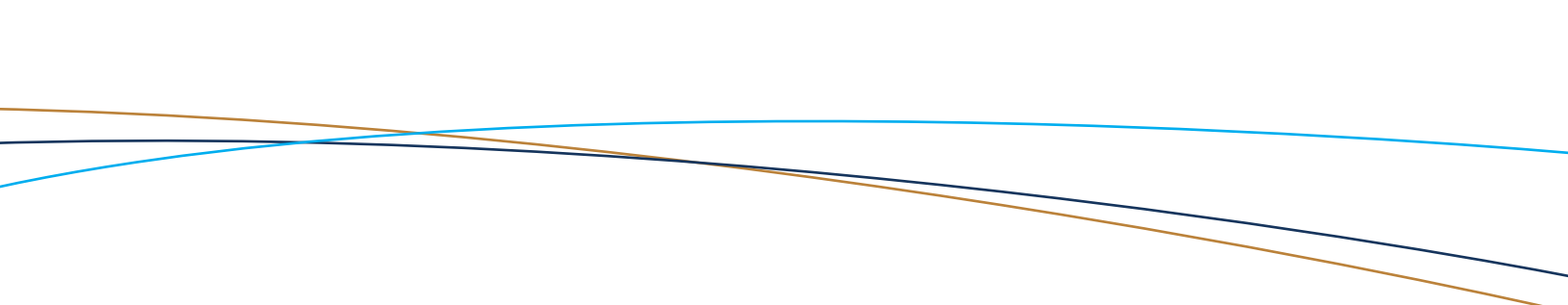




# **The Implementation Plan**

## **Second Annual Report: 2013–2014**



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## Preface

This annual report was prepared by the Alberta Environmental Monitoring Evaluation and Reporting Agency (AEMERA) and Environment Canada.

The report presents information on the progress made in year two (April 1, 2013 to March 31, 2014) of the Implementation Plan. The scope of this report covers the second year of the three-year Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring, which is co-led by Alberta Environment and Sustainable Resource Development on behalf of the Government of Alberta and Environment Canada on behalf of the Government of Canada.

Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA) assumed provincial responsibility for the Joint Canada-Alberta Plan for Oil Sands Monitoring (JOSM) upon the proclamation of the *Protecting Alberta's Environment Act* on April 28, 2014. Since its establishment, the Agency has led the Government of Alberta's contributions and input to JOSM, including the preparation of this report.



## Executive Summary

The Joint Canada/Alberta Implementation Plan outlines how the governments of Alberta and Canada will work together as partners to implement a world class monitoring program for the oil sands that integrates air, water, land and biodiversity. Monitoring commitments made by the governments in the Implementation Plan are intended to improve characterization of the state of the environment as well as understanding the cumulative effects of activities in the oil sands area.

The Implementation Plan is funded by industry to a maximum of \$50 million annually. The approach to implementation is both phased (2012–2015) and adaptive to ensure governments are responsive to the priorities that emerge through new information and knowledge, as well as input from key stakeholders.

Working together in year two (2013–2014), Canada and Alberta made progress on various fronts including strengthening the Joint Oil Sands Monitoring governance and planning structures to meet the commitments and objectives outlined in the Implementation Plan.

The Government of Alberta made notable progress in creating the conditions for achieving commitments made under the Joint Implementation Plan through legislative and regulatory changes to support ambient environmental monitoring province-wide.

This annual report presents highlights of progress made against commitments and objectives, and a technical annex summarising monitoring activities in the second year (2013–2014) of the Implementation Plan.

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## 1.0 Introduction

In February 2012, the governments of Canada and Alberta announced the Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring (“Implementation Plan”), which outlines a three-year commitment to implement a single, government-led monitoring program for the oil sands (see **Appendix A**). The Implementation Plan recognizes the importance of the oil sands as a key natural resource and driver of economic development for Canada, and also acknowledges that the expansion of industrial development in the oil sands region necessitates a better understanding of cumulative environmental impacts. In the Implementation Plan, both governments committed to a scientifically rigorous, comprehensive, integrated and transparent ambient environmental monitoring program of the cumulative environmental effects of oil sands development.

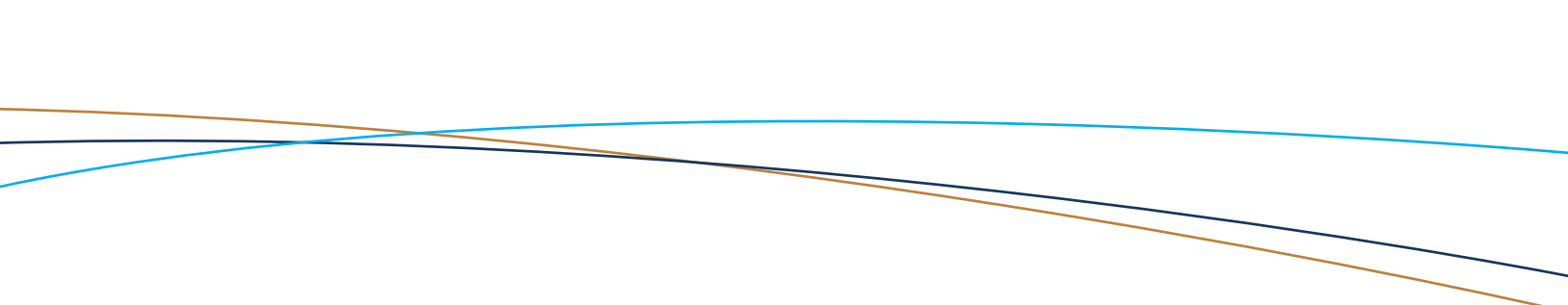
The Implementation Plan builds on a foundation of existing environmental monitoring, with enhancements phased in over three years (April 1, 2012 to March 31, 2015). The phased approach helps to ensure an orderly installation of the necessary infrastructure, incremental enhancement of activities, the inclusion of Traditional Ecological Knowledge, and the appropriate integration of existing monitoring activities in the region.

### Key Commitments of the Plan:

- Funding.
- Accountable administration and review.
- Adaptive management.
- Transparent and accessible results.

The overarching commitment is establishing a single, government-led monitoring program for the oil sands, which includes the following key commitments: funding, accountable administration and review, adaptive management, and transparent and accessible results. These key commitments help achieve a world class monitoring program that fulfills the following objectives:

- Support sound decision-making by governments, as well as stakeholders;
- Ensure transparency through accessible, comparable and quality-assured data;
- Enhance science-based monitoring for improved characterization of the state of the environment and collect the information necessary to understand cumulative effects;
- Improve analysis of existing monitoring data to develop a better understanding of historical baselines and changes, and;
- Reflect the trans-boundary nature of the issue and promote collaboration with the Governments of Saskatchewan and the Northwest Territories.



At the conclusion of the three-year Implementation Plan, monitoring of the impacts of development on the ambient environment will be more comprehensive, with more compounds sampled at more sites, with greater frequency, using consistent scientific standards and protocols. The results will help characterize the condition of the environment in the oil sands area, and provide an enhanced understanding of cumulative environmental effects as well as environmental change due to oil sands development activities.

Reporting annually on the progress made in achieving these objectives is a commitment made by the governments of Canada and Alberta to ensure transparency of the work. The 2013–2014 reporting is divided into two parts. This first part presents a summary of the status of implementation of year two (2013–2014) activities under the Implementation Plan. The second part, to be released later this year, will present the technical and scientific results of 2013–2014 monitoring work.

## 2.0 Reporting Against Key Commitments

In the second year (2013–2014) of JOSM implementation activities, progress was made against key commitments and overall objectives of the Implementation Plan, including the areas of: funding; accountable administration and review; adaptive management; and transparent and accessible results.

### 2.1 FUNDING

In the Implementation Plan, the governments of Canada and Alberta committed to working with the oil sands industry to develop a sustainable, ongoing funding arrangement to support the Plan. As articulated in the Implementation Plan, the costs of implementing enhanced environmental monitoring of oil sands development for the three-years (2012–2015) are paid for by industry, up to \$50-million annually. The oil sands industry members through the Canadian Association of Petroleum Producers (CAPP) worked collaboratively with government to develop a funding formula to allocate monitoring costs to oil sands operators.

