

**PROPOSED TERMS OF REFERENCE  
ENVIRONMENTAL IMPACT ASSESSMENT REPORT  
FOR KOREA NATIONAL OIL CORPORATION'S  
PROPOSED  
BLACKGOLD EXPANSION PROJECT**

**Approximately 10 km southeast from the community of Conklin, Alberta**

**ISSUED BY: Korea National Oil Corporation**

**DATE: September 17, 2009**

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## **PURPOSE OF THE TERMS OF REFERENCE**

The purpose of this document is to identify for Korea National Oil Corporation (KNOC), aboriginal communities and appropriate stakeholders the information required by government agencies for an Environmental Impact Assessment (EIA) report prepared under the *Environmental Protection and Enhancement Act* (EPEA) for the Blackgold Expansion Project (the Project).

Korea National Oil Corporation (KNOC) continues to evaluate the potential of oil sands leases, located approximately 10 km southeast of the community of Conklin, Alberta in the Regional Municipality of Wood Buffalo. This document describes KNOC's plans to expand operations in the BlackGold Project area. The proposed Expansion Project will be located adjacent to and integrated with KNOC's Initial Project. KNOC holds a 100% working interest in 15 sections of land that make up the leases in Township 76, Range 7, W4M.

KNOC has identified sufficient oil sand reserves to support an additional 3 180 m<sup>3</sup>/d (20 000 b/d) of bitumen production over a period of 25 years. Initially, 28 SAGD well pairs will be drilled from three well pads, together with some modification of the Central Processing Facility (CPF) and associated infrastructure to facilitate bitumen recovery on the site and its export off the site either by pipeline or truck. Additional production wells and well pads will be developed, as required, to maintain production throughout the Project life.

## **SCOPE OF THE EIA REPORT**

KNOC shall prepare and submit an EIA report that examines the environmental and socio-economic effects of the Project.

The EIA report shall be prepared considering all applicable provincial and federal legislation, codes of practice, guidelines, standards and directives.

The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under EPEA and associated regulations, and the *Canadian Environmental Assessment Act* if applicable. The EIA report will form part of KNOC's application to the Energy Resources Conservation Board (ERCB). An EIA report summary will also be included as part of the ERCB Application.

KNOC shall refer to the *Guide to Preparing Environmental Impact Assessment Reports in Alberta* published by Alberta Environment (the Guide) and these Terms of Reference when preparing the Environmental Impact Assessment report. In any case where there is a difference in requirements between the Guide and these Terms of Reference, the Terms of Reference shall take precedence.

## **CONTENT OF THE EIA REPORT**

### **1 PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION**

- [A] Document the public engagement program implemented for the Project including:
- a) a list of all meetings and the specific comments or issues raised at the meetings;

- b) description and documentation of concerns and issues expressed by the public, KNOC's analysis of those concerns and issues, and the actions taken to address those concerns and issues; and
  - c) how public input was incorporated into the Project development, impact mitigation and monitoring.
- [B] Document the aboriginal consultation program implemented for the Project including:
- a) a list of all meetings and the specific comments or issues raised at the meetings;
  - b) description and documentation of concerns and issues expressed by aboriginal communities and groups, KNOC's analysis of those concerns and issues, and the actions taken to address those concerns and issues;
  - c) how aboriginal input was incorporated into the Project development, impact mitigation and monitoring; and
  - d) consultation undertaken with aboriginal communities and groups with respect to traditional ecological knowledge and traditional use of land.
- [C] Describe plans to maintain the public engagement and aboriginal consultation process following completion of the EIA report to ensure that the public and aboriginal peoples will have an appropriate forum for expressing their views on the ongoing development, operation and reclamation of the Project.

## **2 PROJECT DESCRIPTION**

### **2.1 The Proponent**

- [A] Provide:
- a) a corporate profile; and
  - b) the name of the legal entity that will develop, manage and operate the Project and hold the operating approvals.
- [B] Describe KNOC and its history in Alberta, with specific reference to existing operations, proposed operations, mineral resources, environmental studies and community involvement.

### **2.2 Project Development**

- [A] Provide a development plan that includes:
- a) the phases of development;
  - b) bitumen/heavy oil recovery facilities;
  - c) processing facilities;
  - d) steam and/or power generation facilities;
  - e) infrastructure (pipelines, access roads and power lines);
  - f) other buildings and structures;
  - g) field maintenance operations; and
  - h) activities associated with each stage of the Project.
- [B] Provide a schedule outlining the proposed phases of development and the sequence and duration of key project components, including the timing of key

steps in the construction, operation, decommissioning and reclamation stages of each phase.

- [C] Discuss the key factors controlling the schedule, restrictions for conducting certain development activities, and uncertainties.

## **2.3 Evaluation of Alternatives**

### **2.3.1 Project Alternatives**

- [A] Discuss the need for the Project including:
  - a) any alternative means of carrying out the Project that are technically and economically feasible and where applicable indicate their potential environmental effects and impacts;
  - b) a comparison of identified alternatives to the Project or components of the Project and the anticipated effects and impacts of the alternatives. Discuss reasons for not selecting any identified alternatives;
  - c) implications resulting from a delay in proceeding with the Project, or any phase of the Project; and
  - d) potential cooperative development opportunities (e.g., shared infrastructure).
- [B] Discuss the implications of not going ahead with the Project.

### **2.3.2 Process and Infrastructure Alternatives**

- [A] Describe the process and criteria used to select sites for facilities and infrastructure.
- [B] 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.
- [C] Discuss the options considered for supplying the thermal energy and electric power required for the Project and their environmental implications. Discuss the implications that alternate fuel sources may have on the selection of pollution abatement equipment or technologies.
- [D] Describe the criteria and rationale for selecting the preferred water supply sources. Include options for using saline groundwater and the criteria used to assess the feasibility of its use.
- [E] Discuss the potential for new or additional technology to increase resource recovery at later times in the field development and to affect the number of wells required.
- [F] Discuss options and technologies considered for wastewater treatment, wastewater management and wastewater disposal and reasons, including water quality and environmental considerations for selecting the preferred options in the context of best management practices and best available technologies.
- [G] Discuss options and technologies considered for air emission and air quality management and the evaluation of emission minimization options, including air emission control technology considerations, for selecting the preferred options in the context of best management practices and best available technologies.

