term for the configuration of the ground surface as a factor in soil formation; it includes slope steepness and aspect as well as relief. Also, configurations of land surfaces taking distinctive forms and produced by natural processes (e.g., hill, valley, plateau).
LANDSAT	A specific satellite or series of satellites used for earth resource remote sensing. Satellite data can be converted to visual images for resource analysis and planning.
Landscape	A heterogeneous land area with interacting ecosystems that are repeated in similar form throughout. From a wildlife perspective, a landscape is an area of land containing a mosaic of habitat patches within which a particular “focal” or “target” habitat patch is embedded.
Landscape Composition	All the types of stands or patches present across a given area of land.
Landscape Connectivity	A measure of the probability that individuals are capable of moving across a landscape and colonizing suitable habitat patches within their dispersal range.

Landscape Diversity	The size, shape and connectivity of different ecosystems across a large area.
Landscape Ecology	The study of the structure, function and change in a heterogeneous land area composed of interacting ecosystems.
Landscape Structure	The spatial relations among a landscape's component parts including composition; the presence and amount of each patch type without being spatially explicit; and landscape configuration, the physical distribution or spatial character of patches within a landscape.
Leaching	The removal, by water, of soluble matter from any solid material lying on top of bedrock (e.g., soil, alluvium or bedrock).
Leakage	The flow of water from one hydrogeological unit to another. It may be natural or anthropogenic.
Leakance	A property of a leaky layer. Expressed as ^K' divided by b', where K' refers to the hydraulic conductivity of the leaky layer confirming an aquifer in units of length/time and b' refers to the thickness of the leaky layer in units of length.
Lean Oil Sands	Oil bearing sands that do not have a high enough saturation of oil to make extraction of them economically feasible.
Leave Area	An area of standing timber retained among areas of logging activity to satisfy management objectives, such as seed source, wildlife habitat or landscape management constraints.
Lesions	Pathological change in a body tissue.
Lethal	Causing death by direct action.
Lift Gas	Gas injected into the reservoir to lighten the oil column and help it flow from the well.
Linear Corridor	Roads, seismic lines, pipelines and electrical transmission lines, or other long, narrow disturbances.
Lipid	One of a large variety of organic fats or fat-like compounds, including waxes, steroids, phospholipids and carotenes. Refers to substances that can be extracted from living matter using hydrocarbon solvents. They serve several functions in the body, such as energy storage and transport, cell membrane structure and chemical messengers.
Lithic Scatter	A small concentration of lithic (stone) artifacts on the surface. This term is usually used when there is insufficient information present to identify the function of the site.

Lithics	Of or pertaining to stone.
Lithology	The systematic description of sediment and rocks, in terms of composition and texture.
Littoral Zone	The zone in a lake that is closest to the shore. It includes the part of the lake bottom, and its overlying water, between the highest water level and the depth where there is enough light (about 1% of the surface light) for rooted aquatic plants and algae to colonize the bottom sediments.
Liver Somatic Index (LSI)	Ratio of liver versus total body weight. Expressed as a percentage of total body weight.
Loading Rates	The amount of deposition, determined by technical analysis, above which there is a specific deleterious ecological effect on a receptor.
Local Study Area (LSA)	The project-specific study area used in the context of impacts within the development area. Defines the spatial extent directly or indirectly affected by the project.
Lognormal	Of, relating to, or being a logarithmic function with a normal distribution.
Long Range Sustained Yield Average (LRSYA)	The sum of Mean Annual Increments (MAI) for all forest cover types in a study area. LRSYA is an estimate for the sustained yield or expected annual growth of the coniferous and deciduous fibre in a study area.
Lowest Observed Adverse Effect Level (LOAEL)	In toxicity testing, it is the lowest concentration at which adverse effects on the measurement end point are observed.
Lowest Observed Effect Concentration (LOEC)	The lowest concentration in a medium that causes an effect that is a statistically significant difference in effect compared to controls.
Lowest Observed Effect Level (LOEL)	In toxicity testing, it is the lowest concentration at which effects on the measurement end point are observed.
Luvisol	An order of soils that have eluvial (Ae) horizons, and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.
Macrophytes	Plants large enough to be seen by the unaided eye. Aquatic macrophytes are plants that live in or in close proximity to water.
Macroterrain	A large area of the landscape.
Mainstem	The main portion of a watercourse extending continuously upstream from its mouth, but not including any tributary watercourses.

Make-Up Water	The process water required to replace that lost by evaporation or leakage in a closed-circuit, recycle operation.
Marsh	A non-peat-forming (generally <40 cm of accumulated organics), nutrient-rich wetlands characterized by fluctuating water levels.
Mass Balance Error	The difference between the groundwater flows into and out of a model domain. For a numerical groundwater flow model with a perfect solution, the mass balance error is zero (i.e., inflows equal outflows). In practice, small mass balance errors are acceptable.
Mass Loading	The rate of atmospheric deposition (including wet and dry deposition) of a compound over a given area for a set time. Typically expressed in units of kilograms per hectare per year (kg/ha/yr).
Matrix	The most extensive and most connected landscape element type present, which plays the dominant role in landscape functioning.
Mature Fine Tailings (MFT)	Fine tailings that have dewatered to a level of about 30% solids over a period of about three years after deposition. The rate of consolidation beyond this point is substantially reduced. Mature fine tailings behave like a viscous fluid.
Mature Forest	A forest greater than rotation age with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstorey trees; some with broken tops and other decay; numerous large snags and accumulations of downed woody debris.
Mature Stand	A stand of trees for which the annual net rate of growth has peaked.
Maximum Acceptable Concentration (MAC)	Maximum acceptable concentration of contaminants for drinking water quality.
Maximum Allowable Daily Dose	The upper limit of the amount of chemical that can be received by a particular receptor, every day for an entire lifetime, without experiencing adverse health effects.
Maximum Depth	The maximum depth of the surveyed section of the stream recorded for each pool, riffle and run.
May Be At Risk	Any species that “May Be At Risk” of extinction or extirpation and is therefore a candidate for detailed risk assessment.
Mean	Centroid value of a data population when viewing its probability distribution function (or histogram) as a mass distribution.

Mean Annual Increment (MAI)	The measure of cubic metres of fibre that accumulates per year from each hectare of forest. Calculated MAI for each stand is summed by forest cover type, and multiplied by its area to derive expected fibre accumulation for that forest cover type.
Mean Nearest Neighbour (MNN)	The mean of the shortest distance, in metres, between each patch and each adjacent patch of the same type.
Mean Patch Fractal Dimension (MPFD)	A measure of the complexity of a patch's shape. It also determines the amount of core area contained in the class.
Mean Patch Size (MPS)	The area of an ecosystem type divided by the number of patches of that type. For total undisturbed areas, it is the mean size of the undisturbed patches.
Mean Proximity Index (MPI)	A measure of connectivity of patches within the landscape. The MPI is determined by whether the patch has neighbours of the same type within a specified radius.
Media	The physical form of the environmental sample under study (e.g., soil, water, air).
Median	Fifty percent of the data population values are greater than, and 50% are less than, the median value.
Mercaptan	A group of organosulphur compounds that are derivatives of hydrogen sulphide in the same way that alcohols are derivatives of water. These compounds have a characteristically disagreeable odour, are found with other sulphur compounds in crude petroleum, and are added to odourless fuel gases to give them a distinctive odour for safety purposes.
Merchantable Forest	A forest area with potential to be harvested for production of lumber/timber or wood pulp. Forests with a timber productivity rating of moderate to good.
Merchantable Timber	A forest area with potential to be harvested for protection of lumber/timber or wood pulp. Forests with a timber productivity rating of moderate to good.
Mesic	Pertaining to, or adapted to an area that has an intermediate supply of water; neither wet not dry.
Mesotrophic	Refers to a moderate nutrient-rich status.
Metabolism	The total of all enzymatic reactions occurring in the cell; a highly coordinated activity of interrelated enzyme systems exchanging matter and energy between the cell and the environment. Metabolism involves both the synthesis and breakdown (catabolism) of individual compounds.

Metabolites	Organisms alter or change compounds in various ways, such as removing parts of the original or parent compound, or in other cases adding new parts. Then, the parent compound has been metabolized and the newly converted compound is called a metabolite.
Metacarpal	The digits in an animal's foot consist of many bone segments. The longest segment in a digit is the metacarpal.
Metastable	A state of being in equilibrium (oscillating around a central position) but susceptible to being diverted to another equilibrium.
Meteoric Water	That which occurs in or is derived from the atmosphere.
Method Detection Limit (DL)	The lowest concentration at which individual measurement results for a specific analyte are statistically different from a blank (that may be zero) with a specified confidence level for a given method and representative matrix.
Microbiological Control	The science of keeping microorganisms within acceptable limits, such as by adding chlorine or other process chemicals to water to eliminate or control algae, fungi and bacteria.
Microclimate	The temperature, precipitation and wind velocity in a restricted or localized area, site or habitat.
Microtine	Small mammal species (voles) with the genus name Microtus.
Microtopographic	The fine-scale topography of a site.
Microtox™	A toxicity test that includes an assay of light production by a strain of luminescent bacteria (*Photobacterium phosphoreum*).
Mineral Soil	Soils containing low levels of organic matter. Soils that have evolved on fluvial, glaciofluvial, lacustrine and morainal parent material.
Mineralization of Groundwater	Synonym of total dissolved solid concentration.
Mitigation	The elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damages to the environment caused by such effects through replacement, restoration, compensation or other means.
Mitigative Measures	Procedural, locational and timing constraints and methods employed to address project-related impacts. Mitigative measures can address both positive and negative impacts.
Mixed Function Oxidase (MFO)	A term for reactions catalyzed by the Cytochrome P450 family of enzymes, occurring primarily in the liver. These reactions transform organic chemicals, often altering toxicity of the chemicals.

Mixedwood	A stand containing both deciduous and coniferous trees. Defined in this report as stands where the primary species is deciduous and the secondary species totals ≥30% coniferous species, or vice-versa. Also, multistory stands of an "A" density with a deciduous primary overstorey species, and the dominant understorey species is coniferous, or vice-versa.
Mixing Height	The depth of surface layer in which atmospheric mixing of emissions occurs.
Model Calibration	The trial-and-error process of matching the hydraulic heads and groundwater flows in a numerical groundwater flow model with observed values. An acceptable model calibration depends on the intended use of the numerical model.
Model Domain	The region of interest for a numerical groundwater flow model.
Modelling	A simplified representation of a relationship or system of relationships. Modelling involves calculation techniques used to make quantitative estimates of an output parameter based on its relationship to input parameters. The input parameters influence the value of the output parameters.
Mole	An amount of substance of a system which contains as many elementary units as there are atoms of carbon in 0.012 kilograms of the pure nuclide carbon-12. The elementary unit must be specified and may be an atom, molecule, ion, electron, photon, or a specified group of such units. Abbreviated by mol.
Monitoring	Repetitive measurement of specific environmental phenomena to document change primarily for the purpose of: 1) testing impact hypotheses and predictions and b) testing mitigative measures.
Moraine	A deposit of rocks and debris carried and dropped by a glacier.
Movement Corridor	Travel way used by wildlife for daily, seasonal, annual and/or dispersal movements from one area or habitat to another.
Multi-Directional Core	A core bearing scars that show that flakes or blades were removed in more than two directions.
Multilayered	Forest stands where two or three storeys exist and each storey is significant, clearly observable and evenly distributed.
Multilayered Canopy	Forest stands with two or more distinct tree layers in the canopy; also called multistoreyed stands.
Multistorey	A forest canopy with two or more distinct tree layers.

Muskeg	A soil type comprised primarily of organic matter. Also known as bog peat. A swamp or bog formed by an accumulation of sphagnum moss, leaves and decayed matter resembling peat. Prevalent in Canada and Alaska and part of the North American boreal forest biome.
Mycorrhizal	Fungi that form symbiotic relationships with plants, resulting in improved nutrient uptake by the plant.
Naphthenic Acids	Generic name used for all the organic acids present in crude oils.
Native Species	Species that are known to be historically present in a given area.
Nearest Neighbour Coefficient of Variation (NNCV)	A percentage measurement of the variability of mean nearest neighbour (MNN) distance to the actual MNN distance. The number of patches and patch density are required to provide a complete understanding of NNCV.
Nearest Neighbour Standard Deviation (NNSD)	A measurement of patch dispersion. A uniform or regular distribution of vegetation units will have a low standard deviation. Clustered or dispersed patches will have a large standard deviation compared to the mean.
Nitrogen Oxides (NO_x)	A measure of the oxides of nitrogen comprised of nitric oxide (NO) and nitrogen dioxide (NO_2).
No Net Loss Plan	A working principle which strives to balance unavoidable habitat losses with habitat replacement on a project by project basis so that reductions to fisheries resources due to habitat loss or damage may be prevented
No Observed Adverse Effect Level (NOAEL)	In toxicity testing, it is the highest concentration at which no adverse effects on the measurement end point are observed.
No Observed Effect Concentration (NOEC)	The highest concentration in a medium that does not cause a statistically significant difference in effect as compared to controls.
No Observed Effect Level (NOEL)	In toxicity testing, it is the highest concentration at which no effects on the measurement end point are observed.
Node	Location along a river channel, lake inlet or lake outlet where flows, sediment yield and water quality have been quantified.
Non-Benzene Aromatic	Aromatic benzene ring type hydrocarbon other than benzene itself (e.g., toluene $C_6H_5CH_3$).
Non-Carcinogen	A chemical that does not cause cancer and has a threshold concentration, below which adverse effects are unlikely.
Non-Filterable Residue	Material in a water sample that does not pass through a standard size filter (often 0.45 mm). This is considered to represent “total suspended solids” (TSS), i.e., particulate matter suspended in the water column.

Non-Methane Hydrocarbons (NMHC)	A measure of the airborne hydrocarbons, less methane.
Non-Segregated Tailings (NST)	Tailings formed from a mixture of cycloned sand tailings and thickened fine tailings in a non-segregating stream. These consolidate relatively rapidly upon placement in tailings disposal areas to form a trafficable surface. Consolidated tailings is one type of NST.
Non-Threshold Chemicals	A chemical which does not act via a threshold mechanism of action. That is, a specific chemical concentration does not need to be reached for adverse effects to occur, since any exposure could potentially cause adverse effects. The only dose level associated with no potential for adverse effects to occur is zero. Most non-threshold chemicals are genotoxic chemicals.
Non-vascular plant	Plants that do not possess conductive tissues (e.g., veins) for the transport of water and food.
Not at Risk	A species that has been evaluated and found to be not at risk.
Numerical Groundwater Flow Model	A computer-based representation of one or more groundwater flow systems. The numerical model calculates the distribution of hydraulic head and the resulting groundwater flow by subdividing a region of interest (the model domain) into many grid cells, defining the mathematical representations for each cell and solving the resulting set of equations with the computer using specialized techniques. Numerical groundwater flow models are typically used for groundwater flow systems with complex boundary conditions, geometry, or hydrostratigraphy.
Nutrients	Environmental substances (elements or compounds) such as nitrogen or phosphorus, which are necessary for the growth and development of plants and animals.
Observation Well	A constructed controlled point of access to an aquifer that allows groundwater observations. Small-diameter observation wells are often called piezometers.
Obsidian	Volcanic glass which is easily worked into tools and attains a very sharp edge.
Ochre	Iron oxide or hematite. The colour is generally reddish-brown to yellow. Used as a natural pigment.
Odourant	Material, usually a compound containing sulphur or mercaptan, that is added to odourless fuel gases to give them a distinctive odour for safety purposes.