#### Highlights of 2013–2014 commitment on funding:

- Oil Sands Environmental Monitoring Program Regulation enabling the collection of monitoring fees from oil sands operators.
- Industry responsible for funding monitoring organisations directly.
- Funding of monitoring activities within \$50 million cap.

During the first year of implementation (2012–2013), funding was compelled by a Government of Alberta Ministerial Order as a transition measure until appropriate Alberta legislation and regulations were put in place.

In December 2013, the Government of Alberta amended the *Environmental Protection and Enhancement Act* (EPEA) to allow the Minister of Environment and Sustainable Resource Development to create regulations identifying environmental monitoring programs and to assess fees for their support. On December 31, 2013 the *Oil Sands Environmental Monitoring Program Regulation* (see **Appendix B**) came into force enabling the collection of monitoring fees from oil sands operators for the Implementation Plan, which were used to fund government-led monitoring activities in year two (2013–2014). Since the regulation came into force late in the year, industry



continued to be responsible for funding independent regional organizations to monitor the environmental impacts of oil sands activities; this changes in year three (2014–2015) as all funding for monitoring activities will be collected and disbursed by the Government of Alberta.

Consistent with the governments' commitment to ensure funding transparency by reporting on expenditure, a total of \$48,129,003 of industry funding was earmarked for JOSM (see Tables 1 and 2) in year two. \$21,246,363 was spent by governments and a \$26,882,640 allocation was provided directly by industry to regional monitoring organizations. Of the \$21,246,363 spent by governments, \$18,010,579 reimbursed Environment Canada monitoring expenses and \$3,235,784 funded Alberta's Environment and Sustainable Resources Development monitoring activities.

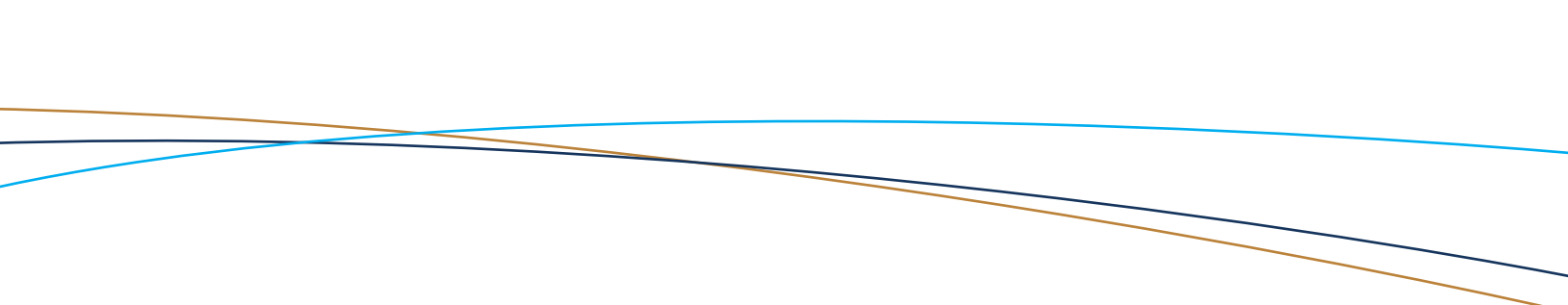
A summary of 2013–2014 budget allocations and expenditure is provided in Tables 1 and 2, for further details please see **Appendix C**.

| <b>2013–2014 BUDGET SUMMARY (Government)</b> |                     |                     |                    |
|--|---------------------|---------------------|--------------------|
|  | <b>Planned</b>      | <b>Expenditure</b>  | <b>Variance</b>    |
| <b>EC</b>                                    | \$20,556,077        | \$18,010,579        | <b>\$2,545,498</b> |
| <b>ESRD</b>                                  | \$3,825,563         | \$3,235,784         | <b>\$589,779</b>   |
| <b>Total</b>                                 | <b>\$24,381,640</b> | <b>\$21,246,363</b> | <b>\$3,135,277</b> |

Table 1: Summary of 2013–2014 planned budget and expenditure – Environment Canada (EC) and Environment Sustainable Resources Development (ESRD)

| <b>2013–2014 BUDGET SUMMARY (Monitoring Organizations)</b> |                      |
|--|----------------------|
| <b>WBEA</b>  | \$ 13,828,887        |
| <b>LICA</b>  | \$ 923,150           |
| <b>ABMI</b>  | \$ 6,628,500         |
| <b>EMCLA</b>   | \$ 770,000           |
| <b>HATFIELD/RAMP</b>                                       | \$ 4,732,103         |
| <b>Total</b>   | <b>\$ 26,882,640</b> |

Table 2: Summary of 2013–2014 allocations paid directly by Industry to Monitoring Organizations (ABMI, EMCLA, LICA, Hatfield /RAMP, and WBEA)



As previously stated, regional monitoring organizations received funding directly from industry for the 2013–2014 fiscal year, therefore, this report does not present information on expenditure by regional monitoring organizations for the 2013–2014 fiscal year as this falls under the purview of industry.

## 2.2 ACCOUNTABLE ADMINISTRATION AND REVIEW

### 2.2.1 Alberta’s Legislative and Regulatory Changes

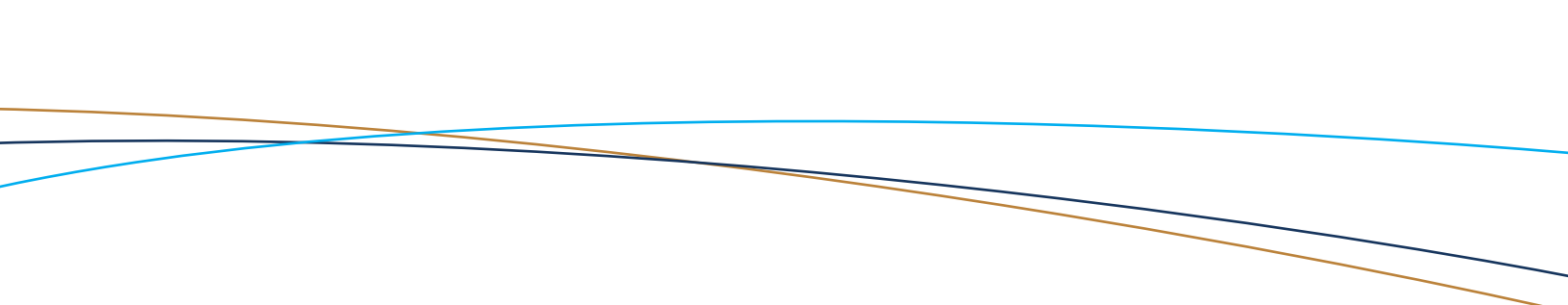
Industry is required by provincial and federal regulations to monitor source emissions and other environmental impacts resulting from their operations to demonstrate that their facilities are in compliance with predefined performance objectives. Much of this type of information has been collected by independent monitoring organizations; however, these responsibilities will be transitioned to government.

To facilitate this change, in December 2013 the Government of Alberta passed the *Protecting Alberta’s Environment Act* (see **Appendix D**) creating the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA). The legislation established AEMERA as the provincial organization responsible for environmental monitoring in Alberta. The Agency is governed by a board of directors, operated by a CEO, and accountable to the Minister of Environment and Sustainable Resource Development. The AEMERA mandate is to provide open and transparent access to scientific data and information on the condition of Alberta’s environment, including specific indicators as well as cumulative effects, both provincially and in specific locations. When AEMERA was proclaimed on April 28, 2014, it became responsible for leading the province’s involvement in Joint Oil Sands Monitoring.

Prior to the creation of AEMERA, much of the accountability for ambient/effects monitoring was through the regulatory system i.e. mandates in approvals, executed either by individual approval holders, or through third party monitoring organizations on behalf of industry. These approval clauses establish objectives for both general regional monitoring and ambient/effects monitoring that may be detectable from individual facility operations.

### 2.2.2 Joint Management of Monitoring Program

In the Implementation Plan, the two governments jointly committed to delivering integrated, credible and transparent monitoring of the environmental impacts of oil sands development in a manner consistent with both Canada and Alberta’s approach to monitoring.



The plan also indicates that monitoring arrangements will be rationalized and integrated into a single, government-led program under the joint management of the two governments. Implementing common approaches to the planning of monitoring activities is a key step towards achieving a single government-led environmental monitoring system. A collective, integrated planning cycle was presented to stakeholders at the June 2013 multi-stakeholder forum in Edmonton, Alberta. Multiple planning processes led by independent organizations were replaced by a single, integrated, government-led monitoring planning process during year two (2013–2014) and a fixed fiscal year (April 1 to March 31) was established for all participants to be adopted by year three (2014–2015).