- [H] Discuss the waste disposal options. Discuss the strategy for on-site waste disposal versus off-site waste disposal and identify:
- the location of on-site waste disposal;
  - the availability of off-site waste disposal facilities;
  - site suitability from a groundwater protection perspective;
  - site suitability from a geotechnical perspective; and
  - site suitability with regard to existing and potential human activities in the area.

## **2.4 Project Processes and Facilities**

- [A] Provide maps and/or drawings of the Project components and activities including:
- existing infrastructure, leases and clearings, including exploration clearings;
  - proposed central processing/treatment and field facilities;
  - other buildings and infrastructure (pipelines and utilities);
  - temporary structures;
  - transportation and access routes;
  - on-site hydrocarbon storage;
  - containment structures such as retention ponds and storage ponds (e.g., lime sludge, stormwater runoff, boiler blow-down);
  - water wells/intakes, pipelines, and storage structures;
  - sources of aggregate resources, borrow material and other construction material and locations of any stockpiles that will be developed; and
  - waste storage area and disposal sites.
- [B] Provide a list of facilities for which locations will be determined later.
- [C] Describe the primary resource recovery process, any proposed follow-up recovery process and other related processes and process facilities of the Project.
- [D] Discuss the amount and source of energy required for the Project.
- [E] Describe the proposed method to transport product to markets.
- [F] Provide a listing of chemical products to be manufactured, processed or otherwise used for the Project and describe, in general terms, how these products will be stored and managed. Identify products containing substances that are:
- Canadian Environmental Protection Act, 1999* toxics;
  - listed on the National Pollutant Release Inventory;
  - dangerous goods as defined by the federal *Transportation of Dangerous Goods Act*; and
  - on the Domestic Substances List and categorized as requiring further assessment under Canada's Chemicals Management Plan.
- [G] Describe the nature and amount of on-site hydrocarbon storage. Discuss containment and other environmental protection measures.

## **2.5 Transportation Infrastructure**

- [A] Provide a summary of any Traffic Impact Assessment study carried out for the Project, or where no Traffic Impact Assessment study has been conducted, describe the anticipated changes to traffic (e.g., type, volume) on highways,

- including an assessment of impacts for all stages of the Project. Consider other existing and planned uses of the same highway.
- [B] Describe and map the locations of any new road or intersection construction, or any improvements to existing roads or intersections, related to the development of the Project, from the boundary of the Project Area up to and including the highway access, and
    - a) discuss the alternatives and the rationale for selection of the preferred alternative;
    - b) describe the impacts to local communities of the changes in transportation infrastructure;
    - c) provide a proposed schedule for the work;
    - d) provide the estimated cost of the work; and
    - e) provide a summary of consultation with Alberta Transportation and the local authority, including their views on the compatibility of the proposed work with their own local or regional infrastructure development plans.
  - [C] Identify the type, volume, location and availability of road construction and reclamation materials for all road construction and road improvement work, related to the development of the Project, within and outside of the Project Area.
  - [D] Describe access corridors needed and/or planned by other resource development stakeholders including those responsible for Forest Management Areas and other timber quota holders, and
    - a) describe how their needs are accommodated to reduce overall environmental impact from resource development; and
    - b) describe opportunities for cooperation in access development.
  - [E] Indicate where Crown land dispositions may be needed for roads or other infrastructure for the Project.
  - [F] Describe crossings of watercourses or waterbodies required and provide example diagrams of each type of crossing. Discuss:
    - a) timing;
    - b) construction standards or methods; and
    - c) environmental protection plans.

## **2.6 Land Management**

- [A] Provide a description and timing of land clearing activities.
- [B] Provide a timber salvage plan, highlighting end users and identifying proposed volumes for removal (by species and year) for all stages of the Project.
- [C] Identify any access restrictions including where appropriate, measures taken to control access to the Project Area while ensuring continued access to adjacent wildland areas.
- [D] Provide a fire control plan highlighting:
  - a) measures taken to ensure continued access for firefighters to adjacent wildland areas;

- b) forest fire prevention, detection, reporting, and suppression measures, including proposed fire equipment;
- c) measures for determining the clearing width of power line rights-of-way; and
- d) required mitigative measures for areas adjacent to the Project Area based on the FireSmart Wildfire Assessment System.

## **2.7 Air Emissions Management**

- [A] Provide emission profiles (type, rate and source) for the Project's operating and construction emissions including point and non-point sources and fugitive emissions. Consider both normal and upset conditions. Discuss:
- a) odorous or visible emissions from the proposed facilities;
  - b) annual and total greenhouse gas emissions during all stages of the Project. Identify the primary sources and provide examples of calculations;
  - c) the intensity of greenhouse gas emissions per unit of bitumen produced and discuss how it compares with similar projects;
  - d) the Project's contribution to total provincial and national greenhouse gas emissions on an annual basis;
  - e) KNOC's overall greenhouse gas management plans;
  - f) amount and nature of Criteria Air Contaminants emissions;
  - g) the amount and nature of acidifying emissions, probable deposition patterns and rates;
  - h) control technologies used to minimize air emissions;
  - i) emergency flaring scenarios (e.g., frequency and duration) and proposed measures to ensure flaring events are minimized;
  - j) upset condition scenarios (e.g., frequency and duration) and proposed measures to ensure upset conditions are minimized;
  - k) gas collection and conservation, and the applicability of vapour recovery technology;
  - l) applicability of sulphur recovery, acid gas re-injection or flue gas desulphurization to reduce sulphur emissions; and
  - m) fugitive emissions control technology to detect, measure and control emissions and odours from equipment leaks.

## **2.8 Water Management**

- [A] Discuss potential cooperation with other parties regarding water related infrastructure and management including, but not limited to, water intakes, pipelines, water storage and withdrawals, flow monitoring and reporting and ecological monitoring.

