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April 15, 2016

Erin Flanagan
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219-19 Street N.W.
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**Reference: Response to OSEC July 2015 review of Frontier Oil Sands Mine Project Update**

Dear Ms. Flanagan:

In response to OSEC's July 2015 Statement of Concern (SOC) regarding the Frontier Project Update, Teck has carefully reviewed the SOC and prepared the enclosed response. To ensure completeness, a technical issues table was developed that identifies where Teck has responded to or considered all questions and information requests.

Teck met with OSEC on a regular basis between 2014 and 2015 under an Agreement for Consultation Arrangements that allowed both parties to share and understand each other's views. Teck shared information about the Project Update prior to filing it in June 2015. This included detailed sessions on Teck's proposed tailings management strategy, discussions on conservation offsets and water management.

Teck respectfully disagrees with OSEC's assertion that the environmental assessment is incomplete. Based on a thorough review of the provincial terms of reference, federal requirements and clarifications, and past oil sands EIAs, Teck is confident that (i) the Project application meets all regulatory requirements, and (ii) the EIA is complete and ready to proceed to the Joint Review Panel process. Further, Teck trusts that the responses included in this package present the required level of detail for your review.

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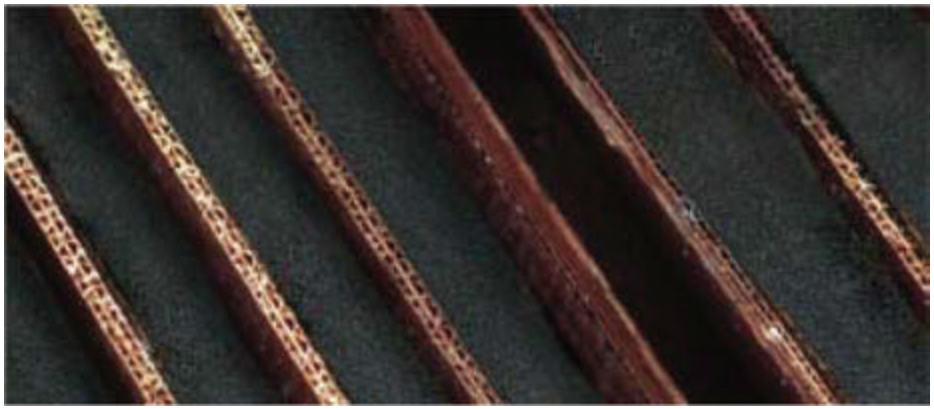
Sincerely,

Scott McKenzie
Director, Regulatory and Environment, Energy
Teck

# Frontier Oil Sands Mine Project



## Responses to Oil Sands Environmental Coalition (OSEC) Statement of Concern Regarding the Project Update (Received August 2015)

April 2016

Teck

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# Abbreviations

| | |
|---|---|
| $\mu g/m^3$ | micrograms per cubic metre |
| AAAQG | Alberta Ambient Air Quality Guideline |
| AAAQO | Alberta Ambient Air Quality Objective |
| AACO | Alberta Association of Conservation Offset |
| AEP | Alberta Environment and Parks |
| AER | Alberta's Energy Regulator |
| AMP | access management plan |
| ARM | Athabasca River model |
| AVI | Alberta Vegetation Inventory |
| bbl | barrel, petroleum (42 U.S. gallons) |
| bbl/cd | barrels per calendar day |
| CAAQS | Canadian Ambient Air Quality Standard |
| CAC | criteria air contaminant |
| CASA | Clean Air Strategic Alliance |
| CC&R | closure, conservation and reclamation |
| CEAA | Canadian Environmental Assessment Agency |
| CEMA | Cumulative Environmental Management Association |
| CERI | Canadian Energy Research Institute |
| $CO_{2e}$ | carbon dioxide equivalent |
| $CO_{2e}$/bbl | carbon dioxide equivalent per barrel |
| COSIA | Canada's Oil Sands Innovation Alliance |
| DFO | Fisheries and Oceans Canada |
| DFOP | detailed fisheries offsetting plan |
| EIA | environmental impact assessment |
| *EPEA* | (Alberta) *Environmental Protection and Enhancement Act* |
| ERCB | Energy Resources Conservation Board |
| ESRD | (Alberta) Environment and Sustainable Resource Development |
| ETA | external tailings area |
| GHG | greenhouse gas |
| ha | hectare |
| HSPF | Hydrological Simulation Program–Fortran |
| IEA | International Energy Agency |
| JRP | Joint Review Panel |
| kt | kilotonnes |
| kt $CO_{2e}$/a | kilotonnes of carbon dioxide equivalent per annum |
| LSA | local study area |
| m/s | metres per second |
| MFSP | Mine Financial Security Program |
| $Mm^3$ | million cubic metres |
| Mt | megatonne |

| | |
|---|---|
| Mt $CO_{2e}$/a | megatonnes of carbon dioxide equivalent per annum |
| MW | megawatt |
| NAAQS | National Ambient Air Quality Standard |
| NOx | oxides of nitrogen (NO, $NO_2$) (gas), or all nitrogen species (e.g., $NO_x$, $N_2O$, $N_3O$) |
| $NO_2$ | nitrogen dioxide |
| NPI | net positive impact |
| NYMEX | New York Mercantile Exchange |
| OSEC | Oil Sands Environmental Coalition |
| PDA | Project disturbance area |
| PDC | Planned Development Case |
| $PM_{2.5}$ | particulate matter less than 2.5 µm in diameter |
| RSC | reduced sulphur compound |
| SGER | Specified Gas Emitters Regulation |
| SIR | supplemental information request |
| $SO_2$ | sulphur dioxide |
| SOC | statement(s) of concern |
| t/d | tonnes per day |
| Teck | Teck Resources Limited |
| the Project | Frontier Oil Sands Mine Project |
| TJ | terajoule |
| TOR | terms of reference |
| U.S. EPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WBEA | Wood Buffalo Environmental Association |
| WMMP | wildlife mitigation and monitoring plan |
| WTI | West Texas Intermediate |

# 1 Introduction

## 1.1 Overview

In 2011, Teck Resources Limited (Teck) submitted an Integrated Application to the Energy Resources Conservation Board (ERCB) and Alberta Environment and Sustainable Resource Development (ESRD) for the Frontier Oil Sands Mine Project (the Project). The Project was referred to a federal review panel in 2012. Federal and provincial reviewers subsequently provided four rounds of supplemental information requests (SIRs) prior to Teck filing a Project Update in June 2015.

Teck has been meeting with Oil Sands Environmental Coalition (OSEC) since 2013 and in November 2014, signed an Agreement to formalize consultation arrangements between Teck and OSEC. As part of this Agreement, Teck and OSEC agreed to meet on a regular basis to discuss OSEC's concerns about the Project and have transparent discussions about the changes contemplated in the Project Update. OSEC submitted a statement of concern (SOC) regarding the Project in July 2015. This document provides Teck's response to OSEC's July 2015 SOC, which includes concerns and requests for information (collectively referred to here as statements of concern [SOCs]).

Teck is confident that this response package is complete and provides an appropriate level of detail in response to the OSEC July 2015 SOCs (see Section 3). The approach and format of Teck's responses, and the key elements of this submission, are summarized below.

## 1.2 Approach and Format of SOC Responses

During its review, Teck identified overarching themes in the SOCs provided to date. These 'key themes' are described in Section 2 and provide an opportunity to discuss related concerns. The key theme responses provide a basis from which to facilitate and focus future discussions with OSEC. Where an issue does not align with a key theme, or requires a technical explanation, a separate and specific response to the SOC is provided in Section 3.

Teck's responses to the July 2015 SOCs are compiled and summarized in an OSEC technical issues table (see Section 1.3). This table uses the same format as the technical issues table provided in Volume 1, Appendix 17A of the Project Update. The technical issues table can be sorted and filtered by discipline and theme and concords similar issues. Teck's intent in providing this table is to work through these SOCs with OSEC to reach mutually satisfying outcomes. Teck trusts that providing responses in this manner will best support efforts to resolve SOCs.

## 1.3 OSEC Technical Issues Table

The technical issues table is an Excel workbook that has two worksheets:

- **Legend and User Guide** – Provides information to assist users in navigating the table and sorting information in a manner that meets specific needs and interests.
- **2015 SOCs** – Identifies SOCs in the July 2015 SOC package and cross-references Teck's responses.

The workbook has a format that is largely consistent with the format of the technical issues table provided in Volume 1, Appendix 17A of the Project Update. The only exception is that the updated table includes two additional columns that make it easier to locate OSEC concerns and the corresponding SOC responses. Table 1-1 illustrates the format of the technical issues table with the new columns and titles highlighted in **bold** text.

**Table 1-1 OSEC Technical Issues Table – Structure and Content Description**

| COLUMN A | COLUMN B | COLUMN C | COLUMN D | COLUMN E | COLUMN F | COLUMN G | COLUMN H | COLUMN I |
|---|---|---|---|---|---|---|---|---|
| SOC Date | **Source Document** | TECK Assigned SOC No. | Discipline | Theme(s) | Type of Concern | Relates to SIR (Round and #) | SOC Text | **Location of Teck Response** |
| Month and Year of SOC (e.g., F2013 = February 2013)[1] | Source of OSEC SOC[1] | Teck sequential numbering of SOCs | Primary technical discipline | Themes are used to describe and categorize issues. These are different than Key Themes | Types of concern include: information requests, methodology, mitigation, monitoring, and impacts | SIRs that correspond with an SOC are provided here, if identified | Copied from OSEC submissions | Location of Teck's response to the SOC |

NOTE:
[1] See legend and user guide in the OSEC technical issues table for all SOC abbreviations.

To manage the size and usability of the technical issues table, the table references the location of Teck's response but does not include the response. Column I ("Location of Teck Response") directs the reader to one of the following:

- Section 2 of this document, which includes all key theme responses to SOCs
- Section 3 of this document, which includes all individual responses to SOCs

# 2 Key Themes

Based on its review of OSEC SOCs provided for the Project, Teck identified three key themes (see Table 2-1) that it believes are best addressed with a comprehensive, collective response. Key theme responses are presented in the following subsections. In Teck's view, identifying and responding to key themes will help facilitate and focus future discussions with OSEC.

**Table 2-1 Key Themes**

| Key Theme | Description |
|---|---|
| Adequacy of the Environmental Impact Assessment | Issues and concerns related to the adequacy of the EIA for the Project, including but not limited to, baseline data, assessment methodology, and desire for additional assessment work. |
| Management, Mitigation and Monitoring | Issues and concerns related to the desire for detailed engineering design, management and mitigation plans, and monitoring programs. |
| Economic Viability | Issues and concerns related to the economic viability of the Project as a result of recent economic conditions and changing regulations. |

## 2.1 Adequacy of the Environmental Impact Assessment

Several of the statements of concern (SOCs) Teck has received from Aboriginal communities and stakeholders relate to the adequacy of the environmental impact assessment (EIA) completed for the Frontier Project. These SOCs focus on the adequacy of baseline data, assessment methodology, modelling methods and level of engineering detail provided in the Integrated Application and other regulatory submissions. Teck's views on the adequacy of the EIA, its methods and completeness are discussed in this response.

Based on a thorough review of the provincial terms of reference (TOR), federal requirements and clarifications, and past oil sands EIAs, Teck is confident that (i) the Project application meets all regulatory requirements, and (ii) the EIA is complete and ready to proceed to the Joint Review Panel (JRP) process.

Teck's application for the Project is based on an appropriate level of engineering at this stage of the development, and it reflects relevant regulations and reference documents. In preparing its application, Teck:

- adhered to the provincial TOR, the federal requirements and clarifications, relevant legislation, policies, regulations and directives
- considered technical guidance documents, applicable environmental criteria (including guidelines, thresholds and objectives), industry best practice documents, regional environmental frameworks, past oil sands applications, and information and preferences gathered through consultation with potentially affected Aboriginal communities and stakeholders

Teck is confident that the quantity and quality of baseline data collected to inform the Integrated Application and Project Update is sufficient to meet provincial TOR requirements, support the EIA, and provide regulators, Aboriginal communities and stakeholders with adequate and appropriate information about current and expected environmental and socio-economic conditions in the Project area and region.

The assessment methods used in the Integrated Application and Project Update provide appropriate and robust EIA findings. Further assessment work beyond what has been included in the Integrated Application, Project Update, five rounds of supplemental information requests (SIRs) and these current SOC responses would not substantially assist or improve the assessment or understanding of the Project, nor would it yield substantially different conclusions. Any remaining differences of opinion about assessment methods, the scope or adequacy of data collected in support of the Project, or other concerns about the assessment's completeness should be discussed within the JRP process.

### *2.1.1 Assessment Methods and Completeness*

As indicated, many of the SOCs Teck has received relate to the adequacy of the EIA conducted for the Project and the completeness of Teck's responses to SIRs. Where possible and appropriate, Teck has provided clarification and additional information in its response to specific concerns and information requests (see Section 3). However, some SOCs that question the adequacy of the EIA reflect differences of professional opinion or preferred assessment methods. Other SOCs are inconsistent with regulatory guidance or standard practice for oil sands EIAs. Teck will continue to work with Aboriginal communities and stakeholders to better understand their perspectives; however, Teck is confident that all TOR requirements have been adequately met and that the EIA is complete.

Teck considered a large quantity of reference documents in developing its EIA approach. It also incorporated important information from local and diverse sources such as:

- traditional knowledge
- environmental data from the oil sands region
- recent and relevant scientific literature
- input and advice from initial and ongoing engagement with regulators, Aboriginal communities and stakeholders

The Project Update further enhanced the thoroughness of the assessment because it incorporated additional baseline data, emerging science, new regulations, and additional traditional knowledge. For a complete list of reference documents considered in developing the EIA approach and methods, see the list of references provided at the end of each assessment section in the Project Update.

Among the many reference documents Teck reviewed and considered were regulatory applications and hearing transcripts for other developments in the region. Previous EIAs and JRP decision reports provided valuable insight into the type of information needed and the level of effects analysis regulators require to be able to determine whether the Project is likely to cause significant adverse environmental effects, understand the benefits of the Project, and ultimately decide whether it is in the public interest. Teck also sought early federal involvement in the review process to provide federal regulators with the opportunity to participate in the review process from the first Project filing.

Since detailed, project-specific guidance is not available for all aspects of an EIA, practitioners must apply judgement based on best available information and professional opinion. Teck has assembled a credible and experienced technical team that has completed an appropriate and robust EIA for the Project. Teck's team of consulting professionals has been involved in nearly every oil sands mine application approved in Alberta in the past 15 years, which brings a depth of experience and knowledge on key issues and regional concerns. This level of consultant expertise is supported by Teck's more than 100 years mining history and global experience completing EIAs for mining developments in various jurisdictions and environmental settings since this type of assessment has been required. Based on all these factors, Teck's technical team is eminently qualified to provide professional judgement as needed to support the effects analysis and conclusions provided in the Integrated Application and Project Update.

### *2.1.2 Additional Baseline Data*

Teck has received a number of requests for additional (or different) baseline data, including toxicity data, snow survey data, soil inspection points, noise monitoring, socio-economic data, and invertebrate data. Teck has carefully evaluated each of these requests and considered the benefit of gathering additional information against the effort, cost and perceived value of this information. At this stage of the process, additional data gathering is warranted only if it would improve the application or add environmental value.

Based on this evaluation, additional baseline surveys were conducted after the Integrated Application was filed and this information was used to inform the Project Update. The Project Update also incorporated, where possible, information from traditional land use and knowledge studies that were provided to Teck after the Integrated Application was filed.

Overall, the body of site-specific environmental data collected since 2008 to support Teck's Application for the Project is more than what has been done for other approved applications in the oil sands region. The quantity and quality of baseline data collected to inform the EIA for the Project (as submitted in the Integrated Application and Project Update) meets or exceeds the TOR requirements. Accordingly, Teck's view is that additional baseline data is not required to complete the EIA.

Teck understands that some reviewers have an alternate opinion about the adequacy of the baseline data collected for the EIA, and Teck respects the right of reviewers to offer opinion on scope and methodology of baseline data collection. Teck will discuss opportunities for preconstruction baseline monitoring with Aboriginal communities and stakeholders and will consider monitoring activities that are important to them. However, it is ultimately the responsibility of Alberta's Energy Regulator (AER) to determine whether the EIA is complete, and the role of the JRP to determine, on the basis of the evidence and argument, whether the assessment methods used by Teck are appropriate.

### *2.1.3 Assessment Methodology*

Some SOCs regarding the Project Update and Teck's SIR responses express concern about conservatism and how it relates to the assessment, concerns about reversibility, and differences of opinion related to assessment assumptions, modelling, issue screening, statistical analysis and parameter selection. It is Teck's position that the assessment methods selected for the Integrated Application and Project Update are appropriate and provide robust EIA conclusions that regulators can rely on to make decisions, and that support consultation and engagement with Aboriginal communities about potential Project effects.

As indicated, the EIA methods were selected to meet the TOR for the Project and considered relevant reference documents. Since detailed, project-specific guidance is not available for all aspects of an EIA, practitioners applied judgement based on available science and professional opinion as is common practice. When selecting assessment methods, the practitioners balance a number of factors to make a final selection, including regulatory requirements, scientific rigor, regulator acceptance, stakeholder input, data availability, practicality and regulatory precedence. It is ultimately the responsibility of AER to determine whether the EIA is complete, and the role of the JRP to determine, on the basis of the evidence and argument, whether the assessment methods used by Teck are appropriate.

### *2.1.4 Conservatism*

Teck has received SOCs that request that modelling methods be revised to remove excessive conservatism. These requests are based on Teck occasionally identifying that predicted guideline exceedances are due to conservativeness inherent in the assessment that can be verified as being conservative by operational monitoring. On this basis, Teck justifies that the exceedance is not a concern requiring mitigation. Teck recognizes that there are some disadvantages in overpredicting potential environmental effects; however, it believes that these consequences are outweighed by the benefits—so long as assumptions and reasons for the conservatism are clearly stated and understood. Teck has identified where the EIA is conservative and has provided the appropriate rationale. The level of conservatism built into each aspect of the EIA was set according to the certainty in the modelling approach and input data used in the assessment, so that predictions were not underestimated.

Conversely, several SOCs request that modelling methods be revised to increase conservativeness. These requests stem from concerns that Teck has not adequately considered possible adverse outcomes because (i) generic criteria have not been considered, or (ii) insufficient safety factors have been applied. It is Teck's position that the EIA is appropriately conservative because it was informed by guidance documents and the opinion of experienced professionals (see Section 2.1.1). On balance, some SOCs request that Teck remove conservativeness and others add conservativeness. Teck believes the assessment achieved the right balance between the two.

Teck believes that the EIA provides an appropriately conservative assessment of possible effects and does not intend to reassess conservatism built into models. However, as part of planning for post-approval monitoring, Teck will identify opportunities to verify and refine predictions. For additional information about management, mitigation and monitoring plans for the Project, see *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

### *2.1.5 Reversibility Criteria*

Reversibility is a key criterion required under federal EIA guidance, and several SOCs focus on reversibility criteria for the effects classification. The approach to reversibility used in the EIA is similar to proven methods used in previous EIAs in the region, including those used for existing oil sands mines approved through a JRP process. Concerns about reversibility tend to focus on (i) whether environmental components are truly reversible, and (ii) whether effects are likely to be reversed in the timelines considered by the EIA.

Teck has acknowledged these concerns by conservatively considering a predevelopment reference condition and by not considering reclamation in prediction outcomes in the traditional land use assessment. Although Teck considers this approach overly conservative (see Section 2.1.4), it opted to use this approach in the effects assessment because it reflects Aboriginal community preferences.

Teck has a successful track record and has received widespread recognition regarding its ability to reverse the effects of mining at historic and operating properties. As such, Teck is confident that equivalent land capability will be established when mining is complete. Through its adaptive management process, Teck will monitor mitigation success and the progress of reversible components. This process will enable Teck to adjust mitigation based on observed conditions and evolving societal preferences. For more information about Teck's adaptive management process, see Section 2.2.

### *2.1.6 Modelling Methods*

Several SOCs focus on modelling approaches for the EIA and request changes such as:

- additional modifications to model assumptions
- further model validation
- revised screening procedures
- additional statistical analysis
- inclusion of more chemical parameters beyond that provided in the Project Update

Teck considers these SOCs differences of professional opinion regarding assessment methods. Nonetheless, it has carefully reviewed each request and maintains that the assessment methods selected for the EIA are the appropriate technical approach to address the requirements of the TOR.

Teck understands that some reviewers have an alternate opinion, and Teck respects the right of reviewers to offer opinion on methodology. It is ultimately the responsibility of AER to determine whether the EIA is complete, and the role of the JRP to determine, on the basis of the evidence and argument, whether the assessment methods used by Teck are appropriate. Based on the outcome of past JRP hearings, Teck anticipates that model validation may be a condition of approval in instances where uncertainty remains.

### *2.1.7 Additional Assessment Work*

Generally, requests for additional assessment work seek further assessment of specific technical areas or additional geographic areas. Teck's view is that the EIA and additional supporting information provided for the Project application are adequate, and that further assessment work beyond what has been included in the Integrated Application, Project Update, five rounds of SIRs and these current SOCs is not required.

Teck recognizes that discussion and debate are important part of the regulatory process, and has considered input and advice provided through ongoing engagement with regulators, Aboriginal communities and stakeholders. Based on this and the extensive information included in EIA and Teck's regulatory application for the Project, Teck is of the opinion that all contentious items have been identified, discussed and assessed to an appropriate extent. There is a practical need for any remaining discussion to proceed via the JRP process where it can be explored and decided upon in a timely manner.

Teck has received several SOCs that request additional or alternate assessment work related to predevelopment or existing conditions. Examples include:

- further discussion and definition of these conditions
- development of a socio-economic predevelopment condition
- requests for additional health risk assessment work related to these conditions

Teck notes that the TOR does not require assessment of predevelopment and existing conditions. These temporal snapshots were included to provide context for the mandatory assessment cases (i.e., Base Case, Application Case and Planned Development Case) and in response to community preferences. Teck's view is that adequate and appropriate information for predevelopment and existing conditions is included in the existing assessment work for the Project.

### *2.1.8 Appropriate Stage of Engineering*

Some SOCs request information that is typically and most logically provided during future stages of engineering. Examples include groundwater seepage control system design, detailed tailings pond emission profiles, expected changes in solvent quality over time, aircraft flight schedules and bridge design details. The EIA is based on two full cycles of prefeasibility engineering (i.e., one for the Integrated Application and one for the Project Update), which is greater than what has typically been done for other oil sands mine applications in Alberta. Teck intends to complete additional engineering studies; however, this work should be done after the Project receives the anticipated regulatory approvals.

Similarly, several SOCs request more detailed modelling of mitigation systems and their performance. Examples include the groundwater interception system, mitigation for karst features, drawdown effects, and dyke failure scenarios. Teck has reviewed these requests and concluded that more detailed modelling will not provide better or different results than what is presented in the Project Update. EIA predictions reasonably represent what future conditions will be. Future monitoring requirements are expected to be a condition of the anticipated approval for the Project, and will test the effectiveness of planned mitigation. In the unlikely event that monitoring identifies that a particular mitigation measure is not as effective as predicted, Teck's adaptive management plan will guide appropriate action. For details on Teck's monitoring and adaptive management plans, see *Key Theme – Management, Mitigation and Monitorin*g (Section 2.2).

## 2.2 Management, Mitigation and Monitoring

Several of the SOCs Teck has received from Aboriginal communities and stakeholders relate to management, mitigation and monitoring identified for the Project. Some SOCs request additional Project detail, primarily detailed engineering designs, management and mitigation plans and monitoring programs. Teck's view on these requests and the proposed evolution of these plans and programs throughout the development and operation of the Project are discussed in this response.

Based on a thorough review of the provincial TOR, federal requirements and clarifications, and past oil sands EIAs, Teck is confident that the Project application meets all regulatory requirements and the Project EIA is complete and ready to proceed to the JRP process (see Section 2.1). Teck understands and appreciates the interest in detailed engineering designs, management and mitigation plans and monitoring programs; however, Teck's view is that the Project Application is based on an appropriate level of engineering that describes a project that can realistically be built (see Volume 1, Section 12.3 of the Project Update). The information provided to date is appropriate for proposed development projects seeking regulatory approval.

Although the need for various management (e.g., emissions management, water management, tailings management) and mitigation (e.g., conceptual closure, conservation and reclamation plan, conceptual fisheries offsetting plan, wildlife mitigation and monitoring plan) plans and monitoring programs has been identified within the Project Application, detailed plans and programs need not be finalized at this stage of the Project. These plans and programs will be developed in further detail, subject to further engagement with Aboriginal communities, regulators and government agencies, in future phases of the Project.

Teck recognizes and appreciates the desire to review detailed designs, plans and programs but has had to balance Project information available at this stage of engineering with the level of information required to develop detailed designs, plans and programs. An important part of developing these items is the input and feedback received from regulators, Aboriginal communities and stakeholders. Further, Teck has had to balance the desire and willingness of some Aboriginal communities with the expressed reluctance of other communities to engage on the development of plans and programs before a Project has received approvals and authorizations. Teck understands that these latter communities are concerned that participation could be misinterpreted to imply consent, which Teck understands is not the case. Teck has made best efforts to balance these viewpoints when advancing plans and programs at this stage of the Project.

Teck recognizes three key phases of development for management and mitigation plans and monitoring programs aligned with development of the Project (see Table 2-2):

(1) project definition phase

(2) project execution planning phase

(3) implementation and adaptive management phase

Teck will continue to engage Aboriginal communities, listen, consider and respond to their interests throughout these three key phases of development.

**Table 2-2 Phased Development of Project Management, Mitigation and Monitoring Plans and Programs**

| Phase | Description |
|---|---|
| Project Definition | • Conceptualization of management, mitigation and monitoring plans and programs early in the Project timeline<br>• Based on a prefeasibility study level of engineering<br>• Influenced by engagement with Aboriginal communities, regulatory and government agencies and stakeholders<br>• Incorporated into the EIA<br>• Meets the provincial TOR and federal requirements and clarifications for the Project<br>• Project definition influenced throughout the regulatory process |
| Project Execution Planning | • Formalization of management, mitigation and monitoring plans and programs following regulatory approval and sanction of the Project<br>• Meets conditions of the regulatory approval<br>• Influenced by more advanced engineering<br>• Influenced by engagement with Aboriginal communities, regulatory and government agencies and stakeholders<br>• Informed by collaboration with existing oil sands developments and regional research consortia<br>• Influenced by preconstruction monitoring results |

**Table 2-2 Phased Development of Project Management, Mitigation and Monitoring Plans and Programs (cont'd)**

| Phase | Description |
|---|---|
| Implementation and Adaptive Management | • Implementation of management, mitigation and monitoring plans and programs<br>• Monitoring of the effectiveness of the management and mitigation plans, including operational and regionals monitoring programs<br>• Adaptation of the plans, as required, based on monitoring results and engineering advances<br>• This iterative process allows management, mitigation and monitoring plans to evolve throughout the life of the Project<br>• Influenced by ongoing input from Aboriginal communities, regulatory and government agencies and stakeholders |
| NOTE:<br>This table summarizes the key activities within each phase but is not meant to be a comprehensive list of all activities within a phase. | |

This management, mitigation and monitoring key theme response describes the phase-by-phase evolution of management and mitigation plans and monitoring programs for the Project. The influence of key activities within each phase on the development of these plans and programs is discussed. See Volume 1, Section 12 of the Project Update for an explanation of Teck's approach to Project overall implementation.