Oil Sands	A sand deposit containing a heavy hydrocarbon (bitumen) in the intergranular pore space of sands and fine grained particles. Typical oil sands comprise approximately 10 wt% bitumen, 85% coarse sand (>44 µm) and a fines (<44 µm) fraction, consisting of silts and clays.
Old Growth Forest	An ecosystem distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species, composition, and ecosystem function. Old growth forests are those forested areas where the annual growth equals annual losses, or where the mean annual increment of timber volume equals zero. They can be defined as those stands that are self-regenerating (i.e., having a specific structure that is maintained).
Olfactory	Relating to the sense of smell.
Oligotrophic	Trophic state classification for lakes characterized by low productivity and low nutrient inputs (particularly total phosphorus).
Open Canopy	Less than 6% tree cover.
Organic Soil	Soils containing high percentages of organic matter (fibric and humic inclusions).
Organics	Chemical compounds, naturally occurring or otherwise, which contain carbon, with the exception of carbon dioxide (CO_2) and carbonates (e.g., $CaCO_3$).
Outcrop	An outcrop is a geologic unit that is exposed at the earth's surface.
Outlier	A data point that falls outside of the statistical distribution defined by the mean and standard deviation.
Outwash	A glaciofluvial sediment that is deposited by meltwater streams emanating from a glacier.
Overburden	The soil, sand, silt or clay that overlies a mineral deposit and must be removed before mining.
Overstorey	Those trees that form the upper canopy in a multi-layered forest.
Overwintering Habitat	Habitat used during the winter as a refuge and for feeding.
Oxidants	Chemical compounds that are capable of oxidizing other atmospheric compounds.
Pad	The surface parts of multiwell drilling sites, including wells, buildings, piping and electrical facilities.

Paleosol	A paleosol is a soil that was formed in the past. Paleosols are usually buried beneath a layer of sediments and are thus no longer being actively created by soil formation processes like organic decay.
Paleotopography	Ancient topography.
Paleo-Valleys	A valley of the geologic past, frequently buried under younger sediments.
Paleozoic	An era of geologic time, from the end of the Precambrian to the beginning of the Mesozoic, or from about 570 to about 225 million years ago. Also, the rocks deposited during the Paleozoic.
Paludification	When sphagnum moss blankets dry land and prevents water from leaving the surface leading to bog formation.
Palynology	The study of living and fossil pollen grains and plant spores.
Paraconformity	An uncertain or obscure unconformity in which no erosion surface is discernible or in which the contact is a simple bedding plane and in which the beds above and below the break are parallel.
Parasitism	The relation between two different kinds of organisms in which one receives benefits from the other by causing damage to it (usually not fatal damage).
Parent Material	The unconsolidated and weathered mineral or organic material from which the upper horizons o soil have been developed.
Passerine	Perching birds, mostly small and living near the ground with feet having four toes arranged to allow for gripping the perch; most are songbirds.
Patch	An area that is different from the area around it (e.g., vegetation types, non-forested areas). This term is used to recognize that most ecosystems are not homogeneous, but rather exist as a group of patches or ecological islands that are recognizably different from the parts of the ecosystem that surround them but nevertheless interact with them.
Patch Density (PD)	The number of patches per 100 hectares divided by total landscape area. Patch density equals the number of patches of the corresponding patch types (NP) divided by total landscape area, multiplied by 10,000 and 100 (to convert to 100 hectares).
Patch Richness (PR)	A measure of the number of different patch types that occur within a study area or landscape unit within a study area. The patch types used here are vegetation units.
Patch Size Coefficient of Variation (PSCV)	The patch size coefficient builds off the mean patch size (MPS) as the variability of patch size relative to the mean. The PSCV is calculated as the standard deviation of patch size divided by the MPS and is thus a relative measure.

Pathology	The science that deals with the cause and nature of disease or diseased tissues.
Peat	A material composed almost entirely of organic matter from the partial decomposition of plants growing in wet conditions.
Pebble Core	So termed because of its size. These miniature objective pieces will display the full range of reduction processes such as bi-polar and multidirectional flake removal often associated with larger core artifacts.
Pelagial Zone	Open water portion of a lake.
Pelagic	Inhabiting open water, typically well off the bottom. Sometimes used synonymously with limnetic to describe the open water zone (e.g., large lake environments).
Percentile (e.g., 95%) in Context of Exposure Ratios (ERs)	The 95^{th} percentile is the reference level used when a stochastic analysis is conducted. The stochastic analysis can calculate Exposure Ratios (ERs) at various percentile levels of distribution. Stochastic analysis uses a range of values (e.g., body weights, consumption rates, inhalation rates) in an attempt to adequately depict the assessed population. Exposure model results are presented as a range of values. The 95^{th} percentile represents a level of risk that 95% of the population should never experience. In other words, the ER value at the 95^{th} percentile indicates that 95% of the population will experience an ER equal to or less than the value at the 95^{th} percentile. Thus, only 5% of the population would experience ER values greater than the value at the 95^{th}.
Performance Assessment	Prediction of a reclaimed lease's future performance, identifying potential adverse effects with respect to geotechnical, geomorphic and ecosystem sustainability.
Permeability	The capacity of porous rock, sediment, soil or a medium for transmitting a fluid. Has dimensions $Length^2$. When measured in cm^2, the value of permeability is very small, therefore more practical units are commonly used (i.e., Darcy [D] or millidarcy [mD].
Permissible Sound Level (PSL)	The allowable overall A-weighted sound level of noise from energy industry sources, as specified by the Alberta Energy and Utilities Board Noise Control Directive, which may contribute to the sound environment of a residential location.
Permit Holder	The director of a Historical Resource Impact Assessment. Responsible for the satisfactory completion of all field and laboratory work and author of the technical report.
Petrified Wood	Agatized wood used for the manufacture of stone artifacts.

pH	The negative logarithm of hydrogen ion concentration. The pH scale is generally presented from 1 (most acidic) to 14 (most alkaline). A difference of one pH unit represents a ten-fold change in hydrogen ion concentration.
pH Value	The degree of acidity (or alkalinity) of soil or solution. The pH scale is generally presented from 1 (most acidic) to 14 (most alkaline). A difference of one pH unit represents a ten-fold change in hydrogen ion concentration.
Pharmacodynamics	The interactions of a chemical with biological systems of an organism, including the mechanism of action, and associated effects. The dose-response relationship of a chemical is included as a part of the quantitative aspect of pharmocodynamics.
Phenology	The study of flowering time in relation to climate.
Phosphorus	The key nutrient influencing plant growth in lakes; total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.
Phreatic Surface	Synonym of unconfined groundwater surface. The planar surface between the zone of saturation and the zone of aeration. Also known as the water table.
Physiography	Synonym of geomorphology.
Physiological	Related to function in cells, organs or entire organisms, in accordance with natural processes of life.
Pictograph	Designs painted by Aboriginal peoples on natural rock surfaces. Red ochre is the most frequently used pigment.
Piezometer	A pipe in the ground in which the elevation of water levels can be measured, or a small diameter observation well.
Piezometric Surface	If water level elevations in wells completed in an aquifer are plotted on a map and contoured, the resulting surface described by the contours is known as a potentiometric or piezometric surface.
Piscivorous Diet	Feeding on fish.
Pit Lake	A man-made lake used to fill a mine pit area into which tailings may be discharged. Pit Lakes are typically filled with waters pumped from adjacent rivers.
Pixel	The basic unit of digital image data. Shortened from “picture element”. The intensity of each pixel corresponds to the average “brightness” measured electronically by the sensor.

Planned Development Case	The assessment of the effects of one project with consideration of current conditions, other existing projects, other approved projects and typically, other planned projects.
Plant Community	An association of plants of various species found growing together.
PM_{10}	Airborne particulate matter with a mean diameter less than 10 µm (microns) in diameter. This represents the fraction of airborne particles that can be inhaled into the upper respiratory tract.
$PM_{2.5}$	Airborne particulate matter with a mean diameter less than 2.5 µm (microns) in diameter. This represents the fraction of airborne particles that can be inhaled deeply into the pulmonary tissue.
Pneumatic Piezometer	A device used to measure hydrostatic and/or pore pressure in a borehole or engineered structure.
Point Estimate	A single numerical value used to describe a particular exposure parameter in the deterministic analysis of a risk assessment. As opposed to the use of a 95^{th} percentile in the stochastic analysis, the point estimate does not use a range of values. For example, when considering body weights, only one value is chosen to represent the population. Single values are chosen for all exposure parameters, resulting in one level of risk that "roughly" represents the exposed population. Most times, the point estimate is deliberately chosen to represent a conservative, worst-case scenario.
Polishing Pond	Pond where final sedimentation takes place before discharge.
Polyacrylamide	A white polyamide related to acrylic acid used in geleiectrophoresis.
Polycyclic Aromatic Hydrocarbon (PAH)	A chemical by-product of petroleum-related industry. Aromatics are considered to be highly toxic components of petroleum products. PAHs, many of which are potential carcinogens, are composed of at least two fused benzene rings. Toxicity increases along with molecular size and degree of alkylation of the aromatic nucleus.
Polygon	The spatial area delineated on a map to define one feature unit (e.g., one type of ecosite phase).
Pool: Run: Riffle Ratio	The ratio of pool: run: riffle based on the percentage of each stream type in the surveyed section of the stream. These habitat types are described as: • Pool: a deep area of low current velocity; • Run: a moderately deep area within the main current; and • Riffle: a shallow area where the water surface is broken into waves by bed material.
Population	A collection of individuals of the same species that potentially interbreed.

Population Viability Analysis (PVA)	A modelling process that uses estimates of landscape changes, demographic rates and environmental variation to calculate the probability of species extinction within a given period of time and space.
Porewater	Water between the grains of a soil or rock.
Porosity	The percentage of the bulk volume of a rock or soil that is occupied by interstices (minute openings or crevices), whether isolated or connected.
Potable Water	Water that is suitable for drinking.
Potential Acid Input (PAI)	A composite measure of acidification determined from the relative quantities of deposition from background and industrial emissions of sulphur, nitrogen and base cations.
Potential (Hydrology and Hydraulics)	Any of several scalar variables, each involving energy as a function of position or condition; of relevance here is the fluid potential of groundwater.
Potential (Water Quality)	A water quality issue or problem identified by a river authority as being a potential problem, or a problem without current supporting data.
Potentiation	An interaction that may be considered a special type of synergism. Potentiation occurs when a substance that is not toxic by itself increases the toxic potency of another substance.
Potentiometric	Synonym to piezometric.
Primary Decortication Flake	First series of flakes removed from a nodule. The dorsal surfaces of such flakes are covered by cortex and lack any real arris or flake scars on the dorsal side. Removed by percussion or pressure technique.
Primary Flakes	The first series of flakes removed from a core or nucleus in the process of tool manufacture.
Probable Effects Level	Concentration of a chemical in sediment above which adverse effects on an aquatic organism are likely.
Probable Maximum Flood (PMF)	The most severe flood that may be expected from a combination of the most critical meteorological and hydrological conditions that is reasonably possible in the drainage basin. It is used in designing high-risk flood protection works and siting of structures and facilities that must be subject to almost no risk of flooding. The probable maximum flood is much larger than the 100-year flood.
Probable Maximum Precipitation (PMP)	The maximum amount of precipitation for a given period that can reasonably be expected to occur in a specific drainage basin.
Problem Formulation	The initial step in a risk assessment that focuses the assessment on the chemicals, receptors and exposure pathways of greatest concern.

Produced Gas	Gas co-produced with the bitumen,. It includes lift gas, solution gas and associated gas.
Productive Forest	Forests on lands with a capability rating of equal to or greater than three, and stocked with enough trees to meet the standards of a merchantable forest.
Projectile Point	An inclusive term for arrow, spear or dart points. Characterized by a symmetrical point, a relatively thin cross-section and some element to allow attachment to the projectile shaft. Flaked stone projectile points are usually classified by their outline form.
Propagules	Root fragments, seeds, and other plant materials that can develop into a plant under the right conditions.
Provenience	The horizontal and/or vertical position of an artifact in relation to known coordinates.
Quality Assurance/Quality Control (QA/QC)	A set of practices that ensure the quality of a product or a result. For example, "Good Laboratory Practice" is part of QA/QC in analytical laboratories and involves such things as proper instrument calibration, meticulous glassware cleaning and an accurate sample information system.
Quartz Crystal	Pure silicate rock crystal. Usually perfectly clear.
Quartzite	A granular metamorphic rock consisting essentially of quartz.
Quaternary	The most recent geologic time period, encompassing the last two million years.
Raptor	A carnivorous (meat-eating) bird; includes eagles, hawks, falcons and owls.
Rare Plants	Rare plants have restricted spatial, ecological and temporal distributions in a variable, or diverse environment.
Raster	A graphic structure where the data is divided into cells on a grid. An example would be a computer screen where an image is represented by horizontal lines of coloured pixels. Shapes are represented by cells of the same colour or content adjacent to each other.
Rating Curve	A curve showing the relation between the discharge of a gauge, meter or other hydraulic structure or instrument and the pertinent hydraulic conditions affecting the discharge, such as pressure, hydrostatic head and velocity of approach.
Reach	A comparatively short length of river, stream channel or shore. The length of the reach is defined by the purpose of the study.
Rearing Habitat	Habitat used by young fish for feeding and/or as a refuge from predators.

Rearing Habitat	Habitat used by wildlife for feeding and/or as a refuge from predators. In aquatic environments it is a place used by young fish for feeding or as a refuge from predators.
Receptor	The person or organism subjected to exposure to chemicals or physical agents.
Recharge / Discharge Area	Areas that either contribute (recharge) or take away (discharge) to/from the overall volume of groundwater in an aquifer.
Recharge-Seepage Face	A boundary condition used to define a relationship between groundwater flow into or out of the model domain and the hydraulic head in a grid cell. It differs from the general head boundary in that the maximum groundwater inflow rate and the maximum hydraulic head are both specified for the recharge-seepage face boundary.
Reclamation	The restoration of disturbed land or wasteland to a state of useful capability. Reclamation is the initiation of the process that leads to a sustainable landscape (see definition), including the construction of stable landforms, drainage systems, wetlands, soil reconstruction, addition of nutrients and revegetation. This provides the basis for natural succession to mature ecosystems suitable for a variety of end uses.
Reclamation Certificate	A certificate issued by an Alberta Environment signifying that the terms and conditions of a conservation and reclamation approval have been complied with.
Reclamation Unit	A unique combination of reclamation conditions, namely surface shape, sub-base material, cover material and initial vegetation.
Recovery Test	A method of obtaining quantitative information on the hydraulic characteristics of an aquifer, routinely used following a pump test. After pumping has been terminated, the water level will stop dropping and will begin to rise towards its original position. The rise of the water level can be measured as residual drawdowns (i.e., as the difference between the original water level before pumping and the actual water level measured at a given time after pumping is stopped).
Redd	A hollow in sand or gravel on a riverbed, scooped out as a spawning place by salmon, trout or other fish.
Reference Concentration (RfC)	For a specific chemical that is conceptually equivalent to an air quality objective, and is expressed in $\mu g/m^3$. It is an exposure limit that is established for chemicals which are locally acting (e.g., irritant chemicals), whose toxicity is dependent solely on the air concentration, and not on the total internal dose received via multiple exposure pathways.