### **2.8.1 Water Supply**

- [A] Describe the water supply requirements for the Project, including:
- a) the expected water balance during all stages of the Project. Discuss assumptions made or methods chosen to arrive at the water balances;
  - b) the process water, potable water, and non-potable water requirements and sources for construction, start-up, normal and emergency operating situations,

- decommissioning and reclamation. Identify the volume of water to be withdrawn from each source, considering plans for wastewater reuse;
- c) the location of sources/intakes and associated infrastructure (e.g., pipelines for water supply);
  - d) the variability in the amount of water required on an annual and seasonal basis as the Project is implemented;
  - e) the expected cumulative effects on water losses/gains resulting from the Project operations;
  - f) potable water treatment systems for all stages of the Project;
  - g) type and quantity of potable water treatment chemicals used; and
  - h) measures for ensuring efficient use of water including alternatives to reduce the consumption of non-saline water such as water use minimization, recycling, conservation, and technological improvements.

### **2.8.2 Surface Water**

- [A] Describe the surface water management strategy for all stages of the Project, including:
  - a) design factors considered, such as:
    - i) site drainage,
    - ii) run-on management,
    - iii) road, well pad and plant run-off,
    - iv) erosion and sediment control,
    - v) groundwater and surface water protection,
    - vi) groundwater seepage,
    - vii) produced water management,
    - viii) flood protection, and
    - ix) geotechnical stability concerns; and
  - b) permanent or temporary alterations or realignments of watercourses, wetlands and other waterbodies.
- [B] Provide a description of navigable waterways and the results of navigability assessment(s) for waterways that may be affected by the Project.

### **2.8.3 Wastewater Management**

- [A] Describe the wastewater management strategy, including:
  - a) the source, quantity and composition of each wastewater stream from each component of the proposed operation (e.g., bitumen extraction and associated facilities) for all Project conditions, including normal, start-up, worst-case and upset conditions;
  - b) the proposed disposal locations and methods for each wastewater stream;
  - c) formations for the disposal of wastewaters;
  - d) design of facilities that will collect, treat, store and release wastewater streams;
  - e) type and quantity of chemicals used in wastewater treatment; and
  - f) sewage treatment and disposal.

## 2.9 Waste Management

- [A] Characterize and quantify the anticipated dangerous goods, and hazardous, non-hazardous, and recyclable wastes generated by the Project, and:
- a) describe the composition and volume of specific waste streams and discuss how each stream will be managed;
  - b) identify the amount of drilling wastes and the options considered for disposal and the option(s) chosen;
  - c) describe how the disposal sites and sumps will be constructed; and
  - d) describe plans for pollution prevention, waste minimization, recycling, and management to reduce waste quantities for all stages of the Project.

## 2.10 Conservation and Reclamation

- [A] Provide a conceptual conservation and reclamation plan for the Project considering:
- a) any existing Conservation and Reclamation Plan;
  - b) existing 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) integration of operations, decommissioning, reclamation planning and reclamation activities;
  - d) anticipated timeframes for completion of reclamation stages and release of lands back to the Crown including an outline of the key milestone dates for reclamation and how progress to achieve these targets will be measured;
  - e) constraints to reclamation such as timing of activities, availability of reclamation materials and influence of natural processes and cycles including natural disturbance regimes;
  - f) post-development land capability with respect to:
    - i) self-sustaining topography, drainage and surface watercourses representative of the surrounding area,
    - ii) existing traditional use with consideration for traditional vegetation and wildlife species in the reclaimed landscape,
    - iii) wetlands,
    - iv) self-sustaining vegetation communities representative of the surrounding area, and
    - v) reforestation and forest productivity;
  - g) a revegetation plan for the disturbed terrestrial and aquatic areas;
  - h) reclamation material salvage, storage areas and handling procedures;
  - i) reclamation material replacement indicating depth, volume and type;
  - j) existing and final reclaimed site drainage plans;
  - k) integrating surface and near-surface drainage within the Project Area; and
  - l) promotion of biodiversity.
- [B] Provide a predicted Ecological Land Classification map for the post-reclamation landscape considering potential land uses, including traditional uses, and how the landscape and soils have been designed to accommodate future land use.

[C] Provide a conceptual plan to monitor reclamation performance and success (including soils, vegetation, wildlife and aquatic resources).

[D] Discuss uncertainties related to the conceptual reclamation plan.

### **2.11 Environmental Management Systems**

[A] Summarize key elements of KNOC's existing or proposed environment, health and safety management system.

[B] Describe adaptive management plans that minimize the impact of the Project. Describe the flexibility built into the Project to accommodate future modifications required as a result of:

- a) any change in environmental standards, limits and guidelines; or
- b) findings from Project-specific regional monitoring programs.

[C] Describe KNOC's current and proposed monitoring programs with respect to:

- a) source air emissions, including fugitive emissions;
- b) wastewater treatment and release; and
- c) hazardous and non-hazardous waste treatment and storage.

[D] Discuss:

- a) how monitoring data will be disseminated to the public or other interested parties; and
- b) how the results of monitoring programs and publicly available monitoring information will be integrated with KNOC's environmental management system.

### **2.12 Regional and Cooperative Initiatives**

[A] Discuss KNOC's involvement in regional and cooperative efforts to address environmental and socio-economic issues associated with regional development, including:

- a) potential cooperative ventures that KNOC has initiated, could initiate or could develop with other operators and other resource users;
- b) how KNOC will work to develop and implement such cooperative opportunities;
- c) KNOC's participation in any regional forums;
- d) how KNOC would design and implement research programs; and
- e) how regional environmental management initiatives will be incorporated into KNOC's management practices.

[B] Discuss KNOC's regional monitoring activities including:

- a) monitoring that will be undertaken to assist in managing environmental effects, confirm performance of mitigative measures and improve environmental protection strategies;
- b) monitoring done independently by KNOC;
- c) monitoring performed in conjunction with other stakeholders, including aboriginal communities and groups; and
- d) new monitoring initiatives that may be required as a result of the Project.

### **3 ENVIRONMENTAL ASSESSMENT**

#### **3.1 Air Quality, Climate and Noise**

##### **3.1.1 Baseline Information**

- [A] Discuss the baseline climatic and air quality conditions including:
  - a) the type and frequency of meteorological conditions that may result in poor air quality; and
  - b) appropriate ambient air quality parameters.
- [B] Provide representative baseline noise levels at receptor locations.

