Review of

Shell Pierre River Mine Project

Application and Environmental Impact Assessment

For:

Athabasca Chipewyan First Nation
Industry Relations Corporation

September 2010
(V. 17)

DS Environmental Consulting Inc.

Executive Summary

The Athabasca Chipewyan First Nation (ACFN) commissioned DS Environmental Consulting to review Shell Canada's (Shell) submissions pertaining to the Pierre River Mine Project (PRM). Shell originally applied for this project in December 2007 along with the Jackpine Mine Expansion Project (JPME). An update to the Environmental Impact Assessment (EIA) for both projects was released in May 2008 to separate the impacts of each project. Shell also issued a project update and supplemental information on the PRM in May 2009, and supplemental information filed in April and August 2010 in the form of responses to questions from Alberta's regulators.

The proposed PRM would be a new large open pit oil sands mine, located on the west side of the Athabasca River. The mine would directly disturb over 10,000 hectares of land.

All reviews made in this report (from assessing the methodology used in the EIA, to reviewing Shell's assessment of the project's impacts on air quality, noise, aquatic resources, terrestrial resources, reclamation, human health, land use, cumulative effects, and social economics of local and regional communities) were done with consideration of the ACFN's beliefs, expectations, and Treaty rights. Wherever necessary, specific comments, questions, and requests are made for Shell to address.

Summarized below are the overall deficiencies and issues identified in this report.

EIA Methodology:

- Lack of pre-industrial baselines;
- Cumulative effects not adequately addressed, resulting in an underestimation of the project's impacts;
- Lack of Traditional Knowledge (TK) and Traditional Land Use (TLU) information;
- Overly large Regional Study Area (RSA) boundaries and artificially high Base Case scenarios do not allow for meaningful assessment;
- Portions of the assessment based on weak / unsupported assumptions or poor scientific methods.

Groundwater:

- Long lasting adverse groundwater impacts, which may in turn affect aquatic resources, including surface water flows, surface water quality, wetlands and terrestrial vegetation;
- Seepage from external tailings disposal area effects on groundwater and surface water;
- Predicted changes in groundwater levels, flows, flow directions, and quality.

Surface water quality:

- Water quality assessment inadequate due to impacts often being downplayed;
- Many water quality uncertainties due to poor methodology;

- Significant increases predicted in the concentrations of metals within Big Creek;
- Unknown project-related and cumulative water quality impacts related to tailings pond seepages and end pit lake discharges.

Aquatic health and fish / fish habitats components:

- Aquatic health impacts downplayed and aquatic health benchmark exceedances dismissed;
- Unknown project-related and cumulative aquatic health impacts related to tailings pond seepages and end pit lake discharges;
- Mercury contamination in the compensation reservoir not assessed;
- Concerns about the approval and construction of mines without a clear understanding of the fish habitat compensation plan.

Hydrology:

- Uncertainties related to Athabasca River flow changes due to diversions and watershed disturbances;
- Significant increase in open water area following closure;
- Cumulative impacts to the Athabasca Delta not assessed.

Air quality:

- Poor understanding of secondary pollutants and their impacts;
- Incomplete understanding of greenhouse gas emissions;
- Foul odour impacts on locations of importance to the ACFN;
- Potential Acid Input levels predicted to exceed guidelines;
- Unknown impacts of multiple projects on regional air quality.

Wildlife:

- Significant habitat loss;
- Risks to wildlife health;
- Wildlife survey gaps;
- Uncertainties related to cumulative impacts of multiple projects on wildlife;
- Restricted use of Athabasca River valley as a regional wildlife corridor;
- Cumulative effects of tailings ponds on migratory bird populations not assessed;
- Concerns with validity of impact predictions;
- Shell's modeling results conflict with field data and TK.

Vegetation, wetlands, and biodiversity:

- Significant and irreversible loss of wetlands (including peatlands);

- Decrease in plant and animal biodiversity, especially in wetlands habitats;
- Loss of rare plants, rare plant habitat, and old growth forests;
- Unclear impacts of air emissions on vegetation;
- Cumulative impacts of regional loss of wetlands.

Reclamation, soils, and landforms:

- Closure landscapes that are very different from the baseline landscape;
- Reclamation strategies are simplistic and rely heavily on unsupported assumptions;
- Disturbance of 10,400 ha, with no specific reclamation timeline and reliance on adaptive management;
- Destruction of the Eymundson Sinkholes;
- Uncertainties related to reclamation of wet tailings;
- Uncertainties related to reclamation of wetlands as upland forest.

Traditional Land Use:

- EIA does not comply with the Terms of Reference for traditional use assessment;
- ACFN members not directly consulted about their traditional lands or their use of specific areas proposed for disturbance;
- Long term loss of traditional land and the associated traditional land uses;
- Uncertainties related to timing and success of reclamation of traditional lands;
- Cumulative impacts to traditional users.

Human Health:

- Human Health Risk Assessment not as conservative as portrayed in the application;
- Realistic and comprehensive views of individual and community health not addressed;
- Poor understanding of acute inhalation health risk for the most sensitive individuals.

In addition to assessing the PRM EIA and updates, this review addresses Shell's responses to technical questions submitted to them by the ACFN, requesting additional information or clarification. Only a small portion of the questions posed by the ACFN were adequately addressed. Most responses from Shell were found to be deficient. In many cases Shell refused to answer the question. Many of these requests are re-stated in this report.

List of Acronyms

AAAQO - Alberta Ambient Air Quality Objectives

ACFN - Athabasca Chipewyan First Nation

AENV - Alberta Environment

ANHIC - Alberta Natural Heritage Information Centre

ANPC - Alberta Native Plant Council

AOSERP - Alberta Oil Sands Environmental Research Program

AVI - Alberta Vegetation Inventory

bgs – Below Ground Surface

CC&R - Closure, Conservation, and Reclamation

CCME - Canadian Council of Ministers of the Environment

CCP- Conceptual Compensation Plan

CEMA - Cumulative Environmental Management Association

CONRAD - Canadian Oil Sands Network for Research and Development

COPC - Chemical of Potential Concern

CWS - Canada-Wide Standards

DFO - Fisheries and Oceans Canada

EC - Environmental Consequences

EIA - Environmental Impact Assessment

ERCB - Energy Resources Conservation Board

ETDA - External Tailings Disposal Area

GHG - Greenhouse Gas

ha - Hectares

HHRA - Human Health Risk Assessment

JPME - Jackpine Mine Expansion Project

KIR - Key Indicator Resource

LCCS - Land Capability Classification System

LSA - Local Study Area

MDL - Method Detection Limits

MFT - Mature Fine Tailings

NNL - No Net Loss

NOEC - No Observable Effects Concentration

NRV - Natural Range of Variation

NSMWG - NOx-SO_2 Management Working Group

OGF - Old Growth Forest

PAH - Polycyclic Aromatic Hydrocarbons

PAI - Potential Acid Input

PDC - Planned Development Case

PM - Particulate Matter

PRM - Pierre River Mine Project

PVA - Population Viability Analysis

RAMP - Regional Aquatics Monitoring Program

RPP - Rare plant potential

RSA - Regional Study Area

RSF - Resource Selection Function

SEWG - Sustainable Ecosystem Working Group

SIR - Supplemental Information Request

SSOB - Saline Sodic Overburden

TK - Traditional Knowledge

TEMF - Terrestrial Ecosystem Management Framework

TLU - Traditional Land Use

TOR - Terms of Reference

TRV - Toxicity Reference Values

TUS - Traditional Use Study

USEPA - United States Environmental Protection Agency

VOC - Volatile Organic Compound

WMF - Water Management Framework

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1.0 Introduction

The Athabasca Chipewyan First Nation's (ACFN) Industry Relations Corporation contracted DS Environmental Consulting Inc (DS Environmental) to review the application by Shell Canada (Shell) for the proposed Pierre River Mine oil sands Project.

This report is the culmination of a two and half year review and involved detailed technical reviews of all the publicly filed reports on the application. The review included the following reports:

- Pierre River Mine Project application (Volume 2, Dec 2007);
- Environmental Impact Assessment (EIA) reports (Volumes 3-5);
- Environmental Setting Reports (ESR) [4 volumes];
- EIA Update - Jackpine Mine Expansion and Pierre River Mine Project (May 2008);
- Pierre River Mine Project Update & SIR Response (May 2009);
- Shell's responses to the ACFN's technical questions on the project (July 2009);
- Pierre River Mine Project Supplemental Information – Round 2 (April 2010);
- Jackpine Mine Expansion / Pierre River Mine Project Supplemental Information – Round 3 (August 2010).

The Jackpine Mine Expansion Project will be reviewed in a separate report.

2.0 Project Description

The Pierre River Mine Project is a proposed new oil sands mine, to be located 100 km north of Fort McMurray on the west side of the Athabasca River, that would produce 200,000 barrels per day of bitumen. It would include an open pit oil sands mine and bitumen extraction and processing facilities. The start-up of the first ore process train is planned for 2018, and closure of the mine would happen sometime after 2039 (a 22 year mine life). The total disturbance footprint for the proposed mine and out of pit tailings area would be approximately 10,400 ha.

In addition to the above, Shell is proposing to build a new road to access the site, including a new bridge and product pipeline(s) to cross over the Athabasca River.

3.0 Traditional and Treaty Rights

The Athabasca Chipewyan First Nation (ACFN) is a signatory to Treaty 8 and holds Treaty and Aboriginal rights which are protected under Section 35 of the Constitution Act. For the purposes of this review, we understand the Treaty and Aboriginal rights of the ACFN to include the rights to hunt, fish, and trap throughout their traditional lands. The Treaty and Aboriginal rights also comprise the incidental rights (e.g., access, sufficient quality and quantity of resources, including water resources, values associated with pristine environments, access to safe lands within which to practice rights, etc.) that support the practice of the Treaty rights - collectively referred to as the ACFN's Rights (or 'Rights') in this report. According to the ACFN, the meaningful practice of their Rights is dependent upon the ecological conditions of their traditional lands and resources, as well as upon other socio-cultural and economic factors.

A complete understanding of the project's impacts on the ACFN's Rights and traditional practices requires scientifically credible and culturally appropriate information on the ACFN's land and resource needs – including criteria and indicators to measure the ACFN's ability to practice their Rights and carry out their traditional way of life. The ACFN have put Alberta on notice that that land and resource use decision-making and planning must consider their Rights, that these Rights are sustained for future generations, and that impacts to their Rights must be assessed (i.e. letter dated February 1, 2010 from Lisa King, ACFN IRC to Alvaro Loyola, Senior Advisor, Aboriginal Relations, Alberta Environment and to John Abbot, EVP Heavy Oil, Shell Canada Energy, RE: Shell Canada Ltd. – Jackpine Mine Expansion and Pierre River Mine Project EPEA Application File numbers: 001-00245358, 005-00153125, 006-00153125, Water Act File numbers: 00245489, 00186157 ("the Application") (Appendix A). For the purposes of the technical review, several key areas are considered important to the ACFN when determining if Shell's information is adequate and relevant such that decision-makers are able to evaluate whether the ACFN's Rights are impacted. These key areas are:

- Are the ACFN's Rights explicitly acknowledged and assessed in the EIA?
- Is there sufficient diligence in scientific method to provide certainty about Shell's conclusions of interest to the ACFN?
- Does Shell demonstrate an accurate understanding of the project's impacts on the environment (socio-economic, cultural and ecological)?
- Are monitoring plans, mitigation strategies, and reclamation expectations realistic?

Should the proposed Pierre River Mine Project (PRM) receive approval and proceed as planned, there would be a number of project-related impacts that could ultimately affect the ACFN's traditional livelihood and infringe upon their Rights. Listed below are specific examples of how the PRM could adversely impact the ACFN's Rights:

- Land disturbance:
  - Direct loss of traditional lands - leads to a loss of harvesting areas, spiritual sites, oral traditions (stories linked to specific landscape features that transmit important traditional knowledge), hereditary harvesting and hunting rights (linked to a complex social network) - as well as traditional knowledge related to all the above;
  - Impacted access, connectivity, use, and occupancy of traditionally important areas.

- Aquatic ecosystem impacts:
  - Long-lasting and adverse impacts on groundwater and surface water quality, and their potential use by ACFN members, due to seepage from the proposed external tailings disposal area (ETDA);
  - Impacts on water quality, aquatic health, fish, and fish habitat - plus a persistent uncertainty about the quality and integrity of these resources from project-related and cumulative effects to water;
  - Diversions, withdrawals, and watershed disturbances which will contribute to flow reductions in the Athabasca River and to impacts on the Peace-Athabasca Delta.

- Air ecosystem impacts:
  - Increases in foul odour occurrences at some cabin locations and, potentially, at the ACFN's Poplar Point Reserve;
  - Impacts of degraded air quality on human health, wildlife health, and plant health - plus a persistent uncertainty about the quality and integrity of these resources from project-related and cumulative effects to air;
  - Increased acidic deposition affecting water and traditional plants.

- Terrestrial ecosystem impacts:
  - Restricted wildlife movement along the Athabasca River (a major regional wildlife movement corridor) and related effects on the exercising of the ACFN's Rights within their traditional territories, including the success and quality of those hunts.
  - Loss of wildlife, wetlands, and traditionally important plants;
  - Long-lasting (or permanent) changes in biodiversity and habitat;
  - Unproven reclamation, resulting in simplified landscapes and more open water (in the form of pit lakes).

4.0 Subject Areas Reviewed

A full technical review of Shell's application and environmental impact assessment reports for the proposed Pierre River Mine Project (PRM) was undertaken by DS Environmental on behalf of the ACFN's Industry Relations Corporation. Listed below are the subject areas reviewed and addressed in this report, followed by (in parentheses) the author of the original technical review report for that subject:

- EIA methodology (Bush Ecological - C. Dana Bush);
- Cumulative effects (DS Environmental Consulting – Daniel Smith);
- Groundwater (Agua Consulting - Lew Fahner);
- Surface water quality (Clearwater Environmental Consultants - Fay Westcott);
- Aquatic health and fish (Clearwater Environmental Consultants - Fay Westcott);
- Hydrology (Summit Environmental Consultants – Dr. Brenda Miskimmin);
- Air quality and climate (Dr. Karen McDonald);
- Wildlife (Puma Environmental - Dave Westworth);
- Vegetation, Wetlands, and Biodiversity (Bush Ecological - C. Dana Bush);
- Reclamation, soils, and landforms (PedoCan Land Evaluation - Len Knapik);
- Traditional land use / Traditional knowledge (Little Seed Consulting - Janelle Baker);
- Human health (SolAero Ltd. - Dr. John Dennis).

Each subject area discussed below includes an overview highlighting the key environmental issues arising from the PRM, a brief discussion of Shell's assessment of the subject matter, followed by a description of the specific concerns and requests for additional information from Shell. A summary list of these concerns and requests can be found in Appendix B. Many of the requests in this report repeat the original technical questions posed to Shell in March 2009 (Appendix C, which includes Shell's responses to the original technical questions) as Shell's responses to the ACFN were largely inadequate. Appendix D contains the original DS Environmental technical review reports, as well as additional reports related to the review of the PRM.

4.1 EIA Methodology

4.1.1 Overview

This section includes an examination of Shell's approach to assessing environmental impacts related to the Pierre River Mine Project (PRM), and whether this approach reflects acceptable practice.

The key environmental issues arising from the PRM with respect to methodology are:

- Lack of pre-industrial baselines[1] in the assessment;
- Cumulative effects not adequately addressed;
- Lack of traditional knowledge and traditional land use information;
- Regional study area is too large to determine significance;
- Portions of the assessment are based on weak / unsupported assumptions or use poor scientific methods.

For complete details, please refer to the full technical review reports:

- Shell Jackpine Mine Expansion and Pierre River Mine Project – Environmental Impact Assessment Methodology Review for Athabasca Chipewyan First Nation – April 5, 2010, by C. Dana Bush of Bush Ecology, attached to this report as Appendix D-1.
- Cumulative Effects Review of Shell Pierre River Mine and Shell Jackpine Mine Expansion Projects for Athabasca Chipewyan First Nation, August 2010, by Daniel Smith of DS Environmental Consulting Inc. – attached to this report as Appendix D-2.

4.1.2 Discussion and Assessment Review

The methods used by Shell when assessing the Pierre River Mine Project (PRM) have a direct bearing on the interpretation of the project's impact on the environment and people. It is imperative that sound methodological practices be carried out in any assessment. Shell's assessment of the PRM contains a number of methodological flaws.

A significant methodological failing in Shell's impact assessments, including the cumulative effects assessment, is the lack of a pre-industrial baseline. The ACFN's traditional (pre-Treaty) and Treaty rights are tied to a pre-industrial landscape. Failure to assess changes caused by industry against this pre-industrial landscape disregards infringement on the ACFN's Rights and fails to provide the ERCB and other regulators with information essential to the Public Interest Determination.

In the PRM assessment, all impacts were compared against an artificial Base Case that consists of all currently operating projects plus all previously approved (but not yet operating) projects. Such a Base Case serves to mask any possible impacts the proposed project would have – especially when applied to the excessively large Regional Study Areas (RSAs) often used in this assessment. These overly-large RSAs obscure cumulative effects by increasing the likelihood that the contribution of PRM-related impacts will be considered negligible.

[1] In this report, a "pre-industrial baseline" refers to environmental conditions in 1965. This date was selected as it is shortly before the commercial production of oil sands began in the Athabasca Oil Sands Region.

Another methodological failure in the PRM assessment pertains to Shell's limited Planned Development Case (PDC). The Planned Development Case is supposed to include all known and reasonably expected projects (i.e., those with applications for approval and any projects publicly announced at the time that the EIA was prepared – projects disclosed since July 2007 were not included in the assessment). The PDC also includes the PRM and all existing and approved projects (known as the 'Application Case'). However, for the PRM, the PDC assessment only included those potential impacts that were deemed significant in the Application Case (the PRM and all existing and approved projects) assessment. Shell carried out a PDC assessment only when the PRM-related impacts predicted for the Application Case were rated greater than negligible, in the local or regional scale. Shell's PDC Case represents their cumulative effects assessment. Shell's approach reflects a fundamental failure to comprehend or implement the concept of cumulative effects assessment, and fails to provide the ERCB and other regulators with essential information.

Shell's artificially high Base Case and limited PDC constitute an unreasonable and unacceptable approach to cumulative effects assessment, in which the outcome is a biased and uninformative assessment. Shell presumes that because the effects related to past projects were determined to be of low environmental consequence, that the effects of the PRM will not be significant. The ACFN reject this logic.

It is important that industry follow sound practices when assessing project impacts. In the PRM assessment, there are many instances where the assessments are based on weak or unsupported assumptions or use poor scientific methods. Examples include the unsupported assumptions that reclamation will be successful and arbitrary environmental consequence ratings that do not provide assurances that the ACFN Treaty rights will be protected and sustained into the future. The ACFN reject these less than credible assessment methods. When planning a project in an area used by traditional peoples for millennia, it is essential that the traditional and ecological knowledge of these people be considered at great length. Traditional Knowledge (TK) was not widely considered in the PRM application and assessment, and on at least one occasion, was discounted[2]. The lack of TK included in the EIA is a methodological failing; further content-specific concerns relating to traditional knowledge and land use are identified in the Traditional Land Use / Traditional Knowledge segment (Section 4.11) of this report. Shell should conclude the work on ACFN's TK / TLU and incorporate this work into the EIA before proceeding with the application.

If the ACFN's TK information is not used, specific steps and commitments need to be defined with Shell on how and when it will be applied, and how its application will be assessed.

[2]Shell predicts that black bear and moose populations would increase over time, despite reports to the contrary from trappers and other First Nations people and contrary to the results of other regional modeling.

4.1.3 Concerns and Requests

In addition to the aforementioned concerns, the following EIA methodology concerns and requests were identified:

1. Athabasca Chipewyan First Nation's TK and TLU not used. The project application and EIA do not make good use of the available TK and TLU information. There is no demonstration in the EIA that TK and TLU were considered in the rating of environmental consequences or in the choices of mitigations.

   Requests*:*

   i. Re-assess the impacts of the proposed project using a pre-industrial baseline and fully integrating available TK and TLU information, including the updated Traditional Use Study.

   ii. Clearly identify all instances where TK and TLU changes the outcome of environmental consequence ratings.

   iii. Incorporate TK and TLU into the development of mitigation strategies, and identify all instances this changes the mitigation or the approach.