Reference Value	The maximum acceptable dose (per unit body weight and unit of time) of a chemical to which a specified receptor can be exposed to, assuming a specified risk (e.g., one in one hundred thousand). May be expressed as a Reference Dose (RfD) for threshold-response chemicals or as a Risk Specific Dose (RsD) for non-threshold response chemicals.
Refugia	Areas of natural ecosystems within, or next to, a development area from which plants or animals may move back into the development area, or to which animals may move from the development area.
Regeneration	The natural or artificial process of establishing young trees.
Regional Aquatic Monitoring Program (RAMP)	RAMP was established to determine, evaluate and communicate the state of the aquatic environment in the Athabasca Oil Sands Region.
Regional Issues Working Group (RIWG)	A group that works to promote the responsible, sustainable development of resources within the Regional Municipality of Wood Buffalo.
Regional Study Area (RSA)	Defines the spatial extent related to the cumulative effects resulting from the project and other regional developments.
Regional Sustainable Development Strategy (RSDS)	A regulatory framework for balancing development of Alberta's oil sands resources with protection of the environment.
Regosol	The only great group in the Regosolic order. The soils in the group have insufficient horizon development to meet the requirements of the other orders.
Relative Abundance	The proportional representation of a species in a sample or a community.
Remediation	The process of planning for, investigating and potentially managing or removing th effects of chemical substances on the environment, including soil or groundwater effects.
Revegetation	The process of providing denuded land with a new cover of plants.
RfD (Reference Dose)	The maximum recommended daily exposure for a non-carcinogenic chemical exhibiting a threshold (highly nonlinear) dose-response based on the NOAEL determined for the chemical from human and/or animals studies and the use of an appropriate uncertainty factor.
Riparian Area	A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affects it.

Risk Specific Dose (RsD)	The exposure limit determined for chemicals assumed to act as genotoxic, non-threshold carcinogens. A RsD is a function of carcinogenic potency (q_1^*) and defined acceptable risk (i.e., q_1^* target level of risk); for example, the RsD for a lifetime cancer risk of one-in-one-million would equal q_1^*, 1×10^{-6}.
Risk-Based Concentration (RBC)	Concentration in environmental media below which health risks are not expected to occur.
Runoff	The portion of water from rain and snow that flows over land to streams, ponds or other surface waterbodies. It is the portion of water from precipitation that does not infiltrate into the ground, or evaporate.
Sedimentation	The process of subsidence and deposition of suspended matter carried by water, wastewater or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material.
Seral Community	One of a sequence of communities in the development stages towards a climax community.
Seral Stage	In an ecological succession, the series of biotic communities that follow one another on the way to the stable stage, or climax community.
Seven-Day 10-Year Low Flow (7Q10)	The period of lowest average stream flow during a seven-day interval that is expected to occur once every 10 years.
Shovel Test	A subsurface test approximately 40 to 50 cm on a side excavated by hand to determine the presence/absence of buried cultural materials.
Significance	Refers to both context and intensity. In terms of context, the significance of an action must be analyzed in relation to human society, the region, affected interests and locality. In terms of intensity, it refers to the severity of the impact. Both short and long term effects are relevant.
Slump Area	Slopes subject to regular mass-wasting events characterized by movement (slow or rapid) of a mass of soil and/or rock.
Soil Amendment	An alteration of the properties of a soil and, thereby, of the soil, by adding substances, such as lime, gypsum and sawdust, to make the soil more suitable for growth of plants. Fertilizers constitute a special group of soil amendments.
Soil Profile	A vertical section of the soil through all the horizons and extending into the parent material.
Soil Series	The basic unit of soil classification in the Canadian System of Soil Classification and consists of soils that are essentially alike in all major profile characteristics except the texture at the surface.

Solonetzic Soils	An order of soils developed mainly under grass or grass-forest vegetative cover in semiarid to subhumid climates. The soils have a stained brownish solonetzic B (Bnt or Bn) horizon and a saline C horizon. The surface may be one or more of Ap, Ah, or Ae horizons.
Solution Gas	Natural gas that is dissolved in crude oil in underground reservoirs. When the oil comes to the surface, the gas expands and comes out of solution.
Spawning Habitat	A particular type of area where a fish species chooses to reproduce. Preferred habitat (substrate, water flow, temperature) varies from species to species.
Species	A group of organisms that actually or potentially interbreed and are reproductively isolated from all other such groups; a taxonomic grouping of genetically and morphologically similar individuals; the category below genus.
Species Abundance	The number of individuals of a particular species within a biological community (e.g., habitat).
Species Distribution	Where the various species in an ecosystem are found at any given time. Species distribution varies with season.
Species Diversity	A description of a biological community that includes both the number of different species and their relative abundance. Provides a measure of the variation in number of species in a region.
Sport / Game Fish	Large fish caught for food or sport (e.g., northern pike, Arctic grayling).
Stand	A group of trees occupying a specific area and sufficiently uniform in composition, age, arrangement and condition so that it is distinguishable from trees in adjoining areas.
Stand Age	The number of years since a stand experienced a stand-replacing disturbance event (e.g., fire, logging).
Stand Density	The number and size of trees on a forest site.
Stratigraphy	The succession and age of strata of rock and unconsolidated material. Also concerns the form, distribution, lithologic composition, fossil content and other properties of the strata.
Stream Day	Maximum daily rate (design capacity for equipment).
Study Area	The geographic limits within which an impact to a key indicator resource or social component is likely to be significant.
Subcrop	A geologic unit that is exposed beneath an overlying geologic layer, usually at an unconformity.

Subsoil	The layer of weathered material that underlies the surface soil.
Surface Soil	The uppermost part of the soil that is ordinarily moved in tillage, or its equivalent in uncultivated soils. It ranges in depth from 7.5 cm to 25 cm and is frequently designated as the “plow layer”, the “Ap layer”, or the “Ap horizon”.
Surface Water	The water on the earth’s surface.
Surficial Deposit	A geologic deposit (clay, silt or sand) that has been placed above bedrock.
Suspended Sediments	Particles of matter suspended in the water.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Synergism	Two or more toxic substances interact such that the toxicity of the mixture is greater than would be expected if the substances were acting additively or independently. For example, people who use both tobacco and alcohol have a much higher risk of some cancers than would be expected if these two products were acting additively.
Temporal	Relating to the consideration of time in the EIA. The temporal boundaries define the time during which something is assessed.
Thalweg	A line extending longitudinally along a watercourse following the deepest portion of the channel.
Threshold Chemicals	Chemicals which act via a threshold mechanism of action require a minimal concentration level to produce adverse effects. Below this specific threshold level, there is no potential for adverse effects to occur.
Till	Sediments laid down by glaciers.
Timber Productivity Rating (TPR)	The potential timber productivity of a stand based on height and age of dominant and co-dominant trees of the leading species. TPR reflects factors affecting tree growth including soil, topography, climate, elevation and moisture.
Total Alkalinity	A measure of the ability of water to resist changes in pH caused by the addition of acids or bases and therefore, the main indicator of susceptibility to acid rain; in natural waters it is due primarily to the presence of bicarbonates, carbonates and to a much lesser extent occasionally borates, silicates and phosphates; it is expressed in units of milligrams per litre (mg/L) of $CaCO_3$ (calcium carbonate). Alkalinity is determined from a discernable inflection point in the measured titration curve.
Total Dissolved Solids (TDS)	The total concentration of all dissolved compounds solids found in a water sample.

Total Suspended Solids (TSS)	The amount of suspended substances in a water sample.
Toxic Threshold	Almost all compounds (except genotoxic carcinogens) become toxic at some level with no evident harm or adverse effect below that level. Scientists refer to the level or concentration where they can first see evidence for an adverse effect on an organism as the toxic threshold. Genotoxic carcinogens exhibit some toxic potential at any level.
Toxicity	The inherent potential or capacity of a material to cause adverse effects in a living organism.
Toxicity Assessment	The process of determining the amount (concentration or dose) of a chemical to which a receptor may be exposed without the development of adverse effects.
Transpiration	Transpiration is the process by which water is transferred from soil and plant surfaces to the atmosphere.
Turbidity	An indirect measure of suspended particles, such as silt, clay, organic matter, plankton and microscopic organisms, in water.
Unconfined Aquifer	A permeable bed only partly filled with water and overlying a relatively impervious layer.
Unconsolidated	Material that is loosely arranged or unstratified.
Understorey	Those trees or other vegetation in a forest stand below the main canopy level.
Universal Transverse Mercator (UTM)	The UTM system applies the Transverse Mercator projection to mapping the world, using 60 pre-defined standard zones to supply parameters. UTM zones are six degrees wide. Each zone exists in a north and south variant. The northern hemisphere projections for the UTM system consists of 120 zones (60 different zones with north and south variants of each). Originally developed for military use and now widely used in civil mapping.
Upset Conditions	An acute time period within which usual conditions become highly unfavourable; severity and duration may vary.
Volatile Organic Compounds (VOC)	Volatile Organic Compounds include aldehydes and all of the hydrocarbons except for ethane and methane. VOCs represent the airborne organic compounds likely to undergo or have a role in the chemical transformation of pollutants in the atmosphere.
Watershed	The entire surface drainage area that contributes water to a lake or river.
Wellbore	Also borehole. The hole drilled by the bit (can be cased or open).

Windrose	Graphic pie-type representation of frequencies of wind directions and speeds over a period of time (e.g., one year) for a meteorological station.
Wood Buffalo Environmental Association (WBEA)	The mission of the Wood Buffalo Environmental Association is to monitor and provide accurate, credible, transparent and understandable information on air quality and air related environmental impacts in the Regional Municipality of Wood Buffalo.

List of Acronyms

Δs	Change in Hydraulic Head
ΔS	Change in Storage
ug	Microgram
2D	Two-dimensional
3D	Three-dimensional
AAAP	Alberta Aboriginal Apprenticeship Project
AAC	Annual Allowable Cut
AADAC	Alberta Alcohol and Drug Abuse Commission
AADT	Average Annual Daily Traffic Counts
AAFRD	Alberta Agriculture, Food and Rural Development
AAQC	Ambient Air Quality Criterion
AAAQO	Alberta Ambient Air Quality Objectives
ACB	Alberta Cancer Board
ACGIH	American Conference of Governmental Industrial Hygienists
ACS	American Cancer Society
AENV	Alberta Environment
AEP	Alberta Environmental Protection
AGCC	Alberta Ground Cover Classification
AGRASID	Agricultural Region of Alberta Soil Inventory Database
AHU	Air Handling Units
AHW	Alberta Health and Wellness
ALCRC	Alberta Land Conservation and Reclamation Council
ANHIC	Alberta Natural Heritage Information Centre
AOSERP	Alberta Oil Sands Environmental Research Program
APEGGA	Association of Professional Engineers, Geologists and Geophysicists of Alberta
ARET	Accelerated Reduction/Elimination of Toxics
ARIES	Aerosol Research and Inhalation Epidemiology Study
ASIC	Alberta Soil Information Centre
ASIR	Age-Standardized Incidence Rates
ASMR	Age-Standardized Mortality Rates
ASRD	Alberta Sustainable Resource Development
AT&U	Alberta Transportation and Utilities
ATC	Athabasca Tribal Council

ATPRC	Alberta Tourism, Parks, Recreation and Culture
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	All Terrain Vehicle
AVI	Alberta Vegetation Inventory
AWI	Alberta Wetland Inventory
BCF	Bioconcentration Factor
BFW	Boiler Feed Water
BMCL	Benchmark Concentration Level
BMD	Benchmark Dose
bpd	Barrels per Day
BSL	Basic Sound Level
BS&W	Basic Sediments and Water
C&R	Conservation and Reclamation
CAC	Criteria Air Contaminant
Cal EPA	California Office of Environmental Health Hazard Assessment
CANSIM	Canadian Socio-economic Information Management Database (Statistics Canada)
CanSIS	Canadian Soil Information System
CAPP	Canadian Association of Petroleum Producers
CARB	California Air Resources Board
CASA	Clean Air Strategic Alliance
CASAC	Clean Air Scientific Advisory Committee
CATEF	California Air Toxics Emission Factors
CCME	Canadian Council of Ministers of the Environment
CCS	Canadian Cancer Society
CCSN	Climate Change Scenario Network (website http://cccsn.ca)
CDWQ	Canadian Drinking Water Quality Guidelines
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Agency
CEARC	Canadian Environmental Assessment Research Council
CEC	Cation Exchange Capacity
CEMA	Cumulative Effects Management Association
CEPA	Canadian Environmental Protection Agency
CEPA/FPAC	Canadian Environmental Protection Act/Federal-Provincial Advisory Committee
CHRS	Canadian Heritage Rivers System
CIP	Canadian Industrial Paramedics

CNRL	Canadian Natural Resources Ltd.
CNS	Central Nervous System
COPC	Chemicals of Potential Concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPDFN	Chipewyan Prairie Dené First Nation
CPDFN-IRC	Chipewyan Prairie Dené First Nation Industrial Relations Corporation
CPF	Central Processing Facility
CPI	Continuous Process Improvement
CPP	Caribou Protection Plans
CV	Chemical Values
CWE	Cold Water Equivalent
CWS	Canada-Wide Standards
d	Day
dB	Decibel, a measure of Sound Power
dBA	A-weighted Decibels
DBH	Diameter at breast height
DDF	Depth Duration Frequency
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
DNA	Deoxyribonucleic Acid
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DST	Drill Stem Test
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
ELC	Ecological Land Classification
EMR/EMT	Emergency Medical Responder/Emergency Medical Technician
EMS	Emergency Medical Services
EPEA	Alberta's *Environmental Protection and Enhancement Act*
ESA	Environmentally Significant Area
ESAR	East Side Athabasca River (Caribou Range)
ESP	Electrical Submersible Pump
ET	Evapotranspiration
EUB	Alberta Energy and Utilities Board
FCSS	Family and Community Support Services