##### **3.1.2 Impact Assessment**

- [A] Identify components of the Project that will affect air quality, and:
  - a) describe the potential for reduced air quality (including odours and visibility) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;
  - b) estimate ground-level concentrations of appropriate air quality parameters;
  - c) discuss any expected changes to particulate deposition, nitrogen deposition or acidic deposition patterns;
  - d) identify areas that are predicted to exceed Potential Acid Input (PAI) critical loading criteria;
  - e) discuss interactive effects that may occur resulting from co-exposure of a receptor to all emissions; and
  - f) describe air quality impacts resulting from the Project, and their implications for other environmental resources, including habitat diversity and quantity, soil resources, vegetation resources, and water quality.
- [B] Identify stages or elements of the Project that are sensitive to changes or variability in climate parameters, including frequency and severity of extreme weather events. Discuss what impacts the change to climate parameters may have on elements of the Project that are sensitive to climate parameters.
- [C] Identify components of the Project that have the potential to increase noise levels and discuss the implications. Present the results of a noise assessment. Include:
  - a) potentially-affected people and wildlife;
  - b) an estimate of the potential for increased noise resulting from the development; and
  - c) the implications of any increased noise levels.
- [D] Describe how air quality and noise impacts resulting from the Project will be mitigated.
- [E] Describe the residual air quality and noise effects of the Project and KNOC's plans to manage those effects.

##### **3.1.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to air quality and noise and to measure the effectiveness of mitigation.

- [B] Describe any monitoring programs proposed to monitor the effects of acid deposition.

## **3.2 Hydrogeology**

### **3.2.1 Baseline Information**

- [A] Provide an overview of the existing geologic and hydrogeologic setting from the ground surface down to, and including, the oil producing zones and disposal zones. Document any new hydrogeological investigations, including methodology and results, undertaken as part of the EIA, and:
- a) present regional and Project Area geology to illustrate depth, thickness and spatial extent of lithology, stratigraphic units and structural features;
  - b) present regional and Project Area hydrogeology describing:
    - i) the major aquifers, aquitards and aquicludes (Quaternary and bedrock), their spatial distribution, properties, hydraulic connections between aquifers, hydraulic heads, gradients, groundwater flow directions and velocities. Include maps and cross sections,
    - ii) the chemistry of groundwater aquifers including baseline concentrations of major ions, metals and hydrocarbon indicators,
    - iii) the potential discharge zones, potential recharge zones and sources, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock groundwater interaction,
    - iv) water well development and groundwater use, including an inventory of groundwater users,
    - v) the recharge potential for Quaternary aquifers,
    - vi) potential hydraulic connection between bitumen production zones, deep disposal formations and other aquifers resulting from Project operations,
    - vii) the characterization of formations chosen for deep well disposal, including chemical compatibility and containment potential, injection capacity, hydrodynamic flow regime, and water quality assessments, and
    - viii) the locations of major facilities associated with the Project including facilities for waste storage, treatment and disposal (e.g., deep well disposal) and describe site-specific aquifer and shallow groundwater conditions beneath these proposed facilities. Provide supporting geological information.

### **3.2.2 Impact Assessment**

- [A] Describe Project components and activities that have the potential to affect groundwater resource quantity and quality at all stages of the Project.
- [B] Describe the nature and significance of the potential Project impacts on groundwater with respect to:
- a) inter-relationship between groundwater and surface water in terms of surface water quantity and quality;
  - b) implications for terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands;

- c) changes in groundwater quality and quantity;
  - d) conflicts with other groundwater users, and proposed resolutions to these conflicts;
  - e) potential implications of seasonal variations; and
  - f) groundwater withdrawal for Project operations, including any expected alterations in the groundwater flow regime during and following Project operations.
- [C] Describe programs to manage and protect groundwater resources including:
- a) the early detection of potential contamination; and
  - b) groundwater remediation options in the event that adverse effects are detected.
- [D] Identify measures to reduce the environmental risks from casing failures.
- [E] Describe the residual effects of the Project on groundwater quality and quantity and KNOC's plans to manage those effects.

### **3.2.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to groundwater quality and quantity and to measure the effectiveness of mitigation plans.

## **3.3 Hydrology**

### **3.3.1 Baseline Information**

- [A] Describe and map the surface hydrology. Include flow regimes of streams in the Project Area.
- [B] Provide surface flow baseline data, including:
- a) seasonal variation, low, average and peak flows for watercourses, and
  - b) low, average and peak levels for waterbodies.
- [C] Identify any surface water users who have existing approvals, permits or licenses.

### **3.3.2 Impact Assessment**

- [A] Discuss changes to watersheds, including surface and near-surface drainage conditions, potential flow impediment, and potential changes in open-water surface areas caused by the Project.
- [B] Describe the extent of hydrological changes that will result from disturbances to groundwater and surface water movement:
- a) include changes to the quantity of surface flow, water levels and channel regime in watercourses (during minimum, average and peak flows) and water levels in waterbodies;
  - b) assess the potential impact of any alterations in flow on the hydrology and identify all temporary and permanent alterations, channel realignments, disturbances or surface water withdrawals;
  - c) discuss both the Project and cumulative effect of these changes on hydrology (e.g., timing, volume, peak and minimum flow rates, river regime and lake

- levels), including the significance of effects for downstream watercourses; and
  - d) identify any potential erosion problems in watercourses resulting from the Project.
- [C] Discuss changes in sedimentation patterns in receiving waters resulting from the Project.
- [D] Describe impacts on other surface water users resulting from the Project. Identify any potential water use conflicts.
- [E] Describe potential downstream impact if surface water is removed.
- [F] Discuss the impact of low flow conditions and in-stream flow needs on water supply and water and wastewater management strategies.
- [G] Discuss how potential impacts of temporary and permanent roads and wellpads on wetland hydrology will be minimized and mitigated.
- [H] Describe mitigation measures to address impacts during all stages of the Project including:
- a) alteration in flow regimes;
  - b) potential water use conflicts; and
  - c) increased sediment loadings.
- [I] Describe residual effects of the Project on hydrology and KNOC's plans to manage those effects.