### *2.2.1 Project Definition Phase*

In the project definition phase, management and mitigation plans and monitoring programs are conceptual, which is recognized in the provincial TOR. For example, the provincial TOR for the Project require a *conceptual* closure, conservation and reclamation (CC&R) plan and *potential* plans for fisheries offsetting. Because the Project timeline spans more than 15 years from initial concept through project start-up, detailed plans and programs should not be finalized in the midst of the regulatory process. Figure 2-1 illustrates the information provided in Volume 1, Sections 12.2 and 12.3 of the Project Update in relation to the three phases of management and mitigation plan and monitoring program development that Teck recognizes.

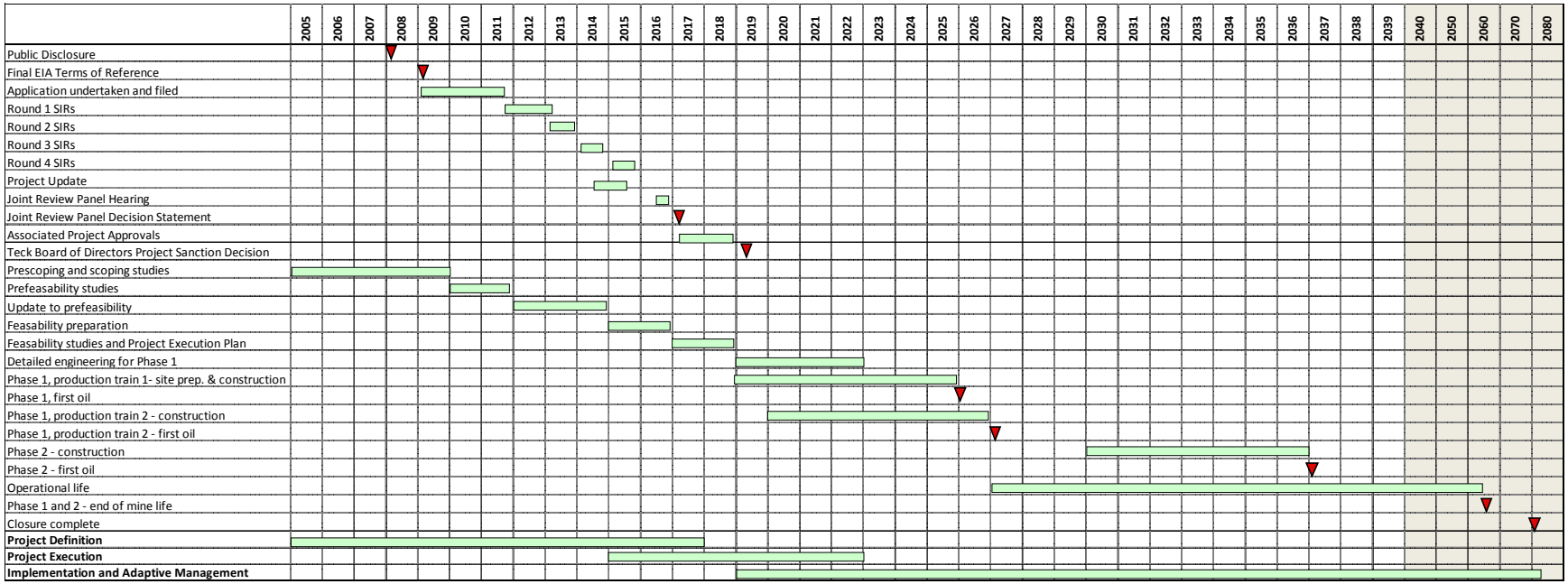


**Figure 2-1 Planning Schedule for the Frontier Oil Sands Mine Project**

Plans and programs evolve as input is collected throughout the regulatory and community engagement processes. As an example, Table 2-3 describes the influences that the regulatory and community engagement processes have had on the progress of the access management plan (AMP), biodiversity management plan, detailed fisheries offsetting plan (DFOP) and wildlife mitigation and monitoring plan (WMMP). Teck has advanced these plans in line with, or beyond, what has historically been done in the oil sands. Teck's ability to do so is due, in part, to its extensive mining experience and existence of similar plans at its operating mines as well as the willing participation of Aboriginal communities and regulators. Teck recognizes that other plans have been identified and anticipates additional plans may be identified in the future as the Project, and commensurately the engineering, progresses. Teck anticipates that management and mitigation plans and monitoring programs will evolve in a similar manner to what is discussed below.

**Table 2-3 Influence of Regulatory and Community Engagement Processes on Project Plans to Date**

| Purpose | Influence of Regulatory and Community Engagement Processes on Project Plans |
|---|---|
| **ACCESS MANAGEMENT PLAN** | |
| The AMP aims to safely manage all aspects of land access (including type and frequency of access) through or around an area that is being developed. | • Aboriginal communities have shared opinions and concerns during engagement regarding access and access management. These include: (i) loss of, or hindrance to, access to lands and resources considered important for traditional and cultural use, and (ii) increased access by non-Aboriginal land users.<br>• Teck committed to develop an AMP in Volume 8, Section 6.5.4 in the Integrated Application.<br>• In response to a provincial information request, Teck presented a draft table of contents for a conceptual AMP (see the response to ESRD/CEAA Round 3 SIR 75, Appendix 75a.1).<br>• In Volume 1, Section 14.8.5 of the Project Update, Teck committed to advance the AMP in 2015, which was achieved by a November workshop with Aboriginal communities and regulatory agencies. |
| **BIODIVERSITY MANAGEMENT PLAN** | |
| A biodiversity management plan sets out how Teck's vision of having a net positive impact (NPI) on biodiversity may be achieved, on the basis of information that has been gathered and assessed to date. | • In response to ESRD/CEAA Round 1 SIR 221 and ERCB Round 2 SIR 29b, Teck stated that offset planning should not occur until the anticipated *Environmental Protection and Enhancement Act (EPEA)* approval for the Project is received.<br>• In Volume 1, Section 14.8.3 of the Project Update, Teck discussed its nine-step approach to biodiversity management planning.<br>• In Volume 1, Appendix 14A of the Project Update, Teck provided an example of Teck's approach to biodiversity management planning.<br>• In response to CEAA Round 5 SIR 131b, Teck provided a general timeline for completing the nine-step process. Information is currently available to complete a draft of Steps 1 through 4. Step 5 can be completed in the detailed phase of management, mitigation and monitoring plan and program development. Steps 6 and 7, while underway, require more regulatory certainty. Steps 8 and 9 are implementation, monitoring and adapting actions. |

## Table 2-3 Influence of Regulatory and Community Engagement Processes on Project Plans to Date (cont'd)

| Purpose | Influence of Regulatory and Community Engagement Processes on Project Plans |
|---|---|
| **DETAILED FISHERIES OFFSETTING PLAN** | |
| A DFOP is a required component of an application for authorization under the *Fisheries Act.* | • Teck developed a conceptual fish habitat compensation plan which was included in Volume 1, Section 15 of the Integrated Application.<br>• The conceptual fish habitat compensation plan was revised in 2013, based on engagement with DFO regarding affected fish populations. The conceptual plan was resubmitted in response to ESRD/CEAA Round 2 SIR 30 (see Appendix 30j.1).<br>• In 2013, the Frontier Fisheries Offsetting Framework, an agreement between Teck and DFO, was developed because of several uncertainties that were external to the proposed fish habitat compensation lake's function to offset losses in fisheries productivity associated with the Project.<br>• In July 2014, Teck engaged Aboriginal communities and regulatory and government agencies on the Frontier Fisheries Offsetting Framework.<br>• Teck included a conceptual fisheries offsetting plan as part of the Project Update (see Volume 1, Section 15.4), which included the Frontier Fisheries Offsetting Framework.<br>• In April 2015, Teck held a workshop to receive feedback on the fisheries offsetting options included in the Frontier Fisheries Offsetting Framework. Feedback received from Aboriginal communities will be considered in the draft DFOP.<br>• In response to CEAA Round 5 SIR 164b, Teck describes how feedback from the April 2015 workshop was considered and how decisions were made.<br>• In November 2015, Teck held a workshop to present decisions regarding fisheries offsetting measures. Teck also identified three opportunities for continued input into the DFOP:<br>(i) identifying a potential fish species assemblage for the proposed fish habitat compensation lake<br>(ii) discussing community interest in the design and execution of fish and fish habitat monitoring<br>(iii) discussing community interest in developing regional Aboriginal fisheries offsetting objectives as a complimentary measure that includes a list of potential offsetting options in the oil sands region that meet regional Aboriginal community desires |

## Table 2-3 Influence of Regulatory and Community Engagement Processes on Project Plans to Date (cont'd)

| Purpose | Influence of Regulatory and Community Engagement Processes on Project Plans |
|---|---|
| **WILDLIFE MITIGATION AND MONITORING PLAN** | |
| The purpose of a WMMP is to outline how predicted effects on wildlife and wildlife habitat will be mitigated during all phases of a project, how mitigation effectiveness will be monitored, and how mitigation will be adapted, if necessary, based on monitoring results. | • Aboriginal communities have raised a number of concerns during engagement regarding wildlife habitat, abundance and health, and traditional and cultural use of wildlife. Aboriginal communities provided some preliminary guidance on wildlife mitigation, including monitoring.<br>• In response to ESRD/CEAA Round 1 SIR 440, Teck stated that concerns expressed by potentially affected Aboriginal communities related to wildlife will be considered during the development of a wildlife mitigation and monitoring plan, and that the plan will be developed together with potentially affected Aboriginal communities and regulators.<br>• Teck has stated that development of a WMMP would begin in 2014 (see the response to ESRD/CEAA Round 1 SIR 226). It has since revised this timeline and confirmed that development of the WMMP will be delayed to allow for a plan that will better reflect the updated Project (see the response to ESRD/CEAA Round 3 SIR 54).<br>• Teck has identified specific measures that will be included in the WMMP (e.g., see the response to ESRD/CEAA Round 1 SIR 211, ESRD/CEAA Round 3 SIRs 54, 59 60).<br>• In Volume 1, Section 14.8.4 of the Project Update, Teck states that it "will advance the development of the WMMP using the data and analysis that have been provided in the Project Update; however, the WMMP cannot be completed in 2015 as it will be informed by the Joint Review Panel process."<br>• Teck expects that a detailed WMMP will be a condition of the anticipated *EPEA* approval and that its content will be influenced by provincial direction at that time. Therefore, the WMMP is scheduled for detailed development following regulatory approval.<br>• In response to CEAA Round 4 SIR 31, Teck provided a framework for a WMMP.<br>• In Volume 1, Section 14.8.4 of the Project Update, Teck states that "the form and content of the WMMP will be determined in consultation with regulators, Aboriginal communities and stakeholders."<br>• On November 5, 2015, Teck held a workshop to discuss guiding principles for a WMMP. Teck heard that continued engagement is extremely important throughout the process of developing the WMMP. |

### *2.2.2 Project Execution Planning Phase*

In the project execution planning phase, management and mitigation plans and monitoring programs will be advanced as their development will be informed by regulatory approvals, detailed engineering, additional input from Aboriginal communities, regulatory and government agencies and stakeholders and, preconstruction monitoring results.

- **Regulatory Approvals** – The AER decides whether an *EPEA* approval will be issued and under what conditions. Management and mitigation plan and monitoring programs must take into account applicable conditions.
- **Detailed Engineering** – Once approved and sanctioned by Teck's Board of Directors, project engineering and environmental management designs can advance to a higher level of definition as required to enable tendering for construction. Engineering and environmental management designs are studied in greater depth and consider additional geologic and processability test work. The increased level of understanding gained by continued investment during this phase fully defines a project (definitive technical, environmental and commercial details). Detailed management and mitigation plans and monitoring programs that are aligned with the project execution plan can be produced during this phase. Accordingly, clear management, mitigation and monitoring actions, and procedures for execution of the actions, can be determined.
- **Additional Input from Aboriginal Communities, Regulatory and Government Agencies and Stakeholders** – Engagement with Aboriginal communities, regulatory and government agencies and stakeholders is the primary means through which Teck understands expectations and identifies opportunities to reduce impacts and enhance potential benefits from Project activities. This engagement will occur early enough to inform Teck's engineering and environmental management designs. Continued engagement during this phase will reveal new detail, improve understanding and enable refinement of designs and plans.
- **Preconstruction Monitoring** – The purpose of preconstruction monitoring is to further develop the baseline of environmental reference conditions as required to support operational monitoring (discussed in the implementation, monitoring and adaptive management phase). While much of the preconstruction monitoring takes place in preparation for and during the regulatory process, the data set is refined and becomes more detailed after approval has been granted. With site preparation being planned to start two years after Project approval, ample time exists to refine the environmental and socio-economic baseline data set, as appropriate. In some cases, preconstruction monitoring results may be required to finalize a mitigation plan.

### *2.2.3 Implementation, Monitoring and Adaptive Management Phase*

In the implementation, monitoring and adaptive management phase, management and mitigation plans and monitoring programs will be evaluated for effectiveness and adapted as needed on an ongoing basis. Management and mitigation plans and monitoring programs are subject to refinement throughout the life of a project as lessons are learned and circumstances change and technologies advance. As a global mining company with over 100 years of experience, Teck has been recognized for its commitment to effective environmental management, mitigation, monitoring and adaptive management (for more information, see http://www.teck.com/about/awards/).

Project-specific and regional monitoring will be part of Teck's ongoing operations, as monitoring is a critical learning and adaptive management tool. Regional, multi-stakeholder organizations provide data, perspective, knowledge and experience that help identify environmental and socio-economic challenges and solutions. Collaborative monitoring with Aboriginal communities and regulators, whether through operational or regional monitoring initiatives, is an area of interest for Teck. Approaches that involve Aboriginal communities provide key advantages, namely:

- They improve trust and confidence in the data and in management decisions.
- They enable Teck to develop monitoring programs that answer the questions posed by Aboriginal communities.
- They provide an opportunity to integrate traditional knowledge into the monitoring program.
- They provide an opportunity for Teck to implement adaptive management solutions that consider Aboriginal community interests.

Two examples of Teck's involvement in collaborative monitoring are:

- Teck and Aboriginal communities have had early discussions about Aboriginal community involvement in the design and execution of a fish and fish habitat monitoring program, a component of a detailed fisheries offsetting plan (for details, see the response to CEAA Round 5 SIR 164b).
- Under the Wood Buffalo Environmental Association (WBEA), a Traditional Knowledge Committee has designed a community-based project to share Fort McKay traditional knowledge and concerns about local berry populations. Teck will consider these findings alongside scientific monitoring of berry populations. Additional themes for future study have been identified, including wetland, medicinal plant and animal tissue monitoring.

Participation in relevant regional initiatives is important to Teck and will be a requirement of the anticipated *EPEA* approval for the Project. Teck acknowledges that support for multi-stakeholder organizations that include Aboriginal communities, like WBEA and Ronald Lake Bison Herd Technical Team, is important. Therefore, Teck will consider and respond to Aboriginal community views on multi-stakeholder organizations now and in the future. Currently, Teck is a member of the following organizations:

- the Alberta Environmental Monitoring, Evaluation and Reporting Agency
- Canada's Oil Sand Innovation Alliance
- the Wood Buffalo Environmental Association
- the Ronald Lake Bison Herd Technical Team (see CEAA Round 5 SIR 134 for an update on the team's activities)

Adaptive management is a key part of environmental management for the Project and will allow management and mitigation plans to evolve in step with changing circumstances, local and regional monitoring results, and advances in science. Teck will develop an adaptive management plan to enable appropriate response to trends detected through accrued operational, regional and collaborative monitoring initiatives. See Volume 1, Section 13.3.4 for a description of Teck's approach to adaptive management.

Teck has committed to including Aboriginal communities in the development of mitigation plans and their implementation. For example:

- As part of the CC&R plan, and through a Reclamation Working Group, Teck will develop and implement a program to salvage and relocate known occurrences of rare (vascular) species to areas outside the Project footprint. Traditional resource harvesters will be invited to harvest traditional plants before disturbance. With the involvement of local Aboriginal communities, Teck will harvest and collect seeds and individuals (as relevant) of rare and culturally important species for use in propagation and revegetation efforts.
- As part of the historical resources management plan, Teck will invite members of local Aboriginal communities to participate in future historical resources assessments and mitigations where logistically feasible.

In summary, Teck's view is that the Project application is complete and ready to proceed to the JRP process. The Project application is based on an appropriate level of engineering and sufficient mitigation has been identified at this stage of the Application. Detailed management and mitigation plans and monitoring programs should not be finalized at this stage of the Project as they need to be informed by the outcome of the JRP process and additional Aboriginal community and stakeholder input. Teck will continue to listen and respond to the interests of, and engage with, Aboriginal

communities and stakeholders throughout the three key phases of development: (1) project definition, (2) project execution planning phase, and (3) implementation and adaptive management phase. Management and mitigation plans and monitoring programs cannot be fully detailed until the Project execution and planning phase because detailed plans rely on a complete regulatory process, advanced engineering designs and additional input from regulatory and government agencies, Aboriginal communities and stakeholders. In the implementation, monitoring and adaptive management phase, management and mitigation plans and monitoring programs will be evaluated for effectiveness and adapted as needed on an ongoing basis.

## 2.3 Economic Viability

The economic viability of the Frontier Project has been raised in several SOCs Teck has received from Aboriginal communities and stakeholders. These SOCs focus on (i) the balance between economic benefits and environmental consequences of the Project, and (ii) the data used to evaluate the Project's economic viability. Teck's views on the economic benefits and viability of the Frontier Project are discussed in this response.

Teck believes that the Project is in the public interest as it will have a significant net positive economic benefit to residents of the Athabasca Oil Sands Region, including local Aboriginal communities and contractors, the province of Alberta, and Canada. Economic benefits from the Project include:

- paying taxes, royalties and user fees mandated by all levels of government
- providing additional substantial economic benefits (direct and indirect), including but not limited to:
    - construction and operational employment
    - acquisition of goods and services
    - meeting or exceeding requirements mandated by all levels of government for resource conservation and environment protection

Volume 1, Section 1.4 of the Project Update summarizes the Project justification and benefits as follows:

- *The Project will create a total of 278,190 person-years of direct, indirect and induced employment across the country.*
- *The Project will contribute to government revenues at all levels through property taxes, corporate taxes and royalties in the amount of $66 billion, of which an estimated 17% will accrue to the federal government, 77% to Alberta in royalties and taxes and 6% to the local municipality.*

- *The Project will contribute to personal income tax revenues of the federal and provincial governments.*
- *The phased development approach for the Project will spread out the industry demand for construction skills and will facilitate successful implementation and cost control of the Project*[1].

Volume 1, Section 16.3 of the Project Update further describes anticipated Project economic and fiscal effects through construction and operation employment and capital expenditures including the purchasing of goods and services beginning with planned site clearing in 2019.

### *2.3.1 Long-Term Price Fluctuations and Forecasts*

Some SOCs suggest that low oil prices, such as those experienced since late 2014, may challenge the economic viability of the Project and the Project's economic benefits. It is important to note that first oil production from the Frontier Project is planned for 2026, and production is expected to occur for 41 years. Economic viability is evaluated based on the best information available for oil prices during the Project's operational period (2026 to 2066). Teck has used independent, third-party global crude oil supply and demand models and price forecasts as guidance in analyzing the Project's financials and determining Project economics and viability.

Despite a price decline of 65% in the benchmark New York Mercantile Exchange (NYMEX) West Texas Intermediate (WTI) price (from US$102 to US$36 per barrel between April 2014 and the end of 2015), pricing forecasts published in 2015 continue to show long-term values in excess of US$100 per barrel for 2025 and beyond. These price forecasts were based on the following references, published in 2015:

- The US Energy Information Agency Annual Energy Outlook (Reference Case) – http://www.eia.gov/forecasts/aeo/
- The International Energy Agency (IEA) World Energy Outlook (New Policies Scenario) – http://www.worldenergyoutlook.org/weo2015/

[1] This benefit, which was identified in the Project Update, is supported and expanded upon by the IHS Energy (2015) *Oil Sands Cost and Competitiveness* report.

These long-term price forecasts are consistent with third-party supply and demand modelling for petroleum products, which show demand consistently increasing throughout the forecast period. Prices are forecast to be US$80 to US$90 per barrel by 2020, and increasing thereafter. These forecasts also show a need for increasing global oil production alongside other fossil fuels and renewable energy sources to meet rising global energy demand. Based on these forecasts, Teck believes that the economic scenario considered for the Project Update (based on US$95 per barrel) is appropriate.

Teck recognizes that there are limitations to long-term oil price forecasts and expects there will be times over the Project life when oil prices will be higher or lower than these forecasts. The long life of the Project in conjunction with its consistent rate of production makes the cyclical nature of oil prices less relevant than developments that have shorter lives and declining production rates. The Project will remain cash-flow positive during periods of depressed pricing and will realize increased profits during higher-price periods. Oil sands mine operating costs are currently around US$30 per barrel (IHS Energy 2015), which allows mines to cover expenses associated with day-to-day operations during periods of depressed prices. As such, Teck is confident that the Athabasca Oil Sands Region will remain a substantial contributor to Canada's energy resources over the life of the Project and be a viable option for global oil producers.

### *2.3.2 Construction and Operating Costs*

In addition to the price of oil, construction and operating costs are critical to the economic viability of the Project. In its report on oil sands costs and competitiveness, (IHS Energy 2015) identified that oil field development costs are poised to reset at a lower level. Even prior to the 2014/2015 oil price decline, cost pressures appeared to be moderating owing to both local and international factors. Major input cost pressures subsided in recent years, fabrication yard capacity expanded, global steel prices softened, and oil sands companies realized the need to better manage cost pressures. These trends were reflected in the $2.3 billion reduction in forecast Project construction costs between the Integrated Application and the Project Update. The cost reduction was identified in spite of the recoverable resource increasing by 200 million barrels.

Other changes that contributed to the improved Project economics are discussed in Volume 1, Section 2 of the Project Update and include:

- reduced time between process trains 1 and 2, which improves Project economics by enabling a continuous-build strategy
- development of a more efficient mine plan by completing the Teck–Shell asset exchange, optimizing the east pit wall, and relocating external disposal areas

- reduced off-site sourced gravel costs achieved by identifying a local sand source, relying to a greater extent on coarse sand tailings as a construction material, and using headwater lakes in the post-closure landscape to reduce the need for granular fill
- an improved plant layout that is smaller, uses fewer materials, and is more efficient to build and operate

### *2.3.3 Evolving Climate Regulations*

In November 2015, the Government of Alberta released its Climate Leadership Plan and announced its goal to become one of the world's most progressive and forward-looking energy producers. Regulations to implement the plan are not available at the time of writing. However, the Climate Leadership Report recognizes that oil is a trade-exposed commodity that will continue to play a part in the world's transition to a low-carbon economy. As such, the proposed carbon pricing model is structured to create incentives for ongoing and design phase improvements, without enabling emissions leakage. The plan also:

- contemplates allocations of emissions credits to lower the average cost of compliance for trade-exposed sectors
- identifies that cogeneration of steam and electricity will be recognized

Given the provincial government's stated intent and the Project's modern design, which employs cogeneration of heat and power, Teck believes that the pending regulations will not unduly impair the Project economics. Teck believes that Project greenhouse gas emissions of approximately 4 Mt (megatonnes) per year will not exceed the 100 Mt annual emission cap established by the provincial government and that at 38.4 kg of $CO_{2e}$ per barrel, that the Project represents best-in-class for greenhouse gas emissions from oil sands developments. Teck will continue to evaluate the implications of the Climate Leadership Plan as details from government become available.

### *2.3.4 Summary*

Teck considers the economic scenario used in the Project Update (based on US$95 per barrel) appropriate. Teck also believes that Project economics will improve as additional studies are completed and the Project design and operations are optimized during future stages of engineering. The current assessment is conservative, robust and clearly demonstrates that the Project is in the public interest.

**References**

IHS Energy. 2015. *Oil Sands Cost and Competitiveness.* Canadian Oil Sands Dialogue Report, December 2015. Available at: https://www.ihs.com/products/energy-industry-oil-sands-dialogue.html?ocid=cera-osd:energy:print:0001.

# 3 SOC Responses

## Economic Viability of the Project

**OSEC Question 1**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

1. **Please describe the criteria and analysis used to conclude that the current proposed development plan for the Project maximizes the value of the resource to Albertans.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 2**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

2. **In order for the public interest test to be adequately evaluated, Teck must produce evidence showing the viability of the Project under a range of plausible economic scenarios. To this end, please provide data and economic evidence to support the claim that global demand for petroleum products stemming from partially deasphalted bitumen will remain robust and economical over the life of the Project. Please comment on impacts to the economic viability of the Project under these scenarios.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 3**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

**3. Please justify, using credible domestic and international economic modelling, the Project's expectation of an average long-term real oil price of US$95 per barrel for West Texas Intermediate.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 4**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

**4. Please provide analysis on high and low global supply and demand scenarios for crude oil, and discuss the economic viability of the Project under these scenarios.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 5**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

**5. Please provide analysis on expected royalties to Albertans over the life of the Project when following the currently proposed development path, versus following a development path that delays extraction of the resource for 20 years. For both scenarios, please provide an assessment of potential cost overruns and an estimate of the payback period.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 6**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

**6. What is the projected per-barrel supply cost of the Project? How does the per-barrel supply cost compare to per-barrel price projections for other oilsands resources?**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 7**

**Volume 1, Sections 1.3.7.3 and 16.3.3.2**

**7. Albertans derive value from a healthy environment, including clean air, clean water and biodiversity. What is the impact on regional environmental indicators of delaying the Project or staging it more slowly?**

**Teck Response:**

Teck has completed comprehensive environmental impact assessments (EIAs) of two Project development scenarios:

1. The Integrated Application evaluated a four-phase mine development occurring from 2021 to 2057, a 37-year mine life. The full-build production rate of 277,000 barrels of bitumen per calendar day (bbl/cd) would be reached 10 years after first oil and 2.8 billion barrels of partially deasphalted bitumen would be produced.
2. The Project Update evaluated a two-phase mine development occurring from 2026 to 2066, a 41-year mine life. The full-build production rate of 260,000 bbl/cd would be reached 12 years after first oil and 3.0 billion barrels of partially deasphalted bitumen would be produced.