FEARO	Federal Environmental Assessment Review Office
FGD	Flue Gas Desulphurization
FMA	Forest Management Agreement
FMFN	Fort McMurray No. 468 First Nation
FMFN-IRC	Fort McMurray First Nation Industrial Relations Corporation
FMIS	Alberta Environment Fisheries Management Information System
FMU	Forestry Management Unit
FWKO	Free Water Knock-out
GCM	Global Climate Models
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GLM	Generalized Linear Model
GPS	Global Positioning System
h	Hour
HEC	Human Equivalent Concentration
HEI	Health Effects Institute
HEMP	Human Exposure Monitoring Program
HFAN	High Flash Aromatic Naphtha
HHRA	Human Health Risk Assessment
HLFN	Heart Lake First Nation
HLS	Hot Lime Softeners
HP	High Pressure
HRIA	Historical Resources Impact Assessment
HRMB	Historic Resources Management Branch of Alberta Tourism, Parks, Recreation and Culture
HS&E	Health, Safety and Environment
HSI	Habitat Suitability Index
HU	Habitat Units
i.e.	that is to say, in other words
IARC	International Association for Research on Cancer
IDF	Intensity Duration Frequency
ILCR	Incremental Lifetime Cancer Risk
INAC	Indian and Northern Affairs Canada
IPCC	Intergovernmental Panel on Climate Change

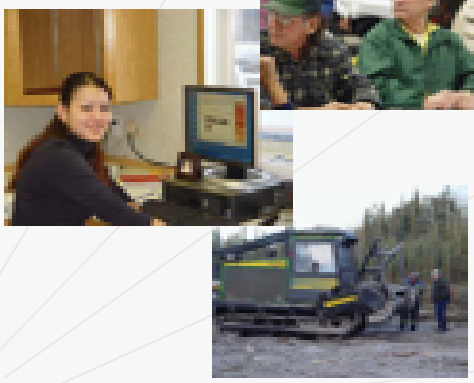
IPCS	International Programme on Chemical Safety (World Health Organization)
IPM	Individual Polycyclic Aromatic Hydrocarbon (PAH) Model
IRIS	Integrated Risk Information System Database
IRC	Industrial Relations Corporation
IRP	Integrated Resource Plan
ISO	International Organization for Standardization
JACOS	Japan Canada Oil Sands Limited
KB	Kelly Bushing
LAI	Leaf Area Index
lb/MMscf	Pounds (lbs) of Containment per Million Standard Cubic Feet (MMscf) of Natural Gas Combusted
LCR	Lifetime Cancer Risk
LDAR	Leak Detection and Repair
LICA	Lakeland Industry and Community Association
LLBRICC	Lac la Biche Regional Industry Consultation Committee
LOAEL	Lowest Observed Adverse Effect Level
LOEL	Lowest Observed Effect Level
LP	Low Pressure
LSA	Local Study Area
LSAS	Land Status Automated System
MA DEP	Massachusetts Department of Environmental Protection
MARP	Measurements, Accounting and Reporting Plan
MIEDM	Manitoba Industry, Economic Development and Mines
MNA	Métis Nation of Alberta
MRL	Minimal Risk Level
MSC	Meteorological Service of Canada
MTU	Miscellaneous Timber Use
NAAF	National Aboriginal Achievement Foundation
NAAQO	National Ambient Air Quality Objective (Health Canada)
NAAQS	National Ambient Air Quality Standards (U.S. EPA)
NCASI	National Council for Air and Stream Improvement, Inc.
NIA	Noise Impact Assessment
NNADAP	National Native Alcohol and Drug Abuse Program
NOAEC	No-Observed-Adverse-Effects Concentration
NOAEL	No-Observed-Adverse-Effects-Level

NO_x	Nitrogen Oxides
NPRI	National Pollutant Registry Information
NRC	United States National Research Council
NRCB	Natural Resources Conservation Board
OBIP	Original Bitumen in Place
OEHHA	California Office of Environmental Health Hazard Assessment
OLM	Ozone Limiting Method
OMOE	Ontario Ministry of the Environment
ORP	Oxidation-Reduction Potential
OSVRC	Oil Sands Vegetation Reclamation Committee
OSWWG	Oil Sands Wetlands Working Group
OTSG	Once Through Steam Generator
PAH	Polycyclic Aromatic Hydrocarbon
PAI	Potential Acidifying Input
PCA	Principal Components Analysis
PDA	Pre-disturbance Assessment
PET	Potential Evapotranspiration
PM	Particulate Matter
PM_{10}	Particles Larger than 2.5 Micrometres (um) but Smaller than 10 um, known as "Coarse" Particles
$PM_{2.5}$	Particles Less than 2.5 Micrometres (<2.5 um), known as "Fine" Particles
POI	Point of Impingement
ppbv	Parts per Billion by Volume
PPC	Plume Path Coefficient
PRIME	Plume Rise Model Enhancements
PSL	Permissible Sound Level
PSL-Day	Permissible Sound Level during the Day, daytime hours are 07:00 – 22:00
PSL-Night	Permissible Sound Level at Night, nighttime hours are 22:00 – 07:00
P-Y	Person Year
QA/QC	Quality Assurance / Quality Control
RAMP	Regional Aquatics Monitoring Program
RCMP	Royal Canadian Mounted Police
REL	Reference Exposure Level
REV	Representative Elementary Volume
RfC	Reference Concentration

RfD	Reference Dose
RFMA	Registered Fur Management Area
RIVM	Netherlands National Institute of Public Health and the Environment
RIWG	Athabasca Regional Issues Working Group
RMWB	Regional Municipality of Wood Buffalo
ROI	Region of Influence
ROW	Right-of-Way
RQ	Risk Quotient
RSA	Regional Study Area
RsC	Risk-Specific Concentration
RsD	Risk-Specific Dose
RSDS	Regional Sustainable Development Strategy
RSF	Resource Selection Function
RSPF	Resource Selection Probability Function
SAGD	Steam Assisted Gravity Drainage
SAOSG	South Athabasca Oil Sands Group
SAR	Species at Risk
SARA	Species at Risk Act
SCA	Soil Correlation Area
SEIA	Socio-Economic Impact Assessment
SI	Suitability Index
SOR	Steam Oil Ratio
SRES	“Special Report on Emissions Scenarios”, produced by the United Nations Intergovernmental Panel on Climate Change
STEL	Short-Term Exposure Limit
SWL	Sound Power Level
TCA	Tolerable Concentration In Air
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TEEM	Terrestrial Environmental Effects Monitoring Program
TEF	Toxic Equivalency Factor
TEK	Traditional Ecological Knowledge
TGR	Theoretical Gypsum Requirement
THC	Total Hydrocarbons
TKN	Total Kjeldahl Nitrogen

TLV	Threshold Limit Value
TMAC	Trace Metal and Air Contaminant
TOC	Total Organic Carbon
TOR	Terms of Reference
TPR	Timber Productivity Rating
TRS	Total Reduced Sulphur
TRV	Toxicological Reference Value
TSS	Total Suspended Solids
TWA	Time Weighted Average
TU	Traditional Use
U.S. DOE	United States Department of Energy
U.S. DOE SCAPA	United States Department of Energy Subcommittee on Consequence Assessment and Protective Actions
U.S. EPA	United States Environmental Protection Agency
U.S. EPA OSW	United States Environmental Protection Agency's Office of Solid Waste
U.S. NRC	United States National Research Council
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
VRU	Vapour Recovery Unit
WAC	Weak Acid Cation
WBEA	Wood Buffalo Environmental Association
WBHDC	Wood Buffalo Housing and Development Corporation
WDS	Alberta Environment Water Data System
WHO	World Health Organization
WLS	Warm Lime Softener
WMM	Whole Mixture Model
WMU	Wildlife Management Units
WSC	Water Survey of Canada
y	Year

REPORT TO THE COMMUNITY, JUNE 2006



NORTH AMERICAN
OIL SANDS CORPORATION

Report to the Community

June 2006

Kai Kos Dehseh

Welcome,

North American Oil Sands Corporation (North American) is a new Canadian company and a new neighbor in your communities. This is our first report card to you about our work with your community.

In the last year hundreds of people contributed to North American's first full season of drilling and seismic operations.

The winter 2005-2006 was a tremendous season of accomplishments and learning for all of us at North American. With a successful delineation drilling and seismic program we can look forward to building our Leismer Demonstration Project. We feel confident in the future of our company.

A significant part of our success arises from the contributions made by members of the local communities near our operations. This past year we had the opportunity to work with community leaders and gain valuable input from Elders. We also had the opportunity to employ many community members, form partnerships with local contractors and partner with community schools.

As we go forward, the best measure of our business success will be the balance of ensuring solid financial return to our shareholders while building strong, trusting partnerships with the communities. Please take the time to provide us with your comments and suggestions. Thank you for your support.

Sincerely,

Pat Carlson
President & CEO
North American Oil Sands Corporation

Question or comments? Please see page 12.
North American Oil Sands Corporation
Toll Free 1-888-Ph-NAOSC (746-2672)

North American Oil Sands Corporation Project Area

This report is one of the ways North American provides open communication about who we are and how we work with the communities surrounding our project area. We are committed to publishing a report to the communities, and to share with you how we are doing each year.

We asked for and reviewed feedback from community representatives and contractors in preparing this report. Although we are pleased with this year's accomplishments, we are also aware that we can improve in many areas. We will continue to use the feedback we receive from you, members of the community, to help us continue to improve as our company grows.

North American formed as a company in 2002, but the winter of 2005–2006 was our first full season of field operations. Our field operations this past year included drilling and seismic programs. A significant amount of engineering and environmental work will help us determine how the company will grow in the future.

It takes many people to run an oil sands company. In the fall of 2004, there were only two employees and several contractors. Now we have over 40 employees with many more people working with us on a contract basis. We feel fortunate to be able to assemble a team with exceptional experience in all aspects of the oil sands business.

Elders' Naming Ceremony

When we began acquiring our first mineral leases in 2004, we knew the land was very special to the Aboriginal people. We appreciate the role of Elders in the communities, and North American was honored to have a group of Elders name our project.

On January 18, 2006, a group of Chipewyan Dene Elders and community representatives gathered at North American Oil Sands Corporation's Calgary office for a naming ceremony. The Elders gave the name Kai Kos Dehseh to our project. We view this as a great honour.

Red Willow River (or Kai Kos Dehseh) is the Chipewyan Dene name for the river commonly known as the Christina River. Since their childhoods, the Elders remember that the red willow trees have always grown thick with branches overflowing the banks of the river. In August each year, the red willows produce white berries providing rich nourishment to the animals of the region. One Elder shared with us that he always anticipates seeing a bear on the shore feeding on the berries as his canoe turns the next corner.

To be part of the naming ceremony tradition was an incredibly rewarding and meaningful experience for all North American employees.

Fast Facts - About North American

- A Canadian company formed in 2002 with the head office in Calgary, Alberta.
- An integrated oils sands company using SAGD* technology and bitumen upgrading.
- Major shareholders are Arc Financial Corporation, Ontario Teachers' Pension Plan Board and Paramount Energy Ltd.
- Company currently holds nearly 10 townships of oil sands leases between Highways 881 and 63 in the counties of Bighorn and Lake land.
- Four areas are believed to have bitumen resources: Leismer, Corner, Hangingstone and Thornbury.
- Currently planning first 10, 000 barrels/day* demonstration plant at Leismer for start-up in 2008.
- Potential for 165,000 barrels/day being produced in the next decade.

North American staff with Elders and community representatives

From an Elder point of view, North American is the first company to approach our community and wait to listen to what kind of advice and thoughts we as an Elder group had to give them.

The highlight for our Elder Group was the Naming Ceremony in Calgary. It was a great experience to have a company care enough about the meaning of our language and be honored by the meaning of our culture. By having our language and name sincerely valued by people outside of our community, our community was strengthened a little more.

Being a new company, they did a good job of providing some employment and training opportunities to our communities. I know they are open to more ways to provide local employment and training in the next year.

Henry Herman, Chipewyan Prairie Dene Elder, Chard

Elders tour Calgary after naming ceremony

2005 – 2006 Winter Drilling Program

In early 2005, we began planning for the 2005–2006 winter season. A small team of North American representatives began the important process of meeting with local communities and trappers, and engaging local businesses in employment opportunities. At the same time, we leased drilling rigs, planned seismic operations, trained contractors, started the Caribou Protection Plans and secured government approvals to drill delineation* wells - the list was long and the planning was extensive.

We are using seismic and delineation drilling to determine where and how much oil is present on the mineral leases that we own. These operations must occur when the ground is frozen, and are strictly controlled by the Alberta government due to the sensitive nature of the boreal forest and the presence of caribou, moose and other wildlife.

Preparation for the drilling season began in late November 2005, when PTI Camp Services moved North American's 340-man camp to a location 18 kilometers N.W. of Conklin at the intersection of the Waddel and Goose Roads. While we wanted to begin the drilling and seismic programs in early December, mild weather significantly delayed operations. The surveyors were able to begin locating some seismic lines, wells and winter access roads in December, but the ground did not freeze until early January. The drilling rigs and other heavy equipment could not be moved onto the winter roads and leases until mid January.

The drilling program started January 12, 2006. Ten different drilling contractors and 13 rigs drilled 121 delineation wells between January 12 and March 23. Each of the wells was drilled to a depth of approximately 500 meters. We had plans to drill 150 wells, but the late start did not allow us to achieve our goal.

*see Glossary on page 12.

Area	Corner	Leismer	Hangingstone	South Leismer	Thornbury
# Wells Drilled	50	50	9	10	2

It was extremely gratifying that we were able to accomplish a drilling program of this size. In the end, there were only minimal and minor incidents. This is a real accomplishment and the management, field supervisors and our contractors team deserves credit for putting safety first.

Lorne Cannon, Vice President, Operations

Delineation drilling at Leismer

Winter 2005-2006 Seismic Program Completed

While the drilling was proceeding, we undertook extensive 2D and 3D seismic programs between December and March. In total, we completed 245 kilometers of 2D seismic and 24 square miles of 3D seismic. We used new and low impact seismic practices that minimized disturbance to the boreal forest and also produced excellent technical results. These seismic methods reduced our environmental impact on the land by 27% as compared with dynamite surveys. The seismic programs were supported by two 80-person camps located in the area.

We are extremely pleased with the results from our seismic program for this year. Our focus was on using the most advanced technology and devising progressive planning methods to greatly reduce disturbance to the environment and achieve better cost efficiency.

The challenge this year, as it is every year, is to get an appropriate amount of work done for an acceptable risk rate in very sensitive environments with very tight weather-determined timelines. We succeeded – the data produced by the seismic is the best quality data I have seen in my career in geology.

Mike Watson, Vice President, Geology

Seismic Method	North American Operation Areas			
	Leismer	Corner	Hanging-stone	Thornbury
2 Dimensional	94.5 km	0	24.85 km	126 km
3 Dimensional	10.2 sections	9.02 sections	4.73 sections	0

Road and Lease Construction

To support all of these activities, we surveyed and constructed winter roads to access all drilling and seismic locations. We were careful to locate as many of our roads and wells as possible on existing disturbed areas. We also used snow making equipment to build temporary winter bridges over streams and rivers in several locations. Over 85% of our 250 kilometers of access roads followed existing cutlines and roads. As a result we built only 37 kilometers of new winter roads. Ten water trucks worked continuously freezing roads and well sites to ensure that the equipment could work without damaging the wetlands and boreal forest. LaRock Contracting, a local company, was one of the contractors that worked to keep North American roads and well sites frozen throughout the winter.