2. Impact description criteria do not consider *confidence* in the final impact rating. Shell classifies project-related impacts for most EIA components using the following quantification criteria to determine environmental consequence: direction, magnitude, geographic extent, duration, reversibility, and frequency (Volume 3, Section 1.3.6.1, page 1-33, Table 1.3-4). While 'confidence' is used as an initial assessment criterion, it is not used in the determination of the final impact ratings and therefore there is no quantification of uncertainty. Predictions with a low (or even moderate) 'confidence' rating should influence the final classification of project-related impacts; and, as such, should be included in the Impact Description Criteria table.

   Request*:*

   Provide confidence ratings in the final impact ratings, including in the summary table (Table 1.3-4).

3. Pre-industrial baseline not included. The current Base Case assessment scenario does not support an acceptable cumulative effects assessment. Shell states that the "Base Case includes consideration of the existing environmental conditions as well as existing and approved projects or activities within the study area" (Volume 3, Section 1.3.3). While AENV accepts pre-existing disturbance in the definition of a Base Case, this practice does not allow for a true elucidation and examination of impacts to ACFN treaty Rights and traditional livelihood.

By using an artificial Base Case, the assessment is incapable of determining and assessing the impacts of activities that have taken place up to the present separate from the approved projects as there is no pre-industrial or 'undeveloped' scenario for comparison. Incremental impacts from each new project in the region adversely affect local and regional environmental conditions. Shell's use of artificially high baselines masks the true magnitude of environmental impacts. In the context of the ACFN's constitutionally-protected rights, the predicted changes for the project are near meaningless if it is not also understood how much change has already occurred – not just what might occur if all the approved projects are operating at their maximum extent. This only serves to minimize the impacts of each new project. Historical surveys, satellite data, and air photos are available for most key parameters for the pre-industrial disturbance period.

Other EIAs[3] have used a 'hypothetical baseline" where the impacts of existing oil sands projects are lifted off and the polygons joined together. This approach allows for more accurate evaluations of current impacts (and the determination of whether or not these are already significant). This also allows for a more meaningful assessment of the impacts of the proposed project using the commonly used assessment scenarios: project-only, project and the approved, and project with approved and all planned industrial projects.

Requests*:*

i. *Repeat key assessments within the EIA based on a pre-industrial baseline, incorporating the latest TLU information.*

ii. *Update the PDC against the pre-industrial baseline, using currently available project data.*

iii. *Provide documentation that Shell has obtained the ACFN's verification of Shell's interpretation of the ACFN's data.*

4. Regional Study Area too large. The large size of the Regional Study Area (RSA) obscures the cumulative effects by increasing the probability that the contribution of project-related effects will be assessed as 'negligible'.

   In addition, the 'one size fits all' approach used in this assessment does not meaningfully address effects on all receptors. For example, a wildlife RSA appropriate for large roaming animals such as moose is inappropriate for smaller animals such as beaver and Canadian toad. The same flaw in method is apparent for vegetation and aquatic resources.

   The entire terrestrial LSA represents less than one percent of the RSA. Therefore, it is impossible for a local-scale impact to be significant at the regional scale (even if 100% of the LSA).

[3] Petro-Canada used a pre-industrial baseline in the assessment of their MacKay River Expansion Project.

Requests:

i. *Document the purpose and process for the sizing of an RSA, and explain how area-based key indicator resources (KIRs) could be significant in the RSA.*

ii. *Reassess the impacts on wildlife using LSAs and RSAs appropriate for each species.*

5. Assumptions that reclamation will be successful are unsupported. In many instances, Shell's reclamation plans involve assumptions that ecosystems will be reclaimed with a capability equivalent to pre-disturbance, with little mention of landscape diversity. Shell relies on unspecified and long-term timelines to "support" the assumption that biodiversity would eventually be restored, and uses a 'far future' time frame that is unspecified for the reversibility of some of the project impacts. Shell correctly states that for any reclaimed ecosystem, there are a number of potential pathways**.** Yet Shell assumes that ecosite phases would be restored, mitigating the losses in habitat and species diversity.

   These reclamation assumptions do not seem to be supported by any data or experience on a similar scale of disturbance. By using a low diversity reclaimed landscape in an unspecified time-line as a goal, Shell can confidently claim that reclamation will be successful and that most impacts will be reversible. There is no certainty, however, that this claim can be met in reality.

   Requests:

   i. *Identify what timeframe is considered to be 'far future' for full reversibility of impacts of the project.*

   ii. *Explain why ecosite phases are used in the assessment calculations and wildlife models even though Shell admits that it is not possible to predict the final community type.*

   iii. *If Shell maintains that ecosite phases will be restored (including the dominant forbs), then provide specific targets (number of species, species composition, cover etc.) for each ecosite phase/wetland type to monitor and evaluate reclamation success.*

   iv. *If Shell admits that ecosite phases will not be restored, then re-analyze the data using "ecosite analogues" or some other category that indicates the lack of similarity and unpredictability of the final landscape.*

   v. *Explain how Shell overcomes the fact that the approval of end pit lakes has been subject to test and, as yet, no such test has been successfully completed.*

   vi. *Explain how Shell plans to incorporate the objective expressed in the ERCB Directive 074 (to minimize and eventually eliminate long-term storage of fluid tailings in the reclamation landscape) with this application.*

6. Long-term monitoring and mitigation not fully addressed. Monitoring may not detect problems (such as with reclamation, animal or plant repopulation, or seepage of contaminated water into the groundwater) for many decades. Detection may be too late for adaptive management, especially in the case of groundwater contamination. However, the application includes few details on long-term monitoring or mitigation plans – including action plans to address contingencies.

   It is important to the ACFN that they are involved in the design of monitoring and research plans. Shell has not discussed its plans for environmental monitoring for the proposed project with the ACFN, including many elements such as water quality, groundwater, wildlife, and reclamation. Shell suggests that the ACFN's request to review monitoring and research plans might be discussed as part of future negotiations towards an agreement. Establishing a transparent process to develop monitoring programs that allow for meaningful First Nations input should be done prior to ERCB adjudication about whether the project is in the Public Interest. A monitoring plan needs to be provided for each environmental component as part of the project application information to assure regulators and the ACFN that the program would address the needs of the ACFN and that mitigation strategies are effective.

   Requests:

   i. *Address long-term monitoring and mitigation of impacts that may take years, even decades, to be detected.*

   ii. *Provide preliminary monitoring plans or outlines of monitoring plans for each major environmental discipline (where not already provided in the application) for the PRM. Discuss Shell's commitment to provide the ACFN with the opportunity to review and make recommendations about these monitoring and research plans prior to a hearing.*

7. Environmental consequences ratings for high magnitude impact unclear. There is little guidance on what constitutes high, medium, or low impacts for environmental consequence ratings; different EIAs have different thresholds, some highly arbitrary. Shell has chosen 20% as the cutoff for high magnitude impacts for the PRM EIA, which the ACFN consider too high. Other recent EIAs have had high magnitude impacts set lower at 10% and14%.

   Request:

   Explain why Shell has chosen 20% as the cutoff for high magnitude impacts for many parameters, including the scientific basis for this number. Provide peer-reviewed references, documentation that the ACFN have had these peer-reviewed references provided to them, and that the ACFN have verified this assessment criterion.

8. Environmental consequences ratings for reversible impacts unclear. In the PRM AENV SIR 390 (Shell PRM Supplemental Information, First Round SIR Responses, May 2009), Alberta Environment questions the application of a (-3) reversibility rating as part of the environmental consequences ratings system (from Table 1.3-4, Volume 3, Section 1.3.6.2, page 1-37). Shell responded by stating that "A numeric score of (0) for reversibility would not account for the ecological endpoint's potential ability to recover, and would overstate the environmental consequence for the endpoint".

   The Impact Description Criteria denotes (0) as no or negligible impacts for magnitude, geographic extent, duration, and frequency; however, (0) for reversibility is used for partially reversible impacts. The consequence of this scale is that a 'reversible' impact (+3) outweighs the impact of a regional geographic extent (+2), long term impacts (+2), or continuous frequency (+2). Therefore, a negative environmental impact could become a positive impact if it is deemed reversible.

   Request:

   Explain, in biological terms, how a reversible impact could be a positive force, rather than a neutral force, including the scientific basis for these numbers. Provide peer-reviewed references, and documentation that the ACFN have had these peer-reviewed references provided to them and that the ACFN have verified these assessment criteria.

4.2 Cumulative Effects

4.2.1 Overview

As discussed above (Section 4.1), Shell did not properly assess the cumulative effects of the PRM in combination with other completed, existing, and planned regional projects on the environment, and with consideration of traditional lands, traditional use, and Rights of the ACFN.

For complete details, please refer to the full technical review report:

- Cumulative Effects Review of Shell Pierre River Mine and Shell Jackpine Mine Expansion Projects for Athabasca Chipewyan First Nation, August 2010, by Daniel Smith of DS Environmental Consulting Inc. – attached to this report as Appendix D-2.

4.2.2 Discussion and Assessment Review

Cumulative effects are the long-term changes that may occur not only as a result of a single impact but the combined effects of each successive impact on the environment. These incremental impacts may be significant even though the impacts of each action,

when independently assessed, are considered insignificant. Concerns about the cumulative effects of industrial activity in the region and the management of these effects have been raised at each project hearing over the past two decades and by the ACFN in all communications with regulators concerning new projects.

An accurate pre-industrial baseline against which impacts can be assessed is required to realistically predict cumulative impacts from industrial projects in the Athabasca Oil Sands Region. Also important are meaningful assessment cases that, when compared with one another and with a true baseline, reveal environmental changes. As already stated in Section 4.1 of this report, Shell failed to assess cumulative effects for the PRM.

The cumulative effects assessment required by the Terms of Reference is limited and inadequate, yet Shell fails to achieve even this minimal condition. Currently the Alberta government supports cumulative assessments that take a narrow, project-specific approach, examining cumulative effects predominantly when the project in question is predicted to have a significant effect at a local scale. However, cumulative effects can be relatively insignificant at the project-scale, but significant at larger scales of space and time.

In an informative and accurate cumulative assessment, Shell would first need to consider the current baseline, which should be inventoried and compared with a pre-industrial baseline to determine if the degree of change in detected impacts are acceptable. Secondly Shell would verify that the anticipated impacts of the approved project are acceptable, given the new baseline. Finally, the new predicted impacts of the proposed project would be assessed and tested against current and 'approved' cases.

The EIA, including the cumulative effects assessment, is narrowly scoped and, as such, fails to address issues related to ACFN Rights and traditional use. There are no regional management targets, policy guidelines, or thresholds for the majority of the traditional resources important to the ACFN; such objectives are necessary to ensure traditional resources are sustained at levels which would allow the ACFN to practice their Rights. In absence of these targets, guidelines, and thresholds, Shell's impact predictions and promises to monitor and restore environmental impacts are of little worth.

In addition to methodological failures, this report identifies specific deficiencies related to the PRM cumulative effects assessment. Of great concern to the ACFN are the many deficiencies which result in an inaccurate assessment of impacts that would affect their ability to use their traditional lands and to exercise their Rights with respect to traditional use. Specific concerns related to cumulative effects are identified throughout this report, according to subject matter.

4.3 Groundwater

4.3.1 Overview

Several of the activities associated with the Pierre River Mine Project (PRM) would impact the groundwater resources in the project area, and possibly on a regional scale.

The key environmental issues arising from the PRM with respect to groundwater are:

- Changes in groundwater levels, flows, flow directions, and quality;
- Hydrological impacts may in turn affect aquatic resources, including surface water flows, surface water quality, wetlands , and terrestrial vegetation;
- Long-lasting and adverse impacts on groundwater quality (and its potential use by ACFN members) due to seepage from the external tailings disposal area (EDTA);
- Long-lasting and adverse impacts on groundwater quality and availability (and its potential use by ACFN members).

For complete details, please refer to the full technical review reports:

- Shell Pierre River Mine Project – Environmental Impact Assessment Report – Review for Athabasca Chipewyan First Nation – Groundwater Component – September 2008, by Lew Fahner of Agua Consulting, attached to this report as Appendix D-3.
- Shell Jackpine Mine Expansion and Pierre River Mine Projects Responses to ACFN SIRs – Environmental Impact Assessment Report Review for Athabasca Chipewyan First Nation – Groundwater Component, August 2009, by Lew Fahner of Agua Consulting, attached to this report as Appendix D-4.

4.3.2 Discussion and Assessment Review

Several computer model simulations have been used to predict project-related impacts on area groundwater resources. The various parameters used in the models are within acceptable limits and Shell often uses “worst case conditions” to provide conservative predictions. However, the PRM would be located on the west side of the Athabasca River and further north than most previous mining projects. There is less experience with the hydrogeological characteristics of this area. Computer modeling predictions are always subject to possible errors as a result of the hydrogeological uncertainties in a complex environment, and hence the potential impacts could be under- or over-estimated. Ongoing groundwater level and groundwater chemistry monitoring is necessary to ensure computer-predicted results are valid.

The proposed mitigation measures are not unreasonable to prevent contamination; however, confirmation that these mitigation strategies work, especially those related to

reclamation and the mine closure landscape, is essential. Also essential is the need to understand and address the impacts to groundwater that take place over time, through monitoring, reporting, and mitigation planning, and management response.

In response to technical questions from the ACFN, Shell would not commit to specific action regarding groundwater incident reporting, and was not willing to present groundwater monitoring data in a simplified format for easier review by the ACFN. Both the incident reporting and data presentation should be provided now so they can be considered as part of the project application - the ERCB and other regulators cannot assess the Public Interest aspects of this application without full disclosure of relevant information.

4.3.3 Concerns and Requests

The following specific groundwater concerns and requests were identified:

9. Impacts of ETDA on groundwater not assessed. Shell proposes to build the PRM External Tailings Disposal Area (ETDA) on an undisturbed area outside of the mining area. It would be filled by 2029, and reclamation is planned for 2049 when the ETDA would be capped and reclaimed. The ETDA would seep tailings liquids into the ground for 20 years (or more). Also, because this ETDA (and other similar tailings storage / disposal areas) would be elevated with respect to the surrounding areas, the ETDA would effectively become an elevated groundwater recharge zone. The added elevation (about 50 metres) would increase the hydraulic pressure exerted downwards on the tailings liquids forcing them into the underlying strata.

   Process-affected seepage from the ETDA could be expected to enter the shallow surficial deposits (Quaternary) and possibly the Basil Aquifer as well. Once the process-affected seepage reaches these deposits it would enter into the local or regional groundwater flow system, reducing the quality of groundwater releases to Big Creek and the Athabasca River valley. Shell plans to intercept and pump out contaminated groundwater back into the tailings disposal pond. This may reduce, but would not eliminate contamination reaching surface water interfaces. The magnitude of the seepage is difficult to predict. Although the quality of process-affected groundwater would gradually improve over time (if no further contamination occurs), the improvements in quality would be very slow. It could take decades, if not centuries, to fully remediate the impacts on groundwater quality from the tailings pond seepage.

   Requests:

   i. *Identify the impact of ETDA on the discharge of tailings liquids into groundwater.*

   ii. *Identify engineering methods available to reduce this discharge to zero.*

iii. Explain why reclamation of the ETDA would require 20 years or more after filling is complete.

iv. Identify the time period estimates for full remediation of groundwater quality from ETDA seepages, and the basis for these estimates.

10. Groundwater incident reporting to the ACFN unconfirmed. It is unclear whether the ACFN would be advised of any unexpected changes in groundwater quantity and / or quality.

Discussion:

Shell states it would discuss groundwater incident reporting with the ACFN as part of future negotiations towards an agreement. Shell needs to deal with this now, as an essential part of the application; not as part of future negotiations.

Requests:

i. Discuss how the ACFN would be advised of any groundwater incidents at the PRM that are reported to government agencies.

ii. Explain why Shell does not think that impacts on groundwater (and thus on present and future users of that groundwater) are not part of the ERCB's Public Interest Determination.

11. Commitment to presenting groundwater monitoring data to the ACFN unclear. Groundwater monitoring must demonstrate that project activities are proceeding without unacceptable impacts on the groundwater resources in the area. The predicted impacts of the project on groundwater are based on computer models that have inherent uncertainty.

Discussion:

Shell indicates that the "predictions and conclusions presented in this EIA are therefore not considered sensitive to the degree of hydrogeological prediction uncertainty associated with changes in groundwater discharge from the Quaternary deposits to surface water" (Volume 4A, Section 6.3.2.11, page 6-63).

Shell included a proposed groundwater monitoring program in Volume 4B, Appendix 4-9, Section 2.1. The proposed monitoring program has not been designed to confirm computer-predicted results and professional judgments on impacts on groundwater resources. It is important to confirm that the predicted impacts are not under-estimated, especially on traditional-use land.

In response to the ACFN's technical question on this issue, Shell stated it may agree to reassess mitigation measures as part of future negotiations but they did not

express any willingness to simplify the presentation of groundwater monitoring data for easier review by ACFN community residents.

Shell should deal with this now. Any re-assessment of proposed mitigation measures must be done as part of the project assessment, not deferred for "future negotiations".

Requests:

i. *Commit to presenting groundwater monitoring data to the ACFN in a form that will gain the ACFN's confidence by demonstrating that the groundwater modeling is accurate and responsive to potential impacts. This should include comparisons with data from Shell's existing operations.*

ii. *Explain why Shell does not think that data on groundwater quantity and quality should not be held in the public domain when that resource is used (or may be used in the future) by Treaty and Aboriginal rights-bearing First Nations, including the ACFN.*

12. Groundwater contamination transport within the region poorly understood. Shell acknowledges that the project could contribute to groundwater quality impacts as a result of a number of factors (i.e. ETDA seepages, pit backfill, reclamation effects, and plant facility construction and operations). 3-D models were developed for solute transport at a local scale (see Volume 4, Appendix 4-1, Section 1.3), but solute transport modelling was not done on a regional scale. The impact to surface waters from the local-scale transport that was modelled was judged by Shell to be minimal. This is unverified by field data. Extensive groundwater monitoring would have to be carried out to verify this conclusion and to confirm that the quality of the solute in the groundwater potentially being discharged to the surface waterbodies (and streams) as base flow does not exceed anticipated concentrations. Additional work should also be done to assess solute transport at a regional scale.

Requests:

i. *Assess the impact of solution transport of contaminated groundwater on surface water in the region using a 3-D solute transport model.*

ii. *Discuss Shell's plans to monitor and verify the results of the local scale solute transport modelling.*

iii. *Discuss Shell's commitment to regional groundwater modeling.*

iv. *Discuss Shell's commitment to a timely and coordinated management response if issues are identified in the local or regional monitoring.*

13. Access and use of traditional groundwater sources may be impacted. ACFN members could be impacted by the loss of groundwater sources (waterwells, muskegs, or springs) used when visiting traditional lands located in the proposed mine site or the immediate surrounding area. Shallow groundwater from fens is often used during traditional pursuits as a water source as the inflow-outflow of groundwater makes it suitable for consumption. Groundwater sources in the mining area would be permanently impacted and / or be made unsuitable for further use. Groundwater sources located in the surrounding area may be permanently or temporarily impacted and may be unsuitable for further use after closure and reclamation.

Discussion:

In response to the ACFN's technical question on this issue, Shell indicates it is not aware of any groundwater use, other than possibly at trappers' cabins. If ACFN members use[4] groundwater from the Local Study Area then the assessment may not adequately determine impacts on their traditional use and on their Rights.

Request:

Confirm that Shell has discussed the possible locations of groundwater sources used by ACFN members in a manner that ensures that ACFN members are aware that the water sources they use are in fact groundwater-dependent (e.g., fens) and may be affected by the project. Provide the documentation indicating both that this information exchange has occurred, and that the ACFN have verified this exchange.

4.4 Surface Water Quality

4.4.1 Overview

The key environmental issues arising from the PRM with respect to surface water quality are:

- Water quality assessment inadequate due to impacts often being downplayed;
- Many water quality uncertainties due to poor methodology;
- Significant increases predicted in the concentrations of metals within Big Creek;
- Unknown project-related and cumulative impacts of tailings pond seepages and end pit lake discharges on the Athabasca River water quality.

For complete details, please refer to the full technical review reports:

[4] This concept of use includes past use, present use, and future use.

- Shell Pierre River Project Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation, September 25, 2008, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-5.
- Shell Pierre River Mine Project – Application Amendment and Response to the ACFN Review, October 4, 2009, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-6.
- Shell Pierre River Mine Project – Summary of Water Quality and Aquatic Resources Concerns, February 7, 2010, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-7.

4.4.2 Discussion and Assessment Review

When impacts to water quality are identified in the assessment, their significance is often downplayed. If benchmarks can be so easily disregarded, then a more stringent method of determining benchmarks must be employed, so that meaningful results can be determined.