### **3.3.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess the impacts of changes in surface water flows and levels on aquatic resources, wildlife and vegetation and to measure the effectiveness of mitigation plans.

## **3.4 Surface Water Quality**

### **3.4.1 Baseline Information**

- [A] Describe the baseline water quality of watercourses and waterbodies. Discuss the effects of seasonal variations, flow and other factors on water quality.

### **3.4.2 Impact Assessment**

- [A] Identify Project components that may influence or impact surface water quality.
- [B] Describe the potential impacts of the Project on surface water quality:
- a) discuss any changes in water quality resulting from the Project that may exceed the *Surface Water Quality Guidelines for Use in Alberta* or the *Canadian Water Quality Guidelines*;
  - b) discuss the significance of any impacts on water quality and implications to aquatic resources (e.g., biota, biodiversity and habitat);
  - c) discuss seasonal variation and potential effects on surface water quality;
  - d) assess the potential Project related and cumulative impacts of acidifying and other air emissions on surface water quality; and

- e) discuss the effect of changes in surface runoff or groundwater discharge on water quality in surface waterbodies.
- [C] Describe proposed mitigation measures to maintain surface water quality at all stages of the Project.
- [D] Describe the residual effects of the Project on surface water quality and KNOC's plans to manage those effects.

### **3.4.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to surface water quality and to measure the effectiveness of mitigation plans.

## **3.5 Aquatic Ecology**

### **3.5.1 Baseline Information**

- [A] Describe the existing fish and other aquatic resources (e.g., benthic invertebrates). Identify species composition, distribution, relative abundance, movements and general life history parameters.
- [B] Describe and map, as appropriate, the fish habitat and aquatic resources of the lakes, rivers, ephemeral water bodies and other waters and identify:
  - a) key indicator species and provide the rationale and selection criteria used;
  - b) critical or sensitive areas such as spawning, rearing, and over-wintering habitats. Discuss seasonal habitat use including migration and spawning routes; and
  - c) current and potential use of the fish resources by aboriginal, sport or commercial fisheries.
- [C] Quantitatively describe the current extent of aquatic habitat fragmentation.

### **3.5.2 Impact Assessment**

- [A] Describe the potential impacts to fish, fish habitat, and other aquatic resources (e.g., stream alterations and changes to substrate conditions, water quality and quantity) considering:
  - a) fish tainting, survival of eggs and fry, chronic or acute health effects, and increased stress on fish populations from release of contaminants, sedimentation, flow alterations, temperature and habitat changes;
  - b) potential impacts on riparian areas that could affect aquatic biological resources and productivity;
  - c) the potential for increased fishing pressures in the region that could arise from the increased workforce and improved access resulting from the Project. Identify the implications on the fish resource and describe any mitigation strategies that might be planned to minimize these effects, including any plans to restrict employee and visitor access;
  - d) changes to benthic invertebrate communities that may affect food quality and availability for fish; and
  - e) the potential for increased fragmentation of aquatic habitat.

- [B] Discuss the design, construction and operational factors to be incorporated into the Project to minimize effects to fish and fish habitat and protect aquatic resources. Describe how any water intakes have been designed to avoid entrapment and entrainment of fish and provide information on the species of fish considered.
- [C] Identify plans proposed to offset any loss in the productivity of fish habitat. 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.
- [D] Describe the effects of any surface water withdrawals considered including cumulative effects on fish, fish habitat and other aquatic resources.
- [E] Describe the residual effects of the Project on fish, fish habitat, and other aquatic resources and discuss their significance in the context of local and regional fisheries. Describe KNOC’s plans to manage those effects.

### **3.5.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to fish, fish habitat and other aquatic resources and to measure the effectiveness of mitigation plans.

## **3.6 Vegetation**

### **3.6.1 Baseline Information**

- [A] Describe and map vegetation communities for each ecosite phase.
- [B] Describe and map wetlands and discuss their distribution and relative abundance.
- [C] Identify, verify and map the relative abundance of species of rare plants and the ecosite phases where they are found.
- [D] Quantitatively describe the current extent of habitat fragmentation.
- [E] Identify key indicators and discuss the rationale for their selection. Identify composition, distribution, relative abundance, and habitat requirements. Address those species listed as “at Risk, May be at Risk and Sensitive” in *The Status of Alberta Species* (Alberta Sustainable Resource Development) and all species listed in Schedule 1 of the federal *Species at Risk Act*.
- [F] Discuss the potential of each ecosite phase to support rare plant species, plants for traditional, medicinal and cultural purposes, old growth forests and communities of limited distribution. Consider their importance for local and regional habitat, sustained forest growth, rare plant habitat and the hydrologic regime.
- [G] Describe the regional relevance of landscape units that are identified as rare.
- [H] Provide Timber Productivity Ratings for both the Project Area and the Local Study Area, including identification of productive forested, non-productive forested and non-forested lands.

### **3.6.2 Impact Assessment**

- [A] Identify the amount of vegetation and wetlands to be disturbed for all stages of the Project.
- [B] Discuss any potential effects the Project may have on rare plants or endangered species.
- [C] Discuss temporary (include timeframe) and permanent changes to vegetation and wetland communities and comment on:
  - a) the effects and their implications for other environmental resources (e.g., habitat diversity and quantity, water quality and quantity, erosion potential);
  - b) the effects and their implications to recreation, aboriginal and other uses; and
  - c) the sensitivity to disturbance (including acid deposition), as well as the techniques used to estimate sensitivity to disturbance and reclamation, of each vegetation community.
- [D] Describe the regional impact of any ecosite phase to be removed.
- [E] 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.
- [F] Provide a predicted Ecological Land Classification map that shows the reclaimed vegetation. Comment on the importance of the size, distribution and variety of the reclaimed landscape units from both a local and regional perspective.
- [G] Discuss the impact of any loss of wetlands, including how the loss will affect land use.
- [H] Provide a mitigation strategy that will minimize Project impacts addressing:
  - a) mitigation of the adverse effects of site clearing on rare plants, plant communities and plants for traditional, medicinal and cultural purposes. Identify any setbacks proposed around environmentally-sensitive areas such as surface waterbodies, riparian areas and wetlands; and
  - b) measures and techniques that will be used to minimize the impact of loss of wetlands on land use.
- [I] Discuss weeds and non-native invasive species and describe how these species will be assessed and controlled prior to and during operation and reclamation.
- [J] Discuss at multiple spatial scales, the predicted changes to upland, riparian and wetland habitats resulting from increased fragmentation.
- [K] Describe the residual effects of the Project on vegetation and KNOC's plans to manage those effects.