We created our company, called LaRock Contracting, in October of 2005, then purchased a new water truck and shortly after began our water truck contract with North American Oil Sands. We were able to expand our contract by providing ATV and truck rentals to their crews.

North American Oil Sands was very good to work with and it has been a really good opportunity for us to establish our own company. Our company provided several driving jobs to local Aboriginal men, and it was handy being able to work close to home. We are all looking forward to another drilling season with North American Oil Sands.

Audrey and Harvey LaRouque,

Aerial picture of camp

Jacene Piche, an office assistant in our field office, started working with North American in January 2006.

Working in the North American Oil Sands Field Office was my first camp job and I have learned a lot about office work, databases, camp operations and all about drilling and construction. Working with Arlene and Laureen has been fun and a good experience. I would like to be able to work with them and North American again next year.

Jacene Piche, Office Assistant, North American Field Office

Jacene Piche at the North American Field Office

It seemed to me that all the contractors our office worked with in the field worked well as a team; everyone tried their best. We all see quite a few areas where we can make changes to improve for next year, and I know North American Oil Sands is planning to meet with us all in Calgary to make sure this happens.

Working with Jacene was just great, she is a very smart young lady. As soon as she started it was amazing to see how fast she learned; she does her work accurately. We are looking forward to working together next year.

Arlene Dahl, Field Office Manager

Fast Facts – 2005-2006 Operations

- 340-man camp moved and located 18km NW of Conklin in November 2005.
- 1300 different workers given safety orientation for North American's operations.
- Completed 245 km of 2D and 24 sections of 3D seismic by March.
- Drilled 121 wells.
- Full-time safety professionals, a paramedic and emergency technicians managed the safety of all North American workers.
- No lost-time accidents during the entire winter program.
- 51 minor incidents reported – excellent and open safety reporting of these incidents.
- Security and communication procedures implemented on the Goose Road to ensure safety.
- Spent $71M this winter for all drilling, seismic, environmental and safety services.
- Significant local participation in business and employment, $13 million in total.

Safety

Working with North American Oil Sands gave my company the opportunity to expand into providing security management services.

I was able to employ four people from this area. It was a lot of responsibility keeping track of every vehicle on the Goose Road for every kilometer – I am impressed with their good work. They were all well paid – I believe that people who work well deserve to be paid well.

Overall everything was really good working with North American. There were several concerns throughout the season but seemed to be adequately addressed right away.

Margaret Quintal, Owner, Quintal Contracting, Conklin

We completed our winter programs with no serious injuries and no lost-time accidents. We started planning six months in advance and doing so proved critical. The fact that North American hired a full-time paramedic to be stationed at the main camp benefited not only our crews, but also crews from other companies and local people. We believe the paramedic at the North American camp was the only one between Lac La Biche and Fort McMurray.

North American and Quintal Contracting of Conklin formed a great partnership. Quintal Contracting supplied high quality security services to manage the Goose Road. This single lane ice road with many sharp corners and hills required strict 24 hour monitoring of every vehicle for every kilometer traveled on the 20 km road to prevent accidents. In the three months this road was operational, there were 16,000 round trips made by North American crews. There were four minor incidents.

Going into the program we knew that winter driving/vehicle safety and particularly the Goose Road was our number one safety risk and concern. We are extremely pleased with the work that Quintal Contracting did for North American.

Tony Wentworth, President,
Tall Rig International, North American Safety Consultant

Training, Employment and Local Business Expenditures

We are committed to working with local contractors and to employing as many local people in our operations as practical. As a company with plans to be in your community for many years, we are seeking ways to work with local individuals, groups and organizations to build sustainable partnerships. As the company grows, we want local businesses and communities to grow and prosper with us.

Local Business Expenditures

In 2005-2006, North American spent $71 million on the winter drilling, seismic environmental and safety programs.

This past season, we spent over $13M and partnered with over 60 businesses and contractors local to the seven neighboring communities between Lac La Biche and Fort McMurray.

The table below reviews how much we spent locally.

Program	*Amount of Program Spent in Community*
Drilling	$10.3 M
Seismic	$2.2 M
Environment	$0.8 M
Total	**$13.3 M**

We initially anticipated receiving somewhat more local applications and contract bids for work. It was an extremely busy year for all local contractors, and the fact that we are a new company meant some local contractors may not have known about opportunities to work with North American. Through this report and upcoming community open houses we will continue to advertise contract opportunities with North American.

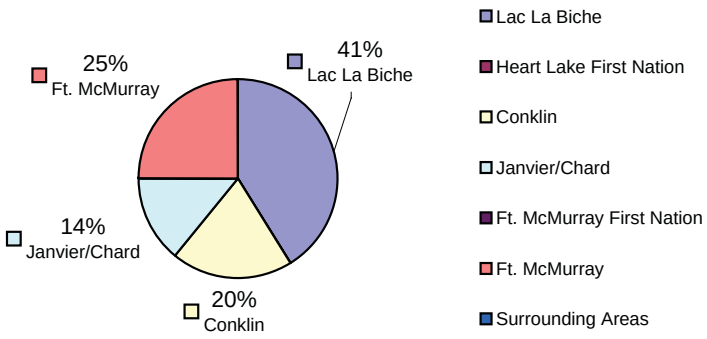
Drilling/Construction Expenditures

About 22% ($10.3 M) of all North American Drilling Program work contracts were completed by local businesses and individuals.

Most of the local contractors helped construct leases, mulch road and well sites. They also worked to freeze roads/well-sites and helped build ice bridges. Some provided water and other services to the drilling rigs.

The table below shows which communities were involved.

Drilling Program - Percent of Local Contracts Per Community

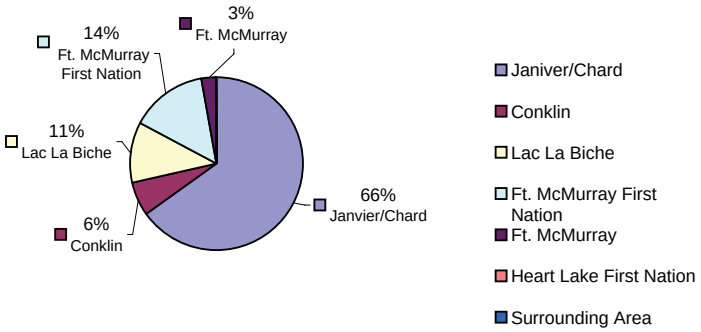


We were pleased to contract an Akita Drilling rig. For many years Akita Drilling has held strong employment and rig ownership partnerships with Aboriginal communities in Alberta. We are pursuing more involvement with Akita Drilling and other drilling contractors with similar Aboriginal ties for our future drilling program.

Seismic Expenditures

Approximately 9% ($1.3 MM) of the seismic program work was completed by local businesses. The table below offers contract details.

Seismic Program - Percent of Local Contracts Per Community



Environmental Expenditures

We rely on many local individuals and businesses to successfully complete the environmental work for regulatory approvals. Last year over $800,000 was spent locally. We have employed local people, including Elders, as field assistants and guides. We have stayed in the community at Karen's Corner and the Christina Lake Lodge, and have used local providers for rental equipment such as trucks, Argos and quads. Our consultants purchased food and gas supplies in the region and used a local helicopter company to access our sites.

This past winter, as the manager of Bill's General Contracting in Conklin, I worked with North American by providing slashing and clearing crews to prepare North American leases, seismic lines and roads. Throughout the fall and winter almost all the guys on the crews were from the community.

I heard about North American as a new company last summer and then met them in late August at the Open House they had here in our community of Conklin. They told me that even though North American had already awarded main contracts for the upcoming drilling season, there would be work for our local crews.

One of our company goals is to train the local guys to be equipment operators so there will be a strong base of operators in the community in the coming years. We are looking to expand our contracting to include heavy equipment and look forward to seeing North American's contracts early so we can place bids for them.

George Quintal, Manager, Bill's General Contracting, Conklin, Alberta

Training

We identified early that offering training and employment to people living in our Kai Kos Dehseh project area is a top priority for us.

Drilling Rig Training and Employment

In October 2005 we decided to offer drilling rig training and employment to local Aboriginals for eight leasehand positions on drilling rigs contracted by North American.

- Four individuals committed to the requirements for this training and the employment opportunity.
- Between December 17 and 23 all four individuals successfully completed training at Enform in Nisku, Alberta.
- Two leasehands started work on January 8 for Akita Drilling. One individual completed one rotation and one individual completed 80% of the full season.
- One leasehand started with SDS Drilling on January 10 and completed the full season.

From interviewing several individuals in the leasehand training and employment program, we learned that our late start did not allow us to fill all eight spots we had reserved. Next year we will begin recruiting for the program much earlier.

Slasher Training

On December 14, North American funded eight local people for chainsaw training, First Aid, WHIMIS*, TDG*, H2S Alive* and ATV* training as well as incident accident investigation training.

Wildlife Orienteer

The training and learning opportunities were shared by the biologist team working in the boreal forest for the first time and the local people working as wildlife orienteers. The local wildlife orienteers filled the critical role of teaching the biologist team about the land, animals, plants and weather patterns. As they worked together, the biologists taught the wildlife orienteers how to use GPS and the scientific processes involved in wildlife studies. North American hopes the orienteers and biologist team will continue to build on these working relationships for wildlife study next year.

Gary Cardinal with Akita Drilling

Once I started working on Akita 3, I was very glad for all the hands-on experience during the leasehand training in Nisku. I wouldn't have known how to get around the rig and how to start without this training. It is a huge advantage having this training. If you are new on a rig without training, it is a liability to the crew.

The support from North American throughout training and the start of my job was great. One challenge was waiting for the drilling season to start. Once North American offered this training and employment to me I was committed to doing this and could not take any other job offers, but since drilling started real late it was difficult to plan for.

Akita Drilling was great to work for. The crew I worked with was good at showing me the ropes. Our rig and crew worked fast so we moved to a new location every second or third day. I have always wanted the experience of working on a drilling rig. I am glad for this opportunity; it was just a great experience for me.

Gary Cardinal, Leasehand, Lac La Biche

* See glossary page 12.

Future Training

We need to build training programs that suit both the needs of the company and the communities. Last summer, we met with representatives of Portage College in Lac La Biche. We see great potential within the next three years to work with Portage College to provide specific training programs for the employment positions needed to be filled in the company's long-term operational facilities in N.E. Alberta.

Environmental Stewardship

Troy Janvier gill netting

We have been carrying out environmental studies since the summer of 2005 and are now preparing an Environmental Impact Assessment (EIA) that will be submitted to the Government of Alberta for commercial development of our Kai Kos Dehseh project.

Our EIA is different from most, since we are disclosing all of our plans for Kai Kos Dehseh for the next 15 years. This allows all communities to have a long-term view of our company's plans.

Conan Janvier, wildlife study orienteer

All of North American's environmental field programs in the past year were conducted with the valuable assistance of local community members. Sixteen assistants from the communities of Conklin, Janvier/Chard and Anzac, including several Elders, participated in our environmental field programs.

Traditional ecological knowledge and scientific knowledge were shared with the local community members and the field scientists.

Our environmental work will focus on the commonly held priorities we have learned about in discussions with the communities:

- Status of wildlife, including health and population
- Water quality and use
- Minimizing land impact

In the spring of 2006, we initiated a partnership with Cynthia Quintal, a young artist from Conklin, Alberta. She provided North American with outstanding sketches of local animals and plants. The artwork created by Cynthia is featured on the inside back cover of this report and in North American's "Environmental Report to the Community."

Community Engagement Processes

North American President & CEO Pat Carlson(left) at a community meeting

Open Houses & Meetings

The first and most important step in building a project is becoming a member of the community in which we work. We recognize the importance of learning about the unique setting, culture and history of each community. We will continue to involve the local communities in meaningful ways to build mutually beneficial relationships.

Fast Facts – Community Meetings

- There are seven communities surrounding Kai Kos Dehseh: Conklin, Janvier/Chard, Anzac, Fort McMurray First Nation, Heart Lake First Nation, Lac La Biche and Fort McMurray.
- Three major community meetings were held during the late summer of 2005 about our business plans for the year.
  - Conklin, August 31, 2005, about 80 people attended
  - Lac La Biche, September 14, 2005, about 45 people attended
  - Janvier/Chard, November 9, 2005, organized for all industry to meet with Elders and youth
- Our representatives have held over 55 meetings since January 2005 with community and business leaders from the seven local communities surrounding Kai Kos Dehseh.
- During 2005, we focused on the communities that are closest to our operations: Janvier/Chard and Conklin.
- Consultations were held with the Chipewyan Prairie Dene First Nation IRC designated Elder group to North American. Our designated Elders group consists of Jean Pat Cardinal, Alma Nokohoo, Jeremy Janvier, Johnny Lemaigre, Henry Herman, Pauline LaRocque. We met with the Elder group November 9, 2005, December 13, 2005, January 18, 2006 at the project naming ceremony and on June 1, 2006 in Janvier.

In these meetings we learned that community members want the ability to gain contracts and economic opportunities from North American's upcoming projects. There was an opportunity for us to assure the community members that our goal is to contract as many local contractors as possible. Several community members brought forward concerns regarding the water quality and the health of wildlife, particularly moose.

Trapper Engagement

There are nine trapping areas within our oil leases. Five are in Leismer area, two in Corner, one in Hangingstone and one in Thornbury.

Trap line 2318	Leismer
Trap line 1523	Leismer
Trap line 1659	Leismer
Trap line 1474	Leismer
Trap line 1569	South Leismer
Trap line 2097	Hangingstone
Trap line 2675	Corner
Trap line 2751	Corner
Trap line 1303	Thornbury

Since 2004, North American has been in contact with all nine trappers.
Prior to each drilling season, they are given a package of material explaining all the activity that will occur on their trap lines. In all cases we organized face-to-face meetings with the trappers to gain a better understanding of the area and attempt to minimize our impact. This consultation has been successful in resolving most issues. Even with significant effort, North American has not been successful in dealing with one trapper. He is objecting to all oil and gas activity on his trap line, a line that has been in his family for five generations.

While we continue to try and resolve issues directly with him, we have had to rely on the EUB's non-routine well licensing process. We understand the environmental and traditional value of this area to local people and will continue to work with all trappers and community members in the region to resolve issues the best way we can.