An uncertainty analysis was not carried out for the PRM. Instead, the results of the Jackpine Mine Expansion (JPME) uncertainty analysis were used to determine prediction confidence. Because similar approaches were used, and the quality of the input data was similar, the JPME results were used - implying that the PRM assessment must also have high confidence. Considering different datasets were used and that some of the PRM predictions relied upon information provided and modelled by the CNRL Horizon project, it would seem prudent to conduct an uncertainty analysis specific to this project.

4.4.3 Concerns and Requests

The following surface water concerns and requests were identified:

14. List of modeled parameters unclear. While key constituents (acute and chronic toxicity, tainting potential, naphthenic acids and total dissolved solids) for the Pierre River were assessed and presented, no other water quality parameters appear to have been included, or at least, were not included in Table 6.5-16. Shell notes that all other Local Study Area (LSA) constituents were within the Base Case range, but no other data are provided. Shell also states that only those constituents modelled for the CNRL Horizon Project EIA could be assessed in this EIA, but that appeared to only include mercury. It is unclear why a full range of metals, nutrients, Polycyclic Aromatic Hydrocarbons (PAHs) (other than naphthenic acids) and other important water quality parameters were not assessed and/or included in Table 6.5-16.

    A few additional parameters are included in the assessment tables for Eymundson Creek and Big Creek (including some metals and PAHs), but a full suite of water quality parameters is still missing.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that the details regarding the full suite of water quality parameters were included in Volume 4, Sections 6.5, 6.5.5.3, 6.5.2.7, and Appendix 4-7. Shell also states that a few parameters were unavailable for the CNRL Diversion Channel, and therefore were not modeled. Shell does not state which parameters were unavailable.

Requests*:*

i. *Provide a list of those parameters (chemicals) that were not modelled due to unavailability.*

ii. *Describe the methods, cost and time required to assess a full suite of metals and PAHs.*

15. Uncertainty analysis for LSA project impacts lacking. For the PRM EIA, Shell relied upon the water quality uncertainty analysis conducted for the Jackpine Mine Expansion Project. No independent uncertainty analysis was conducted for the PRM Local Study Area (LSA) data or predictions. Considering that different datasets were used and that some of the PRM predictions relied upon information provided and modelled by another project (CNRL Horizon), it would seem prudent to conduct an uncertainty analysis specific to this project.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that they are willing to discuss undertaking an independent uncertainty analysis only at an undetermined date in the future (i.e. "as part of future negotiations [with the ACFN] towards an agreement [on this project]") This information should be provided now, not later, so that it can be considered as part of this project application. It is expected that this information would be a basic part of the EIA and not linked with an agreement with the ACFN. The request remains.

Request:

Conduct a water quality uncertainty analysis that is specific for the LSA impacts of the PRM, and provide the results as part of the project application supplemental information.

16. Regulatory guideline exceedances inappropriately used as impact thresholds. Shell concludes that for the Pierre River, Eymundson and Big Creek, the impacts on water quality are low to negligible. Shell outlines in the impact description criteria (Table 1.3-4) whether a constituent has a guideline. The implications of these ratings differ substantially, such that when a parameter has a guideline associated with it, only

guideline exceedances are considered to be significant. All absolute increases in the actual values are completely discounted.

Within the EIA, several of the metals within Big Creek are predicted to double or triple, but because the guideline isn't exceeded, or the guideline is exceeded already under the Base Case, then the assessment does not consider this to be an impact. While guideline exceedances will certainly be the key criteria, regional phenomena (such as increased acid loading) and the causal factors for absolute value increases should also be evaluated and explained as one input to the Public Interest determination, because they represent a change from existing conditions. While guidelines have been developed as representative end points of change in survival, growth, reproduction, behaviour etc., substantial changes in water quality may still impact aquatic organisms, even if guidelines are not exceeded, particularly within natural systems (e.g., through synergistic effects) as opposed to a controlled laboratory.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that the most stringent guidelines (AENV, CCME and USEPA) were applied and that guidelines are meant to protect the most sensitive life stage of the most sensitive species over the long term. While this may be true, Shell does not address the issue. Absolute changes in the numerical values of the water quality parameters were not discussed. Sole reliance on guideline compliance does not necessarily ensure that the ecosystem remains unaffected or unchanged.

Requests*:*

i. *Provide additional discussion on the impacts of absolute increases in a full suite of parameters with guidelines, irrespective of whether guideline exceedances occurred.*

ii. *Discuss the potential impacts and changes that could occur due to the predicted large increases in metals in Big Creek.*

17. Information in the water quality impact tables insufficient. Although the ratings criteria used the percentage increase to determine the magnitude of change for water quality constituents, no percentage increase values are provided in the text or tables. As a result, it is very difficult to check the results tables against the ratings criteria to determine how the ratings have been applied and whether they have been applied correctly.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that there is sufficient information for the ACFN to calculate the percentage change of the data. This is true, but it isn't the ACFN's responsibility to complete tables for the EIA. Information presented in the EIA should be clear and informative to Rights holders and decision makers. Is Shell really requesting that reviewers conduct their own manipulations of the data? The calculation of percentage change and its application to the ratings criteria is a minor point; in the bigger picture, this is not an approach that Shell should permit to be applied and this tactic should not be condoned nor deemed sufficient by the regulators.

Request*:*

Provide the percentage change, as well as the absolute change, in the results tables for the water quality assessment to allow comparison with the ratings criteria.

18. Ratings system for constituents with guidelines unclear. Where water quality guideline exceedances are found to result from the project, it is unclear whether the ratings criteria use the higher acute guideline or the lower chronic guideline, or both, to determine the ratings impact. For example, in Table 6.5-18 the median chromium concentrations in Big Creek from 2015 to 2049 would triple from 0.0021 mg/L (Base Case) to 0.0062 mg/L (Application Case). The acute guideline for chromium is 0.016 mg/L, while the chronic guideline is 0.001 mg/L. Clearly, these exceedances would occur over a chronic time period, and therefore, the 0.001 mg/L guideline should be applied. The question becomes whether this increase (a difference of 0.0041 mg/L) is considered to be negligible, low, moderate or high. The ratings criteria are vaguely described using subjective criteria (low is when the release contributes slightly to existing background values over guidelines, medium is a marginal contribution and high is a substantial contribution). The definitions of "slightly", "marginal" and "substantial" are unclear.

Discussion:

In response to the ACFN's technical question on this issue, Shell clarifies that the chronic guideline is applied when both chronic and acute guidelines are present. Shell does not clarify the ratings system provided in the EIA. The ratings criteria in this section of the EIA are provided as low (when the release contributes slightly to existing background values over guidelines), medium (a marginal contribution), and high (a substantial contribution). Definitions of "slightly", "marginal" and "substantial" are not provided in the EIA and are not included in the response to the ACFN as requested. Shell states that these terms were not used to rate guidelines exceedances. This explanation appears to combine two separate approaches to assess data: first the actual water quality assessment, and then the use of the water

quality data in the subsequent Aquatic Health and Human Health components. This request applies only to the ratings of the water quality component.

Request*:*

Provide additional rationale and clear criteria for the ratings system when guidelines are present. State whether the rating is provided against changes to the acute guideline, chronic guideline or both. Define "slightly", "marginal" and "substantial" exceedances.

19. Pit lakes littoral zones too small. Shell states that the littoral zones of the pit lakes would be adequate to provide biological activity and support a viable ecosystem. The littoral zones would be up to 15% of the total area. This is relatively small compared to other reclamation waterbodies, in which generally 20 to 30% of the area of the lake is comprised of littoral zone. Since the littoral zone is the most productive part of a lentic system, its relative area should be maximized, not minimized.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that the littoral zones of the pit lakes would be between 10 to 30% and that exact areas would be determined during the detailed design stage. This is a very large difference and should be narrowed at this stage of the project assessment.

Request*:*

Ensure that littoral zones for pit lakes are within the range of 20 to 30% and not on the lower end of the expected range (i.e. 10-15%).

20. Impacts of pit lake discharge on traditional water use unclear. Shell states that the pit lakes would discharge to surface waters from this project only when water quality is of sufficient quality and when discharge water quality limits are met. It is unclear what is considered sufficient quality and what these discharge limits would be. It is reasonable to hope that the limits would be the same as the current water quality guidelines. However, this is not likely the intent, since at closure, when discharge would begin, natural concentrations (for many constituents) and guidelines (for PAH group 2, and iron) may be exceeded in the pit lakes. Additionally, Shell must commit that the Treatment Lake would discharge to the Athabasca River only if discharge water quality limits are met.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that the management of pit lakes and the Treatment Lake would meet discharge criteria that are currently being developed by Cumulative Environmental Management Association (CEMA) and would be enforced by AENV in the future.

There are serious concerns about the approval and construction of mines without clear details and specific commitments as to the quality of water to be discharged by these pits to the environment.

Requests:

i. *Identify how the pit lake release criteria will consider potential impacts on traditional use of water downstream and the consequent effects on Treaty and Aboriginal rights.*

ii. *Discuss the role of Fisheries and Oceans Canada (DFO) and other federal regulators in the selection of relevant release parameters and the process of permitting the reconnection of pit lakes to the watershed drainage system of the Athabasca River.*

21. Pit lake sediment quality not modeled. Shell provides the sediment quality of the Mature Fine Tailings (MFT) to be added to the bottom of the pit lakes, but does not characterize the sediment quality of the lakes at the time of closure. Similarly, in the pit lake where MFT will not be stored, the sediments have not been characterized. It is unacceptable that these have not been modeled. In addition to being required as part of the Directive 074 annual reporting (item 14 of Appendix E), these characterizations are essential aspects of the Public Interest consideration.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that the MFT that would be added to the pit lakes is expected to be comparable to the MFT for existing oil sands operations. However, every oil sands operation is different, with variations in geology and extraction and processing methods. Therefore the wastes, including the MFT, will be unique. Regardless, the question asked was what the sediment quality of the pit lakes would be at closure, not the quality of the MFT initially added.

Requests:

i. *Describe characterization of pit lake sediment at closure.*

ii. *Describe how the storage of MFT in pit lakes corresponds to the performance requirements of ERCB Directive 074 and more generally how this unproven*

technology corresponds with the objective of minimizing the retention of fluid tailings in the reclamation landscape.

iii. Describe Shell's environmental and economic liabilities associated with the retention of mixed fluid-containing structures in a reclamation landscape.

22. Cumulative effects of the discharges from multiple end pit lakes into the Athabasca River not adequately assessed. Shell did not adequately assess the cumulative effect of simultaneous water discharge from multiple end pit lakes into watercourses connected to the Athabasca River. Many of the region's oil sands projects are operating on similar timelines and consequently will have pit lakes working at the same time. If several end pit lakes are discharged within similar timeframes into the Athabasca River, there may be incremental increases in contaminant and nutrient loadings to the Athabasca River, the Athabasca Delta and the western portion of Lake Athabasca, possibly impacting their water quality. The lack of guidelines for the release of pit lake waters adds to the uncertainties related to contaminant concentrations of regional water quality. Diluting water quality constituents to below guidelines levels does not diminish the issue of the incremental and cumulative effects of multiple releases on receiving waters.

Requests:

i. Discuss the current status of the testing of end pit lakes, as a provisionally approved mining feature, and prospective options to displace this as yet unproven technology.

ii. Assess the cumulative impact of the discharges of multiple pit lakes in the region on water quality in the Athabasca River and, on downstream ecosystems.

iii. Identify how the cumulative impact of multiple pit lakes discharges in the region would affect the ACFN's Rights and traditional use of the River.

23. Cumulative impacts on Athabasca River from process-affected seepage not assessed. Tailings ponds (both in-pit and out-of-pit varieties) are a major physical feature of conventional oil sands operations. Current estimates are that the present ponds contain 840 000 Mm^3 of contaminated water (ERCB, 2010). The PRM would add another 620 Mm^3 to this inventory. These ponds leak and their seepage is known to contaminate underlying groundwater and contribute toxins from baseflow to the Athabasca River. The current and future cumulative effects of all the current and planned tailings ponds in the region on the Athabasca River are unknown. The residual impacts on groundwater and surface waters could last decades if not centuries after these ponds are closed and reclaimed.

Because the Athabasca River will receive process-affected seepage from tailings ponds located on both sides of the river, a cumulative effects assessment on tailings ponds seepage was required for the PRM. Shell concluded that the net cumulative impact of the seepage on the Athabasca River would be insignificant. However, there is new information indicating that concentrations of toxins in the Athabasca River are significantly elevated downstream of the current oil sands projects relative to the concentrations upstream (Kelly et al., 2009, Kelly et al., 2010; Timoney & Lee, 2009).

Requests:

i. *Identify the impact of the cumulative effects of regional tailings seepage on groundwater and surface water quality and on downstream ecosystems (including the sediments of the Athabasca River and the Peace-Athabasca Delta), against a pre-industrial baseline.*

ii. *Discuss the apparent contradiction between modeled forecast for the concentrations of toxins in the Athabasca River and current data presented in Timoney & Lee (2009) that suggests that the impacts are already significant.*

iii. *Discuss how the cumulative impacts of regional tailings seepage will affect the ACFN's Rights and use of traditional resources.*

24. Proposed bridge and pipeline pose risk to Athabasca River water quality. Shell is proposing building a bridge over the Athabasca River to access the PRM and to convey the bitumen pipelines from the extraction plants to Shell's upgrader in the Edmonton area.

The ACFN are concerned about the risk of a pipeline spill and contamination of the Athabasca River, its ecosystem, and the people living downstream. While Shell has proposed plans to minimize this risk, it cannot be completely eliminated. A catastrophic rupture would significantly affect the downstream water quality, aquatic health of fish and other organisms, and the ACFN's health and lifestyle.

Bridge construction would impact the fish in the Athabasca River by disturbing and removing fish habitat. Mitigation plans for disturbance and destruction of fish habitat would not fully address the impacts. Adequate and acceptable compensation is required.

Presently, recreational activities in the area are limited by access. Shell's proposed bridge would open up the access to the west side of the Athabasca River to industrial and recreational activities. Increased hunting pressures and impacts of off-road recreational vehicles by non-Aboriginals would affect the ACFN's ability to practice their Rights.

Requests*:*

i. Assess the potential effects a worst-case pipeline spill or rupture would have on the Athabasca River, on its downstream ecosystem, and on the ACFN.

ii. Provide a conceptual plan for protecting fish habitat from disturbance and destruction during the construction and use of the bridge, and present a concept for fish habitat compensation in the case where fish habitat would be destroyed.

iii. Assess the potential impacts that increased access due to the bridge and road would have on wildlife abundance and, ultimately, on ACFN Rights.

4.5 Aquatic Health and Fish / Fish Habitat

4.5.1 Overview

The key environmental issues arising from the PRM with respect to fish and fish habitat and aquatic health are:

- Disregarded impacts of predicted exceedances of toxicological benchmarks for aquatic health and fish tissue analyses;
- Several constituents (total dissolved solids, aluminum, chromium, iron, manganese and strontium) were found to exceed the benchmarks for aquatic health;
- Mercury contamination in the Compensation Lake was neither discussed nor assessed in the EIA;
- The release of waters from pit lakes, as a result of this project, and from multiple projects in the Oil Sands Region, would result in relatively large temperature changes in various waterbodies, which would impact fish behaviour, reproduction and habitat;
- Serious concerns about the approval and construction of mines without a clear understanding of the fish habitat compensation plan. A large number of uncertainties related to the No Net Loss Plan (NNP) and the Conceptual Compensation Plan (CCP);
- Unknown impacts of loss and diversions of multiple streams in the region;
- Unknown project-related and cumulative impacts of tailings pond seepages and end pit lake discharges on the Athabasca River aquatics and fish.

For complete details, please refer to the full technical review reports:

- Shell Pierre River Project Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation, September 25, 2008, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-5.
- Shell Pierre River Mine Project – Application Amendment and Response to the ACFN Review, October 4, 2009, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-6.
- Shell Pierre River Mine Project – Summary of Water Quality and Aquatic Resources Concerns, February 7, 2010, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-7.
- Shell Pierre River Project Conceptual Fish Habitat Compensation Plan Review for Athabasca Chipewyan First Nation, September 25, 2008, by Fay Westcott of Clearwater Environmental Consultants, attached to this report as Appendix D-8.

4.5.2 Discussion and Assessment Review

As with the surface water quality assessments, when impacts were identified, their significance was often downplayed. For example, several constituents (e.g., total dissolved solids, aluminum, chromium, iron, manganese and strontium) were found to exceed the benchmarks for aquatic health, but the impacts were considered negligible because the benchmarks did not really represent an impacted state or were not appropriate for the area. In addition, other metals, for which impacts were predicted, were considered to be overestimated due to the conservative assumptions used to complete the assessment.

The Conceptual Compensation Plan (CCP) puts forward a combined plan for both the PRM and JPME projects. The habitat units and actual productive capacity of fish habitat to be lost in either the PRM or JPME projects were not determined at this stage, nor was the productive capacity of the proposed compensation habitats. The proposed compensation would be a constructed reservoir and two engineered channels, which are intended to compensate for the habitat losses for both projects. Similar to other regional mine CCPs, the majority of the compensation appears to be for lacustrine habitat, while the majority of losses would be for riverine habitat. Without additional information, and in particular, habitat unit information, it is not possible to assess the adequacy of this compensation plan. The issue of mercury contamination of the waters and fish in the reservoir was raised in the NNL planning process but was not discussed in the assessment of this project.

4.5.3 Concerns and Requests

The following aquatic health and fish / fish habitat concerns and requests were identified:

25. Benchmark exceedances of several aquatic health constituents dismissed. The results of the aquatic health and fish tissue analysis found that several constituents (total dissolved solids, aluminum, chromium, iron, manganese, and strontium) would exceed the toxicological benchmarks. However, these findings are rated as having a negligible impact on aquatic health which Shell justified in several ways, including: the benchmarks do not really represent an impacted state, baseline levels are already high, or the benchmarks are overestimated due to the conservative assumptions used to complete the assessment.

    If the benchmarks can be so easily disregarded, then perhaps a more stringent method of determining benchmarks should be employed, so that meaningful results can be determined.

    Discussion:

    In response to the ACFN's technical question on this issue, Shell states that the question is a statement of disagreement with their methods, and should be discussed following completion of the technical review. It is unclear why justification of their methodology cannot be provided in responses to the ACFN questions. The purpose of this question is to identify a gap in the assessment and to request the information to fill that gap.

    Requests*:*

    i. *Provide appropriate and meaningful pre-industrial benchmarks for aquatic health constituents, such that compliance and non-compliance can be better assessed.*

    ii. *Discuss the current utility of these benchmarks, how they may be improved in the future.*

    iii. *Describe Shell's commitment to improve the science in this critical input to the ERCB's public interest determination.*

26. Assessment on aquatic health for benchmark exceedances lacking. Several metals are predicted to exceed their benchmarks within the Local Study Area (LSA) and the pit lakes, including total dissolved solids, aluminum, chromium, strontium, manganese, and iron. While the impacts are rated in terms of duration, frequency, location etc., no information on the actual impacts of these exceedances is included. It is essential to know the potential impacts of the metals, individually and synergistically, on the survival, growth, reproduction, and behaviour of aquatic life.

    Discussion:

    In response to the ACFN's technical question on this issue, Shell states that the findings of the assessment were that none of the parameters would pose long-term

impacts to aquatic health. Any exceedances of benchmarks were flagged for further assessment. It is unclear what additional assessment of these exceedances Shell is planning on conducting and the timeline for its completion. The potential impacts on aquatic life were not discussed, apart from the unsupported conclusion that impacts would be negligible.

Requests*:*

i. *Discuss the potential effects of the predicted benchmark exceedances on aquatic health.*

ii. *Describe Shell's monitoring plan for predicted benchmark exceedances on aquatic health, both on lease and off lease.*

iii. *Discuss the effect of decreasing pH levels on the mobilization of metals and other contaminants. Include a description of the regional trends in pH and metal mobilization.*

iv. *Discuss the methods available and their costs to reverse the impacts predicted.*

v. *Discuss Shell's commitment to change its technical methods and associated emissions if actual contaminant levels exceed predicted values.*

27. Fish habitat impacts due to thermal changes unclear. The release of waters from a PRM pit lake in 2049 would result in relatively large changes in temperature in Eymundson Creek during the spring, summer and fall. For example, the mean monthly temperature for May will decrease almost 3˚C, from 5.8˚C in the pre-development scenario to 3.1˚C. The mean monthly temperature for September will increase almost 6˚C from 3.6˚C to 9.4˚C. Despite these large differences, the impact rating on Eymundson Creek temperature changes and fish habitat are considered negligible. While Shell states that thermal equilibrium will quickly be achieved, no mention on the actual extent of the impact is provided. Only mitigations for impacts of the polishing pond releases, which would result in relatively small changes (a maximum change of 0.3˚C) are discussed. No mitigation for pit lake discharges are mentioned, despite this being the major impact on temperature. In addition, the ramifications of these large temperature effects on other water quality parameters (e.g. dissolved oxygen) are not mentioned.