A revised JOSM governance structure introduced media-specific, multi-stakeholder Component Advisory Committees (CAC) that were designed to better solicit and incorporate multi-stakeholder perspectives into the integrated planning process. The CACs were launched and provided with approved Terms of Reference (see **Appendix E**), and Component Leads from both governments were appointed to chair the CACs.

As required under the Terms of Reference, the CACs successfully recommended monitoring plans to achieve the JOSM objectives based on commitments made by the Government of Canada and the Government of Alberta, and these plans were approved by the JOSM co-Chairs (see **Appendix F**). Nevertheless, a review of the 2013–2014 CAC planning process indicated that the CAC approach could be improved and, specifically, would benefit from: more focus on scientific and technical aspects of monitoring; establishing a more regular and consistent schedule for planning meetings; and, a consistent approach across all CACs. These suggestions are being implemented during year three (2013–2014) for 2015–2016 work planning activities.

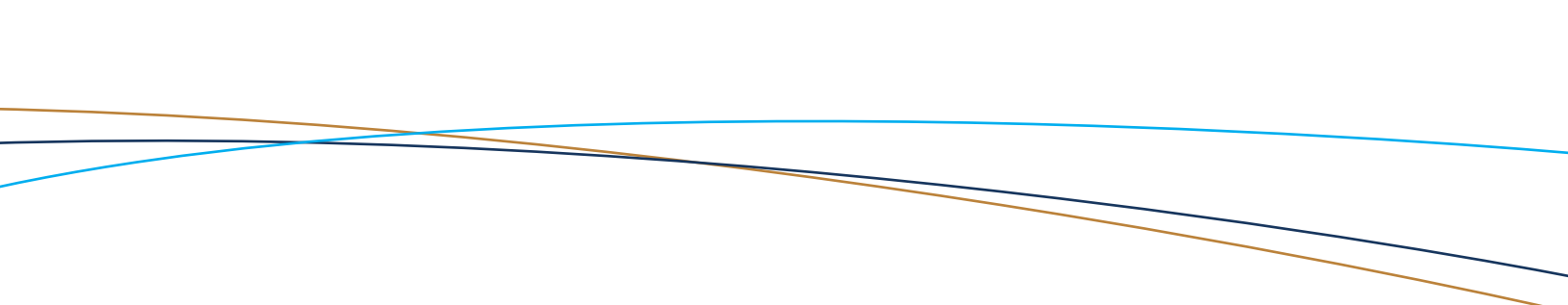
Systemic changes made under JOSM governance and planning presented some challenges to regional monitoring organizations as they worked to align their respective processes and timelines with the new system.

Activities implemented under this commitment help support the JOSM objectives of sound decision-making, transparency and science-based monitoring.

### 2.2.3 Engagement

The governments of Alberta and Canada committed to jointly engage with Aboriginal Peoples, industry, scientists, and stakeholders to provide information, and to seek and incorporate stakeholder advice into JOSM planning.

In 2013–2014, the two governments invited representatives of First Nations and Métis organizations, industry, monitoring organizations in Alberta, as well as other governments, to participate in various JOSM engagement activities. To support a coordinated and consistent engagement approach, an Engagement Strategy



(currently in draft form) that outlines key JOSM strategies for engaging stakeholders including objectives, priority audiences and areas of focus as well as tactics and tools was initiated. In year two, the main engagement activities included:

- Meetings with Aboriginal representatives;
- Multi-stakeholder forums in June and December 2013; and,
- Component Advisory Committee work planning sessions with meetings held between September and October, 2013.

### **2.2.3.1 Multi-stakeholder Forums**

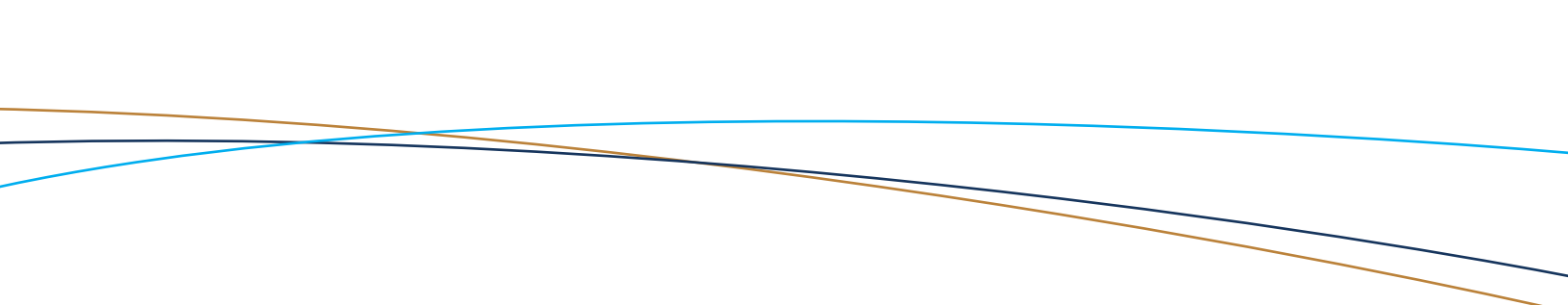
The JOSM Multi-stakeholder Forums is one mechanism, through which the governments of Canada and Alberta share information and seek feedback from stakeholders on implementation progress including: monitoring results and priorities, data management, as well as engagement activities. The Forums brought together representatives from the three levels of government, oil sands industry, First Nations, Métis Organizations, non-governmental organizations, and academia.

In the second year of the Implementation Plan, two multi-stakeholders forums were held in June and December, 2013 respectively (see **Appendices G and H**). Highlights from the multi-stakeholder sessions include information sharing through presentations to stakeholders on the changing governance in monitoring of the oil sands region and the progress on implementation activities of the media components, as well as gathering stakeholder perspectives on improving monitoring and integration across the media. These forums have been an effective means of informing and engaging a diverse group of stakeholders. Based on lessons learned from stakeholder feedback and post-forum surveys, multi-stakeholder forums have been adapted to provide information on implementation activities and opportunities for stakeholder input; technical/science-based discussions now take place primarily at the CACs.

These activities and changes support the objectives of sound decision-making, transparency and science-based monitoring. A multi-stakeholder forum was held in June 2014 and another one is planned for December 2014.

### **2.2.3.2 Aboriginal Engagement**

In the Implementation Plan, the governments of Canada and Alberta committed to the delivery of a monitoring program based on the principles of inclusion of Traditional Ecological Knowledge (TEK) and the establishment of appropriate mechanisms to incorporate advice from Aboriginal peoples. Progress has been made on this commitment, but challenges still exist.



In 2013–2014, JOSM officials met with representatives of First Nations and Métis Organizations on several occasions to discuss information on JOSM, its connection to the provincial system, Aboriginal participation in JOSM, and First Nations and Métis environmental concerns.

Representatives of some First Nations and Métis organizations communicated their desire for meaningful participation in JOSM and expressed interest in:

- directly influencing JOSM planning, delivery and decision making, including the respectful use of TEK;
- seeing their environmental concerns clearly reflected in JOSM;
- ensuring support for their participation (e.g. access to experts to represent their interests on CACs and to understand technical plans); and
- ensuring support for capacity building.