These assessments show that the impact on regional environmental indicators would be similar for both of these scenarios, within regulatory limits and acceptable overall. Teck has no plans to assess additional development scenarios.

Question 7 does not specify a timeframe for delaying or staging the Project; however, the general implications of delaying the Project or staging it more slowly are discussed below:

- Advancing or delaying Project first oil by two to five years would result in little or no change to the cumulative regional environmental effects predicted in the Project Update. Timing changes of this magnitude would result in the Frontier Project still operating at the same time as the other developments already considered in the Application Case and Planned Development Case (PDC), and at the same or similar production levels. The result would be little or no change from the scenarios presented in the Project Update, and therefore, Teck would expect little or no change to the cumulative regional environmental effects.
- Delaying the Project by 25 to 40 years would result in the Project operating at a time when many of the developments considered in the Application Case and PDC are no longer operating, or are near the end of their operating life. In a hypothetical scenario where no other developments would occur in the region in the next 25 to 40 years, the cumulative regional environmental impacts at this future point would be much lower than the effects presented in the EIA since fewer projects would be in operation in the region. However, recognizing the level of undeveloped bitumen reserves in the region, this hypothetical 'no-development' scenario is unlikely. A more likely scenario would be additional development in the region over time to access identified (but currently undeveloped) bitumen reserves; however, less development than is considered in the PDC of the Project Update (see Volume 3, Section 2.5.2 and Appendix 2A). In this scenario, cumulative regional environmental impacts may be lower than those presented in the Project Update.
- The planned staging of the Project is the result of an iterative mine planning process that identified the most efficient mine plan possible at this stage of engineering. Staging the Project more slowly would reduce its efficiency and result in increased and prolonged environmental effects as a result of the increased duration of environmental disruption, delayed reclamation and increased greenhouse gas emissions.

## Mitigation of Air Exceedances

**OSEC Question 8**

**Volume 3, Section 4.3.4.2 and Section 4.4.3**

**Teck's comparison of modelling results in Section 4-42 identifies significant over- and underpredictions of ambient concentrations for major pollutants. This inaccuracy, combined with the substantial increase in some pollutant emissions from Reference Scenario conditions, has resulted in unreliable predictions from the supplied modeling.[5] For example, NOx emission rates are expected to increase by 69 per cent from the existing conditions to the Application Case. The majority of this increase (95 per cent) is due to other approved projects in the region that have yet to become operational. The lack of accurate modeling makes it difficult to infer what future ambient conditions might be expected once all approved projects are operational.**

8. **What are the related confidence intervals of the predicted ambient concentrations for each pollutant and scenario investigated?**

**Teck Response:**

Because dispersion is controlled by turbulence, and because turbulence is a random process, it cannot be precisely predicted. As a consequence, there is always some uncertainty that cannot be removed (Cheng and Hanna 2004). Regulators have long recognized the presence of this uncertainty and have developed specific guidelines to address uncertainty associated with air quality modelling (e.g., the *Air Quality Model Guideline* [ESRD 2013a]). These guidelines enable modellers to use a consistent approach when selecting and applying air quality models.

The *Air Quality Model Guideline* (ESRD 2013a) identifies a tiered approach to progressively reduce uncertainty by moving from simple and conservative screening modelling to more refined and advanced modelling approaches. The updated air quality assessment (see Volume 3, Section 4 of the Project Update) uses the refined modelling approach described by ESRD. Although the guideline only requires a performance evaluation for the advanced modelling approach, the ESRD *Guide to Preparing Environmental Impact Assessment Reports in Alberta* (ESRD 2013b) requests information about the accuracy of the model. Therefore, the assessment compares ambient measurements and model predictions to demonstrate model performance. These comparisons include over- and underprediction biases for the maximum values to help place the model predictions in context.

Volume 3, Section 4.3.4 of the Project Update presents an overview of the uncertainties associated with air quality modelling. Prediction confidence for each key issue is further discussed in the applicable Volume 3, Section 4.6 subsections (e.g., Section 4.6.1.4 provides the prediction confidence for $NO_2$

concentration predictions). For more detailed comparisons between measured and predicted concentrations, see Volume 3, Appendix 4D, Section 4D.4 of the Project Update. The uncertainties described in Appendix 4D are based on the most recent five years of ambient $NO_2$ and $SO_2$ measurements and three years of ambient $PM_{2.5}$ measurements compared to model predictions based on the existing condition emission scenario using five years of meteorological data.

The resulting predictions reflect uncertainties associated with comparing model results based on existing emissions. Because there is no way to verify the performance of future-year predictions (i.e., those associated with the Base Case, Application Case and Planned Development Case [PDC] scenarios), the fundamental assumption is that the uncertainties associated with the existing condition are also applicable to these future-year cases. However, the future cases assume all developments specific to each scenario will be in operation simultaneously. Although the objective of the future-year assessments is to provide reasonable worst-case predictions for each case, this assumption might add an overprediction bias to the expected future air quality levels.

For regulatory applications, it is often viewed as being more desirable to overpredict (i.e., overstate air quality changes) and be conservative, than to underpredict. As indicated in Volume 3, Section 4.3.4.2 of the Project Update, there is a general bias with overprediction for most parameters. Underpredictions are likely linked to emission estimates and these cases are indicated in the relevant sections.

Although there are uncertainties associated with the predictions, the statement “the lack of accurate modelling makes it difficult to infer what future ambient conditions might be expected once all approved projects are operational” is not valid. The modelling results presented in the updated air quality assessment provide appropriate indications of both the spatial extent and the magnitude of ambient air quality changes, even with the uncertainties.

**References**

Cheng, J.C. and S.R. Hanna. 2004. Air quality model performance evaluation. *Meteorology and Atmospheric Physics* 87: 167–196.

ESRD (Alberta Environment and Sustainable Resource Development). 2013a. *Air Quality Model Guideline*. Air Policy Section, Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. October 1, 2013.

ESRD. 2013b. *Guide to Preparing Environmental Impact Assessment Reports in Alberta.* Environmental Assessment Program, Alberta Environment and Sustainable Resource Development. Edmonton, Alberta. Updated March 2013.

**OSEC Question 9**

**Volume 3, Section 4.5.3**

**Based on the review of historic meteorological and ambient air quality data, Teck has concluded that "the meteorological conditions associated with maxima from tall stacks are inversion breakup fumigation and convection mixing that occur during the day, and high wind speed fumigation which can occur any time of the day." Teck also concludes that the concentration maxima from low-level sources occur during low-wind, stable meteorological conditions.**

**With an increasing number of sources of air pollution within the Local Study Area, it is increasingly likely that emissions from multiple facilities may intersect and cause significant increases to pollutant concentrations for short periods of time. These meteorological events are known to be hazardous to human health. Further, local and Aboriginal communities have increasingly identified exposure to unknown odours within their community and surrounding land as a concern.**

9. **What is the historic frequency of the meteorological conditions that result in pollution concentration maxima (i.e. inversions, low wind speeds, high wind speeds, etc.)? How do these meteorological events correlate to the local community's identification of odour events?**

**Teck Response:**

As indicated in Volume 3, Section 4.5.3 of the Project Update, meteorological conditions play a critical role in determining ambient air quality levels in the atmosphere. The Question 9 preamble focuses on parameters influenced by wind speed and atmospheric turbulence; however, wind direction also influences ambient air quality levels since it can result in overlapping plumes from multiple sources.

By incorporating five years of hourly meteorological data that vary across the model domain, dispersion modelling completed for the Project Update captures a wide range of meteorological conditions that occur in the region. The assessment also explicitly accounts for and addresses emissions from multiple facilities that may intersect and cause significant increases to pollutant concentrations for short periods. Volume 3, Appendix 4A of the Project Update identifies all facilities and other emission sources, which are assumed to all operate on a continuous basis.

Detailed time-series concentration plots from Wood Buffalo Environmental Association (WBEA) ambient air quality monitoring stations are provided in Volume 3, Appendix 4B of the Project Update. The magnitude and frequency of high-concentration events vary at different stations, depending on their proximity to nearby emission sources. For example, hourly $NO_2$ concentration plots (see Volume 3, Appendix 4B, Figures 4B-6, 4B-7 and 4B-9 of the Project Update) show that the peak 1-hour $NO_2$ concentration at Fort Chipewyan, Fort McKay and Patricia McInnes monitoring stations are much less than the Alberta Ambient Air Quality Objective (AAAQO; 300 $\mu g/m^3$). The $NO_2$ concentrations at the Fort McMurray Athabasca station are also less than the AAAQO, except for two events, one occurring in

2004 and the other in 2013. Peaks are greater and more frequent for the monitoring stations located closest to mining areas (i.e., Albian Mine station [see Figure 4B-2] and Millennium Mine station [see Figure 4B-4]).

Volume 3, Appendix 4B of the Project Update also provides statistical summaries that show the variation in peak concentrations for each year (e.g., Volume 3, Appendix 4B, Table 4B-5 shows the year-to-year variation in peak 1-hour $NO_2$ concentration for the period 1997 to 2013). There can be considerable variation in the individual year maxima. The year-to-year variation also reflects variations in emissions that can be systematic or random. Systematic emissions would be associated with greater fugitive dust emissions during high wind speed events or greater volatization of hydrocarbon emissions from tailings areas during the summer months when temperatures are warmer. Random events would be associated with industry upsets such as emergency flaring or tailings solvent recovery unit failures. The variations shown in these time-series plots reflect all factors contributing to the variability.

To further illustrate ambient concentrations dependence on meteorology, box plots are provided for select monitoring stations and compounds (see Figures 9-1 to 9-4). Ambient $SO_2$ concentrations are examined to indicate meteorological conditions associated with stack emissions, and ambient $NO_2$ concentrations indicate the meteorological conditions associated with low-level emissions (e.g., community and mine fleet sources). Time of day and month of the year are used as surrogates for atmospheric turbulence with unstable conditions being biased to daytime and summer periods, and stable conditions being biased to nighttime and winter periods. Neutral conditions tend to occur during high wind speed periods. Measured concentrations and wind data over the past five years (2009 to 2013) are presented.

### $SO_2$

The greatest $SO_2$ concentrations at industrial and community sites occur at the Mannix and Bertha Ganter stations. Figure 9-1 shows the time of day, month and wind speed box plots for the Mannix station, and Figure 9-2 shows the same for the Bertha Ganter station. The figures show 1$^{st}$ and 99$^{th}$ percentiles (whiskers), the 10$^{th}$ and 90$^{th}$ percentiles (boxes), and the medians. Results are summarized here:

- **Time of day:** For both stations, the general bias for larger $SO_2$ concentrations to occur during the day is consistent with the occurrence of unstable conditions.
- **Month:** For both stations, the peak $SO_2$ concentrations tend to occur in late winter and spring. This may be associated with the presence of critical mixing height conditions.
- **Wind speed**: For both stations, the peak $SO_2$ concentrations tend to occur at wind speeds of 3 m/s to 9 m/s (11 km/h to 32 km/h). The higher end of this range would correspond to high wind speed fumigation conditions.

For this dataset, the peak $SO_2$ concentrations are associated with multiple meteorological conditions (e.g., convective [unstable] conditions and high wind speed fumigation) and tall stack emissions.

### *$NO_2$*

The greatest $NO_2$ concentrations at industrial and community sites occur at the Millennium and Athabasca Valley stations. Figure 9-3 shows the time of day, month and wind speed box plots for the Millennium station, and Figure 9-4 shows the same for the Athabasca Valley station. Results follow:

- **Time of day:** For both stations, the larger values tend to occur during the night when stable conditions also occur. The uniform nighttime results for the Millennium station are because the mine fleet emissions tend to be constant during the 24-hour period. In contrast, the values at the Athabasca Station show the influence of the diurnal traffic emissions.
- **Month:** For both stations, the peak concentrations tend to occur during the winter period when stable conditions tend to be more frequent.
- **Wind speed:** For both stations, the peak concentrations tend to be associated with low wind speeds and are consistent with emissions from near ground sources.

The larger $NO_2$ concentrations are associated with stable, low wind speed conditions and with surface emissions (i.e., mine fleets and community traffic).

### *Odourants*

Odourants can result from elevated emission sources (similar to the $SO_2$ emission sources) and from low-level emission sources (similar to the $NO_2$ emission sources). For this reason, the meteorological correlations identified for ambient $SO_2$ and $NO_2$ concentrations are also applicable to the occurrence of odour events. Specifically, odourants released from tall stacks could result in odour events during the day and when wind speeds range from 3 m/s to 9 m/s. Similarly, odour events associated with surface releases are more likely associated with nighttime, low wind speed conditions.

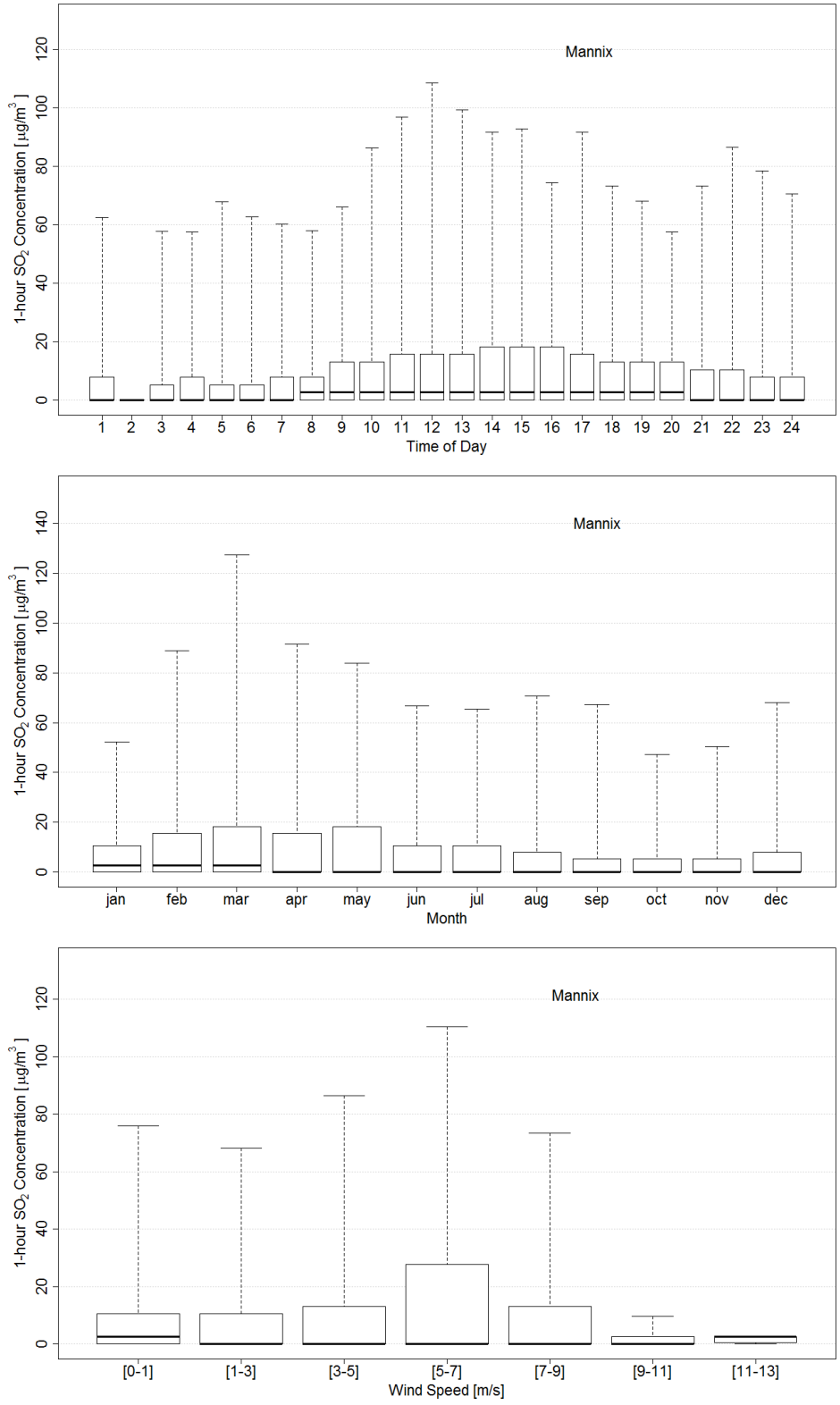


**Figure 9-1 $SO_2$ Concentration Box Plots for the Mannix Station Showing Dependence on (a) Time of Day, (b) Month and (c) Wind Speed**

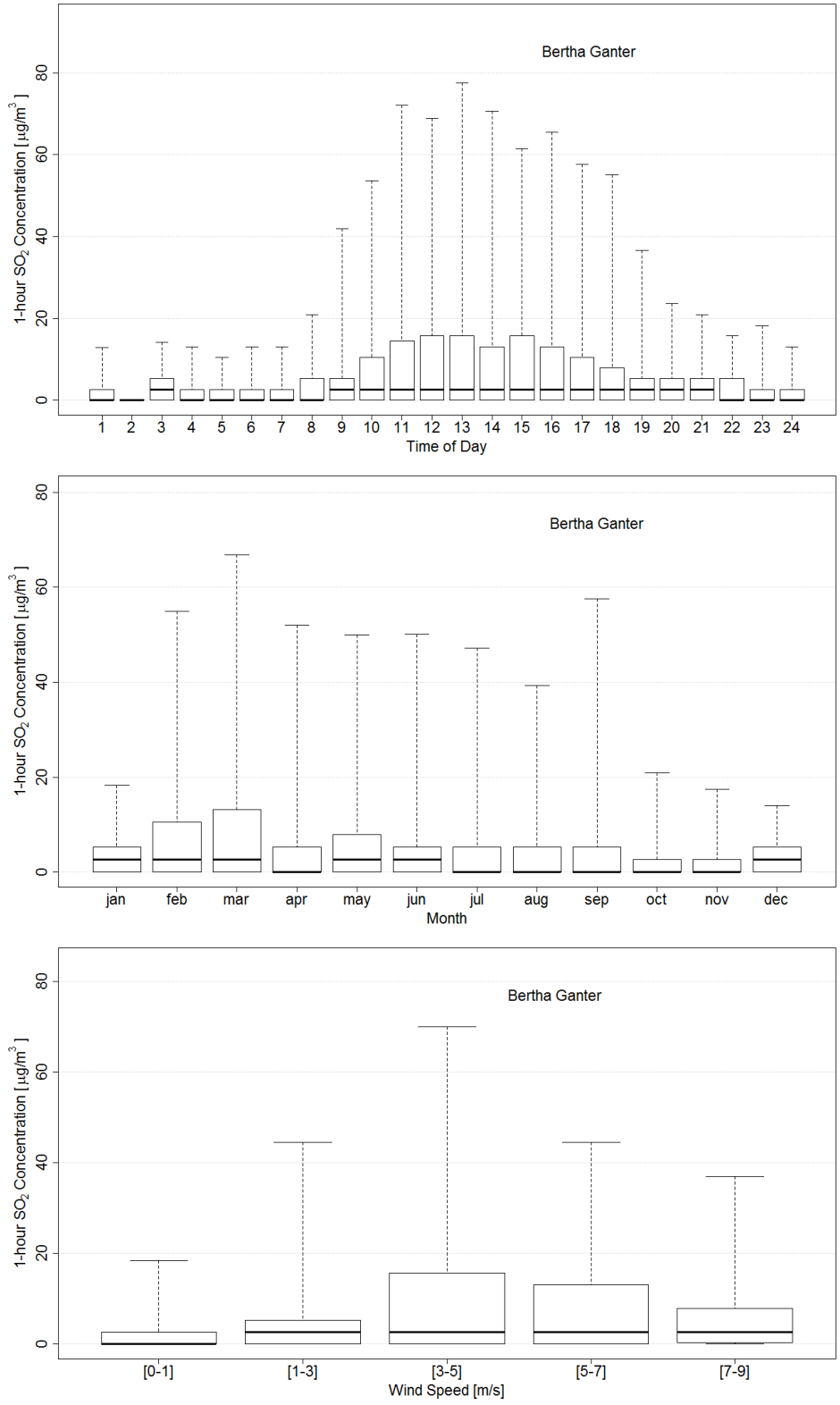


**Figure 9-2 $SO_2$ Concentration Box Plots for the Bertha Ganter Station Showing Dependence on (a) Time of Day, (b) Month and (c) Wind Speed**

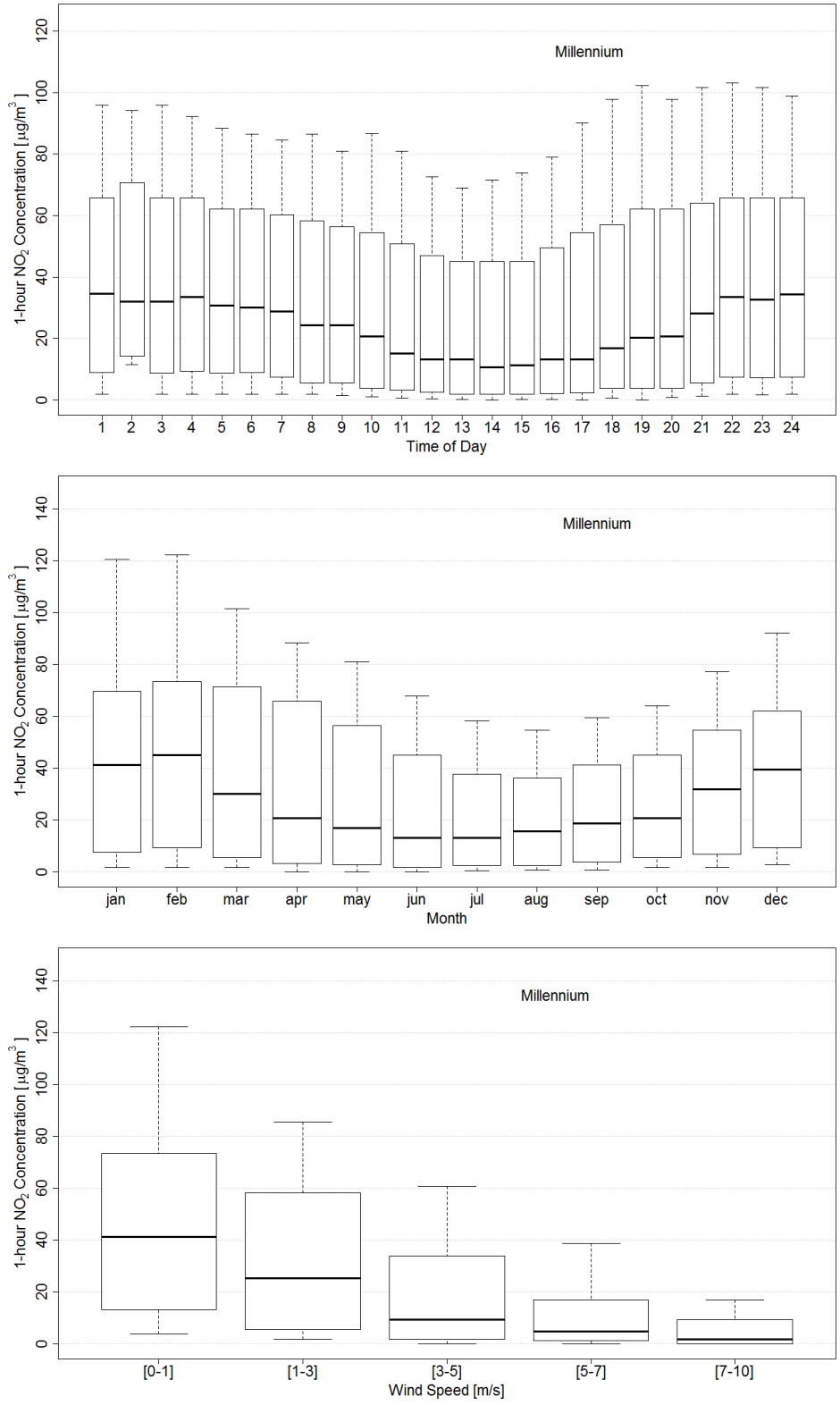


**Figure 9-3 $NO_2$ Concentration Box Plots for the Millennium Station Showing Dependence on (a) Time of Day, (b) Month and (c) Wind Speed**

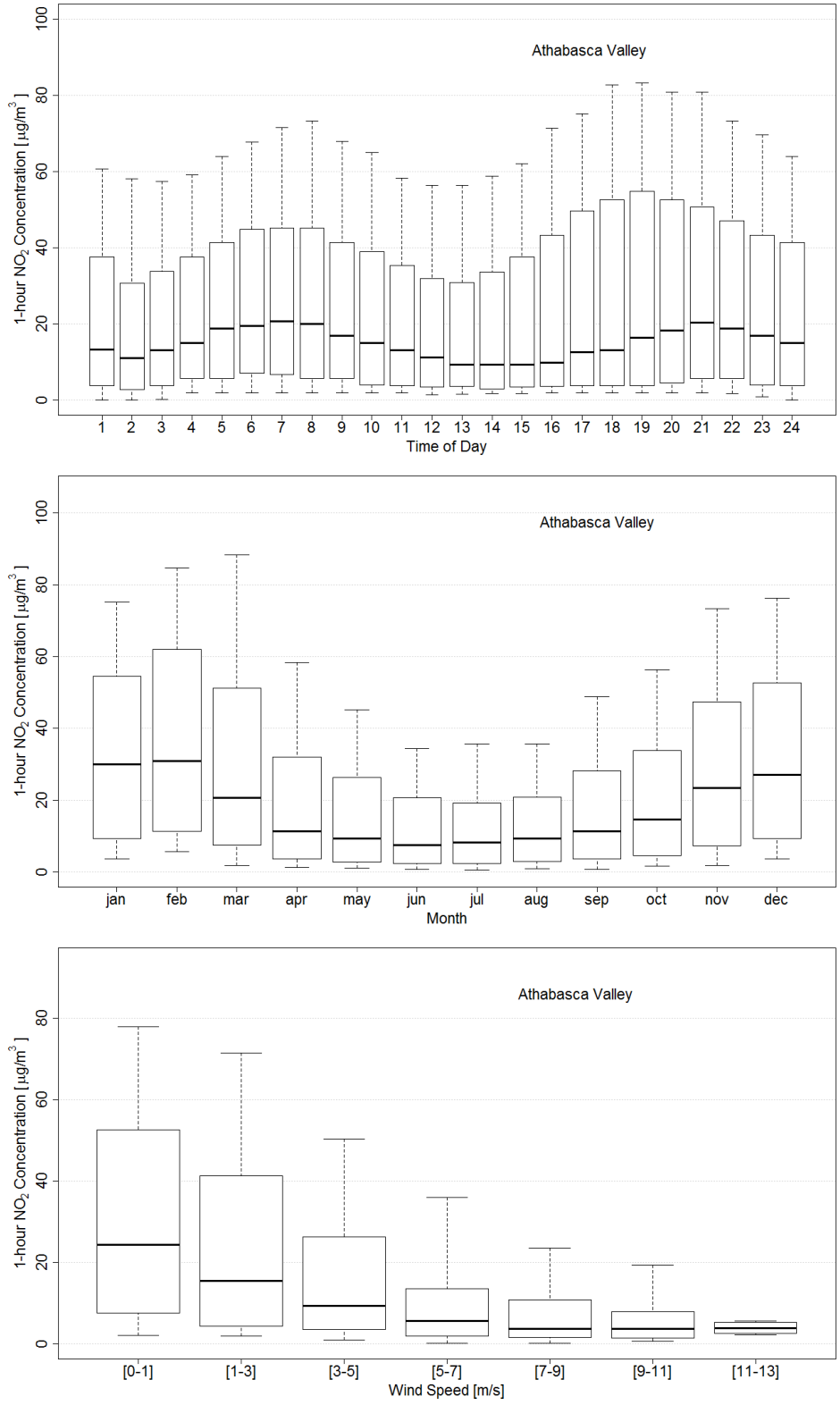


**Figure 9-4 $NO_2$ Concentration Box Plots for the Athabasca Valley Station Showing Dependence on (a) Time of Day, (b) Month and (c) Wind Speed**

**OSEC Question 10**

**Volume 3, Section 4.5.3**

**With an increasing number of sources of air pollution within the Local Study Area, it is increasingly likely that emissions from multiple facilities may intersect and cause significant increases to pollutant concentrations for short periods of time. These meteorological events are known to be hazardous to human health. Further, local and Aboriginal communities have increasingly identified exposure to unknown odours within their community and surrounding land as a concern.**

**10. What is the spatial extent of these concentration maxima? Does Teck expect that these concentration maxima are due to single-source contributions, or due to the combined contribution from multiple sources?**

**Teck Response:**

The updated air quality assessment includes numerous concentration plots to illustrate the spatial extent of maximum concentrations. Specifically, see Volume 3, Section 4.6 of the Project Update for spatial concentration or deposition plots for $NO_2$, $SO_2$, $PM_{2.5}$, odours and other air quality emissions. These plots are based on the combined operation of multiple facilities that are applicable to each development scenario, and therefore reflect the combined contribution from multiple sources. Background values that account for contributions from sources located outside the model domain are also included in these spatial plots. To illustrate the contribution from a single development (i.e., a single-source contribution), see the spatial plots in Volume 3, Appendix 4D of the Project Update, which show the concentration pattern associated with Project emissions.