    In addition to thermal changes in Eymundson Creek, other uncertainties include the cumulative impacts of thermal changes of other waterbodies, including the Athabasca River, due to multiple projects in the Oil Sands Region.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that the temperature changes indicated for Eymundson Creek compare the existing Eymundson Creek to the diversion channel constructed at Closure, and appears to suggest that the comparison is not valid. While it is clear that this comparison is for two completely different channels, Shell is responsible for assessing the impacts of their project on the existing environment. If Shell is planning to eliminate Eymundson Creek and replace it with a diversion channel, then those impacts should be evaluated. The resulting channel would have a temperature difference of up to 6°C from the existing Creek, as stated in the EIA.

Shell also states that Eymundson Creek would be diverted in 2016 (the large temperature changes are predicted to occur in 2049). Because of the operational diversions of Eymundson Creek, full compensation for the estimated loss of fish habitat is included in the Conceptual (fish habitat) Compensation Plan. As it is assumed that this plan will fully compensate for any fish habitat losses, the impacts of the mine are considered by Shell to be negligible.

Requests*:*

i. *Reassess the impact rating for temperature changes to Eymundson Creek that better reflect the predicted data; describe the extent of the changes in temperature along the length of the river; and discuss the effects of these temperature changes on other water quality constituents, particularly dissolved oxygen.*

ii. *Clarify whether Eymundson Creek would have fish or other aquatic life in it in 2049 that would be exposed to these large thermal changes. If so, identify the expected species and the impacts associated with temperature fluctuations.*

iii. *Assess the current and potential cumulative impacts of shifts in water temperature on fish or other aquatic organisms located in waterbodies, tributaries and the Athabasca River from current and planned oil sands projects against a pre-industrial baseline.*

28. Effects on fish habitat are not extrapolated to fish abundance. While Shell discusses the impacts on fish habitat as a result of several impact pathways and linkages, these potential changes are not extrapolated to the implications for fish abundance or populations. For example, there is no discussion of the implications on fish abundance as a result of the elimination of many of the Local Study Area (LSA) watercourses and waterbodies, and replacement by diversion channels. Because some of these channels will be temporary, they will not be built to the same specifications as closure diversion channels would. Presumably fish abundance within the LSA would be reduced until permanent, self-sustaining channels were

constructed and capable of supporting fish populations. Similar concerns exist for impacts of decreased fish passage and accessibility on fish abundance.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that additional information will be provided in their No Net Loss (NNL) Plan, once completed. Shell notes that the ACFN withdrew from the NNL consultation process. The ACFN are not part of the NNL planning process because it felt the process presupposes project approval, a presumption which they did not want to support. The ACFN were also concerned that constitutionally-protected Section 35 Rights would not be considered in the NNL planning process (ACFN IRC, 2009). NNL planning does not directly address the potential impacts of a project on Treaty and Aboriginal rights - instead, it assumes that a trade-off is adequate to deal with any fisheries-related concerns. NNL planning does not address the issue of taking up new lands for the construction of compensation lakes, alteration of the ecosystem and landscape, etc.

There are serious concerns about the approval and construction of mines without a clear understanding of the impacts on fish and fish habitat, traditional use, and Rights of the First Nations and its members as discussed in Section 3 of this report.

Requests:

i. *Discuss the potential impacts of changes to fish habitat, on fish abundance, and local and regional fish populations.*

ii. *Assess the change in impacts if Shell fully adopts the intention of ERCB Directive 074 and commits to no residual fluid tailings (and thus no associated liabilities) in the reclamation landscape.*

29. Productive capacity of fish habitat not determined. Compensation for fish habitat losses is based on the productive capacity of fish habitat. However, the productive capacity of fish habitat has not been determined for any of the habitat losses proposed as a result of the project. Shell states that this will be completed as part of the detailed No Net Loss (NNL) Plan. Until the productive capacity of all the existing and compensation habitats have been calculated, it is impossible to determine whether the compensation efforts proposed are comparable, appropriate, and adequate for the project.

    Shell states that a lake with an area of 4 km^2 is sufficient to provide adequate compensation. The lengths of the compensation channels would be 13 and 15 km. Generally, this project would require at least a 2:1 habitat compensation ratio, but no information is provided to document that the proposed habitat would meet this ratio. Despite this, Shell states that a net gain in the productive capacity of available fish habitat would occur with no predicted adverse impacts on fish habitat. Without

the detailed habitat unit information, it is impossible to determine whether the goal of no net loss of productive capacity will be achieved.

In addition, without information about species-specific habitat losses, it is not possible to determine if the project would exacerbate the stresses and population declines already experienced by several fish species in the region.

Discussion*:*

In response to the ACFN's technical questions on this issue, Shell states that the adequacy of the estimated compensation requirements will be confirmed in the future when the NNL Plan is prepared. Shell notes that the ACFN withdrew from the No Net Loss consultation process. The ACFN are not part of the NNL planning process because it felt the process presupposes project approval, a presumption which they did not want to support. The ACFN were also concerned that constitutionally-protected Section 35 Rights would not be considered in the NNL planning process (ACFN IRC, 2009). NNL planning does not directly address the potential impacts of a project on Treaty and Aboriginal rights - instead, it assumes that a trade-off is adequate to deal with any fisheries-related concerns. In addition, the NNL reservoir will not provide compensation for the lost aquatic resource or traditional use as there are significant uncertainties and a general lack of confidence on the part of the ACFN in the edibility and safety of fish from the NNL ponds and reservoirs. Therefore, these ponds do not provide adequate replacement for the lost resource or traditional use. Additionally, NNL planning does not address the issue of taking up new lands for the construction of compensation lakes, alteration of the ecosystem and landscape, etc.

There are serious concerns about the approval and construction of mines without a clear understanding of the fish habitat compensation plan.

Requests:

i. *Provide details on the productive capacity of the habitat losses and compensation habitat.*

ii. *Provide all information necessary to prove that the compensation habitat would provide at least a 2:1 compensation ratio.*

iii. *Provide species-specific habitat losses, and discuss these impacts on fish species currently experiencing stress and population declines in the region.*

iv. *Given the uncertainties with the ability of the Compensation Lake to adequately compensate for lost aquatic resources or traditional use, discuss how the NNL Compensation Lake will impact the ACFN's Treaty and Aboriginal rights.*

v. *Provide the ACFN with the draft No Net Loss Plan, when available, for review and comment.*

30. Compensation for riverine habitat lacking. The Conceptual Compensation Plan (CCP) does not identify the proportion of riverine or lacustrine habitat units lost or created as a result of the project. Presumably, the majority of fish habitat losses would be from riverine habitat. However, the CCP can be assumed to consist primarily of lacustrine habitat (the Redclay Compensation Lake). While opportunities for compensation in the form of newly created riverine habitat or enhancement of existing habitat may be limited in the region, this is not discussed in the CCP. No explanation is given for why more riverine habitat cannot be recreated locally or enhanced regionally in order to replace lost habitat with like habitat. Further assessment of options to create riverine habitat is warranted.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that this should be discussed as part of the No Net Loss (NNL) consultation process. The ACFN are not part of the NNL planning process because it felt the process presupposes project approval, a presumption which they did not want to support. The ACFN were also concerned that constitutionally-protected Section 35 Rights would not be considered in the NNL planning process (ACFN IRC, 2009). NNL planning does not directly address the potential impacts of a project on Treaty and Aboriginal rights - instead, it assumes that a trade-off is adequate to deal with any fisheries-related concerns. NNL planning does not address the issue of taking up new lands for the construction of compensation lakes, alteration of the ecosystem and landscape, etc.

There are serious concerns about the approval and construction of mines without a clear understanding of the fish habitat compensation plan.

Requests:

i. *Discuss the lack of riverine habitat and the regional implications from this plan and other fisheries habitat compensation plans - which focus almost entirely on lacustrine habitat compensation.*

ii. *Discuss Shell's commitment to address this critical aspect of the impacts on the ACFN's Treaty and Aboriginal rights, and to provide the ERCB with information essential to the Public Interest determination.*

31. Compensation timing details unknown. Shell states that the Compensation Lake would be constructed early in the project and that the compensation channels would generally be constructed later in the project, but no dates are provided. As a result, it is unclear how the compensation habitats would be developed in a timely manner to provide available fish habitat. While construction of the Compensation Lake may occur at the same timeline as the beginning of the existing habitat losses, this is not the same as providing habitat actually capable of supporting fish. There would be a time lag between construction and development of productive fish

habitat (and actual use by fish). This timescale differences and the potential impacts on local fish populations are not clearly outlined in the Conceptual Compensation Plan (CCP). Regional impacts are also not discussed, although this same time lag issue exists for all mine projects.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that these specifics are being determined in the No Net Loss (NNL) Plan. The ACFN are not part of the NNL planning process because it felt the process presupposes project approval, a presumption which they did not want to support. The ACFN were also concerned that constitutionally-protected Section 35 Rights would not be considered in the NNL planning process (ACFN IRC, 2009). NNL planning does not directly address the potential impacts of a project on Treaty and Aboriginal rights - instead, it assumes that a trade-off is adequate to deal with any fisheries-related concerns. NNL planning does not address the issue of taking up new lands for the construction of compensation lakes, alteration of the ecosystem and landscape, etc.

There are serious concerns about the approval and construction of mines without a clear understanding of the fish habitat compensation plan.

Request:

Provide details regarding the timing of the construction of compensation habitat, and when they will be capable of supporting fish and other aquatic organisms as part of a sustainable and diverse ecosystem. Discuss the local and regional implications of this and other compensation plans that will not provide compensation habitat at the same time as habitat losses.

32. Impacts of mercury releases from NNL compensation reservoir not considered**.** Shell did not discuss the potential for the formation of methylmercury during development of the planned Compensation Lake. It is incumbent on Shell to assess the potential for mercury (and other metal) contamination and mobilization and conversion of mercury to methylmercury during the construction and operation of the Compensation Lake in the PRM EIA. In addition, recent scientific evidence suggests that methylmercury production in lakes increases with decreasing pH levels. The relationship between methylmercury and pH levels was not discussed in the EIA.

Requests:

i. Discuss the concentrations of mercury and methylmercury likely to be present within the aquatic ecosystem (including sediment, water column, aquatic plants, plankton, benthic invertebrates and fish), at a variety of time-scales (e.g. construction, 1 year post-construction, 5 years post-construction, far future, etc.).

ii. *Discuss mitigations planned to minimize mercury mobilization (and conversion to methylmercury) and removal of mercury from the system.*

vi. *Discuss monitoring plans to document and track over time the presence of mercury and methylmercury within the aquatic ecosystem of the planned Compensation Lake.*

vii. *Discuss the causal links for the mobilization of mercury and other metals with changes in pH. Include a description of the regional trends in pH and metal mobilization*

viii. *Describe the potential for the mobilization and conversion of mercury to methylmercury during the construction and operation of the NNL lake.*

33. Regional and cumulative effects on fish populations and habitat productivity not assessed. Oil sands operators plan to replace disturbed fish habitat with constructed habitat on a case-by-case basis as required by the federal Fisheries Act. However, the process for replacing fish habitat is experimental and unproven. In addition, there has never been an assessment of the cumulative impact of all of the regional No Net Loss (NNL) projects. Ideally, each NNL pond would replace the habit lost to oil sands projects in advance of the destruction and on a 2:1 basis. However, since there are no functioning NNL projects in the region, it is uncertain how well compensation habitats will work or how long before they reach their full productivity (i.e. minimally replacing lost habitat, and possibly contributing to gains in fish habitat). Fisheries and Oceans Canada will require long-term monitoring to verify the habitat replacement and productivity gains. There should be a contingency plan in case the NNL plan(s) does not meet expectations.

    With the mining-related loss of fish habitat and the construction of NNL habitat, there will be a shift of riverine (stream and river) habitat to lacustrine (lakes) habitats. On a regional scale this could be significant and should be assessed.

    In addition, there is a concern about the release of mercury, from the construction of the NNL reservoirs into aquatic environments and subsequently into fish and other aquatic organisms, and ultimately humans. This is likely also a cumulative effect due to the number of NNL reservoirs being planned or built in the region, which may affect the Athabasca River and downstream ecosystems. No assessment of the cumulative effects of the release of mercury from all regional NNL reservoirs has been completed.

    Requests:

    i. *Assess the regional and cumulative effects on fish populations (including species richness) and habitat productivity of multiple NNL fish habitat compensation projects. Include impacts on:*

a. *regional fish population and species richness;*

b. *total effective habitat units (by fish species);*

c. *productivity of habitat;*

d. *form of habitat – change from riverine to lacustrine;*

e. *mercury levels in fish and aquatic systems from NNL projects.*

ii. *Identify the impact of the cumulative effects noted above on the ACFN's traditional resource use and their Rights. Specifically, identify how the shifts in species and habitat types, along with the time lags and mercury contamination of fish, would affect the ACFN's traditional use and ability to exercise their Rights. Provide documentation to the regulators that these predicted effects have been submitted to the ACFN for verification. Provide documentation that the ACFN have provided this verification.*

iii. *Commit to work with the ACFN to develop a contingency plan in the possible case that the NNL plan(s) does not meet regulatory expectations and/or commitments Shell has made to the ACFN, other Rights holders, and other land users.*

34. Inadequate assessment of impacts from losses of multiple streams in the region. Many small streams are being impacted or lost by increasing regional disturbances. There are many unknowns about the role these streams play, collectively, on regional aquatic health and hydrology.

Requests:

i. *Assess the cumulative effects of the loss of the region's many smaller tributary streams on aquatics and hydrology:*

ii. *Document changes in species richness and quality of habitat, range and populations of affected species, and predicted timeframe(s) to replace these losses in quality and quantity of habitat.*

4.6 Hydrology

4.6.1 Overview

The Pierre River Mine Project would significantly impact local hydrology, by removing the upper portions of a number of streams in the area (including Pierre River) and disrupting flows and altering the flow patterns.

The key environmental issues arising from the PRM with respect to hydrology are:

- Project-related diversions and watershed disturbances would contribute to flow reductions in the Athabasca River;
- Significant increase in open water area following closure;
- Many uncertainties related to project-related hydrology impacts;
- Loss of portions of pristine creeks;
- Cumulative Impacts to the Athabasca Delta not assessed.

For complete details, please refer to the full technical review reports:

- Shell Canada – Pierre River Mine Project – Environmental Impact Assessment Report. Review for Athabasca Chipewyan First Nation, February 17, 2009, by Brenda Miskimmin, Summit Environmental Consultants Ltd., attached to this report as Appendix D-9.
- Shell Canada - Pierre River Mine Project – Review of Shell's Responses to 1) ACFN's Key Concerns, and 2) ERCB/AENV's Supplemental Information Requests, August 24, 2009, by Brenda Miskimmin, Summit Environmental Consultants Ltd., attached to this report as Appendix D-10.
- Shell Canada – Pierre River Mine Project – Review of Shell's Responses to ERCB/AENV's SIR #2, May 3, 2010, by Brenda Miskimmin, Summit Environmental Consultants Ltd., attached to this report as Appendix D-11.

4.6.2 Discussion and Assessment Review

The main hydrologic concerns with the PRM are the replacement of large sections of several undisturbed streams and their tributaries with drainage ditches, the diversion of flows to large open water areas, and the resulting impact on the Athabasca River.

Shell designates reservoir outflows as the mouths of the major streams that feed those reservoirs. In terms of water flows to the Athabasca River, this may be valid at points in time when the outflow is a similar discharge as existed in the natural streams. However for much of the time flows to the River would be reduced for an undisclosed period of time to fill the reservoirs, or by retention for project purposes.

By closure, open water areas would increase almost four times from 7.2 km^2 (Base Case) to 28.2 km^2 (Application Case). Reduced flows to the Athabasca River for the period of pit lake filling would occur. Given the size of the pit lakes relative to the inflowing and diverted streams, it would seem to be a significant loss of streamflows for the period of time required to fill the pit lakes. Shell does not discuss the time period required for pit lake filling, or estimate how long the Athabasca River will be deprived of these flows.

Shell describes pit lakes and constructed wetlands at closure as beneficial to attenuate floods, bioremediate the tailings porewater releases, and capture runoff from reclaimed

areas. In reality, the large open water areas would be formed by the interception of water that would naturally flow to the Athabasca River and the Delta downstream.

While the release of pit lake water to the river is planned to begin in 2049, the adequacy of large pit lakes for bioremediation is still unproven and thus unacceptable.

4.6.3 Concerns and Requests

The following hydrology concerns and requests were identified:

35. Physical dimensions of some large water holding areas unclear. To better understand the fate of surface waters, it would be helpful to know the physical dimensions of some of the large water holding areas proposed.

    Requests:

    i. *Provide a table summarizing the maximum surface areas, filled water volumes, and timing for the External Tailings Disposal Area, pit lakes, Compensation Lake, and all other water storage areas, in a tabular form.*

    ii. *Provide an alternative surface water management scenario where clean water, process-affected water, and fluid tailings are kept separate and managed as three separate functions; include a tabular comparison of surface disturbance, capital, and operating cost implications, and the resultant changes in liability estimates.*

36. Watercourse flows to the Athabasca River not clearly represented. The general assumption that outflows from reservoirs represent flows in lost watercourses is misleading. As one example, the outflow of Redclay Lake has been arbitrarily assigned as the mouth of Big Creek. Big Creek flows near the "mouth" are predicted to change less than 5% even though the site is not a river mouth, but rather this large reservoir's outflow. In reality, the mouths of Big Creek, Unnamed Creek 7 and Redclay Creek would all contribute flows into and out of Redclay Lake.

    As a second example, all flows of Unnamed Creek 1, Asphalt Creek, and Eymundson Creek would go to PRM pit lakes at closure. The outflow of Pierre South Pit Lake in the far future is compared only to pre-industrial Eymundson Creek flows at the mouth. This approach combines the flows of all creeks and results in little change in the outflow of the pit lake at some point in the "far future".

    Discussion:

    Shell did not address the ACFN's technical request on this issue. Instead, Shell suggests that it might do so "following the ACFN's technical review of the EIA". This concern should be addressed now as part of the project assessment, not later. The

purpose of this question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap.

Requests:

i. *Re-calculate inflows to Redclay Lake based on each of the inflowing tributaries on a timescale that captures major changes and provides a relevant scenario for changing inflows to the Athabasca River.*

ii. *Re-calculate inflows to Pierre South Pit Lake based on each of the inflowing tributaries on a timescale that captures major changes and provides a relevant scenario for changing inflows to the Athabasca River.*

37. Water withdrawal plans not detailed. In January 2009, industry was directed under the Water Management Framework (WMF) to reduce water withdrawals when the Athabasca River entered the "yellow zone".

Discussion:

In response to the ACFN's technical questions on this issue, Shell does not provide additional details on the water storage needs for the project, stating it will comply with the Water Management Framework for the lower Athabasca River.

Requests:

i. *Describe Shell's plans for water storage and use during times when restrictions are imposed (within and beyond 30 days planned storage).*

ii. *Commit to abide by the lower Athabasca River WMF restrictions, notably during low flow periods.*

38. Information on open water areas created during operations unclear. Shell indicates that during operations, a 2.5 km^2 water reservoir would be created as part of the diversion system to maintain Redclay Lake. Redclay Lake alone may be 5 km^2, yet the summary section for open water areas only accounts for 1.2 km^2 in new open water areas created by 2039 during PRM operations (refer to Table 6.4-19, Volume 4A, Shell EIA, December 2007).

Discussion:

Shell did not address this request in their responses to the ACFN's technical questions, but suggests they might do so "following the ACFN's technical review of the EIA". The purpose of this question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap. This information

should be provided now, so that it may be included and considered as part of the project approval decision.

Requests:

i. *Re-calculate open water areas in Table 6.4-19 to account for all new open water areas created during project operations.*

ii. *Provide the regulators with the information necessary to make a Public Interest Determination.*

39. Additional NNL compensation lake water details required. The plan for filling the Compensation Lake with water from the Athabasca River is not presented in the EIA, nor is it clear whether this water is a component of the 55 M m^3/yr requested for the early phase of the project.