To address the interests expressed by representatives of First Nations and Métis organizations, the governments of Canada and Alberta proposed a three-pronged approach including:

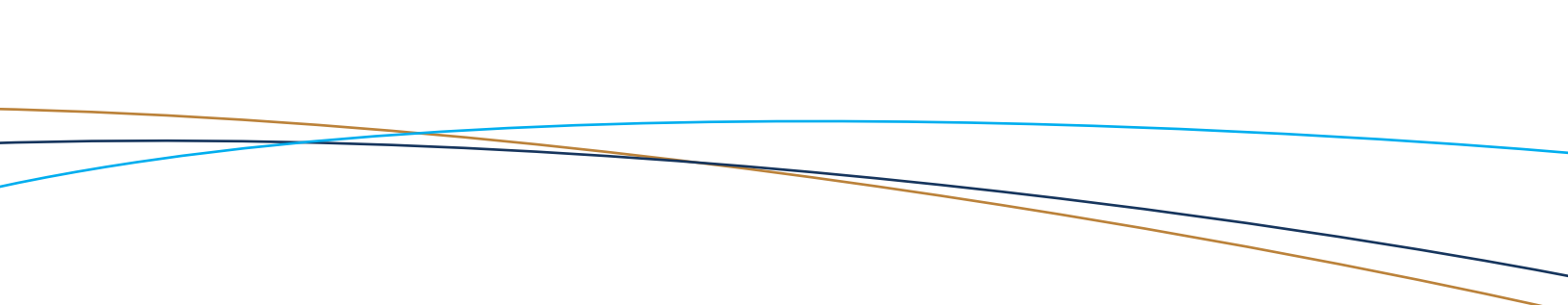
- setting up mechanisms for ongoing relationship development and communication with First Nations and Métis Organizations i.e. a broader, more inclusive Aboriginal advisory body as a forum to directly provide advice and recommendations to the JOSM co-Chairs;
- enabling the use of TEK in monitoring, evaluation and reporting; and,
- building capacity within the communities through the development of training opportunities.

Discussions on further developing the proposed ideas in collaboration with the Aboriginal communities in the oil sands region are ongoing. However, to date, no agreement has been reached on the inclusion of TEK into the Joint Oil Sands Monitoring program.

The governments of Canada and Alberta remain committed to working with representatives of Aboriginal Peoples to foster openness, transparency, and credibility in the monitoring system, by the continued sharing of information with communities about the work done through the joint monitoring program.

### **2.2.3.3 Aboriginal Training and Participation in Monitoring Activities**

In the Implementation Plan, the governments of Canada and Alberta committed to the training and participation of members of local communities in monitoring activities.



The governments, in collaboration with Mikisew Cree First Nation and Athabasca Chipewyan First Nation, provided training opportunities to Fort Chipewyan community members. In May 2013, an Environmental Monitor Training Program trained First Nations and Métis individuals in basic monitoring techniques, such as contaminants and water monitoring, wildlife collections, and tissue preparations for trace contaminant analysis. The delivery of federal upland Species-at-Risk monitoring trained Aboriginal participants to assist in auditory recording devices at sites and gathering data. Training to support sediment sampling in the Peace-Athabasca Delta was also provided to Smith Landing First Nation, Fort Smith, NWT. These courses helped to equip Aboriginal persons with the skills to become involved in existing scientific studies and/or design their own monitoring programs.

Aboriginal persons directly participated in monitoring activities in support of 2013–2014 work plan activities. Graduates of the Environmental Monitoring Training Program were engaged as part of the Winter/Spring Atmospheric Contaminant Snow Survey. An Air Quality Monitoring Site is in operation through an agreement with the Fort McKay First Nation. Several Aboriginal community members were engaged to deliver components of the Wildlife Contaminants and Toxicology monitoring including Mikisew Cree First Nation, Athabasca Chipewyan First Nation, Deninu K'ue First Nations, and several Métis locals.

Governments continue to seek collaborative opportunities for training and capacity building within Aboriginal communities.

#### **2.2.3.4 Industry Engagement**

A government-industry Transition Working Group (TWG) was established in the first year of JOSM (2012–2013) to provide industry an opportunity to inform the governments about their practices and perspectives on the regional environmental monitoring that was compelled by regulatory requirements and would be transferred to a single government-led process as part of the Implementation Plan. In the second year (2013–2014), the TWG held a series of meetings, with discussions and recommendations focused on requirements for transitioning industry's ambient monitoring responsibilities to government in preparation for government leadership of the JOSM program. These ongoing discussions helped identify clauses related to regional, ambient/cumulative effects monitoring, and ensure ambient monitoring and facility performance monitoring are complementary rather than duplicative. Industry approval holders continue to be accountable for all regulatory requirements not transferred to AEMERA.

Activities under JOSM engagement support the objectives of sound decision-making by governments and stakeholders, transparency and science-based monitoring.

#### **Highlights of commitment on accountable administration and review:**

- Integrated planning cycle established.
- Implementation of approved work plans.
- A single, integrated, government-led monitoring planning process replaced multiple planning processes led by independent organizations.
- Fixed fiscal year (April 1 to March 31) established for all participants to be adopted by year three (2014–2015).
- Creation of media specific multi-stakeholder Component Advisory Committees (CAC) designed to better solicit and incorporate multi-stakeholder perspectives into the integrated planning process.
- Release of Terms of Reference for the CACs.
- Two multi-stakeholders forums held in June and December, 2013 respectively.
- Initiated development of Engagement Strategy (currently in draft form).
- Several meetings held with representatives of First Nations and Métis Organizations for discussions on JOSM.
- Aboriginal training and participation in monitoring activities.
- Several meetings held with industry (Transition Working Group) to discuss requirements for transitioning industry's ambient monitoring responsibilities to government.
- Progress made in identifying clauses related to regional, ambient/cumulative effects monitoring, to ensure JOSM and facility performance monitoring are complementary rather than duplicative.

## **2.3 ADAPTIVE MANAGEMENT**

Consistent with adaptive management, plans and activities have evolved to reflect lessons learned and experience gained from the initial work, as well as discussions with JOSM participants. A key lesson learned from the June and December multi-stakeholder forums in the second year of JOSM (2013–2014) was that the forums were better suited for sharing information with a large group of people than for meaningful engagement on technical/monitoring planning. This learning contributed to adapting the CACs into entities that are largely technical in nature to facilitate the development of monitoring plans that achieve the objectives of the Implementation Plan. Stakeholder feedback from the December 2013 multi-stakeholder forum and learnings from

evaluating program activities identified groundwater and wetlands as potential areas in the monitoring system for expanding the scope of monitoring work and these have been captured as part of approved work in year three monitoring plan.

Adaptive management of the JOSM program helps achieve the objective of enhancing science-based monitoring to better understand cumulative effects in the oil sands region.

#### **Highlights of commitment on adaptive management:**

- Lessons learned in 2013–2014 informed adapting the CACs into technical entities – to be implemented in year three.
- Additional groundwater and wetlands monitoring currently being considered in the monitoring system, and have been captured as future areas of work in year three.

## **2.4 TRANSPARENT AND ACCESSIBLE RESULTS**

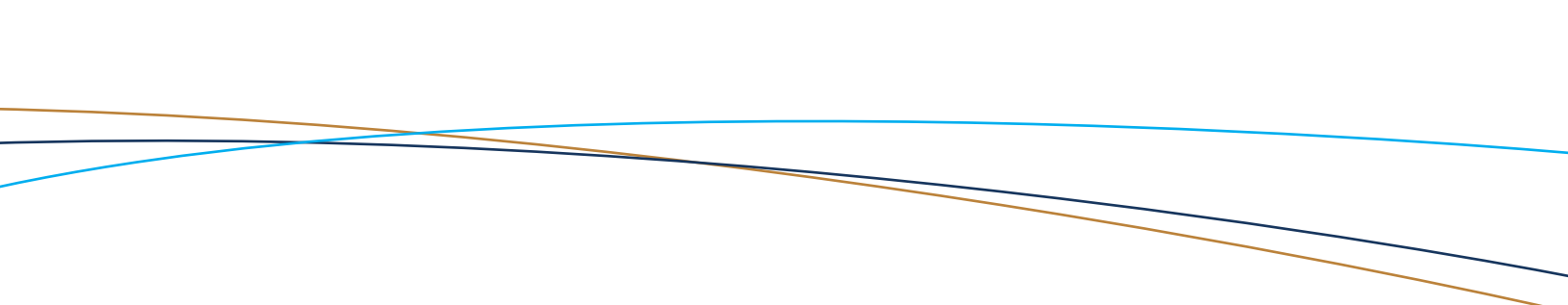
The Implementation Plan commits to providing open, transparent access to monitoring data within a data management framework that allows information to be uploaded, organized and publicly-available in a timely, standardized, and coordinated manner.

To ensure a consistent approach to the dissemination of JOSM data, information and results, all JOSM participants are expected to comply with the *Data Sharing and Information Release Protocol* released in December 2013 (see **Appendix I**). The Protocol continues to evolve with experience and will be fully operational in year three (2014–2015).

The JOSM program presently relies heavily on monitoring organizations for data management, including quality assurance and storage, with data collected through monitoring activities by delivery organizations available through the respective organizations' websites.