The maximum concentrations tend to occur near the respective individual developments and decrease with increasing distance from the emission sources. For developments located close to one another, the plots account for and show the overlapping contributions.

**OSEC Question 11**

**Volume 3, Section 4.6.4.1**

**Teck indicates that $PM_{2.5}$ concentrations predicted in the Fort McMurray community are greater than the applicable ambient air quality objectives. Although Teck's contribution is a small proportion to the ambient concentration in the community, it is unclear how adding additional pollutant sources is aligned with maintaining ambient air quality below the stated objectives.**

**11. What is Teck's conclusion from the prediction of $PM_{2.5}$ exceedances under existing conditions? Do these predictions represent any health risk to the community of Fort McMurray?**

**Teck Response:**

Implications of ambient $PM_{2.5}$ concentrations are discussed in the updated human health risk assessment (see Volume 3, Section 12 of the Project Update), which considers acute and chronic inhalation exposure. Results and conclusions are summarized for the existing condition as follows.

*Acute Exposure*

The potential acute inhalation health risk associated with $PM_{2.5}$ air concentrations in Fort McMurray is described relative to guideline values. For acute exposure, the assessment uses the proposed 2020 Canadian Ambient Air Quality Standard (CAAQS) for acute $PM_{2.5}$ exposure (27 µg/m$^3$ based on a 24-hour 98$^{th}$ percentile averaged over three years). As indicated in Volume 3, Section 12.10.1.2 of the Project Update, the scientific basis for the 27 µg/m³ standard is not clear. The current U.S. EPA 24-hour National Ambient Air Quality Standard (NAAQS) is 35 µg/m³ (which is also based on a 24-hour percentile averaged over three years). This value is based in part on a recent, comprehensive analysis of the scientific literature regarding fine particulate matter and human health effects (U.S. EPA 2009, 2010c).

For existing conditions, the maximum predicted 24-hour (98$^{th}$ percentile) $PM_{2.5}$ air concentrations in Fort McMurray range from 26.0 µg/m$^3$ to 28.7 µg/m$^3$ (see Volume 3, Section 4.6.4.1, Table 4-50 of the Project Update). The corresponding three-year predictions range from 26.8 µg/m³ to 27.3 µg/m³, which bracket the CAAQS of 27 µg/m³ and are less than the U.S. EPA 24-hour NAAQS of 35 µg/m³.

For the purpose of comparison, the maximum measured (first-highest) $PM_{2.5}$ concentrations at the Athabasca Valley and Patricia McInnes monitoring stations are 21 µg/m$^3$and 17 µg/m$^3$, respectively (see Volume 3, Section 4.6.3.2, Table 4-33 of the Project Update). Note that these values exclude data from months when known wildfire events occur. The maximum 98$^{th}$ percentile, three-year average 24-hour $PM_{2.5}$ concentrations based on measurements at these two stations are 15 µg/m$^3$ and 13.3 µg/m$^3$, respectively (see Volume 3, Section 4.6.3.2, Table 4-34 of the Project Update). These three-year values were calculated by Alberta Environment and Sustainable Resource Development (ESRD) and have

neutral and transboundary contributions factored out. The lower measurements indicate a bias to overpredict the 24-hour concentrations.

As indicated in Volume 3, Section 12.12.1 of the Project Update, the anticipated acute health risks associated with $PM_{2.5}$ air concentrations in Fort McMurray are expected to be low. Although the measured three-year (2003 to 2012) 98$^{th}$ percentile values that represent historical and existing conditions are less than the Alberta Framework surveillance trigger (i.e., 15 µg/m$^3$), the predicted concentrations indicate the need for ongoing surveillance of $PM_{2.5}$ levels in the community of Fort McMurray

### *Chronic Exposure*

Potential chronic inhalation health risks associated with $PM_{2.5}$ air concentrations in Fort McMurray are described in Volume 3, Section 12.10.2 of the Project Update. The adopted $PM_{2.5}$ chronic guideline is the proposed 2020 CAAQS of 8.8 µg/m$^3$ based on an annual average over three years. The current U.S. EPA annual NAAQS is 12 µg/m³ (also averaged over three years).

For existing conditions, the maximum predicted annual $PM_{2.5}$ air concentrations in Fort McMurray range from 8.7 µg/m$^3$ to 9.4 µg/m$^3$ (see Volume 3, Section 4.6.4.1, Table 4-51 of the Project Update). The corresponding three-year predictions range from 9.0 µg/m³ to 9.1 µg/m³, which are slightly greater than the CAAQS of 8.8 µg/m³ and are less than the U.S. EPA annual NAAQS of 12 µg/m³.

For purpose of comparison, the maximum measured annual $PM_{2.5}$ concentrations at the Athabasca Valley and Patricia McInnes sites are 7.0 µg/m$^3$ and 5.1 µg/m$^3$, respectively (see Volume 3, Section 4.6.3.3, Table 4-37 of the Project Update). Note that these values exclude data from months when known wildfire events occur. The slightly lower measurements indicate a bias to overpredict the annual concentrations.

As indicated in Volume 3, Section 12.12.2 of the Project Update, the anticipated chronic health risks associated with $PM_{2.5}$ air concentrations in Fort McMurray are expected to be low. However, predicted and measured annual average $PM_{2.5}$ concentrations indicate the need for ongoing surveillance of $PM_{2.5}$ levels in the community of Fort McMurray.

**OSEC Question 12**

**Volume 3, Section 4.6.4.1**

**Teck indicates that $PM_{2.5}$ concentrations predicted in the Fort McMurray community are greater than the applicable ambient air quality objectives. Although Teck's contribution is a small proportion to the ambient concentration in the community, it is unclear how adding additional pollutant sources is aligned with maintaining ambient air quality below the stated objectives.**

**12. Given the expectation of an approximate 25 per cent increase in ambient $PM_{2.5}$ concentrations in Fort McMurray under the application case, what are the major sources contributing to these elevated predictions?**

**Teck Response:**

The updated air quality assessment (see Volume 3, Section 4.6.4, Tables 4-46 to 4-51 of the Project Update) presents modelled $PM_{2.5}$ concentrations in Fort McMurray for various averaging periods and percentiles. At Application Case, the maximum $PM_{2.5}$ concentration in Fort McMurray is predicted to increase by 17.1% to 27.4% relative to the existing condition. Most of these increases are associated with the Base Case; the Project contribution is expected to be 0.2% or less. Community and traffic sources are likely the major sources contributing to the predicted increase in $PM_{2.5}$ concentrations from the existing condition to the Base Case. This is supported by the community $PM_{2.5}$ emissions being projected to increase by 37% between these two cases (see Volume 3, Appendix 4A, Table 4A-122 of the Project Update).

To further examine this change, $PM_{2.5}$ concentrations only from community and traffic sources were extracted and compared to those presented in Volume 3, Section 4.6.4, Tables 4-46 to 4-47 of the Project Update using the same calculation approach. The comparisons are presented in Tables 12-1 to 12-6 and support the premise that most of the predicted $PM_{2.5}$ in Fort McMurray is due to community and traffic emissions.

- For 1-hour and 24-hour averaging periods, the maxima associated with community and traffic emissions account for 90% to 98% of the corresponding maxima associated with all emissions (for the Base Case, Application Case and Planned Development Case [PDC]).
- For the annual averaging period, the maxima associated with community and traffic emissions account for 87% to 89% of the corresponding maxima associated with all emissions (for the Base Case, Application Case and PDC).

## Table 12-1 Community 1-hour (9th Highest) $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | 1-hour (9th Highest) $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | 59.5 | 77 | 77 | 29.1 | 0.02 | 77 | 29.4 | 0.2 |
| | 2003 | 64 | **81** | **81** | 27.4 | 0.01 | **82** | 28.1 | 0.6 |
| | 2004 | 57.4 | 75 | 75 | 30.8 | 0.02 | 75 | 31.0 | 0.2 |
| | 2005 | 56.2 | 72 | 72 | 27.4 | 0.02 | 72 | 27.5 | 0.1 |
| | 2006 | 61.1 | 78 | 78 | 28.3 | 0.01 | 78 | 28.4 | 0.1 |
| | Update (02-06) | 63.6 | **81.1** | **81.1** | 27.4 | 0.01 | **81.5** | 28.1 | 0.6 |
| Fort McMurray (community and traffic only) | 2002 | 56.6 | 75.6 | 75.6 | 33.6 | 0.0 | 75.6 | 33.6 | 0.0 |
| | 2003 | 60.1 | 79.8 | 79.8 | 32.8 | 0.0 | 79.8 | 32.8 | 0.0 |
| | 2004 | 54.3 | 72.5 | 72.5 | 33.5 | 0.0 | 72.5 | 33.5 | 0.0 |
| | 2005 | 54.1 | 70.5 | 70.5 | 30.3 | 0.0 | 70.5 | 30.3 | 0.0 |
| | 2006 | 58.2 | 77.3 | 77.3 | 32.8 | 0.0 | 77.3 | 32.8 | 0.0 |
| | Update (02-06) | 60.1 | 79.8 | 79.8 | 32.8 | 0.0 | 79.8 | 32.8 | 0.0 |
| *AAAQG* | | *80* | *80* | *80* | – | – | *80* | – | – |

NOTES:
Concentrations that are greater than the Alberta Ambient Air Quality Guideline (AAAQG) are shown in **bold**.
Update predictions include a background concentration of 7.1 $\mu g/m^3$.

## Table 12-2 Community 1-hour (95th percentile) $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | 1-hour (95th percentile) $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | 27.1 | 32.4 | 32.4 | 19.5 | 0.2 | 32.6 | 20.4 | 0.9 |
| | 2003 | 29.7 | 35.6 | 35.6 | 19.8 | 0.02 | 35.8 | 20.7 | 0.7 |
| | 2004 | 28.3 | 32.2 | 32.3 | 14.0 | 0.1 | 32.5 | 14.8 | 0.9 |
| | 2005 | 27.4 | 32.1 | 32.2 | 17.3 | 0.08 | 32.5 | 18.4 | 1.0 |
| | 2006 | 28.1 | 33.2 | 33.3 | 18.6 | 0.1 | 33.5 | 19.5 | 0.8 |
| | Update (02-06) | 29.7 | 35.6 | 35.6 | 19.8 | 0.02 | 35.8 | 20.7 | 0.7 |
| Fort McMurray (community and traffic only) | 2002 | 23.2 | 30.0 | 30.0 | 29.3 | 0.0 | 30.0 | 29.3 | 0.0 |
| | 2003 | 25.2 | 33.1 | 33.1 | 31.3 | 0.0 | 33.1 | 31.3 | 0.0 |
| | 2004 | 22.6 | 29.2 | 29.2 | 29.2 | 0.0 | 29.2 | 29.2 | 0.0 |
| | 2005 | 22.9 | 29.8 | 29.8 | 30.1 | 0.0 | 29.8 | 30.1 | 0.0 |
| | 2006 | 23.2 | 30.7 | 30.7 | 32.3 | 0.0 | 30.7 | 32.3 | 0.0 |
| | Update (02-06) | 25.2 | 33.1 | 33.1 | 31.3 | 0.0 | 33.1 | 31.3 | 0.0 |

NOTES:
Update predictions include a background concentration of 7.1 $\mu g/m^3$.

## Table 12-3 Community 24-hour (1st Highest) $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | 24-hour (1st Highest) $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | **34.9** | **44.2** | **44.2** | 26.8 | 0.07 | **44.5** | 27.4 | 0.6 |
| | 2003 | **39.7** | **50.2** | **50.2** | 26.4 | 0.03 | **50.7** | 27.6 | 1.0 |
| | 2004 | **34.1** | **42.1** | **42.2** | 23.6 | 0.07 | **42.5** | 24.6 | 0.9 |
| | 2005 | **32.5** | **40.3** | **40.3** | 24.1 | 0.09 | **40.7** | 25.4 | 1.1 |
| | 2006 | **37.1** | **46.7** | **46.7** | 25.8 | 0.05 | **47.1** | 26.9 | 0.9 |
| | Update (02-06) | **39.7** | **50.2** | **50.2** | 26.4 | 0.03 | **50.7** | 27.6 | 1.0 |
| Fort McMurray (community and traffic only) | 2002 | **30.3** | **42.0** | **42.0** | 38.6 | 0.0 | **42.0** | 38.6 | 0.0 |
| | 2003 | **34.4** | **47.7** | **47.7** | 38.7 | 0.0 | **47.7** | 38.7 | 0.0 |
| | 2004 | 28.5 | **39.0** | **39.0** | 36.8 | 0.0 | **39.0** | 36.8 | 0.0 |
| | 2005 | 27.3 | **37.7** | **37.7** | 38.1 | 0.0 | **37.7** | 38.1 | 0.0 |
| | 2006 | **31.5** | **43.8** | **43.8** | 39.0 | 0.0 | **43.8** | 39.0 | 0.0 |
| | Update (02-06) | **34.4** | **47.7** | **47.7** | 38.7 | 0.0 | **47.7** | 38.7 | 0.0 |
| *AAAQO* | | *30* | *30* | *30* | – | – | *30* | – | – |

NOTES:
Concentrations that are greater than the AAAQO are shown in **bold**.
Update predictions include a background concentration of 6.45 $\mu g/m^3$.

## Table 12-4 Community 24-hour (99th percentile) $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | 24-hour (99th percentile) $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | 29.7 | 38.1 | 38.2 | 28.7 | 0.08 | 38.4 | 29.4 | 0.7 |
| | 2003 | 33.8 | 42.4 | 42.4 | 25.7 | 0.04 | 42.7 | 26.5 | 0.6 |
| | 2004 | 29.6 | 35.0 | 35.0 | 18.3 | 0.1 | 35.4 | 19.4 | 1.1 |
| | 2005 | 28.4 | 35.4 | 35.4 | 24.6 | 0.07 | 35.6 | 25.4 | 0.7 |
| | 2006 | 30.8 | 38.0 | 38.0 | 23.6 | 0.04 | 38.3 | 24.6 | 0.8 |
| | Update (02-06) | 33.8 | 42.4 | 42.4 | 25.7 | 0.04 | 42.7 | 26.5 | 0.6 |
| Fort McMurray (community and traffic only) | 2002 | 25.1 | 34.1 | 34.1 | 35.9 | 0.0 | 34.1 | 35.9 | 0.0 |
| | 2003 | 28.1 | 38.3 | 38.3 | 36.3 | 0.0 | 38.3 | 36.3 | 0.0 |
| | 2004 | 23.1 | 30.6 | 30.6 | 32.5 | 0.0 | 30.6 | 32.5 | 0.0 |
| | 2005 | 23.3 | 31.5 | 31.5 | 35.2 | 0.0 | 31.5 | 35.2 | 0.0 |
| | 2006 | 25.4 | 34.7 | 34.7 | 36.6 | 0.0 | 34.7 | 36.6 | 0.0 |
| | Update (02-06) | 28.1 | 38.3 | 38.3 | 36.3 | 0.0 | 38.3 | 36.3 | 0.0 |

NOTES:
Update predictions include a background concentration of 6.45 $\mu g/m^3$.

## Table 12-5 Community 24-hour (98th percentile) $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | 24-hour (98th percentile) $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | 26.3 | **33.2** | **33.2** | 26.2 | 0.1 | **33.7** | 27.9 | 1.5 |
| | 2003 | **28.7** | **36.8** | **36.9** | 28.5 | 0.08 | **37.1** | 29.3 | 0.6 |
| | 2004 | 27.0 | **31.9** | **31.9** | 18.2 | 0.07 | **32.2** | 19.2 | 0.9 |
| | 2005 | 26.0 | **31.7** | **31.7** | 22.1 | 0.08 | **32.0** | 23.2 | 1.0 |
| | 2006 | 27.3 | **34.4** | **34.5** | 26.2 | 0.09 | **34.8** | 27.5 | 1.1 |
| | Update (02-06) | **28.7** | **36.8** | **36.9** | 28.5 | 0.08 | **37.1** | 29.3 | 0.6 |
| Fort McMurray (community and traffic only) | 2002 | 22.5 | **30.0** | **30.0** | 33.3 | 0.0 | **30.0** | 33.3 | 0.0 |
| | 2003 | 25.1 | **33.6** | **33.6** | 33.9 | 0.0 | **33.6** | 33.9 | 0.0 |
| | 2004 | 21.3 | **28.1** | **28.1** | 31.9 | 0.0 | **28.1** | 31.9 | 0.0 |
| | 2005 | 21.3 | **28.1** | **28.1** | 31.9 | 0.0 | **28.1** | 31.9 | 0.0 |
| | 2006 | 23.4 | **31.4** | **31.4** | 34.2 | 0.0 | **31.4** | 34.2 | 0.0 |
| | Update (02-06) | 25.1 | **33.6** | **33.6** | 33.9 | 0.0 | **33.6** | 33.9 | 0.0 |
| *CAAQS* | | *28* | *28* | *28* | – | – | *28* | – | – |

NOTES:
Concentrations that are greater than the CAAQS metric are shown in **bold**.
Update predictions include a background concentration of 6.45 $\mu g/m^3$.

## Table 12-6 Community Annual $PM_{2.5}$ Concentrations

| Location | Year (for Meteorological Data) | Annual $PM_{2.5}$ Concentration | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Existing Condition | Base Case | Application Case | | | PDC | | |
| | | ($\mu g/m^3$) | ($\mu g/m^3$) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) | ($\mu g/m^3$) | (% change vs. Existing) | (% change vs. Base Case) |
| Fort McMurray (all sources) | 2002 | 8.7 | **10.2** | **10.2** | 17.3 | 0.2 | **10.4** | 18.9 | 1.5 |
| | 2003 | 9.4 | **10.9** | **10.9** | 17.1 | 0.2 | **11.1** | 18.6 | 1.5 |
| | 2004 | 9.2 | **10.5** | **10.5** | 14.7 | 0.1 | **10.7** | 16.4 | 1.6 |
| | 2005 | 8.9 | **10.3** | **10.3** | 16.1 | 0.1 | **10.4** | 17.9 | 1.6 |
| | 2006 | 8.8 | **10.3** | **10.3** | 17.3 | 0.1 | **10.5** | 19.0 | 1.5 |
| | Update (02-06) | 9.4 | **10.9** | **10.9** | 17.1 | 0.2 | **11.1** | 18.6 | 1.5 |
| Fort McMurray (community and traffic only) | 2002 | 7.3 | 9.1 | 9.1 | 24.7 | 0.0 | 9.1 | 24.7 | 0.0 |
| | 2003 | 7.8 | 9.7 | 9.7 | 24.4 | 0.0 | 9.7 | 24.4 | 0.0 |
| | 2004 | 7.3 | 9.1 | 9.1 | 24.7 | 0.0 | 9.1 | 24.7 | 0.0 |
| | 2005 | 7.3 | 9.0 | 9.0 | 23.3 | 0.0 | 9.0 | 23.3 | 0.0 |
| | 2006 | 7.4 | 9.2 | 9.2 | 24.3 | 0.0 | 9.2 | 24.3 | 0.0 |
| | Update (02-06) | 7.8 | 9.7 | 9.7 | 24.4 | 0.0 | 9.7 | 24.4 | 0.0 |
| *CAAQS* | | *10* | *10* | *10* | – | – | *10* | – | – |

NOTES:
Concentrations that are greater than the Canadian Ambient Air Quality Standard (CAAQS) are shown in **bold**.
Update predictions include a background concentration of 3.09 $\mu g/m^3$.

**OSEC Question 13**

**Volume 3, Section 4.6.4.1**

**Teck indicates that $PM_{2.5}$ concentrations predicted in the Fort McMurray community are greater than the applicable ambient air quality objectives. Although Teck's contribution is a small proportion to the ambient concentration in the community, it is unclear how adding additional pollutant sources is aligned with maintaining ambient air quality below the stated objectives.**

**13. What steps has Teck taken, or will it take, to coordinate $PM_{2.5}$ reductions with other sources contributing to the Fort McMurray levels?**

**Teck Response:**

As indicated in Volume 3, Section 4.6.4.1, Tables 4-46 to 4-51 of the Project Update, the Project's contribution to maximum predicted $PM_{2.5}$ concentrations corresponds to an increase of 0.2% or less. The absolute $PM_{2.5}$ concentration increases due to Project emissions are about 0.1 $\mu g/m^3$ or less. Considering that the precision of continuous ambient $PM_{2.5}$ monitors tends to be $\pm 2$ $\mu g/m^3$ (AEP 2015), the effect of the Project on $PM_{2.5}$ concentration in Fort McMurray will not be detectable. This is mainly due to the Project being located about 110 km north of Fort McMurray.

Within most communities, ambient air quality is influenced by community emissions and industrial emissions. Depending on the relative locations and the nature of the emission sources, community air quality may be more strongly influenced by one or by both source types. In this case, $PM_{2.5}$ concentrations in Fort McMurray are more strongly influenced by community emission sources. As described in response to OSEC SOC 12, local community and local traffic emission sources are the main contributors to high $PM_{2.5}$ concentrations predicted in Fort McMurray.

Teck plans to manage $PM_{2.5}$ emissions from the Project's combustion and fugitive sources. Specifically, Teck plans to:

- use natural gas for stationary combustion sources and have mine haul trucks that meet Tier IV standards (see Volume 1, Section 14.4.2.3 of the Project Update)
- implement actions to reduce fugitive dust emissions, including $PM_{2.5}$.These actions include selecting appropriate haul road material, dust suppression, enforcing vehicle speed limits, progressive reclamation, and using vegetation as windbreaks (see Volume 1, Section 14.4.2.6 of the Project Update). Teck's decision to have a fly-in/fly-out program for Project workers is expected to reduce road traffic and associated $PM_{2.5}$ emissions (e.g., exhaust and road dust) near Fort McMurray.

Teck will continue to support regional environmental monitoring associations (e.g., Wood Buffalo Environmental Association) and will consider becoming involved in regional $PM_{2.5}$-reduction programs prioritized by such associations and appropriate for the Project.

**References**

AEP (Alberta Environment and Parks). 2015. *Air Monitoring Directive. Chapter 4: Monitoring Requirements and Equipment Technical Specifications.* Amended July 30, 2015. Edmonton, Alberta. Available at: http://aep.alberta.ca/air/legislation/air-monitoring-directive/default.aspx. Accessed February 2016.

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**OSEC Question 14**

**Volume 3, Sections 4.6.5 and 4.6.5.7**

**Teck has evaluated the odour potential associated with specific pollutants generated by the Project. Further, Teck has indicated the need to establish an ongoing communication protocol between operators and community members in order to work within or improve any existing odour management plans.**

**14. What are the major sources of odour-causing pollutants from the Project?**

**Teck Response:**

Volume 3, Section 4.6.5.7, Table 4-79 of the Project Update lists the odour-causing pollutants (i.e., odourants) from the Project. Odourants are identified as criteria air contaminants (CACs), hydrocarbons or reduced sulphur compounds (RSCs).

Volume 3, Section 4.4.6, Table 4-8 of the Project Update identifies the CAC odourant (specifically the $NO_X$ and $SO_2$) sources associated with the Project. The main $NO_X$ emission sources are the mine fleet exhausts and the continuous stacks. The main sources of the $SO_2$ emissions are the continuous stacks.

The source and emissions inventory (see Volume 3, Appendix 4A of the Project Update) identifies odourant sources. Specifically, see:

- Table 4A-72 for halocarbon and carbonyl odourant sources associated with the Project. The main sources are the continuous stacks and the mine fleet exhausts.
- Table 4A-73 for hydrocarbon naphthalene odourant sources associated with the Project. The main sources are the fugitive mine face emissions.
- Table 4A-70 for RSC sources associated with the Project. The main emission sources are the fugitive mine face and tailings pond emissions.

**OSEC Question 15**

**Volume 3, Sections 4.6.5 and 4.6.5.7**

**15. Given ongoing concerns related to odours and the expected expansion of industrial development in the region, is Teck supportive of enhancing reporting, monitoring, and compliance with the Alberta Energy Regulator's *Odour Management Protocol* in the region?**

**Teck Response:**

To clarify, Teck assumes that the *Odour Management Protocol* referred to in this question relates to the AER (2012) document *Hydrocarbon Odour Management Protocol for Upstream Oil and Gas Point Source Venting and Fugitive Emissions*. This protocol is specific to hydrocarbon compounds and excludes odourous emissions from combustion sources as well as odourous sulphur compounds. Its objective is to outline a process for collecting evidence to support focused enforcement actions. For example, field inspections consider the:

- strength of the odour occurrence
- proximity to nearby roads and occupied dwellings
- frequency of occurrence
- duration of the event

The protocol aims to reduce hydrocarbon emissions to reasonable levels, not necessarily to completely eliminate odours.