Community Investment

Fast Facts: Community Sponsorship

In the last 10 months we supported and sponsored the following initiatives:

- Donation toward the purchase of a van to be used by the Training In Motion Program and Janvier/Chard community use.
- Office Color Laser Printer for Teacher Staff use at Conklin Community School.
- Co-sponsored a Christmas community dinner in Conklin.
- Sponsorship of the Ascent of the Aboriginal Spirit Expeditions inspirational and educational presentations to Anzac Community School, Chipewyan Dene Prairie High School, Keyano College Students, Father Perin School and Conklin Community School.
- Sponsorship of the Training-In-Motion Safety Award at the Graduation Ceremony, Janvier/Chard.
- Sponsorship of the Hospitality Tent at the Winter Speed Festival in Lac La Biche.
- Sponsored a Youth Artwork Initiative, Conklin.
- Development sponsorship to Kak Ki Yaw Cultural Camp, Lac La Biche.
- Sponsored North East Alberta Natural Resource education Society Fundraising Dinner, Lac La Biche.

Community & School Sponsorship

A significant portion of financial resources funding North American are investments from the Ontario Teachers' Pension Fund. North American believes this investment symbolizes an important foundation of any community - the exchange between teachers and students in the process of education.

The schools in each community hold the very heart of the community – the young people. It is our goal as a company to support education in each community. Each year we will support initiatives that contribute to the teachers' and students' ability to teach and learn. In the future we look forward to discussing with local schools initiatives that encourage the positive path of education.

Wendy and Laurie with students at Father Perin School, Chard

North American has been extremely supportive of our school needs. We did not even know about North American as a company. They came to us to ask how they can support the school. From initial discussions before the school year started in September, we determined that a color laser office printer for the teachers' and staff's administrative needs would be forthcoming. Upgrading equipment in the school is always an ongoing need for us, and this color laser printer has been put to great use by the teaching staff and has also been used by the students for special projects.

Then in February when North American sponsored the Ascent of the Aboriginal Spirit Expeditions Team mountain climbers as a speaker presentation, the students were enthralled with seeing real people who have these kinds of adventures around the world. We feel it is so important for the students to know that there are many ways to attain goals, that the sky really is the limit and to see a view of the world beyond what we are used to here. The mountain climbers, Laurie and Wendy, were excellent speakers. It was quite a positive experience for the students to see how they have achieved their goals and dreams.

Again, North American took the initiative to offer this presentation opportunity to us as a school. This kind of support from a company really helps support our jobs as teachers and makes sure the school meets the education needs of the community. North American has provided our school and Aboriginal initiatives with tremendous support.

Mr. Walsh, Principal, Conklin Community School

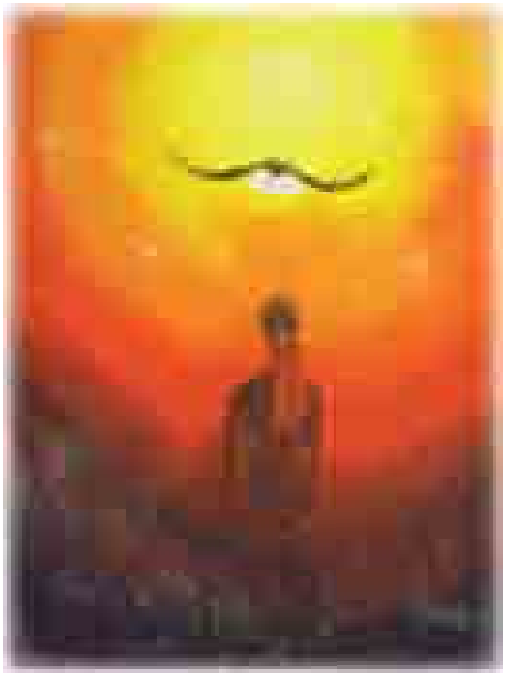
The presentations given by Wendy and Laurie were well received and really enjoyed by students and staff. Since the mountain climbers presentation, I and many of the other teachers agree that it is important for our students to see other people achieving their dreams, and for the students to know that difficult circumstances now in their lives does not mean they cannot have a goal and achieve a dream. Wendy and Laurie are living proof of this to the students.

I believe the students can identify much more with Wendy and Laurie because they are both Aboriginal and because they were so open and realistic about the difficulties in their childhoods and how they have overcome these obstacles. This has been one of the best presentations to come to our school.

Our staff believes the positive impact of such opportunities would be greatly increased if these inspirational individuals could return on a yearly, or more, regular basis to continue to connect with the students and inspire their imagination, goals and dreams.

Randy Chernipeski, Principal, Father Perin School, Chard

Metis Nation of Alberta office



Leonard Janvier's painting and poem reside at the entrance of North American's office in Calgary.

Ancestor Spirit Shadows

Follow the path of your ancestors
try to recognize your past
and live for the moment,
Respect the future.
For the great spirit watches
your every movement.

When you are down and feeling beat
don't stay there too long.
"Get up"
Reach deep and reach for the sky,
therefore thank the creator.
Stand and look at your shadow beside you.

As long as you see your shadow
it is a great day.

The day you don't see your shadow
any longer is the day you do not exist,
and there will be no tomorrow.

Thank the great spirit for this wonderful day,
Ask to see tomorrow.
For tomorrow may never come.

Someday you will answer the creator.
When the creator asks you,
"Why"
What would you say?

Future Plans

Leismer Demonstration Project

Data produced in this past drilling and seismic season provides us with ample information to move forward with the Leismer 10,000 barrel/day project application. We filed the application with the EUB* to build this SAGD production facility in May 2006. Our scheduled plans, subject to EUB approval, for building the facility began in the winter of 2006 with the construction of the initial road to the facility site. During the winter of 2006-2007, we will finish our engineering and planning then apply in late spring 2007 for a 165,000 barrel/day commercial project covering many of the lands in our lease area.

Drilling and Seismic Programs

In the winter of 2006-2007 North American plans to continue delineation drilling and seismic exploration at Kai Kos Dehseh. The company hopes to drill about 175 wells and carry out 250 km of 2D and 25 square miles of 3D (25 sections) of seismic.

Upcoming Employment & Contract Opportunities

	Summer 2006	**Fall 2006**	**Winter 2006/2007**
Contract Bids		• slashing and clearing • road construction	• water trucks • slashing and clearing • lease building • central plant site leveling • drilling pad construction
Individual Employment	• field assistants, environmental studies	• field assistants, environmental studies • drilling rig-mat construction	• equipment operating • orienteer positions for wildlife studies • drilling rig leasehand positions • EMR Positions • Safety Advisors • Seismic support work

*see Glossary on page 12.

Glossary:

Barrels/Day:
Measurement used to measure amount of oil production. One barrel contains 35 gallons.

Delineation drilling:
Strategic drilling process used to find and outline oil resource areas.

SAGD:
Steam Assisted Gravity Drainage, method used to extract oil from oilsands.

EUB:
Energy & Utilities Board, industry regulatory governing body for Alberta Government.

ATV:
All terrain vehicle, course certification.

WHIMIS:
Workplace Hazardous Materials Information System, course certification.

TDG:
Transportation of Dangerous Goods, course certification.

H_2S Alive:
Hydrogen Sulphide training and certification.

Canadian Industrial Paramedics at work for North American

Special thanks to the following people (in alphabetical order) for their contributions to this report:

Wendy Bigcharles, Report Coordinator
Liane Medwick, Report Design & Production
Barry Worbets, Report Editor

Tracey Ball
Lorne Cannon
Randy Chernipeski
Arlene Dahl
Henry Herman
Conan Janvier
Harvey & Audrey LaRocque
Laureen LeClerc
Alex McGillivray
Everett Normandeau
Jacene Piche
Walter Quinn
Cynthia Quintal
George Quintal
Margaret Quintal
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Mike Watson
Tony Wentworth

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About the Artist...

This past Spring 2006, North American initiated a partnership with Cynthia Quintal, an artist from Conklin, A.B. Cynthia provided North American with outstanding sketches of local animals and plants.

She created five pencil sketches of a baby lynx, black bear cub, moose, wolf, and tiger lily. Each of these animals and the tiger lily are local species to the area around her home community of Conklin. Creating artwork, including oil paints, has been a passion of Cynthia's for a long time but, she says, "I always give my artwork away." Many other people who know Cynthia also confirm she is known to gift her artwork to family and friends. When showing North American the pencil sketches, she explained, "I am really proud of the baby lynx, it took extra time and effort and it is my favorite piece."

Cynthia is currently a Grade 11 student at the Father Mercredi High School in Fort McMurray.

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ENVIRONMENTAL REPORT TO THE COMMUNITY, JUNE 2006

NORTH AMERICAN
OIL SANDS CORPORATION

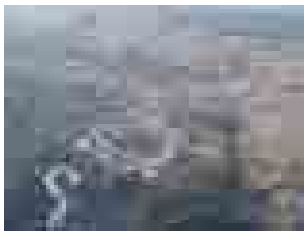
Environmental Report to the Community

June 2006

Kal Kos Dehseh

Foreword

North American Oil Sands Corporation (North American) is a new Canadian company and a new neighbor in your communities. This is our first report card to you about our environmental work near your community.



In the last year hundreds of people contributed to North American's first full season of drilling and seismic operations and environmental studies.

The winter 2005-2006 was a tremendous season of accomplishments and learning for all of us at North American. With a successful delineation drilling and seismic program we can look forward to building our Leismer Demonstration Project. We feel confident in the future of our company.

A significant part of our success arises from the contributions made by members of the local communities near our operations. This past year we had the opportunity to work with community leaders and to gain valuable input from Elders. We also had the opportunity to employ many community members, form partnerships with local contractors and partner with community schools.

Establishing open communication and trustworthy partnerships between local communities and North American forms the cornerstone to environmental stewardship throughout the life of our project. We are committed to conducting our business operations in ways that have the least impact on the environment. We want to ensure the integrity of the land for generations to come.

We hope our report answers any questions you may have and provides the information you need.

Sincerely,

Pat Carlson
President & CEO
North American Oil Sands Corporation

Introduction & Welcome

Writing this report is one of the ways North American opens communication about who we are and how we are working with the communities surrounding our project area. We will publish a "Report to the Community," and share with you how we are doing each year.

To prepare this report, North American gained feedback from some of the local people and contractors we partnered with in the past year. Although we are confident in this year's accomplishments, we are also aware we can improve in many areas next year. The feedback we continue to get from our partners and you, the community members, will help North American continue to improve as our company grows.

From discussions with your communities, we understand that your communities are most concerned about the well being of local wildlife, water, and the increasing level of activity on some of the traditional-use lands surrounding the community. Input from local communities has helped develop our environmental programs. Community participation will continue to be important to North American in meeting our goal of engaging in meaningful and truly beneficial projects for the local communities.

North American's environmental work will focus on the common priorities we have heard in discussions with the communities:

- The status of wildlife, including health and populations
- Quality and quantity of water
- Minimizing land impact

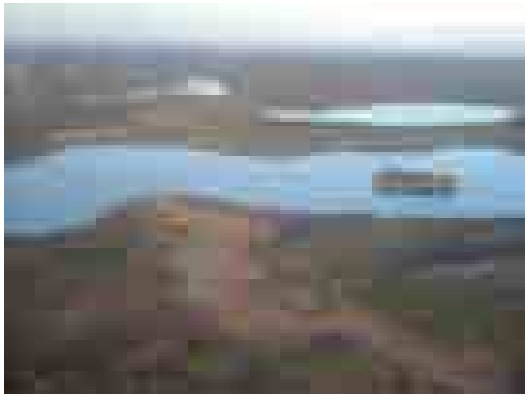
Cynthia Quintal, pencil sketch, April 2006

Environmental Assessments

We are pleased to share with you the North American "Report to the Community" for the Kai Kos Dehseh Project. In this section, we will introduce you to the environmental assessment process, the fieldwork that was conducted in the last year and the additional work planned for the coming year.

North American needs to work closely with communities near our oil sands leases to ensure we continuously practice good environmental stewardship. All of our activities need to respect the traditional and environmental values of the region. It has been a privilege meeting and working with the people of this area.

Barry Worbets, Senior Advisor, Aboriginal Affairs, Safety & Environment



Aerial view of Kai Kos Dehseh from helicopter

What Are Environmental Impact Assessments?

Environmental Impact Assessments (EIAs) are reports required by the Government of Alberta. They provide an evaluation of the environmental and social impacts of a proposed project.

Fast Facts

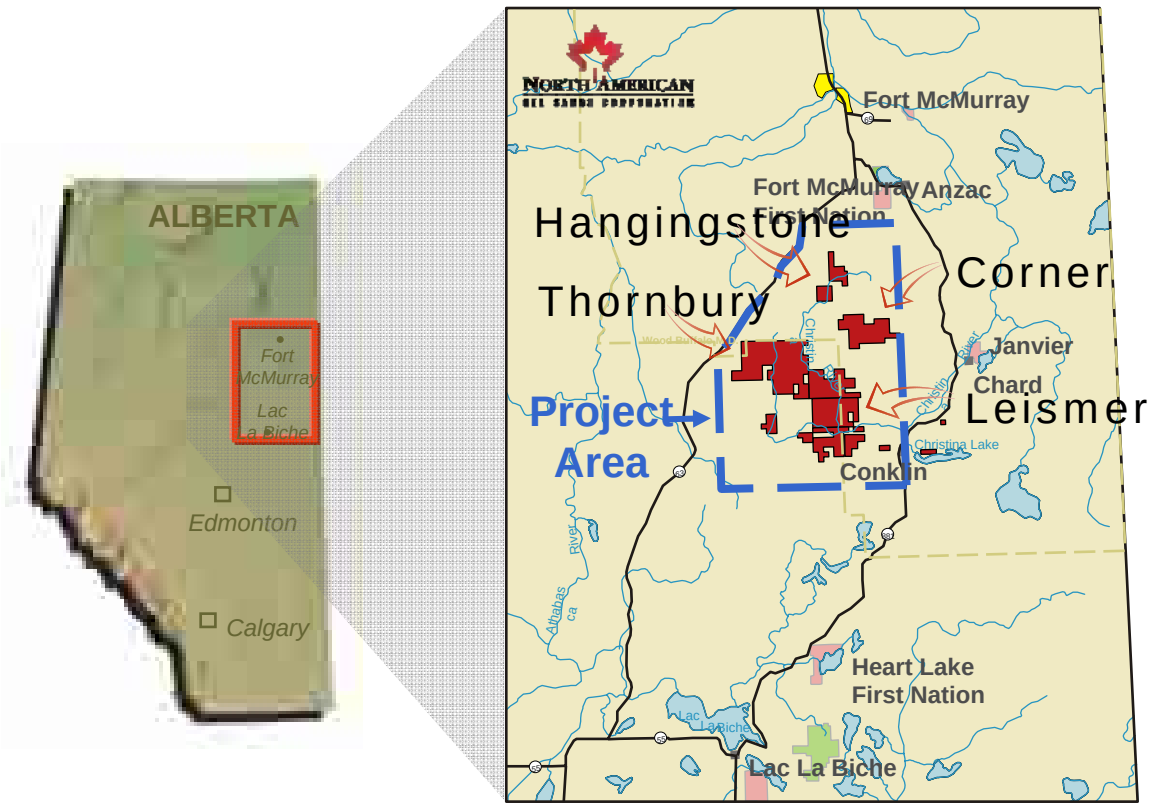
The North American Kai Kos Dehseh* Project EIA report will include:

- A description of the Kai Kos Dehseh Project, including the type and size of all activities that are planned.
- A description of the environmental, social and cultural setting.
- The potential positive and negative environmental, health, social, economic and cultural impacts of the proposed project.
- The companion plans to lessen impacts and respond to emergencies.
- Information on community consultation and actions taken to resolve concerns.