On April 22, 2013, federal Environment Minister Peter Kent and Alberta Environment and Sustainable Resource Development Minister Diana McQueen launched the *Canada-Alberta Oil Sands Environmental Monitoring Information Portal*. The Portal provides transparent access to monitoring data, which are posted as they become available, and information related to the Implementation Plan, including maps of the monitoring region and details of the monitoring sites. Feedback from stakeholders is informing improvements to the Portal, such as an improved search function, that will be implemented in year three (2014–2015).





Monitoring data and information collected under JOSM by government is available on the JOSM web portal and via original data sources. The first (2012–2013) JOSM Annual Report was released and posted on the JOSM Portal. Links to JOSM data can be found at the following locations:

- *JOSM Portal* - [www.jointoilsandsmonitoring.ca](http://www.jointoilsandsmonitoring.ca)
- *CASA Data Warehouse* - [www.casadata.org](http://www.casadata.org)
- *Wood Buffalo Environmental Association* - [www.wbea.org](http://www.wbea.org)
- *Lakeland and Industry Community Association* - [www.lica.ca](http://www.lica.ca)
- *RAMP* - [www.ramp-alberta.org/ramp/data.aspx](http://www.ramp-alberta.org/ramp/data.aspx)
- *ABMI* - [www.abmi.ca/abmi/home/home.jsp](http://www.abmi.ca/abmi/home/home.jsp)

Going forward, implementation of the Data Management Framework will facilitate a single web-entry point to all JOSM-generated data, including data from delivery organizations. Continued improvements to the web portal will include additional data access, search features, and further alignment with the Government of Canada and Government of Alberta Open Data programs.

Work done under data management in year two contributed to ensuring transparency through providing accessible, comparable and quality-assured data.

#### **Highlights of commitment on transparent and accessible results:**

- Data Sharing and Information Release Protocol released in December 2013.
- Implementation of a Data Management Framework to facilitate a single web-entry point to all JOSM-generated data.
- Canada-Alberta Oil Sands Environmental Monitoring Information Portal launched on April 22, 2013.



## 3.0 Next Steps

Progress was made in the second year of JOSM implementation. Enhancements to the environmental monitoring system as outlined in the Implementation Plan were made; processes and governance structures as well as funding mechanisms to support oil sands monitoring, were successfully established.

Implementation activities are underway for year three (2014–2015), and JOSM will continue to adapt based on lessons learned from the first two years to successfully execute year three of the Joint Canada/Alberta Implementation Plan for Oil Sand Monitoring.

In year three, governments will be wholly responsible for the collection and management of all funds related to JOSM and the JOSM fiscal year will be standardized for all participants as April 1 to March 31. A single, integrated, government-led planning and engagement process will be implemented. CAC roles and responsibilities will become technical in nature, with processes established to ensure consistency in work planning activities across the CACs as outlined in the revised Terms of Reference for the CACs.

Aboriginal and stakeholder participation continue to be a vital part of the JOSM program. Through the JOSM engagement process, oil sands-related sectors and stakeholders will continue to be invited to receive information and provide their input on JOSM activities. Focused dialogue will continue with Aboriginal peoples to ensure that JOSM is effective in responding to their interests and concerns, as well as identifying ways and means of encouraging sustained Aboriginal participation, and facilitating the inclusion of TEK within JOSM. Greater project management will be implemented to provide improved oversight of JOSM partners delivering monitoring work.

Achieving scientifically rigorous, comprehensive, and integrated environmental monitoring of the oil sands region will require the continued efforts of both Canada and Alberta, and all JOSM participants in the planning, implementation, evaluation and reporting of activities under the Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring.



## 4.0 Appendices

- A. [Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring \(“Implementation Plan”\)](#)
- B. [Oil Sands Environmental Monitoring Program Regulation](#)
- C. [2013–2014 JOSM Allocations and Expenditure](#)
- D. [Protecting Alberta’s Environment Act](#)
- E. [Multi-stakeholder Component Advisory Committees Terms of Reference \(Approved and adopted by co-Chairs as of May 31st, 2013\)](#)
- F. [JOSM Annual Work Plan for 2014–2015](#)
- G. [Report of the Multi-Stakeholder Meeting on the Canada-Alberta Joint Oil Sands Monitoring \(JOSM\) Implementation Plan \(June 11th 2013\)](#)
- H. [Oil Sands Monitoring Multi-Stakeholder Forum – Summary \(December 12 and 13, 2013\)](#)
- I. [Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring Data and Results Sharing and Release Principles and Protocols](#)



## 5.0 References

Alberta Environment and Environment Canada. 2013. *Oil Sands Monitoring Multi-Stakeholder Forum – Summary (December 12 and 13, 2013)*. Government of Alberta, Edmonton, AB, Canada, 17 p.

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Environment Canada and Alberta Environment. 2013. *Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring Data and Results Sharing and Release Principles and Protocols*.

Environment Canada and Alberta Environment. 2013. *Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring—Charter*.

*Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring—Communications Strategy (in draft, approval pending)*

*Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring—Engagement Strategy (in draft, approval pending)*



## 6.0 Acronyms

|        |   |
|--------|---|
| ABMI   | Alberta Biodiversity Monitoring Institute                         |
| AEMERA | Alberta Environmental Monitoring, Evaluation and Reporting Agency |
| CAC    | Component Advisory Committees                                     |
| CAPP   | Canadian Association of Petroleum Producers                       |
| CASA   | Clean Air Strategic Alliance                                      |
| EC     | Environment Canada  |
| EPEA   | Environmental Protection and Enhancement Act                      |
| ESRD   | Environment and Sustainable Resources Development                 |
| JOSM   | Joint Oil Sands Monitoring  |
| NWT    | Northwest Territories   |
| RAMP   | Regional Aquatics Monitoring Program                              |
| TEK    | Traditional Ecological Knowledge                                  |
| TWG    | Transition Working Group  |

## 7.0 Technical Annex

Monitoring activities implemented for year two (2013–2014) are categorised into the following components: air, water, biodiversity and wildlife health. A summary of the results of work done in the second implementation year to monitor the impacts of oil sands activities in the region is presented in tables as an annex to this report.