Discussion:

The water license application indicates that the purpose for the river water requested is for industrial process and domestic use. However, in response to the ACFN's technical questions on this issue, Shell notes that filling the lake would be one of the uses for the 55M m^3/yr water from the Athabasca River. Yet in response to ERCB SIR 316c (Shell PRM Supplemental Information, First Round SIR Responses, Volume 1, May 2009), Shell states that "Over 90% of the water consumed by the projects goes to filling tailings pore space" with the rest being lost to evaporation and seepage.

These responses appear to be contradictory, making it unclear as to the source of water to be used for the Compensation Lake.

Request:

Clarify whether water from the Athabasca River required to fill Redclay Lake is included in the requested 55 M m^3/yr. If not, provide details of the timing and quantity of water withdrawals for this purpose.

40. Pit lakes filling information unclear. At closure (ca. 2049), runoff from Eymundson Creek, Asphalt Creek, and Unnamed Creek 1 would be directed to PRM pit lakes. Athabasca River water would be used to shorten the time required to fill the pit lakes as the streams may not provide enough water in a timely fashion. This would suggest that flows from the tributaries to the Athabasca River would be nil for the period of time required to fill the lakes. Yet by combining 2049 with "far future" in Table 6.4-21, Shell indicates that mean open water flows in these creeks would only be reduced by 23%.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that Athabasca River water would begin to fill the lakes during a ten year "closure management period" from 2039 to 2049. At the end of this period, the diverted streams used for operations would be diverted to the pit lakes, and water quality in the pit lakes presumed to be acceptable for release. The loss of Eymundson Creek flows to pit lakes is apparent in Table 280-8 of the SIR response document (Shell PRM Supplemental Information, First Round SIR Responses, Volume 2, May 2009).

Requests:

i. *Revise Table 6.4-21 to separate the time periods of 2049 and the "far future".*

ii. *Clarify:*

- *The reason for diverting tributary stream water to pit lakes after 2049 (as opposed to routing them directly to the River);*
- *Whether the pit lakes will be filled by 2049;*
- *Whether water quality is expected to be suitable for release from the tributaries and the end pit lakes at that time.*

41. Impacts of loss of several mainstem sections of pristine creeks inadequately assessed. The PRM would result in the removal of portions of watersheds and the lower reaches of several watercourses.

Request:

Describe the physical aspects of the changes in surface flows, and the physical implications of these changes on remaining waterbodies resulting from stream removals (e.g., flow rates, flow regimes, temperature fluctuations, sediment loads, erosion).

42. Impacts of loss of several mainstem sections of pristine creeks on ACFN Rights inadequately assessed. The PRM would result in the removal of portions of watersheds and the lower reaches of several watercourses that have never been directly impacted by any industrial activity.

Request:

Discuss the impacts on traditional uses and on First Nation's Rights of the loss of the lower portions of tributaries of the Athabasca River within the PRM.

43. Cumulative impacts to the Athabasca Delta not assessed. Shell assesses changes in water depths and flows in the Athabasca River, but does not assess the effect of cumulative changes in water depths on the Athabasca Delta. Changes in depth and flow affect the Delta and reduce flushing of side channels and perched water bodies. Changes to the delta directly affect area residents.

Discussion:

In their responses to the ACFN's technical question on this issue, Shell did not address this question, referencing instead another response that was not related to this question (#34 in the ACFN Technical questions about the PRM). Shell suggested that this "may be discussed as part of future negotiations towards an agreement". This information should be provided now, not as part of a later negotiation, so that it may be included and considered as part of the project approval decision.

Requests:

i. *Extend the Regional Study Area (RSA) for surface water hydrology from Embarras Portage to the inflow of Lake Athabasca (i.e. encompass the Athabasca Delta).*

ii. *Re-calculate the impacts, including those on the Athabasca Delta.*

iii. *Given the significance of the Delta to the ACFN, commit to provide the predictive results to the ACFN and to seek the ACFN's verification of these predictions based on the TK of the ACFN.*

4.7 Air Quality

4.7.1 Overview

The key environmental issues arising from the PRM with respect to air quality are:

- Poor understanding of secondary pollutants and their impacts;
- Foul odours may impact use of locations of importance to the ACFN;
- Potential Acid Input levels are predicted to exceed guidelines;
- Incomplete understanding of greenhouse gas emissions;
- Cumulative impacts on regional air quality not assessed.

Most of the technical questions raised by the ACFN were not adequately answered or resolved. Many of the air issues identified are repeated with each and every oil sands project in the region, and have persisted for a number of years.

For complete details, please refer to the full technical review report:

- Shell Canada Limited Jackpine Mine Expansion Project and Pierre River Mine Project – Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation, October 2008, by Dr. Karen McDonald, attached to this report as Appendix D-12.

4.7.2 Discussion and Assessment Review

Shell is predicting that project-related increases in ambient air quality concentrations would have a negligible environmental consequence. However, it is difficult for the reader to truly assess impacts this project may have on air quality due to the lack of a pre-industrial baseline, Shell's use of an ever-changing Base Case, and the removal of ambient concentration changes within the industrial footprint from the air quality assessment.

Shell predicts that project-related increases in fine particulate matter ($PM_{2.5}$) will be negligible. The $PM_{2.5}$ assessment is based on achievement of the Canada-Wide Standards, which is inadequate given the increasing body of literature indicating that this pollutant does not have a threshold for impacts to human health. In addition, Shell only considered secondary PM from sulphates and nitrates, and not organic PM.

Shell admitted it was unable to clearly assess ground level ozone due to the scientific uncertainties associated with ozone sources in the Oil Sands Region. Although the issue of ground-level ozone has been raised in every impact assessment over the past decade, there is very little advancement evident in this area.

The area predicted to exceed the 1.0 keq/ha/yr level for Potential Acid Input (PAI), due to both the PRM and the Jackpine Mine Expansion Project (excluding the industrialized areas), is 12% above Base Case. This impact is ranked as negligible, but this ranking appears too low given the large spatial range and high degree of PAI in the region.

While Fort Chipewyan is not predicted to experience foul odours from this project, some cabin locations and possibly the Poplar Point Reserve, are predicted to have foul odours from time to time (Shell EIA, Dec 2007, Volume 3, Table 3.4-29).

Shell predicts that emissions from the PRM are not expected to cause a significant deterioration of visibility in the region. However, the visual aesthetics component was not clearly assessed in the EIA. The assessment focused on visible plumes – considering only direct emissions and using a limited 20 km study area. Regional haze due to increased particulate concentrations was not discussed or assessed.

The integration of TK into the air quality assessment (Volume 3, Table 3.3-2) is a first step, however, it would have been of greater value to compare traditional knowledge with the model evaluation scenario and existing air quality.

Shell does not provide an impact classification for greenhouse gas emissions, citing the impossibility of comparing this project directly with other projects that have integrated mine and upgrading activities. It would be useful to have a full understanding of

greenhouse gas emissions from other Shell projects, especially those within the province such as those in the Heartland Region near Edmonton.

4.7.3 Concerns and Requests

The following air quality concerns and requests were identified:

44. Removal of industrial areas from the assessment is misleading. As has typically been done in previous EIAs for the Oil Sands Region, the disturbed areas are excluded from consideration of air impact analysis, minimizing the change in increased ambient concentrations and subsequent deposition as the size of the disturbed area increases. This practice leads to an assumption that industrial disturbed areas in Alberta are no longer required to meet air quality standards and guidelines. Urban regions, which could be considered 'disturbed areas', are expected to meet the air quality guidelines within their boundaries.

    In addition, Shell states (Table 2.2-2) that the eight highest modeled concentrations of various compounds (e.g. sulphur dioxide, nitrogen dioxide, benzene, VOCs) are removed from outside of the disturbed area. It is not clear if these eight highest concentrations are also contained within the disturbed areas removed from consideration or if a further eight compounds with the highest values outside of the disturbed areas have also been removed.

    Discussion*:*

    In response to the ACFN's technical questions on this issue, Shell indicates that the highest eight values at each receptor were removed as allowed by the Alberta government for the purposes of engineering design. For the purposes of regional evaluation, however, this does not enable us to know whether the highest receptor one-hour concentrations were within developed areas or outside of them. The provincial model guidelines insist that these eight highest values must be included in the determination of the 24-hour and annual averages. Within the context of the public interest test and Aboriginal rights, the EIA must respond to the project-specific engineering requirements but also to the understanding of the changes in regional air quality; these two purposes do not always rely on the same data.

    A similar issue was raised by the ERCB in SIRs 228a and 229b (Shell PRM Supplemental Information, First Round SIR Responses, Volume 1, May 2009).

    Requests:

    i. *Provide the results of the re-evaluation of the 24-hour and annual averages including the eight highest values previously excluded.*

    ii. *Engage the ACFN to confirm the veracity of the air quality model(s) by comparison with the ACFN's TK.*

iii. Commit to submitting the outcome(s) of the above dialogue to regulators.

45. Magnitude classification levels not reflective of air guidelines and standards. In the PRM assessment, an exceedance of the Alberta Ambient Air Quality Objectives (AAAQO) is rated as moderate, downplaying the importance of minimizing these exceedances of the regulatory objectives. Exceedances of these objectives should be rated 'high". This would demonstrate Shell's commitment to staying below the objectives.

Discussion:

In response to the ACFN's technical questions on this issue, Shell refuses to reply stating this is a disagreement with Shell's methodology or conclusions. The ACFN agree with Shell: This **is** a disagreement with methodology used by Shell and with their conclusions drawn from the data observed and presented. This concern should be addressed now as part of the project assessment, not later. The purpose of this question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap.

Request:

Reassess the environmental consequences using the higher magnitude ratings for exceedances of the AAAQO to better identify which issues are approaching the environmental limits.

46. Assessment of secondary pollutants and their impacts deficient. The true impacts (visibility, odour, and acidification) of secondary pollutants ($PM_{2.5}$ and ozone) are poorly assessed in the EIA.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states it continues to support research and monitoring of secondary pollutants' impacts in the region by participating as an active member on the Wood Buffalo Environmental Association and the Cumulative Environmental Management Association's (CEMA) NO_x-SO_2 Management Working Group. These agencies are undertaking air quality monitoring in the region but there is little new research on the impacts of air pollutants on environmental receptors (including health risks). New research in this field would be more likely if there were scientifically credible publications of the regional monitoring data.

The EIA did not include an evaluation of organic PM as only the CALGRID model was used to assess secondary PM (sulphates and nitrates only). Regional visibility degradation due to PM concentrations was not assessed.

Despite a poor understanding of the formation and impacts of secondary pollutants, they are a part of the regional mix and must not be ignored in the assessment. Shell needs to use monitoring data to take action on these issues.

Request:

Discuss how and what role Shell will play in further research into secondary air pollutants and their impacts on environmental receptors, including health risks.

47. Potential Acid Input ranking inadequate. The area predicted to exceed the 1.0 keq/ha/yr Potential Acid Input (PAI), due to both the PRM and the Jackpine Mine Expansion Project, and excluding the industrialized areas, is 12% above the Base Case. This impact is ranked as negligible. This ranking does not correspond with the large spatial range and high degree of PAI in the region.

    An increase of the area predicted to exceed the PAI guideline by 12% is a serious concern and not 'negligible'. Any increase in area should be considered at least 'moderate'. According to Shell's EIA methodology for air emission effects a 'negligible' magnitude of change is less than 1% change in the endpoint or "no predicted increase in acidity" (Table 1.3-4, Volume 1, Section 1, Dec 2007 EIA).

    Requests:

    i. *Describe the current state-of-knowledge with respect to acid deposition and trends in the region.*

    ii. *Explain why a 12% increase above Base Case in the area predicted to exceed the 1.0 keq/ha/yr Potential Acid Input is ranked as negligible. Describe the environmental impact and Shell's assessment of the significance of this predicted increase.*

48. Additional details in odour assessment of ACFN locations required. Shell's odour assessment indicates that odours may be expected at several cabin locations in the area, and potentially at the ACFN's Poplar Point Reserve. Shell does not provide adequate details to determine how these odours might affect the ACFN, in particular their use of the Poplar Point Reserve (IR 201G).

    Request:

    Provide additional information including predicted frequency, duration and odour species on the predicted impacts of increased foul odour experiences at the Poplar Point Reserve, and on the ACFN's traditional use.

49. Ground-level ozone poorly assessed. Ground level ozone is poorly assessed in the EIA. Shell includes very little information about the development of a regional conceptual model and the resulting physical models necessary to evaluate the oxidizing potential of the regional air shed.

Request:

Include a rigorous evaluation of the oxidizing potential of the regional air shed, including causal factors, synergistic effects, transport mechanisms and fates, by odour species.

50. Climate change impact classification lacking. The EIA does not include any data comparing the emission intensities of this project with that of other oil sands projects.

Shell states that an impact assessment was completed for greenhouse gas emissions, however, no impact classification is provided. Shell also states that it is not possible to directly compare emissions intensities from the PRM with other projects that have both integrated mine and upgrading activities. Shell indicates that their contribution to greenhouse gases is broader than simply the mine sites in the Oil Sands Region and should include Shell's upgrading activities in the Industrial Heartland Region near Edmonton.

Discussion:

In response to the ACFN's technical questions on this issue, Shell inferred that the ACFN should do its own evaluation of the GHG emissions data from Shell's upgrader. The response seems to indicate that Shell would prefer third party reviewers to summarize and present the company's GHG data.

Request:

Provide a comparison of the relative emission intensities (per unit of production) of this project, including off-site upgrading, with other oil sands projects.

51. Cumulative effect of multiple projects on regional air quality inadequately assessed. Incremental increases in air emissions from each new project in the region adversely affect the overall regional air quality and, ultimately, the health of the ecosystem and animals (including humans). Shell's method of assessing effects, using an artificially high baseline, masks the true magnitude of this effect. Prior to major industrial projects in the late 1960's emissions of air pollutants were near zero. These days there can be no denying the massive amounts of air contaminants being emitted in the Oil Sands Region.

Requests:

i. *Assess and provide an analysis on the cumulative effects of the growth of air emissions in the region using a pre-industrial baseline and projecting this out by 100 years – (i.e. from 1965 to 2065).*

ii. *Provide a summary table of the projects included in the various assessment cases with their projected emissions listed over the same time frame as above.*

4.8 Wildlife

4.8.1 Overview

The key environmental issues arising from the PRM with respect to wildlife are:

- Wildlife baseline information incomplete;
- Large loss of habitat;
- Restricted use of Athabasca River valley as a regional wildlife corridor;
- Uncertainties related to impacts on wildlife health;
- Conflicts between Shell's modeling results and field data and TK;
- Lack of assessment of the cumulative effects of tailings ponds on migratory bird populations;
- Uncertainties related to cumulative impacts of multiple projects on wildlife.

For complete details, please refer to the full technical review report:

- Wildlife Review of the Shell Jackpine Mine Expansion and Pierre River Mine Projects – Review for: Athabasca Chipewyan First Nation, May 2010, by Dave Westworth of Puma Environmental Ltd., attached to this report as Appendix D-13.

4.8.2 Discussion and Assessment Review

Wildlife Indicators: The EIA focuses on a number of Key Indicator Resources (KIRs) that have been identified by CEMA. The list of KIRs is reasonable in that it includes several terrestrial species, several aquatic species, and several species that depend on old growth forest. However, the list is lacking at least one waterfowl species (e.g. mallard); ducks and geese continue to be harvested by Aboriginal people, and some of the nearby waterbodies (Athabasca River and McClelland Lake) are regionally or provincially important for waterfowl. The ACFN have expressed great concern over the effects of tailings ponds on waterfowl. Waterfowl that migrate through the Oil Sands Region may

become exposed to tailings and process-affected water. Those that survive may travel on to the Peace-Athabasca Delta where they could be consumed by local people.

Baseline Surveys: Various wildlife baseline surveys were conducted in the LSA. The survey methods are standard and appropriate for these types of inventories, although there are gaps in the survey coverage.

Wildlife Abundance: Impacts on yellow rail are predicted to be high in the LSA. Modeling for this project concluded that both moose and black bear populations would increase under the Application and Planned Development scenarios. These conclusions do not appear credible given the rapid rate of habitat loss, blockage of movement corridors and increased mortality due to increased human access. In addition, these results conflict with reports from trappers and other First Nations people and with the results of other regional modeling.

Habitat Loss: The loss of habitat associated with the PRM would be very large. There are significant predicted changes in habitat for three important types of wildlife habitat in the mine area: wetlands, riparian habitat, and old-growth forest. These three habitat types account for much of the biodiversity in the area.

Wildlife Movements: The ability to safely move across the landscape to access required habitats is important for the survival of wildlife populations. Shell acknowledges that oil sands activity in the region is affecting the ability of the Athabasca River valley to function as a regional wildlife corridor.

Wildlife Health: A primary concern with the wildlife health assessment is that current Toxicity Reference Values (TRVs) may be too limited to meaningfully assess risks to wildlife health. Also, insufficient toxicological information existed to assess health risks for amphibians, a group of animals thought to be the most sensitive to pollution effects. In addition, there are concerns about the long-term water quality in reclaimed wetlands and pit lakes and potential wildlife health effects. There are also long-term health concerns for terrestrial wildlife. The chemistry of reclamation soils is expected to be considerably different than natural surface soils in the region. In addition to concerns related to the possible bioaccumulation of contaminants in wildlife food chains, there is also concern that elevated levels of certain chemicals (salts, metals, acids) in reclaimed soils could affect the palatability and nutritional value of browse and herbaceous vegetation for moose and other herbivores.

Validity of Impact Predictions: Shell relies on the use of various computer models to predict the impact of its proposed operations on selected wildlife species. There are several instances in the wildlife assessment, identified below, where model results did not correlate with field data, did not take important facts into consideration, or where models relied heavily on unproven assumptions.

4.8.3 Concerns and Requests

The following wildlife concerns and requests were identified:

52. Waterfowl species not selected as KIRs. Although the PRM will be situated close to regionally or provincially significant waterfowl habitats (e.g. Athabasca River and McClelland Lake) and ducks and geese are consumed by First Nations members, no waterfowl species were selected as Key Indicator Resources (KIRs).

    Discussion:

    In response to the ACFN's technical questions on this issue, Shell states that waterfowl species are represented by the choice of beaver as a KIR because they have similar habitat requirements. Shell's assertion that beaver habitat modeling accurately reflects habitat suitability for ducks and geese is unacceptable. The beaver (a mammal that feeds primarily on the bark of aspen and willow) is not a reasonable analogue for migratory birds such as waterfowl. Waterfowl do use beaver impoundments but their ecology and life history is too different.

    Request:

    Provide an assessment of the impacts to at least one species of waterfowl, such as the mallard.

53. Gaps in wildlife baseline surveys. Gaps in baseline surveys (such as breeding birds and bats) prevent full understanding of wildlife resources that might be at risk.

    Discussion:

    Shell did not address the ACFN's questions about this issue, stating that this was a disagreement with Shell's methodology and conclusions. The purpose of the ACFN's recommendation is that the northern half of the PRM LSA was insufficiently sampled for some wildlife species, limiting the understanding of wildlife risks. This gap must be dealt with now, as part of the assessment.

    Various wildlife baseline surveys were conducted in the LSA. The survey methods are standard and appropriate for these types of inventories, although there are gaps in the survey coverage, as listed below:

    a) Winter aerial ungulate survey and the owl call-back surveys - the northern end of the LSA was not surveyed;

    b) Breeding bird surveys - the northern half of the LSA was only sparsely sampled;

    c) Bat mist netting - only the northern half of the LSA was surveyed, and the riparian zones along the Athabasca River were only sparsely sampled;

d) Waterfowl and beaver / muskrat aerial surveys - the Athabasca River was sampled, but no surveys were conducted along streams (Big Creek and First Creek) in the northern half of the LSA.

Request:

Address the wildlife baseline survey gaps identified in the discussion above. Given the significance of the wildlife to the ACFN's traditional resource use and Treaty and Aboriginal rights, commit to provide the predictive results to the ACFN and to seek the ACFN's verification of these predictions based on the TK of the ACFN.

54. PVA and TK information conflicting. The results of the Population Viability Analysis (PVA), which predict growth in moose and black bear populations under all development scenarios, are in disagreement with Traditional Knowledge (TK), trappers, and other First Nations people consistently report declining moose numbers in the region. The PVA results also conflict with modeling conducted in conjunction with the development of a Terrestrial Ecosystem Management Framework for the Regional Municipality of Wood Buffalo (for CEMA). This modeling concludes that several terrestrial ecosystem indicators, including moose, black bear, and fisher, are already below their natural range of variation (NRV) and will continue to decline given expected rates of landscape modification.