### **3.6.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to vegetation, wetlands and riparian areas and to measure the effectiveness of mitigation plans.

### **3.7 Wildlife**

#### **3.7.1 Baseline Information**

- [A] Describe and map existing wildlife resources (amphibians, reptiles, birds and terrestrial and aquatic mammals) and their use and potential use of habitats.
- [B] Identify key indicator species and discuss the rationale for their selection. Identify composition, distribution, relative abundance, seasonal movements, movement corridors, habitat requirements, key habitat areas, and general life history. Address those species:
  - a) listed as “at Risk, May be at Risk and Sensitive” in *The Status of Alberta Species* (Alberta Sustainable Resource Development);
  - b) listed in Schedule 1 of the federal *Species at Risk Act*; and
  - c) listed as “at risk’ by COSEWIC.
- [C] Describe, quantify and map all existing habitat disturbance (including exploration activities) and identify those habitat disturbances that are related to existing and approved Project operations.

#### **3.7.2 Impact Assessment**

- [A] Describe Project components and activities that may affect wildlife and wildlife habitat.
- [B] Describe and assess the potential impacts of the Project on key indicator species and related those impacts to wildlife populations and wildlife habitats, addressing:
  - a) how the Project will affect wildlife relative abundance, movement patterns, distribution and recruitment into regional populations for all stages of the Project;
  - b) how improved or altered access may affect wildlife including potential obstruction of daily and seasonal movements, increased vehicle-wildlife collisions, and increased hunting pressures;
  - c) how increased habitat fragmentation may affect wildlife considering edge effects, the availability of core habitat, and the influence of linear features and infrastructure on wildlife movements and other population parameters;
  - d) the spatial and temporal changes to habitat availability and habitat effectiveness (types, quality, quantity, diversity and distribution);
  - e) potential effects on wildlife resulting from changes to air and water quality, including both acute and chronic effects to animal health;
  - f) potential effects on wildlife from KNOC’s proposed and planned exploration, seismic and core hole activities, including monitoring/4D seismic;
  - g) the resilience and recovery capabilities of wildlife populations and habitats to disturbance; and
  - h) the potential for the Project Area to be returned to its existing state with respect to wildlife populations and their habitats.
- [C] Comment on the availability of species for traditional use considering habitat loss, habitat avoidance, vehicle-wildlife collisions, increased non-aboriginal hunting pressure and other Project related effects on wildlife populations.

- [D] Provide a strategy and mitigation plan to minimize impacts on wildlife and wildlife habitat for all stages of the Project and to return productive wildlife habitat to the area, considering:
- a) consistency of the plan with applicable regional, provincial and federal wildlife habitat objectives and policies;
  - b) a schedule for the return of habitat capability to areas impacted by the Project;
  - c) the use of setbacks to protect riparian habitats, interconnectivity of such habitat and the unimpeded movement by wildlife species using that habitat;
  - d) anticipated access controls or other management strategies to protect wildlife during and after Project operations;
  - e) measures to prevent habituation of wildlife to minimize the potential for human-wildlife encounters and consequent destruction of wildlife, including any staff training program, fencing camps, garbage containment measures or regular follow-up;
  - f) measures to mitigate habitat fragmentation considering impacts to habitat connectivity and wildlife movements resulting from linear features (e.g., above ground pipelines, roads etc.) and other Project infrastructure and activities; and
  - g) measures to minimize the effects of light on wildlife.
- [E] Describe the residual effects of the Project on wildlife and wildlife habitat and KNOC's plans to manage those effects.

### **3.7.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts to wildlife and to measure the effectiveness of mitigation plans, giving special attention to those species
- a) listed as “at Risk, May be at Risk and Sensitive” in *The Status of Alberta Species* (Alberta Sustainable Resource Development);
  - b) listed in Schedule 1 of the federal *Species at Risk Act*; and
  - c) listed as “at risk” by COSEWIC.

## **3.8 Biodiversity**

### **3.8.1 Baseline Information**

- [A] Describe the terrestrial and aquatic biodiversity metrics that will be used to characterize the existing ecosystems and probable effects of the Project, and:
- a) describe the process and rationale used to select biotic and abiotic indicators for biodiversity within selected taxonomic groups;
  - b) determine the relative abundance of species in each ecosite phase;
  - c) provide species locations, lists and summaries of observed and estimated species richness and evenness for each ecosite phase;
  - d) provide a measure of biodiversity on baseline sites that are representative of the proposed reclamation ecosites; and
  - e) rank each ecological unit for biodiversity potential. Describe the techniques used in the ranking process.

### **3.8.2 Impact Assessment**

- [A] Describe the metrics used to assess the probable effects of the Project. Discuss the contribution of the Project to any anticipated changes in regional biodiversity and the potential impact to local and regional ecosystems.
- [B] Identify and evaluate the extent of potential effects of fragmentation on biodiversity that may result from the Project. Discuss those effects at all relevant scales (from site specific to landscape level).
- [C] Discuss the mitigation measures proposed to minimize any anticipated changes in regional biodiversity.
- [D] Describe the residual effects of the Project on biodiversity and KNOC's plans to manage those effects.

### **3.8.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts on biodiversity and to measure the effectiveness of mitigation plans.

## **3.9 Terrain and Soils**

### **3.9.1 Baseline Information**

- [A] Provide descriptions and maps of the terrain and soils conditions, including:
  - a) surficial geology and topography;
  - b) soil types and their distribution. Provide an ecological context to the soil resource by supplying a soil survey report and maps to Survey Intensity Level 2 for the Project Area;
  - c) suitability and availability of soils within the Project Area for reclamation;
  - d) soils that could be affected by the Project with emphasis on potential acidification (by soil type); and
  - e) descriptions and locations of erosion sensitive soils.