| IMPLEMENTATION PLAN ACTIVITIES   | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--|--|---|
| <p><b>Table 1 – Air Quality Implementation Plan Activates (p. 17 in the original plan)</b></p> |  |   |
| <p><b>Element – Ambient Air Quality</b></p>  |  |   |
| <p>Ambient Air Monitoring</p>  | <p>Continuation and expansion of ambient monitoring network, consistent with the Integrated Monitoring Plan.</p>   | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Wood Buffalo airshed               <ul style="list-style-type: none"> <li>- Design, purchase and installation of Wapasu station (AMS-17);</li> <li>- Progress made to secure land, design and purchase equipment for Conklin Fire Tower (AMS-18); and</li> <li>- Developed, deployed solar-powered, low-flow continuous denuders for more accurate measurement of nitrogen deposition.</li> </ul> </li> <li>● Lakeland airshed               <ul style="list-style-type: none"> <li>- Implemented more stringent detection limits for volatile organic compounds (VOCs) and polycyclic aromatic compounds (PACs); and</li> <li>- Added methane/non-methane hydrocarbons (NMHC) analyzers at the portable station and the ability to trigger additional sampling during high NMHC events for addressing odour issues.</li> </ul> </li> </ul> |
| <p>Fixed Platforms</p>   | <p>Installation of three additional ecosystem, transformation and deposition sites in and around the oil sands area.<br/>Continuation of measurements at 4 existing sites.</p> | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● The ecosystem site, Island Falls, SK, has been operational since October 2012; in 2013–2014, work continued on installation of the sites in Wood Buffalo National Park, NT; Pinehouse Lake, SK; Jossard, AB; and Flat Valley, SK.</li> <li>● Continued enhanced monitoring for total gaseous mercury (TGM), speciated mercury and/or BTEX (benzene, toluene, ethylbenzene and xylenes) at the Patricia McInnes (AMS-6), Lower Camp (AMS-11), Bertha Ganter (AMS-1), and Buffalo Viewpoint (AMS-4) sites</li> </ul>  |
| <p>Development of oil sands upwind site.</p>   |  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Ongoing site preparation for installation of upwind site in Jossard, AB</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES               | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--|--|---|
| Monitoring Pollutant Transformation          | Continue seasonal studies on pollutant transformation.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Summer 2013 intensive monitoring campaign completed, including: <ul style="list-style-type: none"> <li>- An airborne component; and</li> <li>- A ground-based component in Fort McKay (Fort McKay South site, AMS-13, was enhanced to accommodate additional equipment in support of the intensive study).</li> </ul> </li> <li>• A ground-based monitoring site (Oski-ötin) was established in the community of Fort McKay, with the assistance of the Fort McKay First Nation, in June 2013.</li> </ul>   |
| Remote Sensing and Modelling                 | Use remote sensing to produce maps of additional pollutants; use models to produce high-resolution air pollutant maps. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Evaluating the latest NASA sulphur dioxide (SO<sub>2</sub>) dataset from the Ozone Monitoring Instrument (OMI) to develop space-based trends in SO<sub>2</sub> (~late 2014).</li> <li>• Acquired measurements of methanol, ammonia, carbon monoxide have from the (TES) Thermal Emission Spectrometer satellite instrument; analyses of these data are underway.</li> <li>• Analyzing satellite measurements of aerosols over the surface mining areas is ongoing.</li> <li>• Developed Air Mapping Tool for the oil sands region.</li> <li>• Worked with National Center for Atmospheric Research (NCAR) on the use of satellite remote sensing data.</li> <li>• Continued measurements with two Environment Canada autonomous aerosol LIDAR systems (deployed in December 2012 and July 2013).</li> <li>• Tested and validated Alberta Advanced Air LIDAR.</li> </ul> |
| Focused Studies                              | Studies on odours, degraded visibility, tree rings and fingerprinting data from oil sands specific sources.            | <ul style="list-style-type: none"> <li>• 2013–2014 commitment on tree rings and fingerprinting work met.</li> <li>• Conducted work under the Monitoring Pollutant Transformation study, which will inform understanding of compounds and atmospheric processes causing odour and/or visibility issues.</li> </ul>   |
| <b>Element – Source Emissions Monitoring</b> |  |   |
| Emissions Inventories                        | Identify gaps in emissions inventories and begin to address information needs.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Finalized report <i>Review of Oil Sands Air Emissions Inventories</i> in December 2013.</li> <li>• Compiled and assessed emissions data from multiple sources, and emissions for each oil sands site projected for 2013.</li> <li>• Identified possible information gaps in PAH and mercury emissions in oil sands inventories.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES      | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|-------------------------------------|---|---|
| Point Sources (stacks and fugitive) | Obtain additional point source data to develop/validate emission factors.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Analyzed CEMS (Continuous Emissions Monitoring Systems) data to compare to reported emissions for any daily/seasonal variations.</li> </ul>   |
| Tailings Ponds                      | Additional monitoring to address gaps in emissions inventories.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met via the aircraft portion of the summer 2013 intensive monitoring campaign.</li> </ul>   |
|                                     | Continuation of studies on tailings ponds emissions.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met by.</li> <li>• Conducted facility-based monitoring of emissions under the aircraft portion of the summer 2013 intensive monitoring campaign.</li> <li>• Monitored one tailings pond—additional monitoring postponed to subsequent years.</li> <li>• Developed an autonomous mobile platform for tailings pond air concentration/emission monitoring.</li> </ul> |
| Mobile and Area Sources             | On-board measurement on buses.  | <ul style="list-style-type: none"> <li>• Work postponed.</li> </ul>   |
|                                     | Development of emissions factors for heavy haulers.   | <ul style="list-style-type: none"> <li>• Work postponed.</li> </ul>   |
|                                     | <i>Additional Progress</i>  | <ul style="list-style-type: none"> <li>• Conducted aircraft-based sampling of emissions from facilities, which include all point, fugitive and area sources from within a delineated flight box as part of the summer 2013 intensive monitoring campaign, and initiated analysis of the measurements.</li> </ul>  |
| <b>Element – Deposition</b>         |   |   |
| Ecosystem Exposure                  | Measurement of pollutants in ecosystem settings to determine deposition and exposure. Link to wildlife monitoring in Table 3 below. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Implemented passive monitoring for PACs at 16 sites.</li> <li>• Co-located passive samplers with bird boxes at various sites to support avian effects studies.</li> </ul>   |
|                                     | Measurement of dry deposition flux.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Work ongoing to measure dry deposition fluxes for PACs.</li> </ul>  |
| Forest Critical Loads               | Improve forest critical load exceedance maps.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Work ongoing to improve forest critical loads and exceedance maps.</li> </ul>   |



| IMPLEMENTATION PLAN ACTIVITIES | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS   |
|--------------------------------|--|--|
| Enhanced Deposition            | Continue measurement of polycyclic aromatic compounds and particulate metals at 3 sites. Add 2 additional sites. | <ul style="list-style-type: none"> <li>2013–2014 commitment met to measure PACs and particulate metals at 3 sites met [Mannix (AMS-5), Fort McKay South (AMS-13) and Lower Camp (AMS-11)].</li> <li>Enhanced the Fort McKay Bertha Ganter site (AMS-1) to house enhanced deposition equipment.</li> <li>Progress made towards preparation (legal and permitting) of Buffalo Viewpoint station (AMS-4) to upgrade for enhanced deposition.</li> </ul>   |
| Deposition Modeling            | Deposition modelling using most recent data.   | <ul style="list-style-type: none"> <li>2013–2014 commitment met.</li> <li>Completed and archived for future use daily forecasts from GEM-MACH (Global Environmental Multi-scale —Modelling Air quality and Chemistry) simulations.</li> <li>Conducted twice-daily forecast runs in support of the summer 2013 intensive monitoring campaign to inform locations of flights.</li> <li>Modified GEM-MACH to include outputs of sulphur and nitrogen deposition, in order to estimate deposition and calculate critical loads exceedances.</li> </ul> |
| <b>Element – Crosscutting</b>  |  |  |
| QA/QC – Air Short Term Study   | Standards and QA/QC work were carried out to support the commitments in the implementation plan.                 | <ul style="list-style-type: none"> <li>Developed Air Data QA/QC Guidance Document for Short Term Studies.</li> <li>Developed inventory of Standards and Protocols template for air monitoring; relevant information were collected from EC, ESRD, and monitoring organizations.</li> </ul>   |

| IMPLEMENTATION PLAN ACTIVITIES  | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|---|---|---|
| <p><b>Table 2 – Water Implementation Plan Activities (p. 19 in the original plan)</b></p> |   |   |
| <p><b>Element – Surface Water Quality/Surface Water Quantity/Sediment</b></p>             |   |   |
| <p>Mainstem Water Quality</p>   | <p>Increase sampling frequency to monthly at specific sites.</p>  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Increased sampling frequency to monthly at M6.</li> </ul>   |
|   | <p>Continue and increase comparability studies and laboratory round-robin.</p>  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Conducted joint field method comparability studies by ESRD and EC in 2012. Analysis of these studies is ongoing.</li> <li>● Studies conducted by ESRD beginning 2013 to assess comparability of samples collected at two Athabasca River monitoring sites. These studies are ongoing and will require the collection of three years of data.</li> <li>● Assessed the comparability of analytical methods for the polar organic fraction initiated with a review in 2011 is ongoing.</li> <li>● Inter-lab comparisons conducted by ESRD and EC in 2013 to assess comparability of analyses for metals and organics in snow samples. Additional comparisons, assessment and follow-up are ongoing.</li> </ul> |
|   | <p>Continue to implement items identified in 2011–2012 and 2012–2013 and phase in monitoring of additional sites.</p> | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Continued monthly sampling at M4 and M5.</li> <li>● Continued quarterly sampling at M3, M7.</li> <li>● Continued water quality sampling with benthos/CABIN mainstem work to provide greater geographical coverage for water quality information.</li> </ul>   |