Discussion:

Shell did not address the ACFN's technical questions for this issue or conduct the additional analysis, stating that the question was a disagreement with Shell's methodology and conclusions. Although Shell was unwilling to answer this question, Shell did respond to essentially the same question posed by Alberta Environment - AENV SIR 450 (Shell PRM Supplemental Information, First Round SIR Responses, Volume 2, May 2009). Shell explained to AENV that because the CEMA models used a different approach and a different set of assumptions from the habitat modeling used in the EIA, the results are not comparable. While the approaches are different, the two modeling approaches are predicting very different outcomes.

This is not simply a disagreement about methodologies – it is a failure by Shell to seriously consider and integrate, or even be willing to test, traditional information. There is little point in using traditional information if it will be disregarded (which goes against the Terms of Reference). This is a clear case of Shell trusting in modelled prediction over the empirical observed data from TK.

Request:

Address why Shell has disregarded the TK data that contradicts its modelled predictions.

55. Validity of habitat models questionable. Some of the Resource Selection Function (RSF) models developed to assess regional changes in habitat supply and habitat suitability of reclaimed lands at closure were found to be unsuitable when validated against field data. This may affect the validity of all impact predictions based on these models. RSF may have advantages over Habitat Suitability Index models for some species. Further work to refine / develop accurate models is strongly recommended.

Discussion:

Shell did not address the ACFN's technical questions for this issue, stating valid models were used to assess cumulative effects and the value of reclaimed lands for wildlife at the LSA scale. Assessing cumulative effects at the LSA scale is not meaningful since it is known that almost the entire LSA will be disturbed by the project.

Requests:

i. *Discuss the potential repercussions of ignoring TK and field data and relying on inaccurate wildlife habitat modelling on traditional use and Treaty and Aboriginal rights.*

ii. *Consider modelling calving/post-calving habitats for moose.*

56. Loss of riparian habitat may be underestimated. Shell predicts a relatively large net loss of wetland and old-growth habitat. The predicted loss of riparian habitat is likely underestimated.

Discussion:

Alberta Environment questioned how impacts to rare wetland wildlife species would be mitigated - AENV SIR 451 (Shell PRM Supplemental Information, First Round SIR Responses, Volume 2, May 2009). Shell stated that fens cannot be reclaimed and refugia planning is not practical.

Shell did not address the ACFN's question about this issue, stating that the question was a disagreement with Shell's methodology and conclusions. The purpose of the question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap.

Requests:

i. *Reassess riparian habitat losses based on accepted scientific criteria (not just the 100 metre mapping offset).*

ii. Discuss additional mitigation and compensation measures that could offset permanent riparian habitat losses.

57. Wildlife movement along the Athabasca River will be restricted. The proposed project will restrict wildlife movement along the Athabasca River, which is recognized as a major regional wildlife movement corridor.

Discussion:

Shell's response to AENV SIR 458c (Shell PRM Supplemental Information, First Round SIR Responses, Volume 2, May 2009) provides a relatively detailed discussion of Shell's position with respect to the width of the Athabasca River setback. Shell provides a rationale for the proposed use of a 250 metre buffer as opposed to the minimum buffer of 400 metres previously recommended by Environment Canada and Alberta Sustainable Resource Development. Shell acknowledges that large carnivores and ungulates prefer wider corridors but provides examples of observations of these species using corridors of 250 metre or less in the oil sands region. Shell concludes that "a 250 metre setback for the project is considered an appropriate balance between resource recovery and maintaining effective wildlife movement". Given the length of the corridor (11 km), the nature of adjacent disturbance (intensive industrial) and the weight of scientific opinion on widths of wildlife corridors, it could prove difficult for Shell to prove that a 250 metre buffer will function as an effective wildlife corridor.

In addition, the Zones of Influence used by Shell in habitat modeling (to indicate the areas adjacent to industrial disturbance where habitat use is likely to be reduced) extend to 250 metres for species such as black bear. A 500 metre buffer was placed around the LSA to account for indirect effects on wildlife, implying that use of the 250 metre buffer along the Athabasca River is likely to be compromised.

Requests:

i. Discuss the data available with respect to wildlife movement in various widths of wildlife corridors in the region.

ii. Discuss the impacts of restricted wildlife movements along the Athabasca River on traditional use and the ACFN's Rights.

58. Research and data directly applicable to wildlife lacking. The lack of field research and toxicity reference data directly applicable to wildlife in this region (as opposed to laboratory animals) may affect the validity of the wildlife health assessment. It is also unclear whether Shell considered potential long-term, residual effects of wildlife exposure to contaminants in wetlands and pit lakes containing process-affected water and/or fluid tailings when conducting the wildlife health assessment.

Requests:

i. *Discuss how the lack of field research and toxicity reference data on wildlife may affect the validity of the wildlife health assessment.*

ii. *Discuss how Shell considered the potential long-term residual effects on wildlife exposure to contaminants in process-affected wetlands and pit lakes when conducting the wildlife health assessment.*

iii. *Discuss the impacts of uncertainty and possible contamination of meat from wildlife health effects on traditional use and on the ACFN's Rights.*

iv. *Given the significance of the wildlife to the ACFN's traditional use and Aboriginal and Treaty rights, commit to provide the predictive results to the ACFN and to seek the ACFN's verification of these predictions based on the TK of the ACFN.*

59. Habitat modeling unclear. Shell's wildlife impact predictions are based on the assumption that reclaimed lands would have the same wildlife habitat value as the undisturbed ecosite phases they are modeled after. No evidence is presented by Shell, or by reclamation progress in the region, to support this assumption. The assessment fails to identify the current limitations on reclamation knowledge, as well as the risks or levels of uncertainty associated with these habitat model predictions.

Discussion:

Shell did not address the ACFN's question about this issue, stating that the question was a disagreement with Shell's methodology and conclusions. The purpose of this question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap.

Although Shell was unwilling to answer the ACFN's question, information on reclamation experience in the oil sands region is provided in the response to AENV SIR 456c (Shell PRM Supplemental Information, First Round SIR Responses, Volume 2, May 2009). The description lacks references and detailed descriptions of reclamation outcomes which would be helpful in evaluating predictions of wildlife habitat values on reclaimed lands.

Request:

Provide references (for response to SIR AENV 456c) and detailed descriptions of reclamation outcomes for re-evaluating wildlife habitat values on reclaimed lands.

60. Information on bison herd near project area insufficient. In the Environmental Setting Report, Shell indicates that bison from the Redclay Creek bison herd occur in the LSA. ACFN elders confirm that bison are known to occur in this area; however, insufficient information was provided in the EIA to provide the ACFN with an understanding of the likely impacts on the proposed PRM on bison in this area.

Discussion:

Shell did not address the ACFN's question about this issue, stating that the question was a disagreement with Shell's methodology and conclusions. The purpose of this question was to point out a deficiency in the information in the assessment and request additional information to fill that gap. The ACFN find it unacceptable for Shell to state they don't want to answer the question. The ACFN wish to know how the proposed PRM may affect this bison herd.

Requests:

i. *Discuss how the proposed project may affect the Redclay Creek bison herd.*

ii. *Given the significance of the wildlife to the ACFN's traditional use and Treaty and Aboriginal rights, commit to provide the predictive results to the ACFN and to seek the ACFN's verification of these predictions based on the TK of the ACFN.*

61. Cumulative effects of tailings ponds on migratory bird populations not assessed. Because of the proximity of the PRM to regionally or provincially significant migratory staging areas (Athabasca River, McClelland Lake, Kearl Lake, etc.), risks of exposure of migrating water birds to tailings might be increased. Cumulative effects of tailings ponds in the oil sands region on wildlife (including migratory birds) have not been assessed.

Discussion:

The ACFN are concerned with mortality of migratory birds exposed to tailings ponds. An assessment of the cumulative effects of all existing, approved, and planned oil sands tailings ponds should be included in the EIA – using a pre-industrial baseline.

Shell did not address the issue or conduct the additional analysis, stating the question was a "statement of disagreement with Shell's methodology and conclusions". The purpose of this question was to identify a gap in the assessment of the project, and to request supplemental information to fill that gap.

Requests:

i. *Provide the results of a comprehensive assessment of the cumulative effects of oil sands tailings ponds on migratory bird populations and health – based on a pre-industrial baseline.*

ii. *Discuss the effects of these changes on traditional use and on the ACFN's Rights.*

iii. *Commit to provide these findings to the regulators as a key input to the public interest determination.*

62. Cumulative effect of multiple projects on wildlife inadequately assessed. Incremental increases in disturbed land area from each new project in the region adversely affect both local and regional wildlife. Shell's method of assessing effects, using an artificially high baseline, masks the true magnitude of this effect. Prior to major industrial projects in the late 1960's impacts on wildlife were restricted to local hunting pressures. Currently wildlife are impacted by many more factors, the majority of which are related to the oil sands industry.

Requests:

i. *Provide estimates of wildlife populations, habitat availability, and vegetation communities (including wetlands) under pre-industrial conditions, and compare these to the present day and 'Base Case' scenarios.*

ii. *Identify the expected area of land from which wildlife and vegetation would migrate back into the reclaimed land, taking into consideration any nearby operations which would be also be cleared.*

iii. *Discuss and assess the impacts of the changes in wildlife in the region on traditional use and on the Rights of the ACFN.*

iv. *Given the significance of the wildlife to the ACFN's traditional use and Treaty and Aboriginal rights, commit to provide the predictive results to the ACFN and to seek the ACFN's verification of these predictions based on the TK of the ACFN.*

4.9 Vegetation, Wetlands, and Biodiversity

4.9.1 Overview

The key environmental issues arising from the PRM with respect to vegetation, wetlands, and biodiversity are:

- Significant and irreversible loss of wetlands (including peatlands);

- Loss of rare plants, rare plant habitats, and old growth forests;
- Unclear impacts of combined air emissions on vegetation;
- Decrease in plant and animal biodiversity, especially in wetland habitats;
- Uncertainties related to cumulative impacts of regional loss of wetlands.

For complete details, please refer to the full technical review report:

- Jackpine Mine Expansion and Pierre River Mine Project - Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation – Vegetation, Wetlands and Forest Resources Component, April 29, 2010 (revised), by C. Dana Bush, attached to this report as Appendix D-14.

4.9.2 Discussion and Assessment Review

The project is expected to cause a net disturbance of 9,657 ha of vegetation (Appendix 5-2, Section 1.1). This disturbance would result in a decrease in plant and animal biodiversity, and a loss of old growth forest, rare plants and rare plant habitat, traditionally important plants, and wetland vegetation.

The PRM area has 3,774 ha of wetlands – 88% (3,330 ha) of which are bog and fen peatlands. The project would destroy 99% of the wetlands in the mining area. A small amount of wetlands in the local study area, outside of the mine footprint, would not be touched. The planned closure landscape is expected to have only 11 ha of wetlands (marshes and shallow open water wetlands), and no peatlands (including bogs and fens). Wetlands offer the highest potential for biodiversity, as well as habitat for rare plants, traditional use plants, and wildlife.

Shell expects that following closure, re-vegetation would largely involve direct placement of reclamation materials and "encouraging" successful natural invasion of native vegetation. These proposed reclamation strategies are simplistic, and rely heavily on unproven assumptions of success.

4.9.3 Concerns and Requests

The following vegetation, wetlands, and biodiversity concerns and requests were identified:

63. KIR frequency ratings between LSA and RSA differ. Three key indicator resources (KIRs) - wetlands, old growth forests, and high rare plant potential - which are assessed as having low frequency in the Local Study Area (LSA), were then rated as having a high frequency in the Regional Study Area (RSA).

    Discussion:

    In response to the ACFN's technical questions on this issue, Shell states that the difference in frequency rating is due to timing or rate of clearing in each case; in the

Application Case, the only source of change to the environment is a single development (the PRM) that will be cleared, all at once - the frequency rating is low for both the LSA and RSA at the Application Case. For the Planned Development Case, the clearing of all developments are considered to be different events, thus a frequency rating of high is assumed.

Request:

Assuming that each piece of land will be cleared once, explain the relevancy of rating the frequency of clearing for different events, in different locations.

64. Regional vegetation data lacking. Shell used coarse scale maps (LANDSAT satellite image classification) at the RSA level to develop land cover classes. Land cover classes are generalized vegetation types (six upland and three wetland native vegetation types plus a burn category). These broad classes cannot differentiate the impacts on, for example, patterned fens, or between a marsh and an open bog (Volume 5, Section 7.5.2). Analyses of traditionally-used plants or rare plant potential using these coarse scale maps is virtually meaningless, as they include vast areas of unsuitable habitat. It may be possible to work with the Cumulative Environmental Management Association (CEMA) to develop ecological land classification maps for the regional study area. However, this will require data sharing and the use of similar databases.

Requests:

i. *Discuss how the lack of refined scale maps (i.e., lack of current and accurate regional vegetation data) affects the impact assessment for this project.*

ii. *Discuss Shell's commitment to fill this gap.*

iii. *Commit to standardize and share vegetation data sets (e.g., through CEMA's database) with other operators and government agencies.*

65. Groundwater-dependent traditional plants may be impacted. The PRM is predicted to lower groundwater levels in the area around the mine during operations. The ACFN could be impacted by the loss of groundwater-supported wetland areas which may contain traditionally important plants dependent on groundwater for survival. Traditionally important plants which are found in non-wetland areas may also be lost if they are dependent on groundwater that would see lower levels as a result of the proposed project. Such losses would be permanent, unless reclamation provides suitable areas where the plants could re-establish. Wetlands that develop after reclamation may have the potential to be impacted by process-affected groundwater from areas where tailings have been stored and may be less desirable areas for the collection of traditionally-used plants.

Discussion:

In response to the ACFN's technical questions on this issue, Shell acknowledges that traditional plants would be impacted and that the most feasible mitigation would be to re-establish areas capable of supporting traditional plants after reclamation. However, CEMA (2007) indicates that, based on current reclamation knowledge and experience in the region, organic bogs and fens cannot be replaced.

The ACFN's access to plants in the LSA would be impacted for a significant period of time. If the plants gathered by the ACFN members are from the areas to be affected, then the assessment may not be adequate to determine the impacts on their traditional use or on their Rights. Shell promises it would "re-establish areas with the capacity to support traditional plants", however, this is not the same as replacing lost plants of traditional use. Because the groundwater-dependent traditional plant gathering areas most likely will not be reclaimable, it is important that Shell explain how it intends to offset these losses.

Request:

Explain in detail, using an appropriate set of time sequences, how the loss of groundwater-dependent traditional plant areas in the active mining area and in the surrounding area would be mitigated, offset, or compensated.

66. Loss of old growth forests inadequately assessed. Shell states that the "project will result in the removal of 1,233 ha of old growth forest, representing a loss of 2% of the LSA [(combined Local Study Area for both Jackpine Mine Expansion Project and the Pierre River Mine Project)]" (EIA Section 7.5, pg. 7-74). However Table 7.5-18 (EIA Section 7.5) indicates that 40% of the old growth forest in the LSA would be removed. While Table 7.5-11 does show the percentage of LSA and percentage of resource, neither the numbers nor discussion are carried through to the final assessment ratings.

Requests:

i. *Explain why "Magnitude of Impact" in the local study area for loss of old growth forest is not ranked as high (>20%), and therefore the environmental consequence also not ranked as high (+17) in Table 7.5-34 (EIA Section 7.5). Explain why using a 2% loss of the local study area is more biologically relevant than using a 40% loss of the actual feature being assessed.*

ii. *Repeat the assessment using the 'high' ranking, as noted above.*

67. Project-related and regional loss of wetlands inadequately assessed. The PRM would result in the loss of 3,763 ha of wetlands (99% of the project area's wetlands), mostly bogs and fens (Volume 5, Appendix 5-2, Table 7, page 56). There is no

compensation planned for this permanent loss of wetland. Shell considers the environmental consequences of this wetland loss to be low.

The PRM is just one of many projects that would lead to the destruction and loss of natural wetlands in the region. As stated in the *CEMA Guideline for Wetland Establishment on Reclaimed Oil Sands Leases* (Harris, 2007), "Natural boreal wetlands are a critical habitat for many important wildlife species, including woodland caribou, moose, muskrat, waterfowl (particularly diving ducks) and amphibians", and "Wetlands in the oil sands region are indelibly linked to the traditional way of life… People of the Fort McKay, Anzac, and Fort Chipewyan communities continue to use wetlands for subsistence hunting and trapping, for food and medicinal plant collection, and for spiritual well-being". A realistic assessment of the cumulative loss of wetlands in the region and the effects of this loss on the traditional use and Rights of the ACFN, using a pre-industrial baseline, has not yet been conducted (see section 4.1.2 of this report).

Requests:

i. *Explain the lack of compensation for the irreversible loss of a significant area of wetlands in the PRM project area.*

ii. *Discuss and assess the cumulative impacts arising from the PRM's predicted permanent wetland loss, as well as the total loss of wetlands in the entire Oil Sands Region on biodiversity, habitat loss, wildlife, traditional users, groundwater, surface water, and vegetation. Use a pre-industrial baseline for all assessments.*

iii. *Identify what biodiversity offsets Shell would plan or be willing to commit to as a means of lessening the consequences of the inevitable loss of natural biodiversity from the PRM or for the losses from regional oil sands industrial activities.*

iv. *Discuss the impact of the loss of wetlands on traditional use and on the Rights of the ACFN.*

68. Wetland ecological equivalency assumption unsupported. Impacts to wetlands are ranked as having a low environmental consequence. Six percent of the treed fens and four percent of the treed bog / poor fens would be lost in the regional study area (of Jackpine Mine Expansion and Pierre River Projects combined), and there would be an increase of 16% in non-treed wetlands after reclamation (Table 7.6-4, Page 7-139). The environmental consequence assumes that non-treed wetlands are ecologically equivalent to peatlands, which is not supported in the report.

Discussion:

In response to the ACFN's technical questions on this issue, Shell states that non-treed wetlands and peatlands are similar enough to both be represented by the same Key Indicator Resource (for all wetlands). Based on generations of use, the ACFN disagree with Shell's response - peatlands and marshes are markedly dissimilar in their biodiversity and their traditional land use.

Request:

Provide research supporting the assumption that reclaimed non-treed wetlands are ecologically equivalent to peatlands, or revise the assessment to reflect the true significance of the full loss of the wetlands in this project area.

69. Additional information for weeds and non-native invasive species required. Shell does not address the likelihood of weeds and non-native species hindering successful restoration or reclamation. Non-native species are common throughout the regional study area, along roads and pipelines, and in borrow pits and wellpads. Although not documented in this EIA, non-native invasive grasses (such as smooth brome, timothy, Kentucky bluegrass and curled dock) occur throughout the boreal forest and can cause problems for reclamation. Non-native invasive species and listed weeds can be introduced by construction and reclamation equipment, and in reclamation seed mixes.

Discussion:

Shell does not address the ACFN's technical questions for this issue; instead simply referencing three SIRs: PRM SIR #350, 381 and 511 (Shell PRM Supplemental Information, First Round SIR Responses, May 2009).

PRM SIR #381 refers to weed seed management plan, and does not describe how contractors are to clean their vehicles. Alberta Environment also requested details about steam cleaning to remove potential weed seeds from vehicles entering the site (AENV SIRs 381 and 365). Shell, in response to Alberta Environment's questions, stated that "…only clean equipment is allowed access for delivery and use on the sites. Contractors or personnel with vehicles new to the site must ensure that the vehicles are clean before entry". Again, Shell deferred the question. The most northern portion of Hwy 63 north of Fort McMurray is gravel (to date) and is often extremely muddy. In addition, the roadsides have been re-vegetated with smooth brome, other agronomic grasses, and weeds. Contractors and personnel driving along these roads may arrive at times carrying mud and grass seeds on their vehicles.

PRM SIR #350 refers to vegetation reclamation and to the monitoring program (Volume 5 Section 7.1).

PRM SIR #511 simply states that Shell would survey, treat and control weeds, and educate its personnel about weed issues.

Requests:

i. *Explain how Shell would control the introduction and spread of invasive non-native species during construction and reclamation.*

ii. *Clarify whether the access to the construction site and subsequent plant site will be fully paved, or if not, how contractors would ensure that their vehicles are clean upon entering the site.*

70. Impacts to traditionally-used plants not adequately assessed. Shell identifies the Traditional Plant Potential, in which plant species used as part of a traditional lifestyle are assigned to vegetation type and scored according to presence and cover. This method assumes, inaccurately, that all these plant species are of equal importance to all the regional Aboriginal communities.

Discussion:

Shell does not address the ACFN's technical questions for this issue, stating that the question was a disagreement with Shell's methodology and conclusions. Changes in traditional species composition or loss of traditional plant areas may affect the ACFN's traditional use and their Rights.