### **3.9.2 Impact Assessment**

- [A] Describe Project activities and other related issues that could affect soil quality (e.g., compaction, contaminants) and:
  - a) indicate the amount (ha) of surface disturbance from plant, field (pads, pipelines, access roads), aggregate and borrow sites, construction camps, drilling waste disposal and other infrastructure-related construction activities;
  - b) provide an inventory of the pre- and predicted post-disturbance land capability classes for soils in both the Project Area and the Local Study Area and describe Project impacts to land capability. Indicate the size and location of soil types and land capability classes that will be disturbed;
  - c) discuss the relevance of any changes for the local and regional landscapes, biodiversity, productivity, ecological integrity, aesthetics and future use resulting from disturbance for all stages of the Project;
  - d) identify the potential acidification impact on soils and discuss the significance of predicted impacts by acidifying emissions resulting from the Project;

- e) describe potential sources of soil contamination;
  - f) describe the impact of the Project on soil types and reclamation suitability and the approximate volume of soil materials for reclamation. Discuss any constraints or limitations to achieving vegetation/habitat reclamation based on anticipated soil conditions (e.g., compaction, contaminants, salinity, soil moisture, nutrient depletion, erosion, etc.); and
  - g) discuss the potential for soil erosion for all stages of the Project.
- [B] Discuss:
- a) the environmental effects of proposed drilling methods on the landscape and surficial and bedrock geology;
  - b) the potential for casing and pipeline failures and their environmental effects;
  - c) the potential for changes in the ground surface during steaming and recovery operations (e.g., ground heave and/or subsidence) and their environmental implications; and
  - d) the potential impacts caused by the mulching and storage of woody debris considering, but not limited to vulnerability to fire, degradation of soil quality, increased footprint, etc.
- [C] Provide a mitigation plan, including:
- a) possible measures to minimize surface disturbance including the use of existing clearings for the Project;
  - b) possible actions to address potential effects of acid deposition;
  - c) possible actions to mitigate effects of any constraint or limitation to habitat reclamation such as compaction, contaminants, salinity, soil moisture, erosion, nutrient regime, etc.;
  - d) possible measures to mitigate changes to ground surface (temperature, heave and subsidence) during operations;
  - e) possible 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.
- [D] Describe the residual effects of the Project on terrain and soils and KNOC's plans to manage those effects.

### **3.9.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts on terrain and soils and to measure the effectiveness of mitigation plans.

## **3.10 Land Use**

### **3.10.1 Baseline Information**

- [A] Identify the current land uses, including oil and gas development, agriculture, forestry, tourism, aboriginal uses and outdoor recreational activities.
- [B] Identify and map all Crown land and Crown Reservations (Holding Reservation, Protective Notation, Consultative Notation).
- [C] Identify and map unique sites or special features such as Parks and Protected Areas, Heritage Rivers, Historic Sites, Environmentally Significant Areas,

culturally significant sites and other designations (World Heritage Sites, Ramsar Sites, Internationally Important Bird Areas, etc).

- [D] Identify any land use policies and resource management initiatives that pertain to the Project, and discuss how the Project will be consistent with the intent of these initiatives.

### **3.10.2 Impact Assessment**

- [A] Identify the potential impact of the Project on land uses, including:
  - a) impacts to unique sites or special features;
  - b) impacts caused by changes in public access arising from linear development, including secondary effects related to increased hunter, angler and other recreational access, decreased access to traditional use sites and facilitated predator movement;
  - c) the implications of relevant land use policies and resource management initiatives for the Project, including any constraints to development;
  - d) potential impacts to aggregate reserves that may be located on land under KNOC's control and reserves in the region;
  - e) the impact of development and reclamation on commercial forest harvesting in the Project Area. Include opportunities for timber salvage, revegetation, reforestation and harvest for the reduction of fuel hazard;
  - f) the amount of commercial and non-commercial forest land base that will be disturbed by the Project. Compare the pre-disturbance and reclaimed percentages and distribution of all forested communities in the Project Area;
  - g) how the Project impacts Annual Allowable Cuts and quotas within the Forest Management Agreement area;
  - h) the potential impact on existing land uses of anticipated changes (type and extent) to the pre-disturbance topography, elevation and drainage pattern within the Project Area; and
  - i) impacts of the Project on public access, regional recreational activities, aboriginal land use and other land uses during and after development activities.
- [B] Discuss possible mitigation strategies to address:
  - a) the need for, and plans to address, access management during and after Project operations;
  - b) the process for addressing the needs of other land users in both the Project Area and the Local Study Area;
  - c) measures to mitigate Project impacts on land use; and
  - d) how potentially-affected aggregate reserves will be salvaged and stockpiled with input provided by Alberta Transportation and Alberta Sustainable Resource Development.
- [C] Describe the residual effects of the Project on land use and KNOC's plans to manage those effects.

### **3.10.3 Monitoring**

- [A] Describe the monitoring programs proposed to assess any Project impacts on land use and to measure the effectiveness of mitigation plans.

## **4 HISTORIC RESOURCES**

- [A] Describe consultation with Alberta Culture and Community Spirit (ACCS) concerning the need for a Historic Resource Impact Assessment (HRIA) for the Project, and:
- a) provide a general overview of the results of any previous historic resource studies that have been conducted, including archaeological resources, palaeontological resources, historic period sites, and any other historic resources as defined within the *Historical Resources Act*;
  - b) summarize the results from the field program performed to assess archaeological, palaeontological and historic significance of both the Project Area and the Local Study Area;
  - c) provide a summary of the results of the HRIA conducted to assess the potential impact of the Project on archaeological, palaeontological and historic resources;
  - d) provide an outline of the program and schedule of field investigations that ACCS may require KNOC to undertake to further assess and mitigate the effects of the Project on historic resources; and
  - e) document any historic resources concerns raised during consultation on the Project.