(Adapted from the Alberta Environmental Assessment Process, 2004.)

*On January 18, 2006, a group of Chipewan Dene Elders honored North American by naming our project area Kai Kos Dehseh. Red Willow River (Kai Kos Dehseh) is the Chipewan Dene name for the river commonly known as the Christina River.

North American Oil Sands Kai Kos Dehseh Project Area



Topics Covered in the EIA

Sixteen topics will be covered in the Kai Kos Dehseh Project EIA. Work for some EIA topics was done in the office and in consultation with local communities while other work required field investigation. The field data is an important part of the EIA and is begun early in the planning stages of the project.

Information about current conditions (baseline) in the Kai Kos Dehseh Project area is being collected through a variety of field programs. This field information will be used by North American to understand the unique aspects of the Kai Kos Dehseh Project area. We will incorporate this understanding in our project plan. Our goal is environmental stewardship.

Field and Office Programs	Soils and Terrain, Vegetation and Wetlands, Wildlife, Surface Water Quality, Fish and Fish Habitat, Archeology
Office and Consultation Programs	Public Consultation, Traditional Land Use, Traditional Environmental Knowledge, Air, Noise, Hydrogeology, Biodiversity, Social, Economic, Human Health

Kai Kos Dehseh

Public Consultation

The focus of the Kai Kos Dehseh Project EIA report was developed with input from local communities and other stakeholders. Once complete, the report will be available to anyone who requests a copy of it.

North American has disclosed the whole Kai Kos Dehseh Project, not just the first phase. This allows local communities to have real input into North American's environmental assessment process and operations, now and in the future

Phil Ullman, President & CEO, Matrix Solutions Inc.

"Last year I worked on three different studies with North American. Working with Matrix and North American has been good. The Matrix biologist group are really good people. When I work with the biologist I look at things in my own way as I know the land and animals and then share this information with them.

I am most concerned about the animals, because there seems to be less and less of them, especially the birds and frogs I have noticed. Hopefully the studies can turn into actions to do something to help the animals. I look forward to seeing North American's report on all the environment work they have done."

Russell Tremblay, Conklin

Field Studies

During the past year, field studies in the Kai Kos Dehseh Project area have been completed for wildlife, soils, vegetation and aquatics. The aquatics component includes evaluations for fish and fish habitat as well as surface water quality. These two studies were done at the same time. A description of the field programs, the involvement of the local community members and the learnings from them are described in the following sections.

Who Did the Field Studies?

North American hired Matrix Solutions Inc. to conduct and manage the field studies required for the Kai Kos Dehseh Project EIA. The folks at Matrix have extensive experience in the boreal forest of Alberta and bring that expertise to this project.

Vegetation field crew, June 2005

DID YOU KNOW?

All of the North American field programs in the past year were conducted with the valuable assistance of local community members. Sixteen assistants, including several Elders, participated in the field programs.

When Field Studies Occur

Some of the field programs had to be completed within specific time frames. For example, the aquatics surveys followed the four seasons of spring, summer, fall and winter. The two rare plant surveys, which are required by the Government of Alberta, had to be done in early and late summer, typically late June and early August.

Wildlife programs are dependent on the species that is being surveyed as each species has its own survey 'window' or time in which the survey must occur. Other field programs like the soil survey do not have such tight time restrictions. The soil survey must be done when the ground is not frozen.

Setting gill nets

Winter environmental field crew

Field Studies That Have Been Done

Summer 2005	**Fall 2005**	**Winter 2006**	**Spring 2006**
Fish and Fish Habitat	Fish and Fish Habitat	Fish and Fish Habitat	Fish and Fish Habitat
Surface Water Quality	Surface Water Quality	Surface Water Quality	Surface Water Quality
Vegetation; Early and Late Summer Rare Plants	Soils	Wildlife	

Wildlife Field Studies

North American will be monitoring the numbers, distribution and health of moose, caribou and wolf within the Kai Kos Dehseh Project area. Monitoring changes over time in numbers, distribution and health of moose and caribou, which are two very different, large prey species, along with the wolf, their main predator (aside from humans), will provide an excellent impact assessment of Kai Kos Dehseh Project activities in the area.

North American is very excited about the wildlife surveys as we have chosen to use a unique and less invasive way to study the animals, rather than common methods such as collaring or aerial surveys. The wildlife studies use specially trained dogs that can detect scat from different animals at distances over 500 metres away.

These same dogs are used to detect drugs at international airports around the world. Scat is the most available animal product in the wilderness, and detection dogs provide a highly effective means of locating those samples.

This scat collection approach has been used successfully around the world to show animal health and populations. From January 16 to March 15, 2006, three teams consisting of a detection dog and two people – a dog handler from the University of Washington (Seattle) and an Aboriginal orienteer – collected 1200 scat samples from moose (515 samples), wolf (90 samples) and caribou (675 samples). These samples are currently being analyzed to identify the individual animal and to evaluate its health. The scat collection studies on each of these animals are not only the first in the boreal forest but also the first in all of Canada.

Cynthia Quintal, pencil sketch, April 2006

Role of the Orienteers

Aboriginal orienteers acted as guides and scouts in the Kai Kos Dehseh Project area. They ensured the dog and dog handler got into the selected areas and avoided any hazards the deep snow might hide. The orienteers also shared their knowledge of the land and the animals living there.

Throughout the last year I worked on soil studies in the fall and then wildlife studies during the winter with North American Oil Sands. North American and the Matrix Environmental Team were great to work with.

My role as an orienteer with the wildlife studies was to be a guide to the biologists and working dogs teams. I would look out for a creek or other danger that might be coming up so the dog and biologist would not be in danger of falling in. I have spent much of my life living and hunting in the bush, so I was able to share a lot with the biologist about the animals, birds and land. They taught me how to use the I-Pack GPS systems, how to work with the dogs and all the study processes of preparing the animal scat to be sent to labs in Washington.

The dogs collecting the scat were awesome even though they had to work in very different environment then they were use to. For next year it would good for the dogs to have about a week to 10 days to just settle in and acclimatize to the area before they start working.

To me these studies are very important and good because we have so much more access to so many more animals over a much larger area, and there is no disturbance to the animals in gathering the scat. In a couple of years when we have several years of study information to compare, we will really be able to make some changes that will actually help the animals. I would like to continue to be part of these studies for the animals in this area.

Conan Janvier, Orienteer, Wildlife Study

Fast Facts

Potential impacts to local environment from oil sands projects may include:

- Nutritional stress, resulting from loss of food due to habitat disturbance and/or the lack of accessibility to previously used resources.
- Toxin exposure from chemicals released into the water or air.
- Stress from noise and other rapidly increased human activities in the area.
- Stress-related suppression of the immune system coupled with increased rates of exposure to, and infection from, human-introduced disease-causing agents.
- Stress-related reproductive suppression.

What We Are Learning

The wildlife information collected in early 2006 and the next field study planned for 2007 will provide the starting point from which to measure any future impacts. This monitoring will help determine, for example, if populations are already at low numbers and/or if the health of the animals is currently being affected by other factors in their environment.

By monitoring changes over time in the caribou, moose and wolf populations, and by comparing these changes to control populations of the same species, we will gain a high probability of detecting impacts quickly. Early detection allows North American to address the cause of the impact before the animal populations are affected further.

Having local community members, especially Elders, work as orienteers with the wildlife surveys provided valuable insights to the habitat in the Kai Kos Dehseh Project area. Walter Quinn did a great job of creating a sense of goodwill and connection between the wildlife teams and the local community. Conan Janvier was a knowledgeable, responsible individual with a strong work ethic. We look forward to working with them again.

Dr. Samuel Wasser,
Director, Center for Conservation Biology,
University of Washington

Who is Sam Wasser?

Dr. Samuel Wasser is a wildlife biologist and center director at the Center for Conservation Biology, University of Washington. He has pioneered unique ways to measure the health of wildlife without ever having to touch the animal or even see it. In 1997, Dr. Wasser developed the scat detection dog program using highly energetic dogs that have an exceptional ability to find animal scat. The use of these dogs has allowed researchers to cover huge areas in remote and unusual locations. Dr. Wasser's dogs have been used to study the health and abundance of grizzly and black bear populations along the eastern slopes of the Canadian Rockies, right whales in the North Atlantic and mammals of the Brazilian Cerrado. Dr. Wasser's studies provide information on the causes and consequences of human disturbances on wildlife, which allows us to better plan for the protection of the wildlife and their habitat.

What's Next?

The work completed this year will be repeated in 2007 to provide two years of data. The information will set the starting point or baseline from which we will measure the potential impacts of the Kai Kos Dehseh Project.

Cynthia Quintal, pencil sketch, April 2006

It was very interesting to work with the dogs for North American's wildlife studies. I think these studies using the dogs are a good idea because it does not stress the animals being studied and the studies cover huge areas. I would really like to be involved in these studies again next year.

The dogs found a lot of wolf scat – I was happy to see this. It was sad to see some of the things in the scat – tin foil, plastic sandwich wrap and other food wrap garbage items. There were challenges in the beginning to find the right snowmobiles and equipment for these studies. These were unique studies and we needed the right equipment for the bush.

The biologists were good to work with. As an orienteer and someone who has lived and worked on this land my whole life, I could see they had much to learn about this country and land. It was our job to help them out. They came in January to my camp near Lac La Biche, and as a group we did a Sweatlodge ceremony. It was an opportunity for me and the people who work with me to share with the biologist team what animals mean to us in our culture and the way we respect the animals and the land.

I made contact with the trappers I know in the area where the dogs and biologist would work, in order to know where the trappers' snares and traps were set so that the dogs were not in danger of being snared or trapped. I have known and worked with these trappers for many years.

North American is the first company to take action and do something different and actually good for the local animals. I made a video of the biologist and dogs. I plan to show the Elders in my communities that there is one company doing good work.

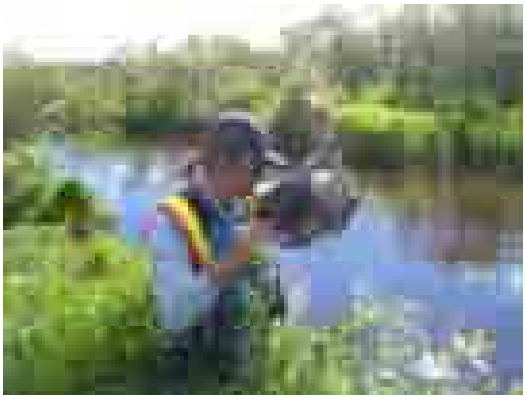
Walter Quinn, Orienteer

DID YOU KNOW?

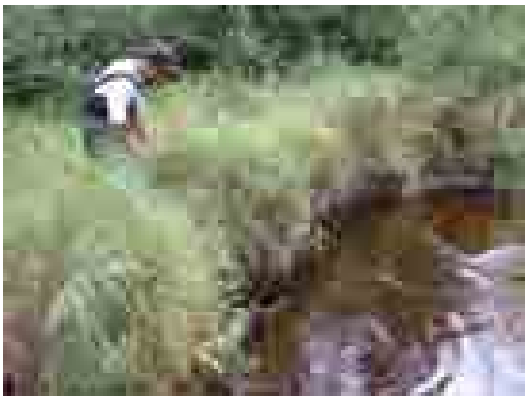
One sample of scat will tell us what kind of animal the scat came from (caribou, moose or wolf) and the animal's sex. The sample can even identify the individual animal. Tests are run on the samples to measure concentrations of stress, nutrition and reproductive hormones, which tell the general state of health or disease for the individual animal. Dietary information can also be learned from the samples, helping to identify the food requirements for the species. This information can be used to determine population numbers and movement patterns of the animals.

Aquatics Field Studies

Fish use different types of habitat during different stages of their life. It is important, therefore, to look at aquatic communities several times a year to account for seasonal changes. The Kia Kos Dehseh Project aquatic sampling program was spread over four seasons: summer, fall, winter and spring.



Roy Cardinal setting a minnow trap



Troy Janvier retrieving minnow trap

Summer

The summer aquatic survey took place in August of 2005 and included visual observations, fish community inventories, analysis of water quality and measurement of stream flow and lake depths. To catch fish, gill nets and minnow traps were set, and boat and backpack electrofishing technology was used to "stun" the fish. This makes them much easier to catch.

Local community members, Roy Cardinal and Troy Janvier, assisted the team of biologists in gear preparation, land surveying, recording of GPS coordinates and taking photos. They were very helpful in all aspects of the aquatics field program, but most importantly, they shared their intimate knowledge of the area. Traditional ecological knowledge and scientific knowledge were shared between the local community members and the field scientists.

Fall

The fall season is the busiest time for the aquatics group. This is when the water levels are lower and the water itself is clearer, making it easier and safer to closely examine the aquatic habitat. At this time, we were able to create habitat maps that helped us determine how the habitat features provided food, spawning habitat, protective cover from predators and migratory 'highways' for aquatic life.

The program took place over 10 days in late September/early October and focused on the migratory patterns of the fish in the Kai Kos Dehseh Project area as they prepare for the winter months. The benthic invertebrates (water insects) that are such an important food source for many small and medium-sized fish were a major area of study.

Russell Quintal of Conklin worked with us on this field program. Russell was very valuable to the crew, aiding in the setting and retrieving of gill nets and minnow traps, gear and boat preparation, navigation through the area, and he built fires to help keep us all warm.

Winter

Winter is the most challenging season for most animals and fish. Fish do not hibernate like mammals, but as temperatures fall, fish activity decreases and they become very sluggish. Some even stop feeding. Most fish are usually found near the bottom of a lake or deep stream pool. It is important the water in streams and lakes is deep enough to not freeze through to the bottom. Oxygen levels in the water are the single most important factor for fish survival. During the winter field program, we set out to determine if overwintering habitat is available in the streams and lakes of the area and if resident fish species are using them.

Finding fish habitat in the winter can be difficult with snow covering frozen streams, and lakes hiding most habitat features. Fortunately, previous site visits allowed us to locate potential overwintering habitat. At each site, we drilled holes through the ice to determine if the stream or lake meets conditions suitable for the area's fish to survive over the winter months. As with the other field visits, minnow traps and gill nets are set to see if fish are present at the time.

Lawrence Lemaige, Adrian Janvier and Jeff Cree participated in the winter program and assisted the Matrix biologists in gear preparation, clearing of snow and site set-up, drilling sample holes through the ice and the painstaking ordeal of setting/retrieving gill nets and minnow traps under ice. Lawrence taught everyone how to keep our sample holes from freezing overnight by layering branches, grasses and snow. This was a wonderful trick and saved us many hours of chipping ice.