Requests:

i. *Describe which plant species are considered important by the Aboriginal communities, and assess the impacts on those species.*

ii. *Identify thresholds/criteria used by Shell to assess potential impacts on traditional users from loss of traditionally-used plants.*

71. Rare plants assumption unsupported. Shell assumes that reclamation would compensate for the loss of rare plants by increasing the rare plant habitat in the reclaimed landscape.

Discussion:

In response to the ACFN's technical questions on this issue, Shell suggests that the reclaimed landscape will provide the potential for the natural re-colonization of rare plants. Shell plans to use direct placement of reclamation materials and expects successful natural invasion of native vegetation (including rare plants), referencing a successful restoration of a river valley in Denmark by natural invasion (Pedersen et al. 2007).

The likelihood of rare propagules surviving direct placement of reclamation materials is small. In many cases, rare plants are adapted for specific ecological conditions which would not be re-created immediately (if at all). The long time between clearing and reclamation would diminish the probability of the few surviving propagules germinating and establishing.

Shell cites (incompletely) a single scientific article (Pedersen et al., 2007) about a very different ecosystem as evidence that all rare plants will re-colonize in situations where the degree of disturbance is very significant. This single article does not inspire confidence that rare plants can be successfully re-colonized in reclaimed landscapes[5] or that the complex interactions of climate, geology, top soils, surface and groundwater, vegetation and wildlife in the region can ever be restored.

Request:

Provide scientific evidence, using multiple species of rare plants with different habitat requirements and rarity classes, that rare plants would move into reclaimed habitats in the Oil Sands Region.

72. Evaluation of Rare Plant Potential inadequate. Shell assesses impacts on high Rare Plant Potential (RPP), referring to areas that might have rare plants. However, it is difficult to accurately predict rare plant occurrences. Simply adding the number of species that could occur in an ecosite phase will overestimate the area in which rare plants would actually be found. This method for evaluating rate plant potential has little science to support it.

Discussion:

In response to the ACFN's technical question on this issue, Shell states that "rare plant potential (RPP) does not predict rare plant occurrences, but identifies those ecosite phases and wetlands types that have been identified as more likely to contain rare plants based on extensive field work in the Oil Sands Region".

Shell correctly states that RPP does not predict rare plant occurrences. However Shell's evaluation of RPP has four problems:

a) Overestimation of areas of rare plant habitat. Mapping rare plant frequency by ecosite phase assumes that any particular spot within the ecosite phase would have the same chance of having a rare plant. Because the factors governing the rarity of most species are unknown, assumptions cannot be made. For example, knowing that rare plant A occurs in BM-d1 is almost meaningless, given how much d1 occurs in the boreal forest;

[5] The research cited describe the restoration of 19 km of the Skjern River and 22 km^2 of the cultivated river valley in Denmark, and included a comprehensive monitoring program including hydrology, nutrients, fish, meadow vegetation, amphibians as well as river morphology, in-stream habitats, macrophytes and macroinvertebrates

b) Inability to distinguish between very rare species with only one or two occurrences and somewhat rare species with, for example, 20 or more occurrences;

c) Actual impacts to existing rare plant populations are not assessed;

d) Difficulties in predicting impacts when considering common/large ecosites versus uncommon/small ecosites. Common/large ecosite phases with several rare species are considered to be of greater importance than uncommon ecosite phases with fewer rare species, but the impact on a smaller sized ecosite may be very different:

   - Scenario 1 - an uncommon ecosite with three rare species / occurrences: 50 hectares out of 50 hectares = 100% loss and the loss of three rare species/occurrences.
   - Scenario 2 - a common ecosite (i.e. BM-d1) with five rare species / occurrences: 50 hectares / 1,000 hectares = 5% loss. The loss of rare species is unknown, but probably low given the large area in which they may occur.

Request:

Evaluate the impacts on actual rare plant occurrences using Alberta Natural Heritage Information Centre (ANHIC) records (Government of Alberta, 2009).

73. Rare plant surveyors not identified. The Alberta Native Plant Council's (ANPC) Rare Plant Survey Guidelines recommend that surveyors for rare plants be identified in reports.

Discussion:

The ACFN technical question for this issue was only partially answered by Shell, who stated that "field protocols were based on guidelines developed by the Alberta Native Plant Council … and integrated with Golder Rare Plant Survey Technical Procedures". The ANPC guidelines recommend that the report include a signature sheet with the names and credentials of the field biologists and authors. The senior author should sign it, acknowledging that all relevant information is included and that they accept responsibility for the accuracy of the report.

Request:

Identify the botanists used for the rare plant surveys in the assessment, as well as their qualifications. Clarify whether these botanists were on all the detailed inventory surveys as well as the rare plant surveys.

74. Additional details about the accuracy of vegetation maps required. Shell uses existing Alberta Vegetation Inventories (AVI) as a basis for developing ecosite phase maps for the LSA, and LANDSAT satellite image classification at the RSA level. However; there is no discussion of the accuracy of these maps or whether field data were used to verify their accuracy (Environmental Setting Report Section 3.3.1.7, pg. 3-16). The resulting maps are used in both the vegetation and wildlife assessment without comment on their accuracy.

Discussion:

In response to the ACFN's technical question on this issue, Shell provides some information on map use, but two uncertainties remain: the accuracy of the original Alberta Vegetation Inventory (AVI), and the accuracy of the model used to convert the AVI to Ecosite Phase.

Request:

Identify whether the accuracy of RSA vegetation maps was determined by ground data or from air photo interpretation.

75. Impacts of combined air emissions on vegetation key indicator resources unclear. The increase in nitrogen causing eutrophication is a concern - nitrogen accumulates in the environment causing long-term to permanent changes.

While nitrogen is a naturally occurring nutrient, most northern vegetation communities are adapted to low nitrogen levels. The addition of nitrogen to treed bogs and poor fens may result in a shift in species, and, potentially, an increase in sedges and shrubs and a decrease in mosses and lichens (depending on the species). Plant species particularly adapted to low nutrient conditions, such as pitcher plant (which is both rare and collected for use by Aboriginal users) may be out-competed in a more nutrient-rich environment. Although the area potentially affected is small, the long-term impacts may be noticeable to Aboriginal users and wildlife.

The combined effects of acid deposition, sulphur dioxide, nitrogen dioxide, and eutrophication on treed / poor bogs may cause more permanent changes than anticipated. The interrelationships between these elements and northern Canadian ecosystems are not well understood, and therefore the confidence level in these assessments is not high.

Discussion:

In response to the ACFN's technical question on this issue, Shell missed an important point: not all combinations of pollutants and their effects on plants (or animals) are additive; many are synergistic.

Request:

Provide a qualitative description of how air emissions (PAI, SO_2, NO_2, and eutrophication) might cumulatively affect plants around the mine during operations and reclamation, taking synergistic effects into consideration.

4.10 Reclamation, Soils, and Landforms

4.10.1 Overview

The key environmental issues arising from the PRM with respect to reclamation, soils, and landforms are:

- Closure landscapes that are very different from the baseline landscape;
- Reclamation strategies are simplistic and rely heavily on unsupported assumptions;
- Disturbance of 10 400 ha, with no specific reclamation timeline and over-reliance on adaptive management;
- Destruction of the Eymundson Sinkholes;
- Uncertainties related to reclamation of wet tailings;
- Uncertainties related to project-scale, and regional-scale reclamation of wetlands as upland forest.

For complete details, please refer to the full technical review report:

- Review of the Shell Pierre River Mine Project: Terrain, Soils, and Reclamation – Review for: Athabasca Chipewyan First Nation, May 2010, by Len Knapik of Pedocan Land Evaluation, attached to this report as Appendix D-15.

4.10.2 Discussion and Assessment Review

Large oil sands projects, such as the PRM, take place over several decades. There is a long time lag between when a project is designed and when reclamation takes place. The PRM closure landscape plans suggest Shell assumes a very optimistic level of success due to anticipated adaptive learning over the next few decades.

The landscapes and landforms described in the closure plans would be very different from natural landscapes and landforms. The landforms do not appear to mimic natural landforms. There would be a very small extent of wetlands in the landscape, which may or may not be wet all summer. The drainage channels would be constructed and would be unlikely to appear natural.

Shell has proposed to use thickened tailings at this project, which should lead to faster reclamation time lines, but they would still be relying on large external tailings ponds and end-pit lakes. It is not clear whether this technology satisfies the intent or the specifics of ERCB Directive 074.

The existing drainage basins and stream channels of creeks would be mined out and new drainage systems imposed that would be very different. The design of new landscape features (including huge overburden dumps) and new creek channels is based on models that have not been proven on these largely sand-based landscapes. Erosion of the watershed and the channels, and sediment transfer to lakes and to the Athabasca River are concerns.

Shell estimates the time required for reclamation to reverse impacts and to achieve a state of equivalent capability and sustainable ecosystems will be 80 years. A more conservative estimate might be hundreds of years for some elements and there may be impacts that should be considered permanent.

The PRM would result in permanent destruction and removal of the Eymundson Sinkholes. These significant terrain features are restricted to north-eastern Alberta. There are several other sinkholes in the immediate region; these are also at risk of being destroyed by oil sands mining and related activities.

4.10.3 Concerns and Requests

The following reclamation concerns and requests were identified:

76. Direct placement of soil strategy unclear. Shell indicates that one third of the topsoil would be used for direct placement and that the other two thirds of the topsoil would be stored in reclamation material piles (EIA Update, Appendix II, Section 3.3.2, table 27).

    Storing soils for long periods of time in large piles, while convenient, destroys much of the living material important for reclamation success. Seeds, propagules, and mycorrhyizae are not likely to survive this method in sufficient quantities to enhance site re-vegetation.

    The success of reclamation is based on several factors: site conditions, weather conditions during the establishment years, and the seed source available in the establishment years. Reclamation sites that are relatively small and surrounded by vegetation communities with high species richness are likely to reclaim to rich / diverse communities. Reclamation sites that are large, such as mines, have areas that are distant from seed sources. The centres of these large reclamation areas would have low species richness - unless significant management steps are taken.

Discussion:

Shell does not address the ACFN's technical questions for this issue, instead providing references to broad statements about direct placement, revegetation, and biodiversity.

Requests:

i. *Estimate the area that would have topsoil placed directly upon it, rather than stored in the reclamation material sites.*

ii. *Explain how biodiversity could be enhanced in the areas where direct placement is not possible.*

iii. *Explain how species richness could be enhanced with the direct placement of the topsoil and the lack of seeding forbs (other than in two shrublands)*

iv. *Describe Shell's willingness to prepare contingency plans, including sufficient reserve funds, in the event that the reclamation strategies described in the Application do not meet their intended outcomes.*

v. *Describe Shell's willingness to use the ACFN and other regional Aboriginal communities as monitors of Shell's success in this matter (and others associated with the Rights held by these communities).*

77. Reliance on LCCS for meeting replacement of equivalent land capability inadequate. Shell states it will reclaim disturbed areas to meet or exceed equivalent land capability for forestry, and use the Land Capability Classification System for Forest Ecosystems (LCCS) to do so. Use of the LCCS does not ensure replacement of equivalent land capability, as is confirmed by the LCCS Field Manual 3rd Edition (CEMA-LCCS, 2006), the CEMA Soils and Vegetation Subgroup – Forest Productivity Task Group (in Timberline, 2008), and the Government of Alberta.

    If Shell has no other data or information to support their assumption of attaining equivalent capability and forest productivity, then the model assumptions need to be revisited and the ratings revised.

    Request:

    Explain why Shell relies solely on the LCCS system to predict equivalent land capability.

78. Closure landscape water quality details required. The reclaimed landscape would include a number of low areas, runoff channels and streams, wetland areas with high water table, and ponds. Poor groundwater quality due to seepage of process-

affected water from tailings seems likely to result in saline wetlands with contamination by salts, hydrocarbons, naphthenic acids, and hydrogen sulphide.

Requests:

i. *Discuss how Shell plans to estimate the location of the long-term water table and seepage areas in an area when groundwater is being affected by other mines and climate change is likely but unpredictable.*

ii. *Discuss how surface water would be separated from process-affected water (in the fine tailings) in the final landscape.*

79. Destruction of Eymundson Sinkholes inadequately assessed. The PRM would result in the destruction of the Eymundson Sinkholes, terrain features restricted to north-eastern Alberta. These sinkholes have value as research sites to understand the development of karst features in areas with relatively thick geological cover over the limestone. The sinkholes have potential for rare species of micro-organisms, plants, and animals but they have not been well investigated. The sinkholes are very deep (30 to 40 metres or more), and are a reliable source of good quality water even in drought years. The unusually great depth and almost perfectly round shape suggest they may have had importance to pre-historic people and have potential for archaeological evidence. It is unclear whether Shell investigated the pre-historic and historic significance of these sinkholes. There are other sinkholes in the immediate region, also at risk of being destroyed by oil sands mining and related activities.

Requests:

i. *Discuss the pre-historic and historic significance of the Eymundson Sinkholes, integrating specific TK about these features into the analysis.*

ii. *Discuss regional commitments, if any, to protect representative examples of these karst features. If none, what would Shell propose to be a reasonable course of action?*

80. Reclamation of wetlands as upland forest inadequately assessed and planned. Of the 3,763 ha of wetlands removed as a result of the PRM, only eleven hectares of marshes and open water wetlands would be reclaimed. There are no plans for reclaiming bogs or fens. The CEMA Guideline for Wetland Establishment on Reclaimed Oil Sands Leases (in Harris, 2007) recommends a watershed:wetlands ratio of 2:1 in reclaimed areas to create sustainable ecosystems in the oil sands region. This means 33% of the reclaimed watershed should be wetlands, but the PRM closure plan shows less than 1 percent.

This same pattern of loss of large landscape-sized wetlands is happening at every oil sands mine in the region. Much of the large areas of wetlands removed as a result of

oil sands mining is expected to be reclaimed as upland forests, constituting a major shift in the ecosystem of the region.

Requests:

i. *Discuss the use of the CEMA Guideline for Wetland Establishment on Reclaimed Oil Sands Leases recommendation of a watershed:wetlands ratio of 2:1 for the creation of sustainable ecosystems in the Oil Sands Region.*

ii. *Present the area of wetlands in the region that would be converted into uplands.*

iii. *Describe the decisions and cost necessary to implement the 2:1 watershed:wetlands ratio.*

81. Large reclamation knowledge gaps and complex issues related to tailings management inadequately assessed. There is a lot of information that is still unknown regarding reclamation all of the disturbances associated with an oil sands project. It will take many years of intensive research to develop trial systems that must be monitored, provide feedback to validate understanding, adjust designs and management, and then test again. Some of these knowledge gaps are listed below[6]:

- **Wetland reclamation**
  - See Harris (2007) Guideline for Wetland Establishment Section 7 – Addressing Uncertainty
- **Drainage Basin / Landform grading, shaping and drainage**.
  - How to construct vegetated waterways
  - How to control salinity
- **Ecosite Ecology**
  For each landform / material / soil type (ecosite):
  - What are the water and energy balances (capital and circulation rates, where and how much water is in the landscape, how is it moving around and why);
  - What are the salt balances, including inorganics, organics, ions, nutrients, metals (capital and circulation rates);
  - What are the plant and ecological responses to water, energy and salt balances;
  - What are the vegetation succession sequences of reclaimed ecosites;
  - Identify best management practices for establishment of boreal plant communities in closure landscapes, including tailored planting**,** selective LFH and topsoil salvage and placement, and propagation techniques for plant species of concern.

[6] Adapted from Syncrude (2006), & Barbour et al. (2007).

- **Soils Capping Research Needs**
  - Suitability of capping prescriptions for tailings sands for drier than mesic sites with water tables > 1.5 m bgs.
  - Schedule for capping.
  - Macro and micro nutrient cycling and dynamics, including effects of fertilization in undisturbed and reconstructed soils.
    - Order of priority: Nitrogen, phosphorous, micronutrients.
    - Impact of moisture regimes on nutrient dynamics.
  - Capping options other than "low risk" should be examined to raise level of confidence in long-term performance:
    - Effects of climate cycling on salt and water balances on sand,
    - Effects of climate cycling on salt and water balances on SSOB,
    - Effects of elevated pH (from tailings-affected water) on ecosystem development,
    - Improved understanding of trajectories for plant community development on reclaimed sites to build confidence that reclaimed areas are moving towards desired end points,
    - Slope and aspect effects on water and salt balances, and
    - Desodification of sodium impacted soils. Flushing rates of dominantly mineral soil profiles.
- **Uncertainties related to reclamation of wet tailings - especially in light of recent regulatory changes and new technologies for dry tailings**

Requests:

i. *Clearly identify the limits of demonstrated reclamation technology replace equivalent capability.*

ii. *Provide examples in the mineable oil sands region where restoration (rather than mere reclamation) is possible, including an order of magnitude estimate of the cost compared to current methods.*

iii. *Discuss the issues specific to stabilization and reclamation of non-segregating tailings.*

iv. *Review impact assessments and confidence ratings based on demonstrated reclamation success.*

v. *Discuss how Shell will manage tailings to develop strength to allow timely capping and meet reclamation and closure requirements.*

vi. *Discuss how Shell will meet the requirement of having tailings with low compressibility so as to minimize settlement and not disrupt the closure landscape.*

vii. *Discuss how water quality and salt load from the de-watering tailings will be managed to not create large areas of saline soils in the reclaimed landscapes*

viii. *Discuss uncertainties regarding tailings reclamation, including the risk of failure with tailings pond dikes and the risk that reclaimed tailings will not support ecosite phases.*

ix. *Compare and contrast the use of dry tailings technologies versus thickened tailings for the PRM. Include reclamation success in the discussion.*

x. *Identify any changes Shell is considering that would eliminate external tailings ponds and the long-term storage of wet tailings in the reclaimed landscape and in end pit lakes.*

4.11 Traditional Land Use and Traditional Knowledge

4.11.1 Overview

Traditional land use for the ACFN is a way of life that includes spiritual, cultural, linguistic, medicinal, and subsistence activities. The many components of traditional land use are inseparable and crucial for the continuation of the ACFN's Rights and culture.

Key issues arising from the PRM with respect to traditional land use include:

- EIA not in compliance with the Terms of Reference for traditional use assessment;
- ACFN not directly consulted about members' traditional lands or their use of specific areas proposed for disturbance;
- Long term loss of land associated with the project footprint and cumulatively in the region, and the associated loss of traditional land uses;
- Many uncertainties related to timing and success of reclamation of traditional lands;
- Unknown cumulative impacts to the ability of ACFN members to continue current and future traditional use practices.
- Adverse direct, indirect and cumulative effects on Treaty and Aboriginal rights not assessed.

For details, please refer to the full technical review report:

- Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project Environmental Impact Assessment Report – Review for Athabasca Chipewyan First Nation – Traditional Land Use & Traditional Knowledge, October 2008, by Janelle Baker of Little Seed Consulting, attached to this report as Appendix D-16.

4.11.2 Discussion and Assessment Review

In 2008, Shell received project-specific Traditional Land Use (TLU) and Traditional Knowledge (TK) information from ACFN community members. Shell reviewed the TLU / TK reports and determined the reports did not contain information that would change the TLU assessment reported in the original EIA. ACFN identified gaps with the 2008 project-specific Traditional Use Study (TUS), and Shell agreed to a final scope for a further TUS in September 2010. The EIA will not be complete until Shell has reviewed and integrated this supplemental TUS work into the EIA.

The mitigations proposed by Shell do not address the ACFN's concerns or the predicted impacts. For example, reclamation in the "far future" and financial compensation to trappers in the project area do not address the loss of traditional territory and associated use for the ACFN in its entirety. Trapper's compensation is meant to address impacts to the individual trapper's commercial activities. The value and use of traplines goes beyond the commercial trapping activities. Treaty and Aboriginal rights are communal rights that are not addressed through trapper's compensation. The term "far future" is not defined and no timeline for far future reclamation is provided. Loss of access to and use of lands for more than a generation can be considered an irreversible impact, as traditional knowledge (which is reinforced and learned through ongoing use of lands), is lost. Damage to wildlife populations and associated harvesting activities were not assessed in full consideration of their impacts to the ACFN, including not only their Treaty and Aboriginal rights, but the psychological toll on individuals, and the sociological bearing on the community – the relationship with the land is of tantamount importance to the ACFN. Their history, until very recently, has consisted of over a thousand years of living off the land, without manipulating the environment through agrarian practices or industrialization. Even the physiology of the Aboriginal people is adapted for traditional diets (Baschetti, 1998). There may be no culturally relevant mitigations for adverse impacts to harvesting.

Shell does not comply with the Terms of Reference with respect to communication with the ACFN about traditional land use and how it will be impacted by the project.