## **5 TRADITIONAL ECOLOGICAL KNOWLEDGE AND LAND USE**

- [A] Provide:
- a) a map of traditional land use areas if the aboriginal community or group is willing to have these locations disclosed);
  - b) a map of cabin sites, spiritual sites, graves and other traditional use sites considered historic resources under the *Historical Resources Act* (if the aboriginal community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns;
  - c) a description of the extent of traditional use of land in both the Project Area and the Local Study Area, including fishing, hunting, trapping, nutritional or medicinal plant harvesting, and cultural use by affected aboriginal peoples; and
  - d) a discussion of:
    - i) access to traditional lands in the Project Area during all stages of the Project,
    - ii) the vegetation and wildlife used for traditional, food, ceremonial, medicinal and other purposes, and
    - iii) aboriginal views on land reclamation.
- [B] Determine the impact of the Project on traditional uses and culture and identify possible mitigation strategies.

## 6 PUBLIC HEALTH AND SAFETY ASSESSMENT

- [A] Describe those aspects of the Project that may have implications for public health or the delivery of regional health services. Determine whether there may be implications for public health arising from the Project. Specifically:
- a) assess the potential health implications of the compounds that will be released to the environment from the Project in relation to exposure limits established to prevent acute and chronic adverse effects on human health;
  - b) provide the data, exposure modeling calculations, and describe the methods KNOC used to assess impacts of the Project on human health and safety;
  - c) provide information, including chemical analyses and modeling results, on samples of selected environmental media (e.g., soil, water, air, vegetation, wild game, etc.) used in the assessment;
  - d) discuss the potential for changes to water quality, air quality and soil quality to increase human exposure to contaminants taking into consideration all Project activities;
  - e) identify the human health impact of the potential contamination of country foods and natural food sources taking into consideration all Project activities;
  - f) document any health concerns raised by stakeholders during consultation on the Project;
  - g) document any health concerns identified by aboriginal communities or groups resulting from impacts of existing development and of the Project specifically on their traditional lifestyle and include an aboriginal receptor type in the assessment;
  - h) assess the cumulative human health effects to receptors, including First Nations and Métis receptors;
  - i) as appropriate, describe anticipated follow-up work, including regional cooperative studies. Discuss how such work will be implemented and coordinated with ongoing air, soil and water quality initiatives;
  - j) describe the potential health impacts resulting from higher regional traffic volumes and the increased risk of accidental leaks and spills; and
  - k) discuss mitigation strategies to minimize the potential impact of the Project on human health.
- [B] Describe those aspects of the Project that may have implications for public safety. Determine whether there may be implications for public safety arising from the Project. Specifically:
- a) describe KNOC's emergency response plan, including public notification protocol and safety procedures, to minimize adverse environmental effects, including emergency reporting procedures for spill containment and management;
  - b) document any safety concerns raised by stakeholders during consultation on the Project;
  - c) describe how local residents will be contacted during an emergency and the type of information that will be communicated to them;

- d) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations, regional mutual aid programs and municipal emergency response agencies;
- e) describe the potential safety impacts resulting from higher regional traffic volumes; and
- f) discuss mitigation plans to ensure workforce and public safety for all stages of the Project. Include prevention and safety measures for wildfire occurrences, water saturated plume from cooling towers, icy roads in the winter months, accidental release or spill of chemicals to the environment and failures of structures retaining water or fluid wastes.

## **7 SOCIO-ECONOMIC ASSESSMENT**

### **7.1 Baseline Information**

- [A] Describe the existing socio-economic conditions in the region and in the communities in the region.
- [B] Describe factors that may affect existing socio-economic conditions including:
  - a) population changes;
  - b) KNOC's policies and programs regarding the use of regional and Alberta goods and services;
  - c) a project schedule and a general description of the overall engineering and contracting plan for the Project;
  - d) workforce requirements for the Project, including a description of when peak activity periods will occur; and
  - e) planned accommodations for the workforce for all stages of the Project.

### **7.2 Impact Assessment**

- [A] Describe the socio-economic effects of construction and operation of the Project, including:
  - a) impacts related to:
    - i) local training, employment and business opportunities,
    - ii) regional and provincial economic benefits,
    - iii) housing,
    - iv) recreational activities,
    - v) hunting, fishing, trapping and gathering, and
    - vi) effects on First Nations and Métis (e.g., traditional land use and social and cultural implications);
  - b) estimated total Project cost, including a breakdown for engineering and project management, equipment and materials, and labour for both construction and operation stages. Indicate the percentage of expenditures expected to occur in the region, Alberta, Canada outside of Alberta, and outside of Canada;
  - c) impacts of the Project on the availability of affordable housing and the quality of health care services. Provide a summary of any discussions that have taken place with the local municipalities and the local environmental public health office of Alberta Health Services concerning housing availability and health care services respectively;

- d) discuss any effects expected on primary and secondary highway systems and other regional roads caused by anticipated traffic changes;
  - e) the impact on local and regional infrastructure and community services, including consideration of municipal “hard services”, education/training services, social services, urban and regional recreation services, law enforcement and emergency services; and
  - f) describe municipal growth pressures as they relate to the Project and the need for additional Crown land to meet these needs.
- [B] Describe the socio-economic effects of any construction camp required for the Project and identify:
- a) its location,
  - b) the number of workers it is intended to house,
  - c) whether the camp will service the Project only or other clients,
  - d) the length of time the camp will be in service, and
  - e) describe what services will be provided in the camp (e.g., security, recreation and leisure, medical services);
- [C] Discuss options for mitigating impacts including:
- a) KNOC’s policies and programs regarding the use of regional and Alberta goods and services;
  - b) plans to work with First Nations and Métis communities and groups and other local residents and businesses regarding employment, training needs, and other economic development opportunities arising from the Project;
  - c) steps that have been undertaken by industry, the municipality, provincial government or through regional and cooperative initiatives to address socio-economic concerns and impacts to local and regional transportation infrastructure;
  - d) the potential to avoid overlap with other Projects that are reasonably anticipated during all stages of the Project;
  - e) mitigation plans that will be undertaken to address issues related to the availability of affordable housing and the quality of health care services; and
  - f) strategies to mitigate socio-economic concerns raised by the local municipality and other stakeholders in the region.
- [D] Describe the residual effects of the Project on socio-economic conditions and KNOC’s plans to manage those effects.
- 7.3 Monitoring**
- [A] Describe the monitoring programs proposed to assess any Project socio-economic impacts and to measure the effectiveness of mitigation plans.