The AER (2012) protocol is one of several recent initiatives that focus on odour management in Alberta. These include:

- **CEMA:** The Cumulative Environmental Management Association (CEMA) is examining odour management strategies that can be applied to the Wood Buffalo region (e.g., Odotech 2013).
- **CASA:** The Odour Management Team of the Clean Air Strategic Alliance (CASA) recently completed four reports on odour management in Alberta (CASA 2015a, 2015b, 2015c, 2015d):
  - *The Prevention/Mitigation Task Group Final Report* (April 2015)
  - *Odour Assessment Task Group Final Report* (May 2015)
  - *Complaints Task Group Final Report* (May 2015)
  - *Enforcement/Role of Regulation Task Group Final Report* (June 2015)
- **WBEA:** Although this study was not specifically focused on odour management, the Wood Buffalo Environmental Association (WBEA) recently assessed emissions, routine ambient air quality, specialized ambient air quality, and meteorological data in the context of regional odour occurrences (Dann 2015). The assessment identified limitations and recommended ways to improve the understanding of linkages between emission sources and odour events.

These studies are more recent than the draft Fort McMurray odour protocol Teck provided in 2013 in response to ESRD/CEAA Round 1 SIR 36b. Based on these and other initiatives, Teck understands that odour management protocols in Alberta will continue to evolve. Teck appreciates the ongoing concern about odours in the region and supports regional odour management efforts. Teck will participate, as appropriate, in multi-stakeholder initiatives to manage odourants and control the off-site occurrence of odours from the Project.

**References**

AER (Alberta Energy Regulator). 2012. *Hydrocarbon Odour Management Protocol for Upstream Oil and Gas Point Source Venting and Fugitive Emissions*. June 14, 2012.

CASA (Clean Air Strategic Alliance). 2015a. *Prevention/Mitigation Task Group Final Report*. Prepared for the Odour Management Team. April 2015. 8 pages plus report titled *Review of Odour Prevention and Mitigation Tools for Alberta* prepared by Pinchin Ltd.

CASA. 2015b. *Odour Assessment Task Group Final Report.* Prepared for the Odour Management Team. May 2015. 7 pages plus report titled *Review of Odour Assessment Tools and Practices for Alberta* prepared by Millennium EMS Solutions Ltd. and Environmental Odour Consulting.

CASA. 2015c. *Complaints Task Group Final Report.* Prepared for the Odour Management Team. May 2015. 16 pages plus report titled *Alberta Odour Complaints Overview* prepared by Scott Rollans.

CASA. 2015d. *Enforcement/Role of Regulation Task Group Final Report*. Prepared for the Odour Management Team. June 2015. 14 pages plus report titled *Report to the Clean Air Strategic Alliance Odour Management Team Enforcement/Role of Regulation Task Group* prepared by RWDI Air Inc.

Dann, T. 2015. *Integration of 2014 Odour Data for the Human Exposure Monitoring Program (HEMP). Final Report*. Prepared for the Wood Buffalo Environmental Association by RS Environmental.

Odotech. 2013. *Review of Odour Management Strategies.* Prepared for the Cumulative Environmental Management Association (CEMA).

**OSEC Question 16**

**Volume 3, Sections 4.6.5 and 4.6.5.7**

**16. How will Teck ensure that an appropriate communication protocol is established prior to construction of the Project to address these concerns?**

**Teck Response:**

Teck will interact with nearby residents, Aboriginal communities and potentially affected stakeholders to address concerns about potential odours resulting from operation of the Frontier Project. Teck has reinforced this commitment in its response to:

- ERCB Round 1 SIR 113:

  *At any time during Project operation, nearby residences will be able to contact Teck if there is a belief that Project operations are causing odours. The contact will be documented, investigative action will be initiated to determine the potential source, and the caller will be notified. If a source can be identified, a review will be undertaken to implement corrective action to reduce the potential for future occurrences.*

- ESRD/CEAA Round 1 SIR 5:

  *Teck recognizes the need to have a system in place to collect public odour complaints that will allow actions to be taken to resolve or prevent further odours. The design of such a program will be undertaken through consultation with Aboriginal communities and other potentially affected stakeholders in the region.*

- ESRD/CEAA Round 1 SIR 36:

  *Teck plans to be a participating member of WBEA and will play a role with evolving odour-monitoring needs in the region.*

Teck agrees that an appropriate communication protocol needs to be established before the main construction activities begin for the Project. Details of the protocol will evolve through provincial, regional and local initiatives (see the response to OSEC SOC 15). For additional information, see *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 17**

**Volume 3, Section 4.6.11.3**

**As per data presented in Table 14.4-5, the Project's estimated greenhouse gas (GHG) emissions are 3,879,220 tonnes of CO2e annually. This represents a 1.5-per-cent increase in Alberta's emissions — and a 5.3-per-cent increase in mining, oil and gas extraction emissions — compared to 2013 emission levels as reported in Environment Canada's 2014 *National Inventory Report*.**

**17. Project direct emissions are estimated at 38.4 kg$CO_2$e per barrel of bitumen. Please describe how this emissions intensity figure compares to other existing and proposed oilsands mining operations. Further, please describe engineering efforts made to date to incorporate best-available technologies for the purpose of GHG reductions and onsite efficiency gains.**

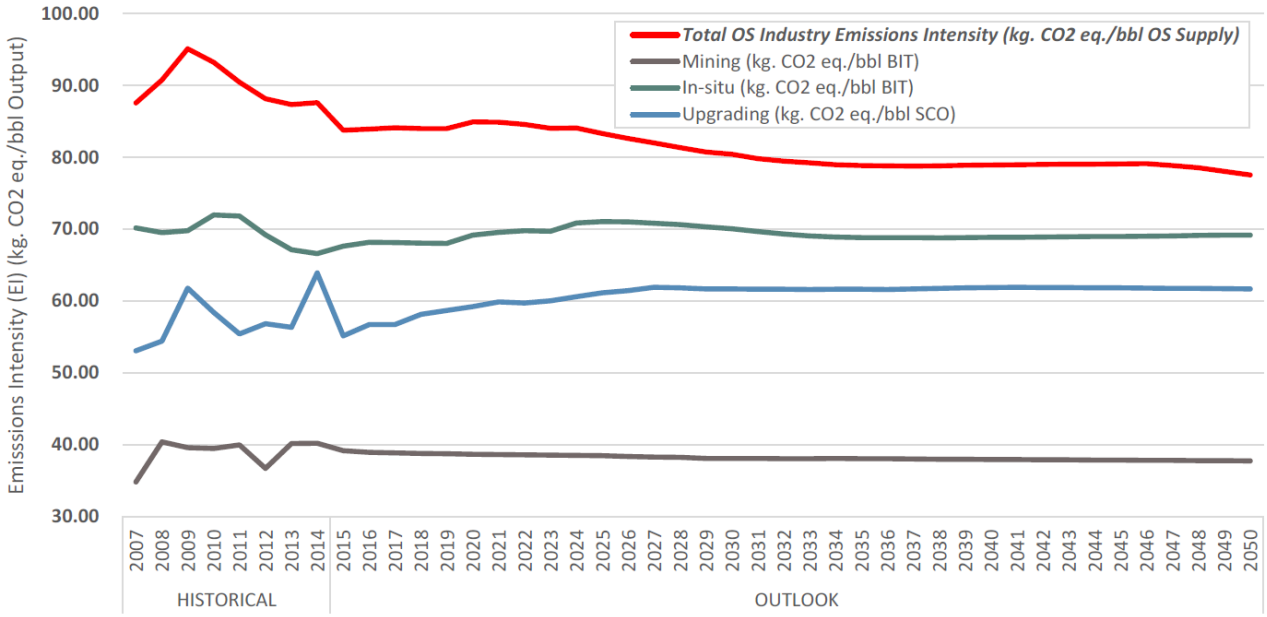
**Teck Response:**

Greenhouse gas (GHG) emission intensities for other existing and proposed oil sands mining operations are provided in the updated project description (see Volume 1, Section 14.4.2 of the Project Update). Based on available data, the Project's GHG emission intensity is predicted to be in the same range as GHG emission intensities associated with other oil sands mining and extraction projects. Teck has provided GHG emission intensities in previous documentation filed in support of the Frontier Project. For details, see:

- Volume 1, Section 14.4.2 of the Integrated Application
- Teck's response to ESRD/CEAA Round 1 SIRs 339 and 340

The Canadian Energy Research Institute (CERI) has published GHG emission intensity projections for the oil sands industry to 2020 (CERI 2015). Figure 17-1 shows the predicted GHG emission intensity by oil sands type. For bitumen extraction, the mining and in-situ intensities are predicted to level out at 38.2 kg $CO_{2e}$/bbl and 69.7 kg $CO_{2e}$/bbl, respectively. The Project's direct and total (direct plus indirect) GHG emission intensities are calculated to be 38.4 $CO_{2e}$/bbl and 40.4 kg $CO_{2e}$/bbl, respectively. These values are consistent with the information provided in Figure 17-1.

Volume 1, Section 14.4.2 of the Integrated Application lists examples of technology and processes (i.e., engineering efforts) that Teck has chosen to reduce GHG emissions and outlines how Teck plans to respond to potential regulatory changes for managing GHG emissions. Further discussion about GHG-reduction technology and Teck's participation in joint research efforts is provided in response to ESRD/CEAA Round 1 SIRs 341 and 342.




SOURCE: CERI (2015).

**Figure 17-1 Oil Sands GHG Emission Intensity by Project Type**

**References**

CERI (Canadian Energy Research Institute). 2015. *Oil Sands Industry Energy Requirements and Greenhouse Gas (GHG) Emissions Outlook (2015–2050)*. Study No. 151. Author: C. Murillo.

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**OSEC Question 18**

**Volume 3, Section 4.6.11.3**

**18. Given recent concerns about the absolute increase in GHG emissions from the oilsands sector, what contribution will the Project have on total oilsands GHG emissions from 2026 to 2066?**

**Teck Response:**

Volume 3, Section 4.6.11 of the Project Update provides greenhouse gas (GHG) emission rates for the pre-operation period (2018 to 2036), the Project operation period (2026 to 2066), and the decommissioning period (2067 to 2074). The operation period reflects the period associated with maximum emissions (i.e., 2056 to 2060), and emission rates are based on a debottlenecked bitumen production of 277,000 bbl/cd (barrels per calendar day). The maximum direct GHG emissions associated with Project operations are 10,628 t/d (or 3,879 kt $CO_{2e}$/a [kilotonnes of carbon dioxide equivalent per

annum] or 3.9 Mt $CO_{2e}$/a [megatonnes of carbon dioxide equivalent per annum]). See the response to AER Round 5 SIR 39 for information on Teck's current plans for managing GHG emissions.

GHG emission rates were estimated over the life of the Project based on projected activity at various stages of production (see Volume 1, Section 4.5.2, Table 4.5-1 of the Project Update). Figure 18-1 shows GHG emission rates for each year by source and activity type. Total estimated GHG emissions over the life of the Project are 134.4 Mt. Sources of Project-related GHG emissions are stacks (64%), mine fleet (26%), fugitive sources (9%), and other non-operating activities (1%).

The Project's contribution to GHG emissions are compared to total oil sands GHG emissions in Teck's response to ESRD/CEAA Round 1 SIR 339b. Total GHG emissions presented in the response to SIR 339b reflect the period from 2005 to 2030. Based on these data, oil sands GHG emissions are expected to peak in 2025. The updated air quality assessment (see Volume 3, Section 4.6.11 of the Project Update) provides more refined estimates of Project GHG emissions. The maximum direct GHG emission rate for the updated Project (3.9 Mt $CO_{2e}$/a) compares to the 2025 industry totals of ~19 Mt $CO_{2e}$/a for mining and extraction operations and ~140 Mt $CO_{2e}$/a for all oil sands operations.

The Canadian Energy Research Institute (CERI) has published updated GHG emission projections for the oil sands industry to 2050 (CERI 2015; see Figure 18-2). Based on these projections, GHG emissions from the oil sands industry are expected to peak in 2031. The updated Project's maximum GHG emission rate of 3.9 Mt $CO_{2e}$/a compares to CERI's (2015) estimates for peak (2031) oil sands emissions of ~20 Mt $CO_{2e}$/a for mining and extraction operations and 130 Mt $CO_{2e}$/a for all oil sands operations. Therefore the Project's contribution to the maximum oil sands GHG emission rate is approximately 3%. These values, including the respective contribution of the Project to total GHG emissions, are consistent with the information provided in response to ESRD/CEAA Round 1 SIR 339b.

Note with respect to units: The Frontier assessment uses M to represent a million, as in Mt=$10^6$ tonnes. The CERI (2015) report and Figure 18-2 use MM to represent a million.

**References**

CERI (Canadian Energy Research Institute). 2015. *Oil Sands Industry Energy Requirements and Greenhouse Gas (GHG) Emissions Outlook (2015–2050).* Study No. 151. Author: C. Murillo.

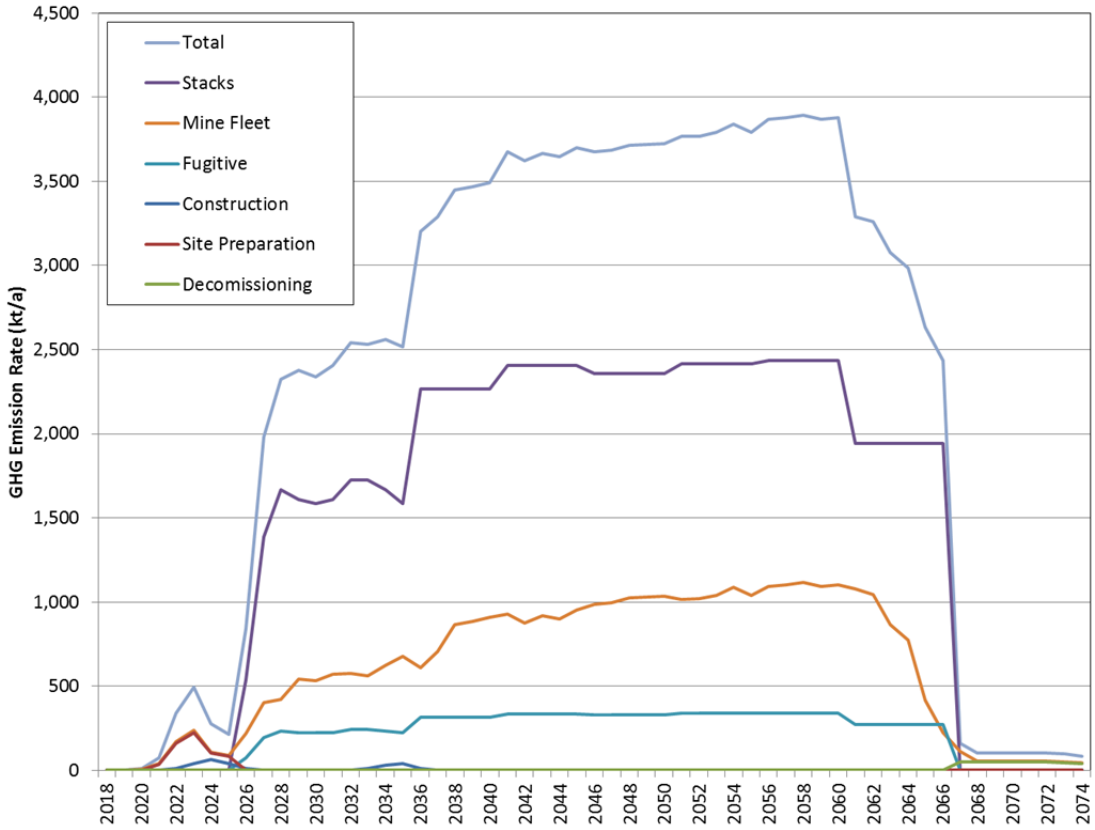
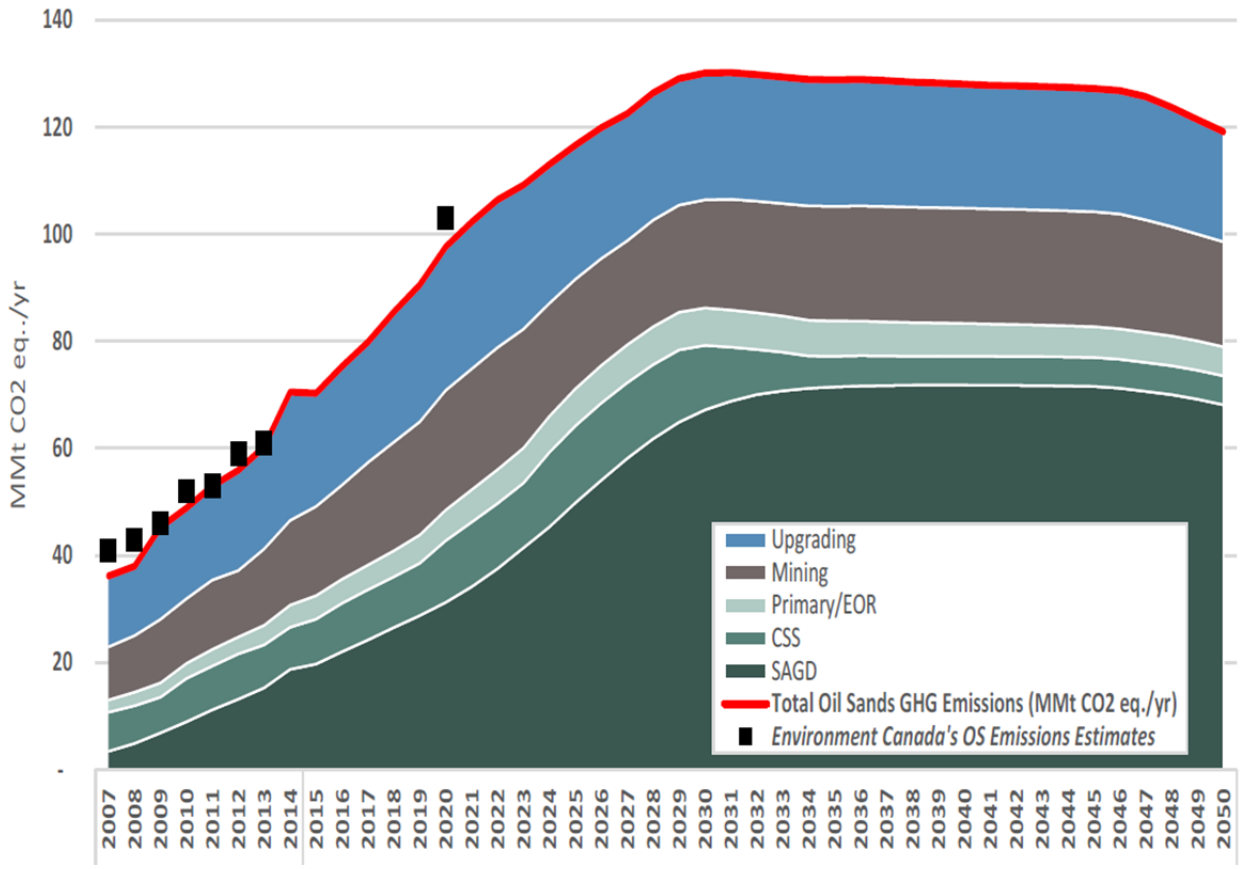



**Figure 18-1 Frontier Project GHG Contribution over Project Life (Maximum Emission Rate=3,900 kt $CO_{2e}$/a or 3.9 Mt $CO_{2e}$/a)**




*Source: Reproduced from CERI (2015).*

**Figure 18-2 GHG Emissions from Oil Sands Energy Demand Projections to 2050**

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**OSEC Question 19**

**Volume 3, Section 4.6.11.3**

**19. Please describe the GHG emissions reduction target for the Project over the course of the Project's life. Further, please describe the ways in which these emissions reductions will be sought (on-site emissions reductions, purchase of offsets, etc.).**

**Teck Response:**

As discussed in Volume 1, Section 14.4.2.5 of the Integrated Application and in response to ESRD/CEAA Round 1 SIR 334, Teck will evaluate and invest in green-energy initiatives to reduce or offset GHG emissions due to the Project. Offsets could include wind, solar, biodiesel and afforestation.

Teck will comply with Alberta's *Specified Gas Emitters Regulation* (SGER) reduction targets or legislation in effect during the Project life. In June 2015, Alberta Environment and Parks (AEP) announced revised targets that will require a 20% reduction six years after baseline emission intensities have been established. Teck expects the Project to establish baseline emission intensities over the first three years of operation. The revised GHG reduction target is a greater reduction than the previous value (12% reduction) stated in the response to ESRD/CEAA Round 1 SIR 334.

As part of Teck's sustainability strategy, Teck is continually evaluating opportunities to reduce energy consumption and GHG emissions. By tracking energy consumption and GHG emissions, Teck has identified and implemented several successful energy and GHG-reduction projects, and has worked to incorporate these opportunities at other sites. For example, Teck has optimized blasting efficiencies to increase grinding efficiencies, installed light weight truck boxes, installed variable speed drive technology on ventilation and dryer fan motors, implemented more efficient fan designs, and used more energy-efficient lighting.

In addition, Teck is participating in several industry research and pilot studies aimed at reducing energy consumption and GHG emissions. For example:

- Teck is piloting bi-fuel (natural gas- and diesel-powered) haul trucks at its steel-making coal mines in Elk Valley, British Columbia. Teck has contributed the results of this pilot study to Canada's Oil Sands Innovation Alliance (COSIA). Although it is not yet known if such technology is appropriate for the Project or oil sands, Teck will evaluate its potential for use at the Project during future stages of engineering.
- Teck is also supporting the SunMine, which is built on the fully reclaimed former Teck Sullivan Mine in Kimberley, British Columbia. The SunMine is Western Canada's largest solar facility, the first developed, owned and built by a municipality in Canada, and the first built at a reclaimed mine site. Teck has provided use of the land, site infrastructure, and has contributed $2 million towards SunMine. The SunMine uses 4,032 solar-cell modules, which are mounted on 96 solar trackers that follow sun movement to maximize solar exposure. The system is currently supplying enough electricity to the BC Hydro grid to power about 200 homes.

Teck is also exploring opportunities for investment in alternative energy sources. As a part of Teck's 2030 sustainability goals (Teck 2015), Teck plans to obtain 100 megawatts of alternative energy generation (i.e., non-carbon-emitting energy), which might offset some of the GHG emissions from the Project. The Wintering Hills Wind Power Facility, Teck's first major investment into renewable energy, has demonstrated strong energy-generation performance. Effective January 1, 2015, Teck increased its ownership in Wintering Hills from 30% to 49%. Teck's investment in Wintering Hills provides an opportunity to further its understanding of wind-power generation and evaluate other opportunities to develop wind farms around Teck's operations. The Wintering Hills offsets could be used to further reduce Teck's environmental footprint after the Project site reductions have occurred. These GHG reductions or offsets could be implemented through Teck's GHG management plan and sustainability strategy using the cost of carbon to drive investment in GHG reduction activities.

The GHG emission projection provided in response to OSEC SOC 18 does not account for GHG emission reductions that will be gained via operation experience and technology improvements, so this projection is likely overstated.

**References**

Teck (Teck Resources Limited). 2015. *Adaptability. Teck 2014 Sustainability Report*. June 2015. Vancouver, British Columbia. Available at: http://www.tecksustainability.com/. Accessed November 2015.

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**OSEC Question 20**

**Volume 3, Section 4.6.11.3**

**20. Please describe management actions pursued by the Project to ensure that it does not interfere with Canada's ability to meet its 2030 Intended Nationally Determined Contribution submitted on May 15, 2015 to the United Nations Framework Convention on Climate Change.**

**Teck Response:**

On May 15, 2015, the federal government announced its intent to reduce Canada's greenhouse gas (GHG) emissions by 30% below 2005 levels by 2030. Teck is prepared to contribute to reaching this target (see the response to AER Round 5 SIR 39 for information on Teck's current plans for managing GHG emissions).

In 2011, Teck launched a comprehensive sustainability strategy that includes six focus areas: Community, Water, Energy, Biodiversity, Materials Stewardship, and Our People. These focus areas represent the biggest opportunities for the company's sustainability initiatives. For each focus area, Teck has established long-term sustainability goals to achieve by 2030. For energy, these long-term goals are to:

- implement projects that reduce energy consumption by a cumulative 6,000 terajoules (TJ) at existing operations
- implement a cumulative 450 kilotonnes (kt) of carbon dioxide equivalent ($CO_{2e}$) GHG reductions at existing operations
- develop or source a cumulative 100 megawatts (MW) of alternative (non-carbon-emitting) energy generation

Having successfully achieved the company's short-term sustainability goals in 2015 (i.e., reducing energy consumption by 1,050 TJ below the 2011 baseline at existing operations, and reducing GHG emissions at existing operations by 170 kt at the end of 2014 (Teck 2015), Teck is now in the process of defining its next set of near-term goals for 2020. This includes reviewing the company's current framework to

confirm that the issues identified are still relevant to communities. Through continued refinement of its sustainability strategy, Teck will continue to move closer to achieving its long-term goals by 2030.

Teck actively participates in organizations that help guide sustainability practices in the mining industry, including the International Council on Mining and Metals and the Mining Association of Canada. In addition, Teck is working with international bodies that aim to improve sustainability performance across sectors, such as the World Economic Forum and the United Nations Global Compact, to which Teck contributes as a Global Compact LEAD company. As one example of a collaborative partnership supporting sustainable communities, Teck provided land, site infrastructure and financial support for the 1.05 megawatt SunMine solar power plant located on the site of Teck's former Sullivan mine in British Columbia. The SunMine plant is community-owned and was constructed over the summer and fall months of 2014. SunMine will have 4,032 solar-cell modules, mounted on 96 solar trackers that follow the sun's movement to maximize solar exposure. Once complete, the SunMine will be the first solar project in British Columbia to sell power to the BC Hydro grid.

Energy is a key focus area for Teck to align with Canada's 2030 GHG reduction plan. Teck's vision for this focus area is to introduce new energy and management systems that make a positive contribution to society's efficient use of energy. Teck is continuously improving energy efficiency at all of its operations, integrating energy efficiency considerations into new projects, pursuing the long-term development of alternative energy projects, and monitoring evolving carbon regulations and policies. Teck's established plan and commitment will ensure that Teck remains focused on building a stronger, more sustainable future and that we are aligned with Canada's 2030 GHG reduction plan.