Shell demonstrates a lack of faith in traditional knowledge. For example, Shell supports the results of the Population Viability Analysis (PVA) which predicts a growth in moose and black bear populations. However, trappers and other First Nations people, as well as modeling results conducted in conjunction with the development of a Terrestrial Ecosystem Management Framework for the Regional Municipality of Wood Buffalo (for CEMA), consistently report declining moose numbers in the region[7].

Shell states that they are consulting the ACFN on potential project-related impacts on their traditional lands and Aboriginal rights.

[7] This concern is addressed in the wildlife section.

4.11.3 Concerns and Requests

The following traditional land use concerns and requests were identified:

82. Traditional land assessment does not meet the Terms of Reference. The Terms of Reference for the EIA that state that Shell must discuss "the extent of traditional land use and cultural use in the Study Area" (TOR 8.0.a) and "project and cumulative effects of development on traditional uses and mitigation strategies to prevent or minimize effects" (TOR 8.0.b). The ACFN were not fully consulted on these topics.

    Request*:*

    Discuss how Shell intends to comply with the Terms of Reference with regards to consultation with the ACFN on traditional use and impacts of the PRM.

83. TK and TLU not seriously considered in the assessment. Shell is not "consulting the ACFN on the potential impacts of the project on the ACFN's traditional lands and rights" to the level of satisfaction to the ACFN. The ACFN have tabled a number of questions and suggestions with Shell and AENV to address this issue and, to date, there has been no response.

    Discussion:

    In response to the ACFN's technical question on this issue, Shell refers to the ACFN's TLU and TK study and claims that funding the technical review is part of consultation. Shell also states they are consulting with the ACFN on the potential impacts of the project on the ACFN's traditional lands and Aboriginal and Treaty rights. However, this information was not used as part of the assessment of this project. Shell agreed to a final scope for a further Traditional Use Study (TUS) in September 2010, following ACFN's identification of gaps with the 2008 project-specific TUS. The EIA will not be complete until Shell has reviewed and integrated this supplemental TUS work into the EIA.

    Requests*:*

    i. *Conclude the work on TK / TLU and incorporate into the EIA before proceeding with the application.*
    ii. *Clarify how the TLU and TK information has been considered in the project planning.*
    iii. *Clarify how the TLU and TK information provided by the ACFN will be considered in the project operation.*
    iv. *Clarify whether the TLU and TK work is complete.*

v. *Identify the specific instances where the TK information provided both corresponds and does not correspond with scientific information in the EIA.*

vi. *Identify how Shell will address ACFN concerns about TLU in the project area.*

vii. *After reconsidering the ACFN's TK submission, re-evaluate how the project would impact the ACFN's ability to exercise their Rights.*

84. Details on the loss of traditional territory required. Shell states that a section of the ACFN's traditional territory would be disturbed and not reclaimed until the far future. No reclamation timeline is provided. This loss of traditional territory translates directly into a loss of use, the potential to use the area, and the associated impacts on Rights and culture.

Discussion:

In response to the ACFN's technical question on this issue, Shell stated it is consulting with the ACFN on the potential impacts of the project on the ACFN's traditional lands and Aboriginal rights. However, this information was not used as part of the assessment of this project.

Request*:*

Clarify whether any identified sites of traditional significance will be avoided or impacts upon them mitigated.

85. Cumulative impacts to traditional users not fully addressed. Shell assumes that after an unspecified amount of time, plants, animals, and fish would move into the area without assistance and that the land would be restored to productive capacity. In some cases the impacts to terrestrial resources (such as old growth forest and barred owls) would not be fully recovered until sometime in the 'far future' (which is undefined). However, the interval between the first disturbance and the site being fully restored there would be a considerable length of time - 80 – 100 years or more (as this time spans several generations, traditional practices in the PRM area may be lost). The desired end state for First Nations is one that would be productive for traditional use – including the ability to exercise their Rights, in conditions similar to pre-industrialization, as those conditions were the basis of Treaty negotiations.

The ACFN are concerned that the impacts from the PRM and the regional industrialization as a whole would have a near permanent impact on the ACFN's use of this area for traditional purposes.

Requests:

i. *Address the impact of the loss of traditional land use of PRM on traditional uses by the ACFN and their ability to exercise their Rights.*

ii. *Re-assess the cumulative impacts from the Pierre River Mine Project and nearby operations, using actual data from reclamation efforts from these neighbouring operations. After identifying the gaps between what was promised and what was delivered, identify what mitigations Shell would consider. Use a pre-industrial baseline for the assessment.*

iii. *Identify how Shell will address the potential liabilities if the planned reclamation measures fail to meet regulatory requirements and the needs of Rights-bearing Aboriginal communities.*

iv. *Assess how the ACFN's ability to exercise their Rights would be impacted by having to carry out their traditional practices in a reclaimed landscape that is vastly different than the pre-industrial landscape.*

86. Industrial activities directly and indirectly impact on TLU and practice of Aboriginal and Treaty rights. The incremental and increasingly prevalent impacts of industrial activity, both in the region and locally, will have a significant and long-lasting impact on First Nation members. With each new industrial project in the region there are incremental and cumulative impacts that cause increased traffic and congestion; light pollution; noise; odours; off-road use; hunting pressures; displacement of wildlife; habitat loss and fragmentation, loss of traditional plants and berries; contamination of traditional foods, air, water, etc. In turn there is increased competition for traditional resources; impediments to access to preferred harvesting areas; deteriorated quality and quantity of traditional resources; deteriorated aesthetic and spiritual qualities of harvesting and occupancy areas; psychosocial barriers to harvesting; and, a decreased ability to pass traditional knowledge and cultural practices to younger generations. The additional stress and anxiety among ACFN members (see Section 4.12 – Human Health) that results from both a lack of confidence in the quality and safety of traditional foods and from impacts to cultural and community well-being as traditional practices begin to decline, is an important effect that goes unexamined and unaccounted for. While the impacts of each individual project may seem insignificant and go unnoticed, over time the additive effects may result in considerable and permanent environmental, socioeconomic, and cultural losses.

    Combined, these impacts result in a decreased ability to practice Treaty and Aboriginal rights, and ultimately in a loss of culture and connection to the land. People use the land less; they take fewer trips and collect fewer foods and medicines; their ability and desire to use the land for traditional purposes is significantly and irreversibly impacted, resulting in more store bought foods, less exercise, fewer social gatherings, loss of language, and poorer health and well-being.

In short, industry's presence impacts the ACFN and its practice of Treaty and Aboriginal rights.

Requests:

i. *Assess the direct and indirect effects of the PRM in combination with all other regional projects on the well-being and culture of the ACFN. Take into consideration the incremental and cumulative effects of industry and other activities in the region.*

ii. *Assess the direct and indirect effects of the PRM in combination with all other regional projects (in the past, present, and future) on the ability of the ACFN to practice their Aboriginal and Treaty rights.*

4.12 Human Health

4.12.1 Overview

Shell concludes that the project alone, and in conjunction with additional existing and future regional industrial projects, is not expected to increase health risks in the oil sands region, and that conservatism has been widely applied in determining health risk. There are flaws in the Human Health Risk Assessment (HHRA) that do not support Shell's conclusion.

The key issues arising from the PRM with respect to human health are:

- Human Health Risk Assessment not as conservative as portrayed in the application;
- Realistic and comprehensive views of individual and community health not addressed;
- Poor understanding of acute inhalation health risk for the most sensitive individuals.

For complete details, please refer to the full technical review reports:

- Human Health Risk Assessment: Review of Jackpine Mine Expansion Project and Pierre River Mine Project EIA, September 28 2008, by Dr. John Dennis, of SolAero Ltd., attached to this report as Appendix D-17.
- Acrolein Issue within the Shell Pierre River Mine Project and Jackpine Mine Expansion Project Human Health Risk Assessments, by Dr. John Dennis, of SolAero Ltd., attached to this report as Appendix D-18.

4.12.2 Discussion and Assessment Review

Shell concludes that the project is not expected to result in a noticeable increase in health risks in the oil sands region. This conclusion does not address potential health impacts to ACFN community members.

Shell also concludes that conservatism has been widely applied in determining health risk. However Shell does not incorporate conservative assumptions to the extent suggested in the HHRA. While it promotes some legitimate inclusion of conservative assumptions, it ignore important aspects, including: exclusion of a large number and diversity of chemicals of concern which are difficult to assess, exclusion of any discussion of potential synergism between chemicals of concern resulting in enhanced health impact (only potential additive effects of a chemical mixture were considered), and exclusion of a realistic presentation of the complex series of sequential estimates.

Rather than include an assessment of the wider impacts on health from the proposed development on ACFN community members, the HHRA includes only a narrow definition of health relating to pollutant exposure and does not address the definition of public health as shared by Health Canada and Alberta Health and Wellness. It is clear that the health of both individuals and communities at large need to be based on more than simply accepting some maximum level of industrial pollution which is currently thought to not cause ill-health.

There is a widely accepted notion within regional First Nations groups, including the ACFN, that pollution from oil sands projects and other industry presents a real risk to human and environmental health. Because of this risk perception (whether real or not), further industrial activity in the oil sands region would result in individual and community stress which in turn can be expected to have an impact on individual and community health at a number of levels. Shell does not address the role of stress in both physical and psychological health impacts in ACFN individuals and community.

All of the ACFN's HHRA technical questions remain unaddressed by Shell. The chief difficulties with this HHRA lie with:

1. Shell's inaccurate understanding and use of 'conservative assumptions'. The 'vast majority' of chemicals have not been addressed directly – but only indirectly through groupings or surrogates;
2. The limiting definition of health in the Terms of Reference - Shell and Alberta Environment fail to acknowledge that there are important health determinants which fall outside the narrow definition of health adopted in the Terms of Reference.

4.12.3 Concerns and Requests

The following human health concerns and requests were identified:

87. HHRA conclusion unclear, with details lacking. Shell concludes that overall, "the project emissions alone, and in combination with other sources of [chemicals of potential concern] are not expected to result in a noticeable increase in health risks

in the Oil Sand Region". The use of the term "noticeable increase in health risk" is unclear; it is uncertain what and who defines the perceptibility of a change in health risk, and whether these health risks are being monitored.

Discussion:

In response to the ACFN's technical question on this issue, Shell appears to confuse 'health risk' and 'health impact'.

The HHRA clearly demonstrated that there is an increase in health risk. The question then becomes whether the increase in health risk is likely to produce an increased adverse health effect or impact.

Requests:

i. *Identify who decides what is a 'noticeable increase' in health risks (or lack thereof), and how a 'noticeable increase' is defined.*

ii. *Identify who, if anyone, is monitoring the overall health risks and health risks to specific groups of people in the region including First Nation communities, and what is being done to address the existing and potential health risks.*

88. Conservative assumptions not fully incorporated into the HHRA. Shell concludes that conservative assumptions were routinely used within the HHRA. However, there are instances where conservatism was not supported.

Discussion:

While it is true that many pages in the HHRA are devoted to explaining conservative assumptions being adopted, the imbedded discussion mainly focuses on when conservatism has been used. Shell does not discuss in great detail instances when conservatism has not been applied. For example, the exclusion of approximately 250 chemicals of potential concern from the risk assessment process was not mentioned in the discussion of conservative assumptions. This relates to one of these areas where the 'vast majority' of chemicals have not been addressed directly – but only indirectly through groupings or surrogates. While commonplace practice in the preparation of HHRAs, this practice does not promote conservatism.

Other example of this include: the potential synergistic effects of chemical mixtures were neither considered nor discussed in the HHRA; the use of surrogates, etc.

In response to the ACFN's technical question on this issue, it is evident that Shell does not accept that there are important areas where conservatism has not been adopted. An example of this is the analysis of the risk posed by acrolein (see below).

Request:

Re-assess the uncertainties in the HHRA, specifically in those areas where conservatism has not been applied in the HHRA.

89. Acrolein assessment flawed. There are serious flaws with the assessment of acrolein and reference to the acrolein report in the HHRA. In the HHRA, Shell summarizes the risk assessment for acrolein. Referencing the 2005 Golder Associates (Golder) report *Acrolein Monitoring in the Oil Sands Region*, Shell claims no detectable concentrations of acrolein were found in all laboratory samples collected "where MDL [Method Detection Limits] ranged between 0.04 and 2.6 ug/m3" (HHRA, Page 5-87). Shell argues that the absence of detectable concentrations of acrolein within the 2005 Golder report provides further evidence that their modeled estimates of acrolein are 'overly conservative'.

    There are serious errors in the science within the 2005 Golder report and Shell's interpretation of the report's findings. The 2005 Golder report did not carry out calculations required to calculate airborne detection equivalent concentrations of acrolein. When the correct calculations were carried out as part of this ACFN review, the average concentration was between 1-2 ug/m^3, with some concentrations found to be above 20 ug/m^3. In comparison, the USEPA reference concentration value used in the HHRA is 0.02 ug/m3. In all cases, Golder listed the acrolein samples to be 'Below Detection Limit'. The USEPA exposure limit is 2-3 orders of magnitude BELOW the calculated minimal detectable concentration limits in the 2005 Golder report. According to the methods used in the Golder report, acrolein levels in the samples would only be detected if they were 100 to 1,000 times the accepted safe limit.

    It is recommended that Shell address the inaccuracies relating to airborne concentrations of acrolein in the 2005 Golder report and re-evaluate it's HHRA for acrolein accordingly. It is also recommended that Shell provide evidence that other referenced reports in the HHRA for this project are not similarly flawed.

    Requests*:*

    i. Discuss and address the inaccuracies in the airborne acrolein concentrations in the 2005 Golder report and re-evaluate the HHRA for acrolein.

    ii. Discuss and address the potential for similar flawed analysis in the HHRA and elsewhere in the EIA.

    iii. Re-assess the significance of this analysis on the Rights of the ACFN.

90. Realistic and comprehensive views of individual and community health not addressed. Shell's HHRA includes only a narrow definition of health relating to pollutant exposure and does not address the definition of public health as shared by Health Canada and Alberta Health and Wellness.

Discussion:

In response to the ACFN's technical question on this issue, Shell states it recognizes that there are many determinants of health other than those characterized in the human health risk assessment, as a person's health and well-being is influenced by many factors, and that its approach to assessing the health risks associated with its proposed project is in accordance with the Terms of Reference (TOR) issued by Alberta Environment. It is accepted that Shell is operating under the TOR set by Alberta Environment, however, it is essential that Shell accepts there are important health determinants which fall outside the narrow definition of health adopted in the TOR. These health determinants have not been addressed in the HHRA but they are impacted by the PRM. The ACFN made specific comments on this in relation to the draft TOR for the assessment, yet these have not been addressed by Shell in the assessment.

Requests:

i. *Discuss the indirect impacts on the individual and community health of the ACFN from this project and other industrial activities in the region.*

ii. *Discuss potential mitigations to address these impacts.*

91. Acute inhalation health risks may not be protective of the most sensitive individuals. Shell states in Section 2.4 (Volume 3) that the acute health risks due to air emissions are to be compared with "health-based guidelines considered protective of the most sensitive individuals". However maximum concentrations are compared with the Canada-Wide Standards (CWS), a standard that is not only health-based but also includes economic considerations. Rather, Shell should have considered Clean Air Strategic Alliance's (CASA) Fine Particulate Matter and Ozone Management tiered Framework (which incorporates the concepts of keeping clean areas clean and continuous improvement), or the World Health Organization's Air Quality Guidelines (WHO, 2005).

Shell must recognize that the CWS is not a guideline considered protective of the most sensitive individuals as clearly stated in the final documentation for the standards: "while [the CWS] will significantly reduce the effect of PM and ozone on human health and the environment, they may not be fully protective and may need to be re-visited at some future date. (CCME-CWS, 2000)". This means that the decisions regarding significance of health effects based on considering this level as protective are highly suspect.

Request*:*

Provide a discussion on the use of the Canada-Wide Standards for particulate matter and ozone in the assessment of health risks from emissions. Consider incorporating CASA's Fine Particulate Matter and Ozone Management tiered Framework, or the World Health Organization's Air Quality Guidelines.

5.0 Literature Cited

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Appendix A

Letter dated February 1, 2010 from Lisa King, ACFN IRC to Alvaro Loyola, Senior Advisor, Aboriginal Relations, Alberta Environment and to John Abbot, EVP Heavy Oil, Shell Canada Energy, RE: Shell Canada Ltd. – Jackpine Mine Expansion and Pierre River Mine Project EPEA Application File numbers: 001-00245358, 005-00153125, 006-00153125, Water Act File numbers: 00245489, 00186157

Appendix B

Technical Information Requests from the Athabasca Chipewyan First Nation

Appendix C

Table of Technical Questions on the Shell Pierre River Mine Project Submitted by the Athabasca Chipewyan First Nation to Shell in March 2009, and Shell's Responses to these Questions

Appendix D

Technical Review Reports - Shell Pierre River Mine Project

Appendix D-1

Shell Jackpine Mine Expansion and Pierre River Mine Project – Environmental Impact Assessment Methodology Review for Athabasca Chipewyan First Nation – April 5, 2010, by C. Dana Bush of Bush Ecology

Appendix D-2

Cumulative Effects Review of Shell Pierre River Mine and Shell Jackpine Mine Expansion Projects for Athabasca Chipewyan First Nation, August 2010, by Daniel Smith of DS Environmental Consulting Inc.

Appendix D-3

Shell Pierre River Mine Project – Environmental Impact Assessment Report – Review for Athabasca Chipewyan First Nation – Groundwater Component – September 2008, by Lew Fahner of Agua Consulting

Appendix D-4

Shell Jackpine Mine Expansion and Pierre River Mine Projects Responses to ACFN SIRs – Environmental Impact Assessment Report Review for Athabasca Chipewyan First Nation – Groundwater Component, August 2009, by Lew Fahner of Agua Consulting

Appendix D-5

Shell Pierre River Project Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation, September 25, 2008, by Fay Westcott of Clearwater Environmental Consultants

Appendix D-6

Shell Pierre River Mine Project – Application Amendment and Response to the ACFN Review, October 4, 2009, by Fay Westcott of Clearwater Environmental Consultants

Appendix D-7

Shell Pierre River Mine Project – Summary of Water Quality and Aquatic Resources Concerns, February 7, 2010, by Fay Westcott of Clearwater Environmental Consultants

Appendix D-8

Shell Pierre River Project Conceptual Fish Habitat Compensation Plan Review for Athabasca Chipewyan First Nation, September 25, 2008, by Fay Westcott of Clearwater Environmental Consultants

Appendix D-9

Shell Canada – Pierre River Mine Project – Environmental Impact Assessment Report. Review for Athabasca Chipewyan First Nation, February 17, 2009, by Brenda Miskimmin, Summit Environmental Consultants Ltd.

Appendix D-10

Shell Canada - Pierre River Mine Project – Review of Shell's Responses to 1) ACFN's Key Concerns, and 2) ERCB/AENV's Supplemental Information Requests, August 24, 2009, by Brenda Miskimmin, Summit Environmental Consultants Ltd.

Appendix D-11

Shell Canada – Pierre River Mine Project – Review of Shell's Responses to ERCB/AENV's SIR #2, May 3, 2010, by Brenda Miskimmin, Summit Environmental Consultants Ltd.

Appendix D-12

Shell Canada Limited Jackpine Mine Expansion Project and Pierre River Mine Project – Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation, October 2008, by Dr. Karen McDonald

Appendix D-13

Wildlife Review of the Shell Jackpine Mine Expansion and Pierre River Mine Projects – Review for: Athabasca Chipewyan First Nation, May 2010, by Dave Westworth of Puma Environmental Ltd.

Appendix D-14

Jackpine Mine Expansion and Pierre River Mine Project - Environmental Impact Assessment Report - Review for Athabasca Chipewyan First Nation – Vegetation, Wetlands and Forest Resources Component, April 29, 2010 (revised), by C. Dana Bush of Bush Ecology

Appendix D-15

Review of the Shell Pierre River Mine Project: Terrain, Soils, and Reclamation – Review for: Athabasca Chipewyan First Nation, May 2010, by Len Knapik of Pedocan Land Evaluation

Appendix D-16

Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project Environmental Impact Assessment Report – Review for Athabasca Chipewyan First Nation – Traditional Land Use & Traditional Knowledge, October 2008, by Janelle Baker of Little Seed Consulting

Appendix D-17

Human Health Risk Assessment: Review of Jackpine Mine Expansion Project and Pierre River Mine Project EIA, September 28 2008, by Dr. John Dennis, of SolAero Ltd.

Appendix D-18

Acrolein Issue within the Shell Pierre River Mine Project and Jackpine Mine Expansion Project Human Health Risk Assessments, by Dr. John Dennis, of SolAero Ltd.