Removing gill netting

Lawrence LeMaigre assisting setting of gill net

Spring

The aquatics field program ran May 2-15 2006. Three local community assistants, Roy Cardinal, Daniel Quintal and Russell Tremblay, joined the aquatics team for this program. The spring aquatic survey included visual observations, habitat mapping, fish community inventories, analysis of water quality and measuring of stream flow and lake depths. To catch fish, gill nets and minnow traps were set, and backpack electrofishing methods were used.

Spring aquatic surveys are important for confirming information observed during the winter, summer and fall surveys and for identifying habitat that may be used during the higher flow periods that occur as the annual snowmelt takes place.

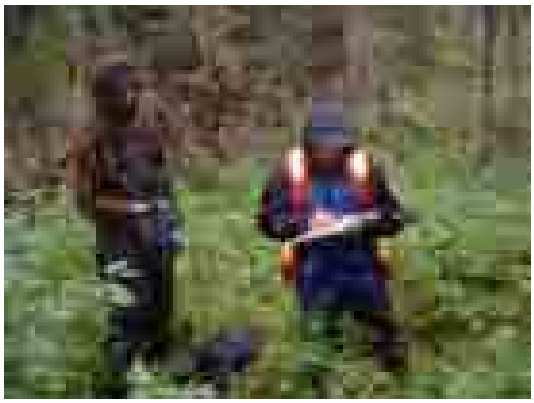
The local community members assisted the team of biologists in land surveying, recording of GPS coordinates, water sampling, organizing and setting up the fishing gear (gill nets and minnow traps) and taking photos. They were very helpful in all aspects of the aquatics field program. Most importantly, while working around water bodies at periods of high water, it is important to have people familiar with the terrain to make travel safer and easier. In many instances the local community members were able to identify locations at the study sites where the crew could safely cross the streams that would otherwise have been considered impassable.

What did we learn?

Of the sport fish species, only a few juvenile northern pike were caught. We also caught numerous suckers and minnows including white and longnose suckers, spottail shiners, fathead minnows, pearl dace, lake chub and brook stickleback (also known as the prickler, sawbelly, tiddler and pinfish because of the spines on its back).

Using Technology

Global Positioning System (GPS) units were used to mark where soil inspection locations and wildlife observations locations occurred as well as locations of vegetation survey sample plots and rare plant survey areas. Aboriginal assistants were responsible for marking the location on the GPS and recording the data as well as for orienteering using the GPS.



Troy Janvier with GPS

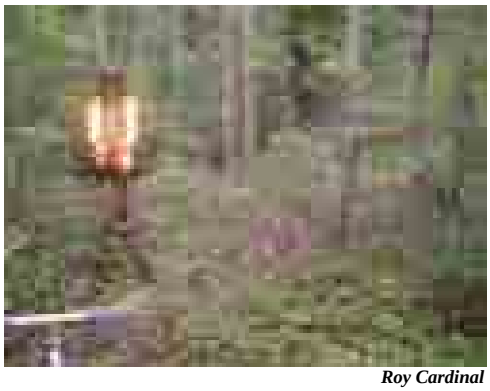
What is electrofishing?

Electrofishing, commonly referred to as “shocking” is a method used to immobilize and collect fish.

Vegetation Field Studies

Vegetation is a key component in all natural living systems, linking humans with the soils, wildlife and many other organisms. To ensure that the areas disturbed by the Kai Kos Dehseh Project will be returned to a similar condition that existed before development, we want to identify what is there now. The vegetation studies and surveys record the kinds of plants and groups of plants (vegetation communities) present in the Kai Kos Dehseh Project area and determine if there are rare plants or rare plant communities that need to be protected. This information is used to guide North American as it reclaims disturbed areas.

Vegetation survey teams consisted of three people - a rare plant specialist, a vegetation scientist and a local community member - working together to gather information on vegetation and wetland communities within the study area.



Roy Cardinal

These surveys were done with the assistance of local community members Roy Cardinal, Troy Janvier, Russell Quintal and Russell Tremblay. Traditional ecological knowledge and scientific knowledge were shared and transferred between community members and the scientists.

Roles were flexible and each member contributed skills in plant identification, data collection methods, navigation, GPS, map reading and remote work experience. Environmental scientists benefited from the Aboriginal crew members' knowledge of the area and familiarity with the land. Aside from navigation skills, their mechanical skills and proficiency with off-road vehicles provided safety and security for the team. The local community members gained knowledge of standard vegetation field data collection methods, including sample plot layout, taking tree measurements (height, diameter, coring to determine age), and marking waypoints using GPS units.

Russell Tremblay measuring vegetation plot

Kai Kos Dehseh Project Success Story – Sustainable Use of Our Forestry Resources

Sustainable development is a cornerstone of North American's Kai Kos Dehseh Project. As an example, our drilling locations were selected to minimize impacts to the forests. Of the 153 leases we prepared for drilling in 2005-2006, only eight leases had timber that was of merchantable value. Seven of these leases were in the Leismer lease and one was in the Thornbury lease.

Vegetation Sample Plots

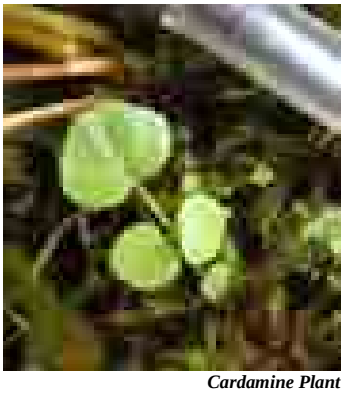
Local community assistants set up circular areas, or sample plots of various sizes (1 meter, 2.5 meters and 10 meters wide). The plants within each plot – mosses, grasses, herbs and shrubs – were measured and named. Tree heights and diameters were measured and cores were taken to determine their age.

Rare Plants Found in the Wetlands

The Pitcher plant (*Sarracenia purpurea*) plant (below) is carnivorous and dissolves insects to acquire nutrients for growth. It is also highly valued as a medicinal plant for Aboriginal traditional use.

Pitcher Plant

The picture (below) shows a rare plant species found in Kai Kos Dehseh Project area called Cardamine (*Cardamine palustris* ssp. *paludosa*). This species was found in wetlands and is a new listing in the province of Alberta.



Cardamine Plant

What did we Learn?

Seven different rare plants were found within the area; some were sited at more than one location. Two of the rare plants identified had never before been listed as growing in Alberta.

What's Next?

Future programs may include monitoring that focuses on a number of key components of terrestrial and wetland ecosystems. The integration of local community members in future vegetation monitoring programs will continue to be encouraged to further promote local stewardship of the land.

Limiting Disturbance

In keeping with our commitment to limiting our impact to the environment, North American uses areas that have already been cleared of vegetation as much as possible. Over 86% of the 279 km of access roads needed by North American for its 2005-2006 drilling program were located on existing seismic lines, cutlines, trails and access roads. The total disturbed area and the total new cut for access are provided in the table following.

Access Roads for the 2005/2006 Drilling Program

Operating Area	Existing lines, trails or access roads (kilometers)	New Cut (kilometers)	Total Cut (kilometers)
Hangingstone	96.4	2.1	98.5
Corner	70.0	14.5	84.5
Leismer South	33.7	3.7	37.4
Thornbury	41.7	2.2	43.9
Leismer	---	14.7	14.7
Total	**241.8**	**37.2**	**279.0**

Soil Surveys

The soil survey, which ran in mid October 2005, identified at a broad level the different types of soils that occur throughout the project area. Seven assistants from the communities of Conklin, Janvier and Anzac worked with our consultants on the soil survey program. Russell Tremblay, Conan Janvier and Mike Herman worked on the southern portions of the Kai Kos Dehseh Project, while Richard Kokonoo, Clifford Cree and Lionel Giant worked on the northern portions. Leo Giroux worked with the soil survey team on all of the project areas.

The local community members helped us in many ways – from driving the argos and finding our way through the bush, to providing details of each site. In the 10-day field program, we were able to carry out over 360 soil inspections. The assistants' knowledge of the area, both from personal and previous work experiences, helped the soil survey consultants understand the area better. This allowed them to move faster and cover more area. The assistants helped with data collection, as they learned how to record the site location on the GPS, describe the soil conditions, and fill in the soil survey data sheets. Many of the local community members picked up the "soil talk" very quickly. The soil scientists also appreciated the opportunity to learn about the local Aboriginal peoples and the history of the Kai Kos Dehseh Project area.

What's Next?

The information collected in October 2005 is now being reviewed by the soils consultants. The soils will be grouped according to their physical and chemical properties. The groupings will help North American identify the areas that are the best places to build our facilities as well as identify the special construction considerations for each soil group. A soils map for the Kai Kos Dehseh Project area will be created based on the soil groupings and the information gathered from the vegetation surveys. The soils information will also help North American work toward defining the end land use, a decision that is based, in part, on input from your communities. North American's goal is to reclaim soils we have disturbed so that it can support the vegetation and wildlife that existed there before the project.

Lunch break on a soil survey, Russell Tremblay & Jim Burke

Additional Field Work

Follow-up soils and vegetation field programs are planned for 2006 to supplement data collected in 2005. These field programs will focus on the Leismer demonstration project area as well as the Corner lease.

Kai Kos Dehseh

Cynthia Quintal, pencil sketch, April 2006

What is a Gallon?

One gallon of liquid would fit into a 4-litre milk jug. It would take about 264 gallons to fill a tank that holds one cubic metre.

Discontinuous Permafrost

Discontinuous permafrost occurs throughout the study area and is displayed by stunted or shortened tree growth. Collapse scars occur where permafrost has melted. The result: "tipped" trees.

Water Use

The wise use of water for North American's operations is very important to us. North American has begun tracking how much water we use and where we use it. By collecting this information, North American will be able to see where we need to make changes to our operations and to demonstrate that the changes have improved our water use. The information North American collects will be provided each year in our "Report to the Community."

During the past winter, we used about 11,900 cubic meters (m^3) or about 3,143,600 gallons of water to prepare our leases and roads by freezing them. Once the warm weather returns, this water will be returned to the environment.

The drilling program used about 9,075 m^3 (2,397,300 gallons) of water or an average of 75m^3 (19,800 gallons) for each of the 121 wells that we were able to drill. A typical well requires about 10m^3 (2,600 gallons) for surface preparation, about 45m^3 (11,900 gallons) for drilling and about 20m (5,300 gallons) for abandonment. In some cases, we lost circulation during the drilling process. For those wells, the water use was higher than average.

At our NAOSC core drilling base camp, we used about 3,210 m3 (848,000 gallons) of water. At the NOREX Seismic Camp, about 745 m3 (197,000 gallons) was used.

Eyes in the Sky
Helping a Search and Rescue Effort

A 96-year-old Elder from the community of Conklin had gone missing at the same time the soil survey team began using helicopters to move further into the study area. Russell Tremblay (pictured below), a Conklin Elder as well as a valued assistant on many of the North American field programs, flew with the helicopter to give the ground-based search some help from the sky. Although the missing Elder was found during the ground search, the helicopter was able to cover more areas in a shorter time frame.

Elder Russell Tremblay

Acknowledgements:

Liz Parkin, Report Coordinator

Barry Worbets, Report Editor

Wendy Bigcharles, Assistant Editor

Liane Medwick, Report Design & Production

Dr. Samuel Wasser, Director, Center for Conservation Biology, University of Washington

Tyler Ray, Matrix Solutions Inc. – Aquatics

Darrell Jobson, Matrix Solutions Inc. – Aquatics

Leslie Monteleone, Matrix Solutions Inc. – Vegetation

Liz Parkin, Matrix Solutions Inc. – Soils

Cynthia Quintal, Artwork

Special Thanks to the following people (alphabetical by last name) for their contributions to this report:

Henry Herman
Conan Janvier
Everett Normandeau
Cynthia Quintal
Walter Quinn
Russell Tremblay
Phil Ullman
Sam Wasser

Cynthia Quintal, pencil sketch, April 2006

North American Oil Sands Corporation Principles

We respect the environmental and traditional values of the communities we work in. We are committed to environmental stewardship. We believe that the health and safety of our employees and contractors are critical to our business success. We want our workers getting home safely each day, every day. Safety will not be compromised for any reason. We are committed to being a good neighbor. We deliver local benefits and keep our commitments.

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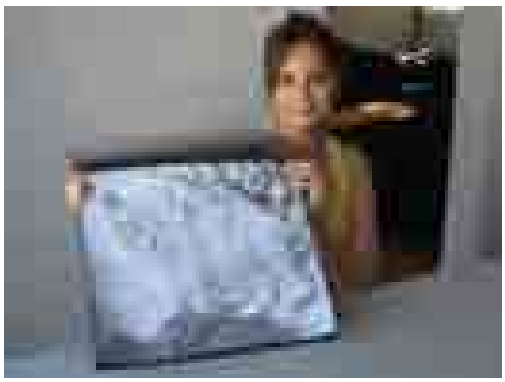
Kal Kos Dehseh

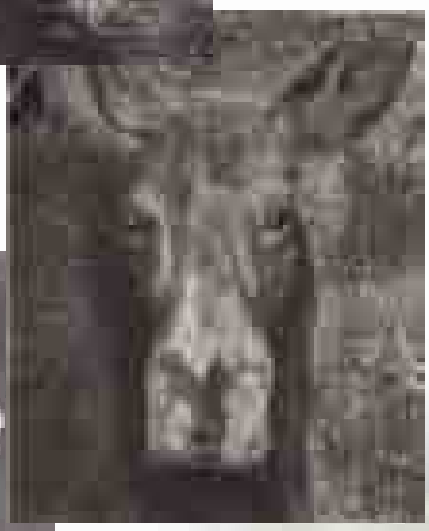
About the Artist…



This past Spring 2006, North American initiated a partnership with Cynthia Quintal, an artist from Conklin, AB. Cynthia provided North American with outstanding sketches of local animals and plants.

She created five pencil sketches of a baby lynx, black bear cub, moose, wolf, and tiger lily. Each of these animals and the tiger lily are local species to the area around her home community of Conklin. Creating artwork, including oil paints, has been a passion of Cynthia's for a long time but, she says, "I always give my artwork away." Many other people who know Cynthia also confirm she is known to gift her artwork to family and friends. When showing North American the pencil sketches, she explained, "I am really proud of the baby lynx, it took extra time and effort and it is my favorite piece."

Cynthia is currently a Grade 11 student at the Father Mercredi High School in Fort McMurray.



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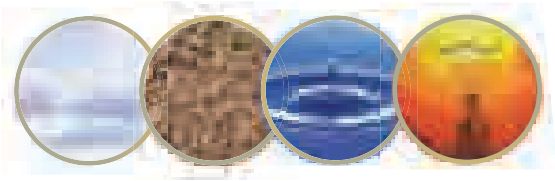

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NORTH AMERICAN

STATOIL

Caribou artwork on cover by Fort McMurray First Nation artist David Cree.

Ancestor Spirit Shadows featured above by Chipewyan Prairie Dene First Nation artist Leonard Janvier.

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