| IMPLEMENTATION PLAN ACTIVITIES  | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015                      | PROGRESS AGAINST COMMITMENTS   |
|---|---|--|
| Tributary Water Quality   | Continue sampling and implement remaining upstream and headwater tributary sites. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Sampled 85% of the core monitoring sites identified in the Phase 1 Plan that are to be in place under full implementation (2015).</li> <li>• Sampled 63 sites in total in 2013.</li> <li>• Monitored 25 key sites on a monthly basis.</li> <li>• Conducted intensive (more than 2 times per week) sampling at 13 strategic locations.</li> <li>• Continued benthos/CABIN and fish work to provide water quality information.</li> <li>• Incorporated additional sites to link with effects based monitoring (also event-based).</li> <li>• Initiated comparative assessment with other agencies.</li> <li>• Additional upstream control monitoring sites added to each tributary.</li> </ul> |
|   | Continue Benthos/CABIN and fish work supporting water quality.                    | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Continued water quality sampling with benthos/CABIN and fish work to provide greater geographical coverage for water quality information.</li> </ul>   |
| Expanded Geographic Extent (Peace Athabasca Delta; Slave River; Lake Athabasca) | Continue sampling and implement up to 10 additional sites.                        | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Collected surface water samples monthly (except during river freeze-up and break-up periods) at 12 sites (M9, M10, M11a, M12, B11, BU1, BU2, MC1, R11, OU1, SL1, SL2).</li> <li>• Increased the number of monitoring locations from 9 to 12 (additional sites: BU1, BU2, MC1).</li> <li>• Deployed passive samplers monthly in open water at three sites (M9, M11a, M12).</li> <li>• Deployed automated samplers at two sites for two months each (M9, M11a).</li> </ul>   |
| Event-based Sampling  | Continue monitoring program as established.                                       | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Monitored tributary water quality during the Freshet (snowmelt period) every second day at key tributary locations, reducing over time to twice weekly, then weekly, and then twice monthly at 12–14 sites.</li> <li>• Continuously monitored 13 sites.</li> <li>• Conducted ‘event-based’ sampling (rainfall/runoff events) starting in July at 6 sites (2 sites each on the Steepbank, McKay, and Ells rivers).</li> </ul>   |

| IMPLEMENTATION PLAN ACTIVITIES | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015                      | PROGRESS AGAINST COMMITMENTS  |
|--------------------------------|---|---|
| Passive Sampler Program        | Increased number of sites to full implementation and increase sampling frequency. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Deployed and retrieved passive samplers at mainstem sites M0, M1, M4, M7 and M9 (and on the Slave and Peace rivers as part of Extended Geographical Area).</li> <li>• Implemented Passive Suspended Sediment Sampling with monthly deployments (M0, M2, M3, M4, M7 and M9).</li> <li>• Deployed and retrieved passive samplers on the Steepbank, Ells, Mackay, Firebag, Joslyn, and Birch rivers.</li> <li>• Deployed and retrieved passive sampling devices in deltaic wetlands in mid-summer in the PAD.</li> </ul>   |
| Groundwater Quality            | Continue monitoring program as per Baseline year.                                 | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Surface/Groundwater Interaction               <ul style="list-style-type: none"> <li>- Investigated potential groundwater discharge locations identified on Mackay River in FY12/13.</li> <li>- Tested DTS system for local detection of groundwater discharge on the Steepbank River.</li> <li>- Tested direct measurement of river discharge (seep) to quantify net groundwater input on selected reaches (Steepbank &amp; Ells), complemented with geochemical &amp; temporal temperature data.</li> <li>- Collected samples from 19 seep sites along the Athabasca and Clearwater rivers.</li> </ul> </li> <li>• Groundwater Source Identification               <ul style="list-style-type: none"> <li>- Collected 23 large-volume groundwater samples across region for background geochemistry &amp; 4 from Pond 1/Ells River for TIE analyses.</li> <li>- Completed a validation study of multi-marker approach for identifying Oil Sands Process Water (OSPW) in groundwater.</li> </ul> </li> <li>• Groundwater Seeps               <ul style="list-style-type: none"> <li>- Sampled groundwater seeps at 5 locations on tributaries and Athabasca mainstem in June or July to assess influence on interpretation of surface water quality.</li> <li>- Sampled deeper groundwater seeps from Devonian carbonates on the Athabasca mainstem and its tributaries to compare against shallow groundwater contributions and begin establishing a temporal record of deeper groundwater contributions to the Athabasca River.</li> </ul> </li> </ul> |

| IMPLEMENTATION PLAN ACTIVITIES | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--------------------------------|--|---|
| Water Quantity                 | <p>Mainstem: Consider new hydromet station at a key location to be determined.</p> <p>Tributary sites and Expanded Geographical Extent: add additional tributary hydromet measurement coincident with water quality monitoring sites, as per the Integrated Monitoring Plan.</p> | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Initiated scoping exercise.</li> <li>● Initiated development of a continuous sediment flux program.</li> <li>● 2013–2014 commitment met.</li> <li>● Switched eight stations to annual (year-round) from seasonal (open water period).</li> <li>● Completed station audit for RAMP hydrometric sites.</li> <li>● WSC to implement hydromet station at M9, upper Steepbank hydromet station implemented by Alberta/Hatfield.</li> </ul> |

| IMPLEMENTATION PLAN ACTIVITIES   | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS   |
|--|--|--|
| <p>Modelling (formerly River Ice Modelling)</p>  | <p>Implement up to 8 more sites on the Athabasca mainstem; increase monitoring frequency.</p>  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Monitored 2013 and 2014 ice break up at many locations along the Athabasca mainstem and in the PAD to provide required supporting information for river ice dynamics modelling.</li> <li>● The actual number and location of sites vary from year to year, depending on the nature of the river ice breakup; monitor locations are determined based on previous year's observations along with current year visual observations made from aircraft during breakup; pressure transducers installed at key locations.</li> <li>● Integration of ice dynamics modelling on sediment and contaminant transport in LAR 2D models.</li> </ul>  |
| <p><i>Additional progress</i></p> <p>Develop hydro-climatic, hydrologic, and hydraulic models for prediction of water quantity and quality and sediment transport.</p> <p>Model sediment dynamics within selected tributaries (relates to REPS below)—complete Ells River model; initiate Steepbank model.</p> | <p><i>Additional progress</i></p> <p>Develop hydro-climatic, hydrologic, and hydraulic models for prediction of water quantity and quality and sediment transport.</p> <p>Model sediment dynamics within selected tributaries (relates to REPS below)—complete Ells River model; initiate Steepbank model.</p> | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Sediment Transport/Dynamics (Modelling) <ul style="list-style-type: none"> <li>- Completed Ells River model and modelling is underway.</li> <li>- Initiated Steepbank River model. Sediment deposition and erosion characterization underway (5m annular flume work occurring now). Microbial characterization underway.</li> </ul> </li> <li>● Developing predictions for water quantity and quality and sediment transport in the Mainstem and Tributaries <ul style="list-style-type: none"> <li>- Completed Active Suspended Sediment Collection at sites M0, M2, M3, M9 during open water high flow, open water low flow and under ice.</li> <li>- Conducted two 5m annular flume experiments as input to numerical models of sediment transport on both tributaries and main stem.</li> </ul> </li> <li>● Hydrological and Climatic Modelling <ul style="list-style-type: none"> <li>- Collected and assessed multi-year historical data.</li> <li>- Assessed Hydro-Climatic variability and extremes.</li> <li>- Modelled water availability based on climate and hydrologic models.</li> </ul> </li> <li>● Hydraulic Modelling <ul style="list-style-type: none"> <li>- Completed initial 1D numerical model of flow and sediment transport in the Lower Athabasca River (LAR) (250Km from Crooked Rapids to Old Fort).</li> <li>- Completed initial 2D numerical model of flow and sediment transport in the LAR and a focus on a 20Km reach above and below Steepbank River—EFDC (common platform between EC and Alberta).</li> <li>- Completed initial modelling of sediment and contaminant transport in Mainstem (near Steepbank) and tributaries.</li> </ul> </li> </ul> |