Teck is a founding member of Canada's Oil Sands Innovative Alliance (COSIA) that was formed in March 2012. Management of GHG emissions is one of four COSIA environmental priority areas, and it is investigating ways to reduce energy use and associated GHG emissions. COSIA has initiated several projects in this regard (for details, see http://www.cosia.ca/initiatives/greenhouse_gases). The benefits of increased energy efficiencies on total oil sands GHG emissions are discussed at a high level by CERI (2015). Specifically, the GHG emission intensity associated with mining projects could potentially decrease from 38.2 kg $CO_{2e}$/bbl to 23.7 kg $CO_{2e}$/bbl.

**References**

CERI (Canadian Energy Research Institute). 2015. *Oil Sands Industry Energy Requirements and Greenhouse Gas (GHG) Emissions Outlook (2015–2050).* Study No. 151. Author: C. Murillo.

Teck (Teck Resources Limited). 2015. *Adaptability. Teck 2014 Sustainability Report.* June 2015. Vancouver, British Columbia. Available at: http://www.tecksustainability.com/. Accessed November 2015.

**OSEC Question 21**

**Volume 3, Section 4.6.11.3**

**21. Please describe the impact of the Government of Alberta's recently updated Specified Gas Emitters Regulation on the Project's predicted economic and environmental performance. Specifically, please address the impact of the updated Regulation on the Project's predicted internal rate of return.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 22**

**Volume 3, Section 4.6.11.3**

**22. Alberta's forthcoming climate change strategy renewal will result in a range of new climate- and emissions-related policies being introduced.[6] In order to ensure the Project remains in the public interest over the course of its operations, please describe, in both economic and environmental terms, the Project's viability under a range of climate change policy scenarios. At a minimum, please describe the Project's economic viability under an economy-wide carbon price of $100 per tonne over the course of mine life (2026 to 2066).**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**[6] For more information, see: Government of Alberta, "Province takes meaningful steps toward climate change strategy", June 25th, 2015. http://alberta.ca/release.cfm?xID=38232B11A8C17-0B34-BB8E-6B03088D90D1C786**

## Tailings Management Plan

**OSEC Question 23**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**23. Please describe management actions pursued by the Project to ensure that Albertans are not responsible for subsidizing the economic and environmental liabilities associated with its operation at present or in the future.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 24**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**24. Please provide the economic analysis and justification supporting the Project's approach to liability management through the MFSP.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 25**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**25. Please provide and evaluate the appropriateness of all consequence ratings for dams proposed in the Project's mine plan.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 26**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**26. Given that responsibility for the structural integrity and safety of dams rests with the dam owner, what assurances can Teck provide as a safeguard against the devastating economic and environmental consequences of a breach, be it at or in the lead-up to its peak fluid fine tailings volume of 242 $Mm^3$?**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 27**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**27. The Environmental Emergency Regulations under the *Canadian Environmental Protection Act* require those who own, or have charge, management or control of listed substances, to submit an environmental emergency plan to Environment Canada. Please submit and describe an environmental emergency plan for the Project in the event of a tailings dam breach.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 28**

**Volume 1, Section 2.1.2 and 6.7, 6.1.1.**

**28. The MFSP will be revised within the next year to include an additional security requirement for tailings reclamation.[9] Please describe the financial viability of the Project under a range of plausible increases to security requirements from the Government of Alberta.**

**Teck Response:**

See *Key Theme – Economic Viability* (Section 2.3).

**OSEC Question 29**

**Volume 1, Section 2.1.9**

**29. Please submit predictive surface and ground water quality data to justify the removal of the passive seepage control system during active mine life.**

**Teck Response:**

Teck's approach for controlling off-site seepage from the Project's external tailings areas (ETAs) is detailed in Volume 1, Section 7.9 of the Project Update. Specifically, Teck plans to install a perimeter network of interception wells along a seepage-control corridor to capture seepage from the ETAs during Project operations. The originally planned hydraulic barrier system (see Volume 1, Section 7.9 of the Integrated Application) will be delayed from the start of operations to the end of mining.

To clarify, the original seepage control plan presented in the Integrated Application did not involve passive seepage collection during operations because groundwater interception wells would be in operation. The hydraulic barrier was a redundant control measure that would not begin passive diversion of water until after pumping wells were decommissioned at the end of mining. Predicted water quality was not a factor in the decision to omit the hydraulic barrier during operations since the pumping wells are expected to be just as effective.

Interception wells are considered a flexible approach because Teck can respond to unforeseen changes in hydraulic conditions simply by modifying pumping rates and installing additional wells as needed. Geologic information gained during installation of the well system, and hydraulic data collected during operations, will assist Teck in designing the most effective hydraulic barrier at the end of mining.

**[9] For more detail regarding these activities, see: Government of Alberta, Tailings Management Framework for the Mineable Athabasca Oil Sands at page 38.**

The interception well network will generate a groundwater divide on the downstream side of the ETAs, between the well network and the Athabasca River. In effect, the interception well network will act as a hydraulic barrier so that no ETA seepage leaves the Project's closed-circuit system. For example:

- Volume 1, Section 7.9.2, Figure 7.9-1 of the Project Update shows the conceptual layout of the seepage control corridor.
- Volume 3, Section 5.5.3, Figure 5-17 of the Project Update shows particle tracking results during Project operations. Particle-tracking simulations indicate that particles released over the ETA footprint will be captured by the interception well network.

Final design of the seepage interception system will be completed during subsequent detailed engineering design phases for the Project. Teck will use the most recent borehole lithology, grain size, geophysical and hydraulic testing data to evaluate and optimize system design. In addition, Teck will install monitoring wells downstream of the interception well system to track system performance, and use this data to further optimize system design.

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**OSEC Question 30**

**Volume 1, Section 2.1.9**

**30. Please describe surface and sub-surface water modeling conducted to determine maximum contaminant loads for each receiving water body. Further, please describe the contaminant level at which a healthy ecosystem will be maintained in order to prevent cumulative effects degradation of nearby streams, lakes and rivers.**

**Teck Response:**

Surface and subsurface modelling of the external tailings area (ETA) consisted of:

- saturated groundwater flow modelling using the United States Geological Survey (USGS) MODFLOW simulator
- groundwater mass transport modelling using the dynamic, probabilistic Goldsim® modelling software (see Volume 1, Section 13.6.5 of the Project Update)
- water quality modelling at surface water receptor locations using the Hydrological Simulation Program–Fortran (HSPF) model and the Athabasca River model (ARM) (see Volume 3, Appendix 7A.2 of the Project Update)

These models and their role in assessing Project-related contaminant loads are described as follows:

**MODFLOW:** The groundwater flow model simulated the predicted steady-state hydraulic head distribution at closure and under full pit lakes conditions. The model assumed that the hydraulic barrier would be in place around the ETA perimeter, and that net surplus recharge would be applied over the ETA footprint (as per the HSPF surface water modelling results). Development and calibration of the groundwater flow model is presented in Volume 3, Appendix 5A of the Project Update. Changes made to the calibrated MODFLOW model to simulate closure conditions are discussed in Volume 3, Section 5.4.2 and Volume 1, Section 7.9.2 of the Project Update.

**Goldsim® and MODPATH:** The groundwater mass transport model was developed using Goldsim® modelling software, and it linked the ETA solute source zone to surface water receptors. Groundwater solute pathways linking the source zones and receptors were defined using transport parameters (e.g., adsorption coefficients, decay rate constants) for the solutes and the geologic materials through which seepage might occur. Forty-two solutes were simulated using the groundwater transport model. In addition, the MODPATH particle-tracking program was used to track the advection of non-reactive particles released uniformly over the ETA footprint to surface water receptors. The proportion of particles captured by each surface water receptor determined how the total seepage from the ETA was split to each groundwater pathway.

**HSPF:** The HSPF model (Bicknell et al. 1993) was used to continuously simulate surface water quality in the aquatics local study area (i.e., Ronald Lake, Redclay Creek and Big Creek). The HSPF model is a comprehensive dynamic modelling system developed by the United States Environmental Protection Agency (U.S. EPA) to simulate watershed hydrology, point and non-point source loading, receiving water quality and temperature. Further details about the HSPF model, including model calibration, assumptions and inputs are provided in the Project Update (see Volume 3, Appendix 7A) and the Integrated Application (see Volume 5, Appendix 4A).

**ARM:** The ARM is a two-dimensional, vertically averaged dispersion model. It was used to (1) simulate loadings into the Athabasca River from the Project and other developments, and (2) predict water quality in the Athabasca River from Fort McMurray to Embarras. Additional details about the ARM, including formulae, assumptions and model inputs, are provided in the Project Update (see Volume 3, Appendix 7A) and the Integrated Application (see Volume 5, Appendix 4A).

For each development scenario (i.e., each snapshot in the Application Case and Planned Development Case [PDC]), the models were modified to reflect physical changes to watersheds and mine-related water releases to receiving watercourses and waterbodies. For the Application Case, physical changes to watersheds include construction of diversion channels, closed-circuit areas, reclaimed land, waste storage areas and pit lakes. The models account for potential water releases, including operational and reclamation waters entering watercourses or waterbodies as channel flow, seepage or upward flux. Mine-related water releases and associated flow rates are listed in Volume 3, Appendix 7A, Table 7A-1 of the Project Update and illustrated for the Application Case in Volume 3, Section 7.4, Figures 7-4 to 7-7 of the Project Update.

Mine-related water releases during construction, operation and closure phases of the Project were added to the models as continuous-source flows draining to the appropriate reach. Flow rates and water quality were defined based on data presented in the Project Update. Specifically:

- Water release rates due to the Project were obtained from the updated groundwater and hydrology assessments (see Volume 3, Sections 5 and 6 of the Project Update).
- For each type of operational and reclamation water release and runoff flow, probability distributions were assigned to the water quality data. These distributions were based on observed water quality for mine-related sources (as discussed in Volume 3, Appendix 7A, Section 7A.3 of the Project Update).

For the closure and far future snapshots, steady-state groundwater seepage rates were applied at surface water nodes (see Volume 3, Appendix 7A, Table 7A-1 of the Project Update). These seepage rates correspond to a closure head boundary condition in the tailings areas that is expected to occur about 15 years after the end of mining. Iterative modelling suggests that unmitigated seepages during these 15 years could cause adverse effects in receiving waters. Therefore, as an additional mitigation, active groundwater pumping (that will be in place during operations) will continue until this steady-state head boundary is established. Teck expects this will occur in 2081 (i.e., it will coincide with closure, when the pit lakes are fully integrated with the surrounding receiving waters). The total volume of seepage that will be captured during this period, as predicted by the groundwater model, was added to the central pit lake model to assess potential effects on the water quality of that pit lake and downstream watercourses (see Volume 3, Section 7.10 of the Project Update).

Post-closure, Teck will manage seepage from the ETAs using a passive control system that will direct seepage to reclamation lakes for treatment before it is discharged to downstream watercourses (see Volume 1, Section 7 of the Project Update). The volume of seepage that will be diverted and treated post closure was predicted by the groundwater model and included in flow source reporting to the reclamation lakes in the HSPF model.

In the Integrated Application, the surface water quality assessment conservatively assumed that solute concentrations in groundwater downgradient of tailings areas would be equivalent to full-strength process water (i.e., the same quality as tailings porewater). The updated assessment included solute-transport modelling, which considered natural attenuation processes (e.g., flushing, adsorption and decay) along the groundwater flow pathways. As a result, water quality models for watercourses and the Athabasca River were updated to include attenuation factors for all substances. For details about the solute-transport modelling, see Volume 1, Section 13.6.5 of the Project Update.

Cumulative effects of the Project along with other operating, approved and planned developments were assessed as part of the PDC (see Volume 3, Section 7.4.6 of the Project Update). The effects analysis for the PDC considers all reasonably foreseeable inputs to Ronald Lake, Redclay Creek, Big Creek and the Athabasca River. The updated surface water quality assessment includes predicted concentrations for 48 substances considered in the assessment. Cumulative effects on aquatic health were evaluated based on predicted changes in surface water quality, including acute and chronic toxicity, changes in fish tissue

metal concentrations, and changes in fish tainting. The Project along with other operating, approved and planned developments is predicted to have negligible effects on aquatic health in Ronald Lake, Redclay Creek, Big Creek and the Athabasca River (see Volume 3, Section 7.11 of the Project Update). The results indicate that under predicted conditions and at predicted constituent levels, a healthy ecosystem will be maintained, and Teck expects there to be no cumulative effects on nearby streams, lakes and rivers.

**References**

Bicknell, B.R., J.C. Imhoff, J.L. Kittle, A.S. Donigian and R.C. Johanson. 1993. *Hydrological Simulation Program – FORTRAN (HSPF): User's Manual for Release 11.0.* U.S. Environmental Protection Agency, Environmental Research Laboratory. Athens, GA.

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**OSEC Question 31**

**Volume 1, Section 2.1.9**

**31. Please describe and assess downstream impacts associated with any substances in tailings effluent with bioaccumulation, persistence and inherent toxicity potential as per the *Canadian Environmental Protection Act.***

**Teck Response:**

See *Key Theme – Adequacy of the Environmental Impact Assessment* (Section 2.1).

## Mitigation of Terrestrial and Wildlife Impacts

**OSEC Question 32**

**32. Please describe which portfolio of potential additional lands will be conserved or restored.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 33**

**33. Please describe, quantitatively, how these actions mitigate Project impacts.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 34**

**34. Provide a technical analysis of potential offsets to quantitatively demonstrate the mitigation of impacts on species at risk, wetlands, old growth forests and other valued ecosystem components.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 35**

**35. Please describe what legal mechanisms will be used to maintain the integrity of offset lands in perpetuity.**

**Teck Response:**

The Alberta Association of Conservation Offsets (AACO) held a workshop on October 20, 2015, that was sponsored by Teck, a founding member of this association. The workshop was also attended by the Pembina Institute, who is a member of the Oil Sands Environmental Coalition (OSEC). Workshop participants received a background paper from the Canadian Institute of Resources Law (Poulton 2015) that describes and evaluates legal mechanisms that could be used to maintain the integrity of offset lands in Alberta. This paper is provided as Appendix 35a.1 and is available on the AACO web site (http://www.aaco.ca/links--resources.html). Although Teck is participating in discussions about how conservation offsets might be used in Alberta, legal mechanisms for realizing offsets are ultimately the purview of the Government of Alberta.

**References**

Poulton, D.W. 2015. *Public Lands, Private Conservation: Bridging the Gap*. Canadian Institute of Resources Law. Background paper prepared for the workshop "Public Lands and Conservation: Bridging the Gap," held October 20, 2015 in Edmonton, Alberta. Available at: http://www.aaco.ca/events--publications.html. Accessed February 2016.

**OSEC Question 36**

**36. Please describe how Teck has consulted stakeholders in the development of its offset mitigation plans.**

**Teck Response:**

See the response to CEAA Round 5 SIR 131b.

**OSEC Question 37**

**Volume 3, Section 13**

**The *Migratory Birds Convention Act* implements an international agreement between Canada and the U.S. for the protection of migratory birds. The Act prohibits the deposit of oil, oil waste or other substances harmful to migratory birds in any waters or areas frequented by migratory birds, except as authorized by regulation.**

**37. Please describe and justify the procedures in place to ensure the Project is in compliance with the Act.**

**Teck Response:**

Teck will take the necessary steps to avoid or reduce incidental take of migratory birds as per the *Migratory Birds Convention Act*.

Tailings areas are a necessary part of the oil production process for open-pit oil sands mines and contain a mixture of process-affected water, residual hydrocarbons, brine, dissolved metals, silts, clays and sand (see Volume 1, Section 6 of the Project Update).

Tailings areas are designed and operated to reduce their attractiveness to waterfowl and other waterbirds (e.g., removal of vegetation from the tailings area, including the inner walls of the tailings dyke and removal of surface peat mats); nevertheless, these species do interact with tailings areas and morbidity and mortality can occur. A summary of annual bird recoveries from 1975 through 2013 for oil sands developments with active tailings areas is provided in Volume 3, Appendix 11F of the Project Update. Industry self-reported mortality data show the average yearly number of avian deaths due to tailings areas to be approximately 65 per year (Timoney and Ronconi 2010), though recent data from industry and targeted mortality searches (St. Clair 2014; Owl Moon 2015) indicate mortality rates may be slightly higher and vary among oil sands operators. For additional discussion on waterbird mortality, see the response to CEAA Round 5 SIR 138d.

In recognition of the potential risk to birds as defined in the *Migratory Birds Convention Act*, Teck will develop a comprehensive waterfowl protection plan based on best practices identified by the Research on Avian Protection Project (e.g., St. Clair 2014), recent literature, and consultation with other operators. This information will be used to develop detailed construction and operational procedures, and mitigation measures to reduce wildlife mortality risk during tailings area start-up and operation. Currently, on-demand, radar-based detection and deterrent systems are considered the best available method to deter birds from tailing areas. Because radar-based, on-demand systems respond to bird activity, they are generally believed to reduce habituation compared to other auditory deterrents (e.g., conventional bird cannons) and visual deterrents that are encountered by birds annually along migration routes (Ronconi and St. Clair 2006).

Teck will follow adaptive management practices with respect to mine operation and bird deterrent measures. Specifically, Teck will monitor and observe the performance of mitigation measures, evaluate their effectiveness and revise the Project design or operation, including mitigation, as necessary. For additional information, see *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**References**

Owl Moon (Owl Moon Environmental Inc.). 2015. *Oil Sands Bird Contact Monitoring Program 2014 Annual Report.* Prepared for Alberta Energy Regulator and Alberta Environment and Sustainable Resource Development.

Ronconi, R.A. and C.C. St. Clair. 2006. Efficacy of a radar-activated on-demand system for deterring waterfowl from oil sands tailings ponds. *Journal of Applied Ecology* 43: 111–119.

St. Clair, C.C. 2014. *Final Report on the Research on Avian Protection Project (2010–2014).* Prepared for Alberta Justice, Edmonton, Alberta.

Timoney, K.P. and R.A. Ronconi. 2010. Annual bird mortality in the bitumen tailings ponds in northeastern Alberta, Canada. *The Wilson Journal of Ornithology* 122 (3): 569–576.

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**OSEC Question 38**

**Volume 1, Section 13**

**38. Please provide an estimate of reclamation costs for the Project. What steps are being taken to ensure the costs of reclamation do not fall on Albertans?**

**Teck Response:**

Teck cannot provide an estimate of reclamation costs at this time and considers liability information for the Project to be confidential financial information, as per Section 7.7.1 of the Mine Financial Security Program (MFSP; AER 2014). However, public access to information is a key component of the MFSP; this includes information about the liabilities, financial security and reclamation progress of each approved oil sands mine. Each year over the life of the Project, Alberta's Energy Regulator (AER) will report Teck's contribution to the financial security fund, the asset safety factor for the Project, and reclamation progress for the Project.

Teck acknowledges OSEC's concerns that security be provided for reclamation activities so that the cost of reclamation does not fall to Albertans. Teck will meet the requirements of the MFSP, which has been developed to protect Albertans from liability costs of oil sands development (AER 2014):

> *The fundamental principle of the Mine Financial Security Program (MFSP) is that the* Environmental Protection and Enhancement Act *Approval Holder is responsible to carry out suspension, abandonment, remediation and surface reclamation work to the standards established by the Province and to maintain care-and-custody of the land until a reclamation certificate has been issued. The Approval Holder must have the financial resources to complete these obligations.*
>
> *The MFSP provides a responsible balance between protecting the people of Alberta from the costs associated with the liability of coal and oil sands development in the event an Approval Holder cannot meet their obligations, and maximizing the opportunities for responsible and sustainable resource development.*

For more than 100 years, Teck has managed extended-term reclamation and mine closure activities and costs. Sustainability is a one of Teck's core values, and its efforts to operate sustainably have been recognized inside and outside the mining industry (see Volume 1, Section 1.2.1 of the Project Update). Given Teck's sustainability core value and the regulatory backstop of the MFSP, residents of Alberta can be confident that the cost of reclamation for the Project will not fall to Albertans.

**References**

AER (Alberta Energy Regulator). 2014. *Guide to the Mine Financial Security Program*. March 2014. Calgary, Alberta.

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**OSEC Question 39**

**Volume 1, Section 13**

**39. Please describe the original percentage of wetland and peatland habitat in the original lease area.**

**Teck Response:**

Results of vegetation mapping conducted in the terrestrial local study area (LSA) are summarized in Volume 2, Section 8.3.1.1, Table 8-4 of the Project Update. Table 8-4 lists the total area and percentage of wetlands and peatlands in the terrestrial LSA. Similarly, Volume 1, Section 13.4.5.1, Table 13.4-9 of the Project Update lists the total area and percentage of wetlands and peatlands in the Project disturbance area (PDA).

These tables are reproduced here for ease of review (see Table 39-1 and Table 39-2). Wetlands occupy 18,472 ha (43%) of the terrestrial LSA and 14,097 ha (48.3%) of the PDA.

## Table 39-1 Upland Ecosites Phases and Lowland Wetland Classes

| Upland Ecosite Phase and Lowland Wetland Class | | Area (ha) | Percent of Terrestrial LSA |
|---|---|---|---|
| Upland | a1: Jack pine/lichen | 3,379.7 | 7.8 |
| | b1: Jack pine–aspen/blueberry | 3,016.2 | 7.0 |
| | b2: aspen–white birch/blueberry | 395.2 | 0.9 |
| | b3: aspen–white spruce/blueberry | 561.0 | 1.3 |
| | b4: white spruce–Jack pine/blueberry | 587.9 | 1.4 |
| | c1: mesic Jack pine–black spruce/Labrador tea | 75.5 | 0.2 |
| | d1: aspen/low-bush cranberry | 6,312.1 | 14.6 |
| | d2: aspen–white spruce/low-bush cranberry | 1,136.2 | 2.6 |
| | d3: white spruce–aspen/low bush cranberry | 1,383.8 | 3.2 |
| | e1: balsam poplar–aspen/dogwood | 3,471.7 | 8.0 |
| | e2: balsam poplar–white spruce/dogwood | 666.9 | 1.5 |
| | e3: white spruce/dogwood | 234.7 | 0.5 |
| | f1: balsam poplar–aspen/horsetail | 1,248.8 | 2.9 |
| | f2: balsam poplar–white spruce/horsetail | 404.7 | 0.9 |
| | f3: white spruce/horsetail | 97.4 | 0.2 |
| | g1: subhygric black spruce–Jack pine/Labrador tea | 320.2 | 0.7 |
| | h1: white spruce–black spruce/Labrador tea | 343.9 | 0.8 |
| | Upland graminoid | 2.3 | <0.1 |
| | Upland shrubland | 295.2 | 0.7 |
| ***Subtotal Upland*** | | ***23,934*** | ***55*** |
| Lowland | Forested bogs without internal lawns (BFNN) | 20.4 | <0.1 |
| | Wooded bogs without internal lawns (BTNN) | 762.3 | 1.8 |
| | Nonpatterned, open, graminoid-dominated fens (FONG) | 503.9 | 1.2 |
| | Nonpatterned, open, shrub-dominated fens (FONS) | 2,493.0 | 5.8 |
| | Patterned, open fen (FOPN) | 51.3 | 0.1 |
| | Nonpatterned, wooded fens with no internal lawns (FTNN) | 1,849.7 | 4.3 |
| | Forested fens without internal lawns (FFNN) | 23.9 | 0.1 |
| | Marshes (MONG) | 517.8 | 1.2 |
| | Shrubby swamps (SONS) | 2,310.0 | 5.3 |
| | Forested and wooded swamps – coniferous (SFNNcs and STNNcs) | 4,568.2 | 10.5 |
| | Forested and wooded swamps – hardwood (SFNNhs and STNNhs) | 4,762.9 | 11.0 |
| | Forested and wooded swamps – mixedwood (SFNNms and STNNms) | 131.0 | 0.3 |
| | Shallow open water (WONN) | 477.8 | 1.1 |
| ***Subtotal Lowland*** | | ***18,472*** | ***43*** |
| Water | Lakes and rivers | 14.3 | <0.1 |
| Nonvegetated | Sand (NMS) | 2.0 | <0.1 |
| Cutblock | | 29.9 | 0.1 |
| Disturbed Land | | 897.3 | 2.1 |
| **Total**[1] | | **43,349** | **100** |

NOTES:
Text in parentheses refers to the AVI mapping code.
[1] Areas and proportions might not add up to totals because of rounding.

## Table 39-2 Ecosite Phases and Wetland Classes in the PDA

| Upland Ecosite Phase and Lowland Wetland Class | | Areal Extent | |
|---|---|---|---|
| | | (ha) | (%) |
| Upland | a1: Jack pine/lichen | 1,531 | 5.2 |
| | b1: Jack pine–aspen/blueberry | 1,725 | 5.9 |
| | b2: aspen–white birch/blueberry | 150 | 0.5 |
| | b3: aspen–white spruce/blueberry | 102 | 0.4 |
| | b4: white spruce–Jack pine/blueberry | 85 | 0.3 |
| | c1: -mesic Jack pine–black spruce/Labrador tea | 67 | 0.2 |
| | d1: aspen/low-bush cranberry | 4,503 | 15.4 |
| | d2: aspen-white spruce/low-bush cranberry | 638 | 2.2 |
| | d3: white spruce-aspen/low bush cranberry | 842 | 2.9 |
| | e1: balsam poplar–aspen/dogwood | 2,567 | 8.8 |
| | e2: balsam poplar–white spruce/dogwood | 330 | 1.1 |
| | e3: white spruce/dogwood | 166 | 0.6 |
| | f1: balsam poplar-aspen/horsetail | 972 | 3.3 |
| | f2: balsam poplar-white spruce/horsetail | 159 | 0.5 |
| | f3: white spruce/horsetail | 52 | 0.2 |
| | g1:subhygric black spruce–Jack pine/Labrador tea | 143 | 0.5 |
| | h1: white spruce-black spruce/Labrador tea | 186 | 0.6 |
| | Upland graminoid | 1 | <0.1 |
| | Upland shrubland | 181 | 0.6 |
| | **Subtotal Upland** | **14,400** | **49.2** |
| Wetland | BFNN: Forested bogs without internal lawns | 8 | <0.1 |
| | BTNN: Wooded bogs without internal lawns | 383 | 1.3 |
| | FONG: Non-patterned, open, graminoid-dominated fens | 405 | 1.4 |
| | FONS: Non-patterned, open, shrub-dominated fens | 1,578 | 5.4 |
| | FPON: Patterned, open fen | 0 | 0.0 |
| | FTNN: Non-patterned, wooded fens with no internal lawns | 916 | 3.1 |
| | FFNN: Non-patterned, forested fens with no internal lawns | 5 | <0.1 |
| | MONG: Marshes | 475 | 1.6 |
| | SONS: Shrubby swamps | 2,057 | 7.0 |
| | SFNNcs: Forested and wooded swamps – coniferous (SFNNcs and STNNcs) | 192 | 0.7 |
| | SFNNhs: Forested and wooded swamps – hardwood (SFNNhs and STNNhs) | 316 | 1.1 |
| | SFNNms: Forested and wooded swamps – mixedwood (SFNNms and STNNms) | 6 | <0.1 |
| | STNNcs: Forested and wooded swamps – mixedwood (SFNNms and STNNms) | 3,587 | 12.4 |
| | STNNhs: Forested and wooded swamps – hardwood (SFNNhs and STNNhs) | 3,758 | 12.9 |

**Table 39-2 Ecosite Phases and Wetland Classes in the PDA (cont'd)**

| Upland Ecosite Phase and Lowland Wetland Class | | Areal Extent (ha) | Areal Extent (%) |
|---|---|---|---|
| Wetland (cont'd) | STNNms: Forested and wooded swamps – mixedwood (SFNNms and STNNms) | 62 | 0.2 |
| | Shallow open water (WONN) | 349 | 1.2 |
| | **Subtotal Wetland** | **14,097** | **48.3** |
| Disturbed[1] | Disturbed Land (CC, II, TC, TR, WS) | 719 | 2.5 |
| | Mineral soil (NMS) | 2 | <0.1 |
| | **Subtotal Disturbed** | **721** | **2.5** |
| **Total[2]** | | **29,217** | **100** |

NOTES:
[1] Vegetation may be cleared with no disturbance of the underlying soils (e.g., seismic lines) so areas of potential soil disturbance were reviewed against field data obtained for those locations. Most areas of disturbed vegetation (e.g., seismic lines or well pads) were found to have undisturbed soil profiles. This result is expected given that winter drilling programs completed by Teck in the PDA have followed low-impact methods that include not stripping topsoil.
[2] Percentage totals might not add up to 100% because of rounding.

**OSEC Question 40**

**Volume 1, Section 13**

**40. Please provide commercial-scale evidence exists to prove equivalent land capability under the *Environmental Protection and Enhancement Act*.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

**OSEC Question 41**

**Volume 1, Section 13**

**41. Please describe intended actions the Project will pursue to achieve compliance with Alberta's *Wetland Policy, 2013*.**

**Teck Response:**

See *Key Theme – Management, Mitigation and Monitoring* (Section 2.2).

# 4 Closing

OSEC input into Teck's submissions for the Project has enabled Teck to better understand OSEC concerns and perspectives regarding development of the Project and industrial development in the Athabasca Oil Sands Region.

Teck is committed to continuing to work through these concerns with OSEC to achieve a full resolution. Teck looks forward to continuing to work with OSEC as the Project continues to move through the regulatory review process and future stages of project planning.

# Appendix 35a.1 Background Paper on Conservation Offsets for AACO Workshop (Poulton 2015)

# *Public Lands, Private Conservation: Bridging the Gap*

**A Background Paper for the Workshop**
**October 20, 2015,**
**Edmonton, Alberta**

**by**

**David W. Poulton,**
**M.A., LL.M.**

**October 12, 2015**

**Acknowledgments**

This work, and the workshop it is intended to support, were stimulated by a series of discussions among members of the Alberta Association of Conservation Offsets, an organization dedicated to understanding the opportunities and barriers to conservation offsets in Alberta, with which I am pleased to be associated. I wish to thank Arlene Kwasniak, Ted Morton and Marian Weber for their generous sharing of ideas and insights, and to Arlene Kwasniak whose comments on an earlier draft of this paper made is substantially better.

Finally, both I and the Alberta Association for Conservation Offsets wish to thank the sponsors set out below, not only for their financial support of this paper and workshop, but their keen interest in this issue and their search to find new ways to contribute to beneficial conservation outcomes.

Alberta Environment and Parks

ABMI

**Alberta Biodiversity Monitoring Institute**

CBFA

**Canadian Boreal Forest Agreement Secretariat**

ConocoPhillips

Teck

## I. INTRODUCTION

Like the television show *Seinfeld*, this paper is about nothing. More particularly it is about the nothing that exists where there is an increasing social expectation of something. I speak of the expectation that private parties, philanthropic individuals and agencies, and for-profit businesses, undertake actions to improve the environmental state of our landscapes. In Alberta law and policy, where there might be tools and instruments to facilitate such action and to secure the ecological gains from them on public lands, there is currently nothing. The purpose of this paper and the workshop which it is written to inform, is intended to explore how that void may be most prudently and practically filled.

This paper approaches the issue by describing the nature of the void through an examination of the legal and policy tools and dispositions which otherwise govern private action and state conservation on provincial public lands. It begins with a general overview of the nature of public lands and their governance. In part three the current conservation toolbox is reviewed, starting with the tools available on private lands and then moving to the tools available to the Province on public lands. The fourth part of the paper briefly examines the system of land management and resource dispositions which applies on the unprotected "working" public lands of Alberta. This section will make clear that allowing private parties to take control of provincial resources is far from a novel concept and in fact is relied on as one of Alberta's social and economic foundations.

Alberta has occasionally been subject to criticism for the unco-ordinated way its multiple use policy on public lands has been developed and applied. To avoid adding to that confused picture, the paper touches on the complex issue of how conservation-oriented dispositions or designations can best be reconciled and co-ordinated with other interests that might be recognized on the land.

Following that I very briefly review some of those arrangements which currently exist which involve private parties in the environmental management of public lands. These arrangements are touched on in the hope that they may offer some lessons on the practicalities of public-private partnerships for ecosystem management.

Because this paper is intended primarily to inform the discussions to occur at the *Public Lands, Private Conservation: Bridging the Gap* workshop, various questions for consideration are interspersed throughout this paper. These are intended to stimulate ideas, and not necessarily be addressed one by one in the workshop itself.

It is my hope that this paper and the discussions which it is intended to spur will form the mortar which will gradually allow us to fill the hole that exists in this area of public policy.

## II. Overview

### A) Land and Resource Tenure in Alberta

In terms of tenure the Alberta provincial landscape[1] is divided between two legal regimes. Deeded private lands are available for private ownership, governed by the laws of private property (both common law and statutory) with title and interests being recorded and secured through the Torrens system of the *Land Titles Act*[2] [*LTA*]. Public lands are owned by the Crown in right of Alberta and managed under the direct authority of the provincial government. While private parties may take a variety of forms of interest in public lands, all of these are temporary and subject to terms dictated by the provincial Crown. Public lands constitute approximately sixty percent of the area of Alberta.[3]

Another dimension is literally added to this picture when one considers rights to sub-surface minerals. Alberta, as many other jurisdictions, has a system of split title, with sub-surface rights usually being dealt with separately from those applicable on the surface. The majority of mineral rights are reserved to the Crown, but many of the Crown rights underlie private lands. Mineral rights are governed in law mainly by the *Mines and Minerals Act*.[4] In general the rights to the surface are subordinated to the rights of access to mineral rights holders.

### b) Economic and Environmental Significance

The use of the surface and sub-surface public resources represents a very large portion of the Alberta and Canadian economy. It also contributes substantially to the public treasury, directly through lease payments, royalties and other charges, and indirectly through taxation of the economic activity that it generates. The nature, extent and stability of these benefits is tied to the form of legal arrangements that are used in developing these resources, so any reform of those arrangements must be sensitive to economic ripples it may cause.

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[1] By the "provincial landscape" I exclude that approximately ten percent of the province that is governed under federal jurisdiction and aboriginal and metis lands. For a good review of all types of non-private lands see Arlene J Kwasniak, *A Legal Guide to Non-Private Lands in Alberta* (Calgary: Canadian Institute of Resources Law, in press; page numbers in this paper may vary from final published version).

[2] RSA 2000, c L-4. For a concise accessible guide to the nature of private property rights in Alberta see Eran Kaplinsky & David Percy, *A Guide to Property Rights in Alberta* (Edmonton: Alberta Land Institute, 2014), online: Alberta Land Institute <http://www.albertalandinstitute.ca/public/download/documents/10432>.

[3] Government of Alberta, *Handbook of Instruments Pursuant to Public Lands Act & Public Lands Administration Regulation* (np: Alberta Environment and Sustainable Resource Development, 2013) [PLAR] at 6, online: Alberta Environment and Parks <http://aep.alberta.ca/lands-forests/public-lands-administration-regulation/documents/PLARHandbookInstruments-Feb19-2014A.pdf>.

[4] RSA 2000, c M-17.

Public and private lands are not evenly distributed on the landscape. The great majority of public lands fall within the forested "green zone" lying in the northern and western parts of the province, as is shown on the map on Figure 1.

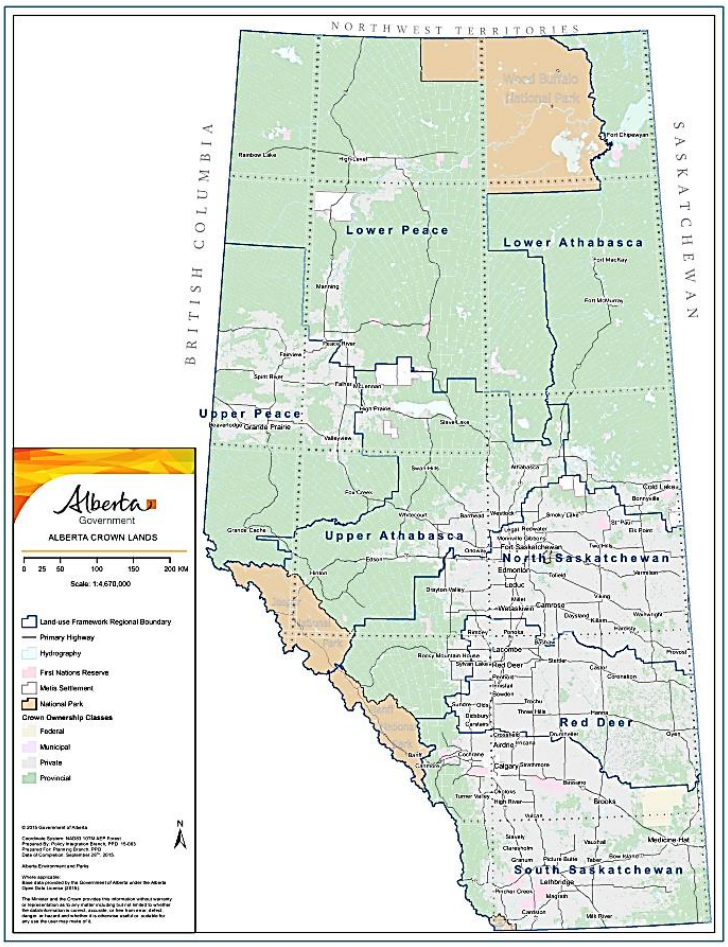


Figure 1: Map of Alberta land tenure, public lands in green.

In terms of natural features, public lands predominate in the boreal forest, Rocky Mountain and foothills natural regions. A significant part of the provinces remaining native prairie also is on public lands in the extreme southeast of the province. The provinces natural regions are shown on Figure 2.

Some of Alberta's most significant economic activity is occurring on public lands. In days of better prices not so long ago, the pursuit of natural gas in the mountains and foothills brought aggressive plans to further penetrate and develop those regions. Of course, the oil sands development on the public lands of the boreal forest is the current focus of much of Alberta's and Canada's economic activity and future plans.

While many of the province's species at risk reside on private lands, particularly in the grasslands region, some particular priorities are found on public lands. Woodland caribou, a species of particular priority for the federal and Alberta governments, and of high interest to the Alberta public, dwell almost exclusively on public lands (see the caribou range map: Figure 3). Grizzly bears, another high profile species of concern, are clustered largely on the public lands of the eastern slopes of the Rocky Mountains, where the bear's best hope for recovery lies (see Figure 4). This means that public lands are a particular focus of conservation concern for both government and the general public.

The coinciding of great economic potential and high environmental concern has made the management of Alberta's public lands a target of controversy and debate. Much of that debate has focussed on whether public authorities are doing enough to protect the environment in the face of

aggressive resource development. For a variety of reasons some private parties have wished to undertake action of their own to take effective environmental action, including on public lands. The next section considers the variety of motivations that may drive private conservation action. It also considers how one of those motivations carries requirements that must be considered in public policy.

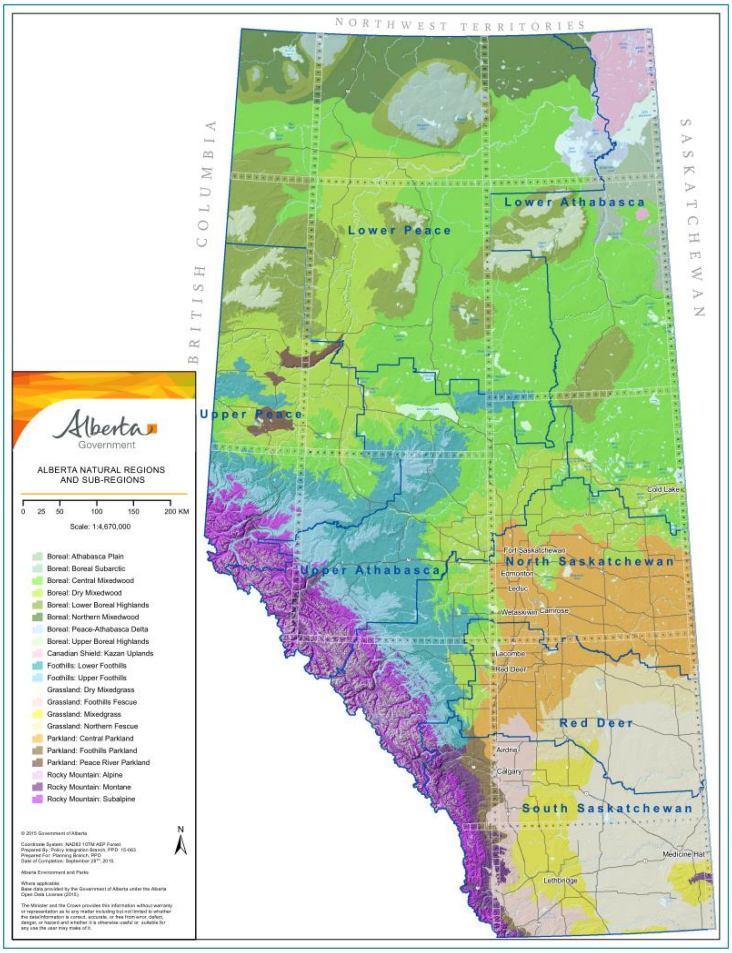


Figure 2: Natural regions and Sub-Regions of Alberta

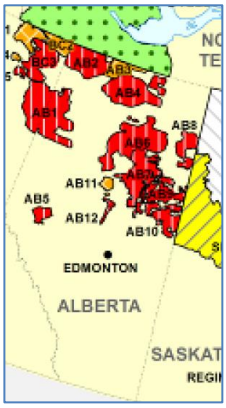


Figure 3: Woodland Caribou Ranges in Alberta[5]

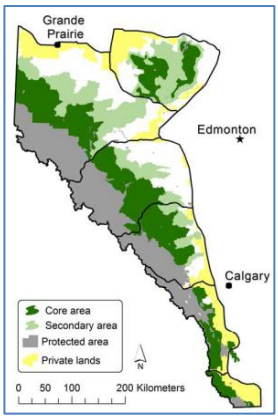


Figure 4: Grizzly bear conservation areas (primary and secondary) in Alberta *per* Neilsen et al 2009. [6]

[5] Environment Canada, *Recovery Strategy for the Woodland Caribou (Rangifer Tarandus Caribou), Boreal Population in Canada*, *Species at Risk Act* Recovery Series (Ottawa: Environment Canada, 2012) at 3, online: Environment Canada < http://www.registrelep-sararegistry.gc.ca/document/default_e.cfm?documentID=2253>.
[6] Scott E Neilsen, Jerome Cranston & Gordon B Stenhouse, "Identification of Priority Areas for Grizzly Bear Conservation and Recovery in Alberta, Canada" (2009) 5 Journal of Conservation Planning 38 at 52, online: Journal of Conservation Planning < http://www.journalconsplanning.org/2009/JCP_V5_4_Nielsen.pdf>.

***For Consideration:***

- ***What policy considerations are applicable to regarding whether private parties be facilitated to undertake and secure conservation action on public lands? What conditions or limitations, if any, should be placed on those opportunities?***

## III. Motivations and Implications

A conservation group or environmentally-minded individual may wish to undertake conservation action on private or public land for purely philanthropic reasons. Landscape conservation is, in fact, the *raison d'être* of many conservation groups, including land trusts. This activity has long been recognized as a valid contribution to the public interest, at least when exercised on private lands.

Commercial and industrial operators may also wish to undertake such action as a means of creating goodwill in a particular community, or more generally enhancing their reputation and social license. Some more progressive companies may have policies of their own committing to particular environmental outcomes, such as no net loss of a valued ecosystem component. In all these circumstances the action is voluntary, though perhaps invested with great importance to the actor.

Conservation offsetting (or biodiversity offsetting, as it is also known) ties an opportunity to develop resources to a commitment to undertake conservation action.. It has been defined as, "measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken."[7] The concept envisions that the residual environmental degradation from the development of one site (the "development site" or "impact site") will be compensated for by an equivalent or greater environmental enhancement on another (usually more or less proximate and similar) site or suite of sites (the "offset site(s)").[8]

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[7] Business and Biodiversity Offset Programme, *To No Net Loss and Beyond: an Overview of the Business and Biodiversity Offsets Programme* (Washington: Forest Trends, 2013) at 4, online: BBOP <http://www.forest-trends.org/biodiversityoffsetprogram/guidelines/Overview_II.pdf>. The Business and Biodiversity Offset Programme ("BBOP") is an international collaboration of more than eighty companies, financial institutions, government agencies, researchers, and civil society organizations working to establish and promote best practices in the use of the mitigation hierarchy to achieve no net loss, or a net gain, to biodiversity. For more information see BBOP's website:< http://bbop.forest-trends.org.>.

[8] For a fuller discussion of the concept see *ibid*; Joseph W Bull, "Biodiversity Offsets in Theory and Practice" (2013) Fauna and Flora International, Oryx, 1; David W. Poulton, *Biodiversity Offsets: A Primer for Canada* (Ottawa: Sustainable Prosperity, 2014), online: <http://www.sustainableprosperity.ca/article3857>.

While conservation offsetting may be undertaken voluntarily for the reasons set out above, regulators are imposing offset conditions on development permits with increasing regularity in Canada. Some recent examples are:

- Between 2010 and 2012 the National Energy Board three times made approval of pipeline development by Nova Gas Transmission in caribou habitat in the Horne River region contingent upon the design and provision of habitat compensation.[9]

- The federal-provincial Joint Review Panel which considered Total E&P's application for the Joslyn oilsands mine closely examined and critiqued the proponent's own offset plans, as did intervenors. The JRP imposed a condition that habitat for species-at-risk be created (preferred) or protected "in locations relatively near the project" so as to offset residual impacts on species at risk. While the condition itself focused on species at risk, the JRP made clear that the offsets should be include sufficient lands to allay concerns with other valued wildlife, vegetation, wetlands, and cumulative effects overall.[10]

- The federal Joint Review Panel charged with examining the impact of Enbridge's controversial Northern Gateway pipeline project recommended approval of the project subject to 209 conditions including nineteen conditions requiring five different kinds of biodiversity offsets (caribou habitat, wetlands, rare plants and ecological communities, fish and fish habitat, marine habitat). [11]

- The federal-provincial Joint Review Panel considering Shell Canada's application to expand the Jackpine oilsands mine released its report in July 2013.[12] The Panel noted that oilsands mining and preservation of natural values on the site were fundamentally difficult to reconcile, but stated

[9] National Energy Board, *Reasons for Decision: NOVA Gas Transmission Ltd. GH-2-2010* online: NEB <https://www.neb-one.gc.ca/ll-eng/Livelink.exe/fetch/2000/90464/90550/554112/590465/601085/665334/665172/A1X3T2_-_Reasons_for_Decision_GH-2-2010.pdf?nodeid=665173&vernum=0>; National Energy Board, *Reasons for Decision: NOVA Gas Transmission Ltd. GH-2-2011* online: NEB <https://www.neb-one.gc.ca/ll-eng/livelink.exe/fetch/2000/90464/90550/554112/666941/685859/793577/793570/A2Q5J5_-_Reasons_for_Decision_-_GH-2-2011.pdf?nodeid=793571&vernum=0>; National Energy Board, *Reasons for Decision: NOVA Gas Transmission Ltd. GH-004-2011* online: NEB <https://www.neb-one.gc.ca/ll-eng/livelink.exe/fetch/2000/90464/90550/554112/666941/704296/833910/833909/A2V3A0_-_Reasons_for_Decision_-_GH-004-2011.pdf?nodeid=834064&vernum=0>.

[10] ERCB Decision 2011-005/CEAA Reference No. 08-05-37519 online: ERCB <http://www.total.com/MEDIAS/MEDIAS_INFOS/4458/FR/full-report-of-joint-review-panel-january27-2011.pdf>.

[11] Canada, National Energy Board, *Report of the Joint Review Panel for the Enbridge Northern Gateway Project, Volume 2: Considerations* (Calgary: National Energy Board, 2013) online: NEB <http://gatewaypanel.review-examen.gc.ca/clf-nsi/dcmnt/rcmndtnsrprt/rcmndtnsrprt-eng.html>.

[12] 2013 ABAER 011, online: ABAER <http://www.aer.ca/documents/decisions/2013-ABAER-011.pdf>.

its belief that "biodiversity offsets (or allowances) provide a potentially viable mechanism for mitigating these effects without sterilizing bitumen resources . . . ."[13] It encouraged federal and provincial permitting authorities to work together to consider the use offsets for the project.[14]

- In August of 2015 the National Energy Board issued a list of draft conditions for the Trans Mountain Expansion proposed by Kinder Morgan Canada. Among these were conditions for offsetting for disturbance of caribou habitat, sowaqua spotted owl habitat, rare ecological communities, wetlands, riparian habitat, and greenhouse gasses.[15]

Meanwhile, we are seeing a series of expressions of interest from the Government of Alberta in making conservation offsetting a tool of land stewardship, one endorsed and structured by regulation or policy. The Alberta *Land-Use Framework* [*LUF*] of 2008 was key, indicating the Province's openness to new market-based tools, including conservation offsets, for land stewardship.[16] Other official documents indicating interest include the Lower Athabasca Regional Plan,[17] the South Saskatchewan Regional Plan, [18] and the provincial plan for the oil sands.[19] Of more legal weight, a regulatory regime of offsetting, including an exchange of offset credits, is enabled by the *Alberta Land Stewardship Act*[20] [*ALSA*].

Offsetting provides the framework for the *Alberta Wetland Policy*,[21] announced in 2013, currently being implemented in the white zone and scheduled for implementation in the green zone in 2016. Under the policy any destruction of a wetland requires a permit, which will be conditional upon the proponent undertaking "wetland replacement" (i.e. offsetting). Alberta Environment and Parks is using the *Wetland Policy* implementation to pilot concepts and principles which are intended to form an overall conservation

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[13] *Ibid* at para 1824.
[14] *Ibid* at para 1828.
[15] Online: National Energy Board < https://docs.neb-one.gc.ca/ll-eng/llisapi.dll?func=ll&objId=2810090&objAction=browse>.
[16] Government of Alberta, *Alberta Land-Use Framework* (n.p.: Government of Alberta, 2008) at 33-34, online: Alberta Environment and Sustainable Resource Development <https://www.landuse.alberta.ca/Documents/LUF_Land-use_Framework_Report-2008-12.pdf > [*LUF*].
[17] Government of Alberta, *Lower Athabasca Regional Plan 2012-2022* (np: Government of Alberta, 2012) online: Alberta Environment and Sustainable Resource Development <https://landuse.alberta.ca/LandUse%20Documents/Lower%20Athabasca%20Regional%20Plan%202012-2022%20Approved%202012-08.pdf>.
[18] Alberta Government, *South Saskatchewan Regional Plan 2014-2024* (np: Government of Alberta, 2014), online: Alberta Environment and Sustainable Resource Development <https://www.landuse.alberta.ca/LandUse%20Documents/SSRP%20Final%20Document_2014-07.pdf>.
[19] Alberta Government, *Responsible Actions: A Plan for Alberta's Oil Sands* (Edmonton: Government of Alberta, 2009) online: Alberta Energy < http://www.energy.alberta.ca/pdf/OSSgoaResponsibleActions_web.pdf>.
[20] SA 2009, c A-26.8, s 45-47.
[21] Alberta Government, *Alberta Wetland Policy* (np: Alberta Government, 2013) online: Water for Life <http://www.waterforlife.alberta.ca/documents/Alberta_Wetland_Policy.pdf> [*Wetland Policy*].

offset framework applicable to other program areas and environmental media. Drafts of that framework have been informally circulated for comment and feedback.[22]

It is interesting to note that the policy documents listed above draw little distinction between the application of offsets on public and private land. Indeed, the LUF makes explicit that offsets are to be evaluated for use on both public and private land.[23] Given that there appears to be a rising expectation that developers will undertake conservation offsetting on public lands, and perhaps may be required to, it is important to consider whether Alberta provides a convenient means for them to do so.

The motivation for seeking to produce an ecologically beneficial outcome – whether for philanthropy, for corporate interests, or for regulatory compliance – may or may not be of any relevance to the tools available to accomplish that end. If the outcome is to be assessed and credited for offsetting purposes, however, then certain special factors are required. Firstly, offsetting is founded on the notion of *additionality* – that the outcome produced by the offset action would not have come about otherwise.[24] On public lands the "otherwise" refers to the expected management of the land by public authorities. Thus offsetting requires that public lands will be managed differently, with better conservation outcomes, than would have otherwise been expected from the management of public authorities.

Secondly, under an offsetting system it is envisioned that the offset credit produced will be used by the development party to compensate for some development. This means that the conservation outcome must be *attributable* to a particular party or setoff parties. This is in contrast to the diffuse constellation of interests that interact to produce many management actions and outcomes on public land in the ordinary course of things.

***For Consideration:***

- ***Should the opportunities and tools available to a conservation actor vary according to the actor's motivation? For example, should a company acting in compliance with conditions imposed by a regulator be able to take action that it could not if it were acting voluntarily?***

[22] Alberta Environment and Parks, "A Framework for Alberta Conservation Offset", draft dated May 25, 2015 (unpublished, copy on file with the author). For a full discussion of the current evolution of Alberta's approach to conservation offsetting see David W Poulton, *Biodiversity and Conservation Offsets: A Guide for Albertans* (Calgary: Canadian Institute of Resources Law, May 2015) CIRL Occasional Paper #48, online: CIRL <http://prism.ucalgary.ca/retrieve/44155/BiodiversityOP48x.pdf>.
[23] LUF, *supra* note 16 at 34.
[24] BBOP, *supra* note 7 at 6 (Principle 6); Poulton, *supra* note 8 at 34-35.

Currently Alberta has no legal or policy framework enabling a private actor to take conservation action on public land. This does not mean that such action has never been taken. There are selected projects, such as the Algar project to restore caribou habitat[25] and Cenovus' Linear Deactivation (LiDea) project,[26] but these are exceptional and *ad hoc* arrangements which are highly context dependent. There is little which is inherently secure about the outcomes produced in these cases. If they are secure, it tends to be because of factors unrelated to the conservation objective, such as the location of the LiDea project on the Cold Lake Air Weapons Range.

In the following section I deal first with those current options for actively secure lands for conservation in Alberta. In order to more fully consider the absence of such options for private actors on public land, first I review the options for a private actor on private land, and then the options for the Government of Alberta to take action on public land. It is hoped that highlighting these two approaches might stimulate some thought about how either might be adapted to the public land/private action gap. Thereafter I very briefly examine the nature of land management on the unprotected "working" provincial public land base, in order to raise the question of whether it may be made more amenable to private actors wishing to undertake conservation on those lands.

### a) The Current Conservation Toolbox

#### i) Private Land

A private party wishing to undertake conservation action, and secure the results, on private land has two common legal options. The first is outright acquisition of the land. The owner of a fee simple interest in land may use the land in any way that is not prohibited by law, providing he or she avoids civil liability to his or her neighbors. This allows for the broadest possible suite of land management options, including undertaking ecosystem restoration or simply avoiding disturbance of the existing ecosystem.

There are some inherent limitations in law to private land ownership. Firstly, the bed and shores of any permanent naturally occurring waterbodies that exist on private land do not form part of that land, but rather are the property of the provincial Crown.[28] Secondly, the water itself is the property of the provincial Crown,[29] and any diversion of the water requires, with certain limited exceptions, a provincial water license.[30] The landowner may not, therefore, interfere with waterbodies on the land, even for a valid

[25] COSIA, "Algar Restoration", online: COSIA <http://www.cosia.ca/uploads/files/Media%20Resources/Media%20Kit/Algar%20Restoration.pdf>.
[26] "Cenovus's Linear Deactivation Project" (April 2014) online: Cenovus < http://www.cenovus.com/news/docs/LinearDeactivationProjectFactSheet.PDF>.
[28] *Public Lands Act*, RSA 2000, c P-40, s 3(1) [*PLA*].
[29] *Water Act*, RSA 200, c W-3, s 3(2).
[30] *Ibid*, s 49.

conservation purpose, without receiving the authorization of provincial authorities via the issue of a water licence. (Whether a water license itself may be held by a private party for the conservation purpose of maintaining in-stream flow is currently a matter before the Alberta courts.[31])

An interested party may take a more limited interest in land for conservation purposes. An instrument such as a lease may entitle the party to make use of the land for a defined period of time, but instruments such as this are primarily economic and not usually designed to accomplish conservation or other social goals.

A conservation-oriented party may also take an interest in the land which is specifically designed for conservation goals. A conservation easement is an interest in land, specifically enabled by statute. Using such an easement a qualified third-party (usually a government agency or non-profit land trust) may acquire an interest in land for the purposes of restricting activities on the land to accomplish an environmental, aesthetic, or agricultural purpose.[32] The conservation easement may be registered against title and, if registered, its restrictions bind the current and future owners of the land. Conservation easements are typically entered into by landowners who wish to secure certain values on the landscape, either as a donation (which may bring favourable tax treatment) or resulting from the purchase of that interest by the third party. They are, in other words, a voluntary commitment from the landowner to the qualified conservation-oriented third-party. While conservation easements are often arranged for indefinite terms, there is nothing in Alberta law which precludes time-limited conservation easements.[33]

Conservation easements are not wholly secure. As with other interests in the surface of the land, conservation easements do not preclude the granting and development of interests in the subsurface, with potential threat to natural values that entails. Conservation easements may be modified or terminated by order of the responsible Minister.[34] As with any agreement or interest in land, they are also subject to legal challenge as to their validity in particular circumstances and the scope of restrictions they apply. They may be particularly susceptible to such legal challenges over time as a future owner of the land may not embrace the conservation goals of the easement, and may be motivated to remove or minimize it as a means of maximizing the economic value of the land.

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[31] *Water Conservation Trust of Canada v Director, Central Region, Operations Division, Alberta Environment and Sustainable Resource Development* (8 March 2013), Appeal No. 10-056-R (A.E.A.B.). Judicial review of the EAB decisions by the Court of Queen's Bench was heard on September 15, 2015. The decision has been reserved.
[32] *ALSA*, *supra* note 20,, s 28-35.
[33] For an excellent review of the nature of conservation easements and how they may be used see Miistakis Institute, "Conservation Easements for Alberta: An Online Resource for Landowners" online: Miistakis Institute <http://www.rockies.ca/ce_guide/index.php>.
[34] *ALSA*, *supra* note 20, s 31(b).

Together the outright acquisition of land and the arrangement of conservation easements are the major conservation tools on private land in Alberta, and the stock in trade of the land trust community. Neither, however, is a convenient option on public land, because they may only be granted by "a registered owner of land", a phrase which is only applicable to the lands administered under the *LTA*.[35]

There is, however, a vehicle to bring public lands under the *LTA*. Section 29 of the *LTA* allows any piece of public land to be converted to registered fee simple land, and for title to be bestowed on any owner, including the provincial Crown.[36] If the Crown came to hold registered title in this manner, presumably it could grant a conservation easement in the same manner as a private landowner. The development of a policy to facilitate the process of creating Crown registered title and the granting of conservation easements might facilitate its use as means of allowing a private party to secure conservation actions on public land. In this regard, general direction might be found in *ALSA*'s provisions enabling the exploration of market-based stewardship tools,[37] the granting of conservation easements,[38] and the development of regional plans including regional objectives.[39] Read together, these aspects may point to the use of conservation easements as a tool for the stewardship if the land toward regional objectives on both private and public land, if public authorities were motivated to take up that approach.

***For Consideration:***

- ***Should the application of conservation easements be broadened to facilitate private conservancy on public lands? If so, how might that best be done?***

### ii) Public Land

#### A. Parks and Protected Areas [PPAs]

Parks and protected areas are pieces of public land under special legal designation for the purpose of protecting natural values and experiences based upon those values. Such designation usually prohibits or prescribes certain activities, and sometimes dispositions, within the boundary of the area for that purpose. Alberta law provides for the designation of eight different kinds of PPAs of varying degrees of prescriptiveness and flexibility. These are as follows (in approximate declining order of protection):

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[35] *Ibid*, s 29.
[36] *LTA*, *supra* note 2 s 29. The procedure for such a transfer is described in the *Alberta Land Titles Procedural Manual*, Procedure CRG-1, online: Service Alberta <http://www.servicealberta.gov.ab.ca/pdf/ltmanual/CRG-1.pdf>. I am indebted to Arlene Kwasniak for drawing my attention to this provision.
[37] *ALSA*, *supra* note 20, s 23
[38] *Ibid*, s 28-33.
[39] *Ibid*, s 8(1).

| Designation | Legislation | Establishment Method |
|---|---|---|
| Wilderness Area | *Wilderness Areas, Ecological Reserves, Natural Areas and Heritage Rangelands Act*[40] [*WAERNAHR*] | Schedule to statute |
| Ecological Reserve | *WAERNAHR* | Order in Council (after public notice) |
| Willmore Wilderness Park | *Willmore Wilderness Park Act*[41] | Specified in legislation |
| Provincial Park | *Provincial Parks Act*[42] | Order in Council |
| Provincial Wildland Park | *Provincial Parks Act* and *Provincial Parks (General) Regulation*[43] | Order in Council |
| Heritage Rangelands | *WAERNAHR* | Order in Council (after public notice) |
| Natural Area | *WAERNAHR* | Order in Council |
| Recreation Area | *Provincial Parks Act* | Order in Council |

It will be noted that all of these designations are established by government action at a high level: Order in Council or directly by statute. Only the rare events of establishment or variation in boundaries of ecological reserves and heritage rangelands require any public notice, and even then there is little required opportunity for public input.[44]

The process of designating parks and protected areas is thus largely the exclusive purview of the provincial government with little input or involvement from private parties or members of the public. At least, that is so in law. In fact, many park proposals have become the subjects of vigorous public campaigns and have frequently become heavily politicized. For example, the recent announcement of new protected areas in the Castle Wilderness of southwest Alberta came after decades of public activism by many environmental and recreational groups, followed by a commitment from the New Democratic

[40] RSA 2000, c W-9 [*WAERNAHR*].
[41] RSA 2000, c W-11.
[42] RSA 2000, c P-35.
[43] Alta Reg 102/85.
[44] *WAERNHR*, *supra* note 40 s 4.2 stipulates that the public notice must give the name and address of a person to whom representation may be made, but gives no indication of how those representations are to be considered. It also requires that *if* a public meeting is to be held (which is optional) the notice is to indicate the place, time and date.

Party in its platform in the 2015 election. Similar activist campaigns have preceded other parks and protected areas, including the Whaleback and Spray Valley protected areas.

The opportunity for a private party to formally propose a park or protected area does not currently exist. That has not always been so. From 1995 to 2000, during the provinces *Special Places 2000* program, protected areas nominations were invited from members of the public, including individuals, corporations and civil society groups. Nominations could also come from within the government. Hundreds of nominations were submitted. They were initially screened by government staff, then submitted for consideration to a Provincial Co-ordinating Committee and a Local Co-ordinating Committee comprised of representatives of stakeholders at the provincial and local levels respectively. The recommendations of each of those committees were considered by the government in deciding the appropriate action.

The involvement of stakeholders in the selection process did not necessarily stem the political aspects of consideration. Stakeholders were active in the public arena and in the backrooms of government promoting or discouraging consideration of particular sites, policies, and the program as a whole.[45] This was stimulated in part by the lack of principled and consistent process to review and consider public nominations.

While parks and protected areas are formally established by statute or Order in Council, it would be possible to establish a nomination system which would allow private parties to advance particular pieces of land for consideration to that end. If such a system were established it might include a requirement to consider the financial costs of reviewing the nomination or even the establishment and management of the PPA itself. By this means the process might pave the way for not just the nomination, but for the private sponsorship of PPAs.

If a private party were to be allowed to sponsor a PPA for the purposes of offsetting, then the conservation provided would have to meet the test of additionality. That would require that the added value of the private action be distinguished from the baseline land management provided expected to be provided by public PPA authorities. The importance and the difficulty in drawing this distinction, has recently been a subject of international academic debate, with some pointing to the danger that private

[45] The author represented the Canadian Parks and Wilderness Society on the Special Place 2000 Provincial Co-ordinating Committee and both observed and participated in these activities.

conservation initiatives and financing might simply displace those which would otherwise come from public authorities, resulting in no actual improvement of management or conditions on the ground.[46]

***For Consideration:***

- ***Should Alberta provide the opportunity for a private party to nominate an area for legal protection under the Province's PPA legislation?***
- ***What requirements or restrictions would apply to such a nomination?***
- ***Should the Province provide the opportunity for a private party to financially sponsor the establishment of new PPA?***
- ***What process, if any, should be established to consider such application?***

### B. Public Land Use Zones [PLUZs]

Public Land Use Zones are areas designated by the *Public Land Administration Regulation*[47] [*PLAR*] wherein (with very limited exceptions) recreational opportunities (particularly motorized recreation) are restricted.[48] The users of a PLUZ are subject to broad duties to "keep the land and improvements in a condition satisfactory to an officer" and to "restore the public land used . . . to as nearly as possible a clean and tidy condition."[49] Further, an officer may order a person to refrain from any activity in order to ensure safety or protect the management of any road, trail, or route.[50] An area within a PLUZ may be closed completely by order of the responsible director.[51]

While motorized recreation appears to be the primary concern of the designation, related activities such as camping, kitchen shelters, and fires are also subject to restrictions. Similar restrictions apply to smaller areas designated as public land recreation areas and public land recreation trails.

PLUZs, public land recreation areas, and public land recreation trails are all designated in schedules to the *PLAR*, which is promulgated by Order in Council.[52] The regulation makes no provision for the private designation, nomination or sponsorship of such areas.

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[46] John D Pilgrim & Leon Bennun, "Will Biodiversity Offsets Save or Sink Protected Areas?" (2014) 7:5 Conservation Letters 423; Martine Maron et al, "Stop Misuse of Biodiversity Offsets" (2015) 523 Nature 401; Leon Bennun, "The Impact of Biodiversity Offsets on Protected Areas" (July 30, 2015) recorded webinar, online: Vimeo <https://vimeo.com/134976112>.
[47] Alta Reg 187/2011 Part 9 [*PLAR*].
[48] *Ibid* s. 185(3).
[49] *Ibid* s. 183.
[50] *Ibid* s 182.
[51] *Ibid* s. 184.
[52] *PLA*, *supra* note 28 s 9.

### C. Reservations and Notations

Section 18(c) of the PLA conveys to the Minister (currently, of Environment and Parks) a broad authority to

> . . . reserve public land for any reason and for any period and permit the use of that land for any period and subject to any terms and conditions that the Minister prescribes by the Crown in right of Canada, by any department of the Government or by any person, without executing a disposition for it, . . . [53]

Notice of such reservations on particular pieces of land are provided through the Geographic Land Information Management Planning System [GLIMPS], a searchable inventory maintained by Alberta Environment and Parks of policies, plans, intentions, interests, and dispositions respecting activities on the surface of the land.[54] (Crown sub-surface dispositions are similarly recorded in Alberta Energy's Alberta Mineral Information.[55]) The placement of a reservation "represents a specific commitment for integrated management of public lands."[56]

The GLIMPS system also allows for the placement of notations on particular pieces of land. These are notices of policies, plans, decisions, or other aspects that may affect the use of that land, which operate to alert prospective users to potential conflicts.[57] There are several different types of notations applicable to different types of interests and concerns. The most relevant for our purposes here are:

- Consultative Notation Company (CNC) – "Indicates a company or individual with a justified interest in the land wishes to be consulted prior to any commitment or disposition of the land;"[58]
- Consultative Notation (CNT) – gives notice that an agency wishes to be consulted prior to any commitment or disposition of the land, but does not impose any restriction;[59]
- Protective Notation (PNT) – "identifies land and water systems requiring special management practices to protect resource values"[60] including, among many other aspects, site-specific administrative or policy controls on land use.[61]

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[53] *Ibid* s 18(c).
[54] Alberta Environment and Parks, "GLIMPS", online: Alberta Environment and Parks <http://aep.alberta.ca/forms-maps-services/industry-online-services/glimps/default.aspx>; Alberta Sustainable Resource Development, *Public Lands Reservation Information Guide*, (np: Alberta Sustainable Resource Development, 2006), online: <http://aep.alberta.ca/forms-maps-services/forms/lands-forms/guides-forms-completion/documents/ReservationNotationManual-Jan-2006.pdf> [Reservation Guide]
[55] Alberta Energy, Searches, online: Alberta Energy <http://www.energy.alberta.ca/OurBusiness/1069.asp>; Kwasniak, *supra* note 1, at 102.
[56] Reservation Guide, *supra* note 54 at A-1.
[57] Kwasniak, *supra* note 1 at 103.
[58] Reservation Guide, *supra* note 54 at B-1
[59] *Ibid* at B-1.

It is important to note that notations do not in themselves convey rights or restrictions on use, but merely provide notice of interests originating in other ways. As set out above, their primary function is to encourage consultation among parties who might otherwise inadvertently be in a position of conflict.

Reservations and notations are placed in GLIMPS upon application by a government agency, with no apparent provisions for such action to be initiated or sponsored by a private party.[62] According to Seiferling, the Government also has the authority to amend or cancel reservations and notations if it is deemed in the public interest to do so, rendering these tools less than fully secure.[63]

***For Consideration:***

- ***If the Crown contracted with a party to carry out conservation activities, and secured the results using the reservation system, would that be an effective enough means of securing the outcome?***
- ***Is there a concern with the Crown fettering its discretion in this situation?***

### D. *Public Lands Act* Protection Programs

In addition to the above specific designations of land for conservation purposes, the *Public Lands Act* provides:

> 11.1 The Minister may establish and support programs and initiatives for the purpose of conservation and resource management including, without limitation, programs and initiatives
>
> (a) to assist in resource protection and enhancement,
> (b) for the purposes of education and research, and
> (c) to assist in the resolution of multiple use concerns.[64]

This section does not appear to provide for the granting of secure rights, though conceivably it might be used in support of conservation actions not requiring rights.

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[60] *Ibid* at C-1-1.
[61] *Ibid* at C-1-5.
[62] *Ibid* at G-1 to H-3.
[63] Morris Seiferling, *Opportunities to Move Forward with Conservation Offsets in Alberta* (np: Alberta Biodiversity Monitoring Institute, 2015) at 12, online: Alberta Biodiversity Monitoring Institute <http://www.abmi.ca/home/publications/351-400/390.html;jsessionid=354DBAC7CA105490D5EBF2BF64A361EA?mode=detail&time=May+2015>.
[64] *PLA*, supra note 28 s 11.1.

### iii) Current Conservation Toolbox Summary

Current Alberta policy appears to be based on the assumption that private action will be enabled on private land, and public action on public land, and this division will apply to conservation as to other activities. Stated so simply, it appears to be a logical division of authority and responsibility. I suggest, however, that the distinction is not so crisp, for our law not only allows, but our government and economic arrangements facilitate and rely on a broad range of private interests participating in the public lands and the management of resources found thereon. Is there a place, therefore, for private conservation interests to participate on a similar footing?

## b) Public Land Management and Dispositions

The *PLA* empowers the provincial cabinet to make regulations authorizing and governing dispositions on public lands,[65] which authority is the basis for the *PLAR*.[66] The *PLAR* lays out a procedure by which a private party may apply for a disposition,[67] whereupon the responsible government agency may issue or refuse the disposition, or apply any terms or conditions to the disposition it considers appropriate.[68] As well, the *PLA* provides for the regulation of occupation and use of public land through the issue of authorizations and licenses of occupation.[69] The tracking of all of these types of dispositions on public land is accomplished provided through GLIMPS.

A multitude of disposition and authorization types area available under the *PLAR* and other legislation and regulations. These include:

- grazing leases
- grazing licences
- grazing permits
- farm development leases
- mineral surface leases
- surface material leases
- pipeline installation leases
- miscellaneous other leases
- licenses of occupation

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[65] *Ibid* s 8(1).
[66] *Supra* note 47.
[67] *Ibid* s 9.
[68] *Ibid* s 10.
[69] *PLA*, *supra* note 28 s 20; *PLAR*, *supra* note 47 s 12.

- commercial trail riding permits
- various easements (especially utility easements)
- mineral exploration licenses and permits
- forest management agreements
- timber quotas and licenses
- timber permits
- fur management agreement
- access permits
- hay permit authorizations.

This list is not exhaustive. An Alberta government list of disposition types from September 2014 is sixteen pages long.[70]

It is important to note that there is no obligation on the Province to create or issue any particular disposition. In addition to the general authority to refuse or set terms and conditions when a disposition is applied for, it is within the authority of the Minister to restrict the issue of dispositions within any specified area, or to prescribe the conditions under which dispositions in such an area may be made.[71]

To the author's knowledge, all of the dispositions and authorizations provided for in Alberta's public land regime contemplate or require the use or development of the land or natural resources. None are designed to prevent or forestall such use of development for conservation purposes, though there is nothing in the *PLA* or the *PLAR* which precludes the development of a conservation disposition. In the absence of such a disposition designed for the purposes of conservation, any conservation action relies on *ad hoc* arrangements, which by their nature are uncertain and inefficient to administer.

Is it possible, however, to undertake the *de facto* protection of public lands by obtaining a use or development disposition with the intention of holding the resource unused, or deferring the development of the land or resource? In other words, is it possible to obtain a "right of non-use" to public land or resources through simply holding a disposition and not acting on its rights? This possibility is precluded by the fact that virtually all Alberta resource dispositions contain "use it or lose it" provisions. If the resource use for which the disposition provides is not undertaken within a specified time, the disposition expires, often to be re-issued to another party on the same terms. This condition, while routine, is not legally necessary, however. The *Mines and Minerals Act*, for one important piece of legislation, enables

[70] Alberta Government, *Disposition Plan Types/Formats* (September 2014) online:<http://esrd.alberta.ca/lands-forests/land-management/documents/DispositionPlanTypesFormats-Sep29-2014.pdf>.
[71] *PLA*, *supra* note 28 s 14.

the Minister of Energy to extend the term of a mineral lease if the Minister is of the opinion that it is in the public interest to do so.[76] Conceivably this authority could be used to allow long term leases for non-development or deferred development of sub-surface resources. Such an approach would only suspend the threat from one source of development, however, and not provide the full suite of protection that might be desired.

***For Consideration:***

- ***Should development dispositions be altered to allow a private party to purchase them for the purpose of avoiding or deferring the subject development to the long term?***
- ***If so, should the conservation-motivated party acquire the disposition on the same basis (usually a bidding process) as development-motivated parties?***

## IV. Conservation and Integrated Resource Management

The diffuse authority to issue public land and resource dispositions and authorizations, and the lack of co-ordination or any identified overall purpose governing the use of public lands has been a long-standing criticism of Alberta's public lands regime.[77] It was this concern that was reflected in the *Alberta Land-Use Framework*, which stated:

> Today's rapid growth in population and economic activity is placing unprecedented pressure on Alberta's landscapes. Oil and gas, forestry and mining, agriculture and recreation, housing and infrastructure are all in competition to use the land – often the same parcel of land. There are more and more people ding more activities on the land. This increases the number of conflicts between competing user groups and often stresses the land itself. Our land, air and water are not unlimited. They can be exhausted or degraded by overuse.[78]

The *LUF* provided the policy basis for *ALSA* and regional planning intended to govern land use with a view to setting economic, environmental and social objectives, plan for the needs of current and future generations, co-ordinate decisions respecting land-use, natural resources and the environment, and enabling sustainable development and cumulative effects management. Regional planning is, of course, underway throughout Alberta, with the Lower Athabasca Regional Plan and the South Saskatchewan Regional plan complete (though with some components outstanding). At the same time work proceeds

[76] *Supra* note 4 s 8(1)(h).
[77] See, for example Steven A Kennett and Monique Ross, *In Search of Public Land Law in Alberta*, CIRL Occasional Paper #5 (Calgary: Canadian Institute of Resources Law, 1998), online: CIRL <http://dspace.ucalgary.ca/bitstream/1880/47207/1/OP05Search.pdf>.
[78] *LUF*, *supra* note 16 at 6.

within the Government of Alberta to better co-ordinate and integrate the multiple aspects of land and resource management.

If we are to work toward the alignment of the large array of land interests into an overall vision for the management of our lands, as has long been advocated and now may be taking shape, then any disposition to enable conservation must be co-ordinated with other dispositions and authorizations on or under the same piece of land. This is obviously so if the conservation is not to be undermined (perhaps literally). Such an integration requires the development of a set of criteria to determine priorities of rights on a particular piece of land. Some possible criteria may be easy to administer, but not serve our land use objectives. For example, a "first in time, first in right" priority system, such as governs water licenses, would see more recent dispositions subordinated to older ones. That would almost certainly mean that new conservation dispositions would be weakened, and possibly rendered meaningless, by older development rights, perhaps to the detriment of regional conservation priorities.

If the priority of rights to land use is to be determined by reference to regional objectives set through the regional planning process, then some older rights for incompatible uses may be reduced in priority, reducing or perhaps eliminating their value. This may create a substantial liability, which would have to be accounted for.

In any case, there is a long-standing need to reconcile the many competing rights which exist on many parts of the Alberta landscape. The development of a conservation-oriented disposition applicable on public land may highlight this need, and should be accompanied by a considered plan to resolve conflicts between dispositions and between disposition holders.

***For Consideration:***

- ***How could conservation-oriented dispositions be reconciled and co-ordinated with other dispositions on the same or nearby lands?***
- ***What principles and priorities should apply?***

## V. Models for Conservation Partnerships?

In discussions about the relationship between the Province of Alberta and the developers who bring expertise and capital to the job of developing public resources, it is common to refer to a (non-legal) partnership between the two parties whose interests in development align. Are there any reasons why such partnerships should be limited to the development of resources, and not extended to the public interest in a healthy environment or in ecosystem services? Both economic development and

environmental protection are often cited as matters of public interest, so the provision of multiple public-private mechanisms for the one and few if any for the other is at best asymmetric.

In fact, there may currently exist some models of how such a partnership might work. We have a small number of arrangements where private parties undertake ecosystem management responsibilities in return for being to derive some special and private benefit from a piece of public land. We see such an arrangement in the cases of Heritage Rangelands, Forest Management Agreements, and Public Recreational Trails.

- As discussed above, Heritage Rangelands are a class of protected area on public land. On heritage rangelands a rancher and grazing lease holder may receive special favourable lease terms in return for undertaking certain ecosystem management activities and assuring a certain integrity of the landscape, under the oversight of the Department of Agriculture. While few such heritage rangelands have been established, those that have been appear to operate well.
- Under a Forest Management Agreement a forestry operator receives the right to harvest timber products from a large landscape. In addition to taking on the usual reforestation duties, an FMA holder may take on extra obligations related to ecosystem management in order to assure the integrity of the forested landscape. Much of Alberta's public lands are covered by FMAs, which means that the ecological well-being of these landscapes is, at least in part, already the responsibility of a private party.
- The *PLAR* allows for a private organization – usually a club – to undertake the stewardship of a designated trail or trail system. While the club receives exclusive access, it is also accountable for the management of the trail system to assure that it does not unduly impact the landscape in which it is found.

Though each of these arrangements pairs a private benefit with an ecosystem management obligation, might we use them, adapt them or create some new but similar mechanism to enable private conservation action in partnership with public authorities to the benefit of the public interest in the environment.

## VI. Conclusion

Alberta currently lacks a convenient toolbox to enable a private party to undertake conservation action, and secure the beneficial outcomes, on the sixty percent of the province that is public land. This

void in law and policy disappoints and frustrates a segment of the public that is motivated by private or public interests, or by regulatory direction.

The above review indicates, however, that we have components of such a tool in the mechanisms we have designed mainly for other circumstances or purposes. We have designed conservation easements to allow a private party to hold a conservation interest in land, and to limit and direct when that interest may apply. We have various types of public protection which allow for protective regimes to be established to meet specific conditions and goals. Finally, we have a broad and active disposition process on public land, which encourages public-private partnerships for activities deemed in the public interest. Perhaps any of these mechanisms might be adjusted to facilitate the connection between a private party, the public interest in conservation, and access and security on public lands. That is unlikely to happen be default, however. This paper and the workshop it is intended to inform are intended to start a discussion about how we can consciously make an appropriate series of decisions to address this situation.

***For Consideration:***

- ***What new tools could be developed to facilitate private conservancy on public lands?***
- ***Is a change of laws needed, or simply new policy guidance?***