| IMPLEMENTATION PLAN ACTIVITIES         | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015                                     | PROGRESS AGAINST COMMITMENTS   |
|--|--|--|
| Sediments                              | Benthos/CABIN and fish work to generate supporting sediment quality data.                        | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Continued Benthos/CABIN and fish work.</li> </ul>  |
|  | New mainstem hydromet station indicated to collect sediment samples.                             | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Initiated development of a continuous sediment flux program, initial sampling at M3.</li> </ul>  |
|  | Continue mainstem historic method sediment sampling. Expand sediment sampling at mainstem sites. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Historical method sediment sampling was determined to be no longer an option. Continued sediment quality sampling with benthos/CABIN work in mainstem to provide greater geographical coverage.</li> </ul>   |
|  | Full scope of sampling of sediment cores from small lakes implemented.                           | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Sampled 6 additional lakes in March 2013.</li> </ul>   |
|  | Process-based sediment monitoring in mainstem/tribes; implement remaining sites.                 | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Completed Bulk Suspended Sediment Collection <ul style="list-style-type: none"> <li>- Centrifuged for sediment quality and sediment physical characteristics.</li> <li>- Collected large volume bed sediment (100 Kg) and water (800 L) from the Steepbank River within an area of benthic effects monitoring and from the main stem Athabasca River within an area of deposition.</li> </ul> </li> <li>• Completed suspended sediment sampling <ul style="list-style-type: none"> <li>- Winter only (under ice) on Mainstem M0, M2, M3, M9.</li> <li>- Tributaries [Ells (3) and Steepbank (4)] (Time integration monthly).</li> <li>- Mainstem at M0, M2, M3, M4, M7, M9 (Time integrated monthly).</li> </ul> </li> <li>• Added bathymetry information to Habitat Mapping Surveillance Program. Completed a 60km swath bank to bank between FM and HWY 63 bridge and additional swaths to M7 (some gaps). Reswathed M3, M4 and M5 for year to year comparison. Completed LIDAR – Alberta raw LIDAR data agreement and contract to interpret/map LIDAR.</li> <li>• Constructed sediment rating curves for Athabasca and tributaries of suspended loads to use as boundary conditions in sediment transport model.</li> </ul> |
| <b>Element – Benthic Invertebrates</b> |  |  |
| Mainstem                               | Mainstem – Continue all sites.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Continued sampling 11 sites (from M0 down to M9).</li> <li>• Retrieved all available historical data and assessed for spatial &amp; temporal coverage.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES   | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--|--|---|
| Tributaries  | Implement up to 30 additional sites focusing on enhanced coverage of reference locations.              | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Conducted more than 120 site visits with full sampling protocol at greater than 60 tributary sampling reaches, plus 25 joint mesh size comparative samples for methodological comparisons.</li> <li>● Sampled an additional 70+ tributary locations in 2013–2014 in the lower Athabasca and in the downstream receiving environments (EGA).</li> <li>● Retrieved all available historical data and assessed for spatial &amp; temporal coverage.</li> <li>● Conducted methods comparison at 6 reaches with 5 of 10 riffles sampled (MacKay, Steepbank and Ells – upper / lower sites) with side by side sampling for a total of 45 comparative samples.</li> <li>● Initiated benthic invertebrate community assessment in both erosional and depositional zones, includes Southern operators region.</li> </ul> |
| Deltaic Ecosystem Health   | Biota/WQ/Sediments complete implementation of all sites as per Plan at the increased sample frequency. | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Sampled 12 Peace Athabasca Delta sites + 6 Slave Delta sites for water quantity and sediments at the increased frequency as per Plan. <ul style="list-style-type: none"> <li>- Instrumented representative PAD wetlands in April/May to measure year-round water temperature, dissolved oxygen, water balance, hydro-period and connectivity to main flow system.</li> <li>- Continued work examining historical and future water availability in PAD wetlands.</li> <li>- Continued work on synthesizing available flood history and historical water level/saturated area information for PAD basins.</li> <li>- Continued surface elevation and bathymetric surveys of study sites using ground and aerial based approaches (LiDAR and total station survey).</li> </ul> </li> </ul>                         |
| <b>Element – Snow/Wet Precipitation (Acid Deposition to Acid-Sensitive Lakes and Snowpack)</b> |  |   |
| Snow and Atmospheric Deposition  | All snow sites continue monitoring.  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Continued snow monitoring to confirm deposition estimates.</li> </ul>   |
|  | Wet precipitation sites co-located with three WBEA sites: ongoing.                                     | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Continued ongoing monitoring of wet precipitation.</li> </ul>   |



| IMPLEMENTATION PLAN ACTIVITIES                      | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|---|---|---|
| <b>Element – Fish Health/Toxicology/Contaminant</b> |   |   |
| Wild Fish Health                                    | Mainstem: all sites fully implemented by Year 2.<br><br>Tributaries: All sites fully implemented by Year 3.                                 | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Monitored all 6 mainstem Fish Health sites monitored (an increase of 1 site from FY 2012–2013).</li> <li>• 2013–2014 commitment met.</li> <li>• Monitored all 13 tributary Fish Health sites (an increase of 1 site from FY 2012–2013).</li> </ul>  |
| Wild Fish Communities / Species Diversity           | Mainstem: all sites fully implemented at existing frequency.<br><br>Tributaries: all sites fully implemented at existing frequency.         | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Monitored all 17 Fish Community sites at existing frequency (3x/year).</li> <li>• 2013–2014 commitment met.</li> <li>• Monitored all 39 tributary Fish Community sites (includes Delta sites).</li> </ul>   |
| Fish Toxicology                                     | Tributaries – sampling program to continue.<br><br>Snow – current snow sites.<br><br>Ponds – ponds, seeps and groundwater to be determined. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Completed laboratory fish and invertebrate bioassays to assess the toxicology of oil sands substances sampled including river waters, sediments, suspended sediments, groundwater, depositional samples (snow) and erosional samples (freshet).</li> <li>• 2013–2014 commitment met.</li> <li>• Continued current snow site sampling for toxicological assessment.</li> <li>• 2013–2014 commitment met.</li> <li>• Continued environmental samples with emphasis on groundwater in 2013.</li> </ul> |
| Riverine In-situ Bioassays                          | Continue sampling program.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Completed caged Hyalella (2 weeks - 9 tributary sites – fall) and caged mussels (1 month - 9 tributary and mainstem sites – fall).</li> </ul>   |
| Lake Health (Fish/Invertebrates)                    | Continue sampling program.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Continued RAMP/Hatfield lake sampling program.</li> </ul>   |

| IMPLEMENTATION PLAN ACTIVITIES                     | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS   |
|--|--|--|
| <b>Element – Acid-Sensitive Lakes</b>              |  |  |
| Acid-Sensitive Lakes                               | 300 sites or more.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Assessed nearly 350 lakes in 2012-13 to inform selection of the level 2 and level 3 lakes to be monitored.</li> <li>• Produced lake survey database (inclusive of field observations and chemistry data from nearly the 350 level 1 lakes).</li> </ul>   |
|  | Align work under RAMP with results from assessment and lake surveys.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Added another 22 RAMP lakes to the network of lakes being monitored.</li> </ul>  |
|  | Conduct additional tiered samples of lake systems as informed by previous years' status and trends analysis. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Sampled Level 2 lakes in Alberta, Saskatchewan, and Northwest Territories, continued baseline characterization and initiated paleoecological analyses.</li> <li>• Selected Level 3 lake ecosystems in Saskatchewan, continued evaluation of candidate lakes in Alberta for Level 3 intensive monitoring, and began instrumentation of selected lakes.</li> </ul>   |
| <b>Element – Focused/Site-specific Assessments</b> |  |  |
| Representative Sub-basin Studies (REPS)            | Examine other potential REP candidates; ongoing analyses/sampling.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Established 8 REPS sites: 4 on the Steepbank; 3 on the Ells; 1 river reach of the Athabasca Mainstem below Fort McMurray.</li> <li>• Integrated process-based measurements (sediment transport/dynamics, fish and invertebrate health, water quality parameters, water quantity (flows), sediment quality parameters, in-situ toxicology, etc.).</li> <li>• Improved data to parameterize models/decision-frameworks (water quantity/quality/ecosystem health, cumulative effects).</li> </ul> |
| Mainstem – paired buoys                            | Continue buoy deployment during open-water season. Add future instrumentation as feasible.                   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment deferred.</li> <li>• Deployed two river platforms with multiple WQ, sediment, hydraulic instruments at two sites (M9, M11a), open-water season.</li> </ul>   |

| IMPLEMENTATION PLAN ACTIVITIES   | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--|--|---|
| <b>Table 3 – Wildlife Contaminants and Toxicology Monitoring Program Implementation Plan Activities (p. 23 in the original plan)</b> |  |   |
| <b>Element – Wild Bird Health and Contaminants</b>   |  |   |
| Colonial Water Bird Health and Contaminants  | Gulls and Terns: Eggs collected at least at the following locations: Rocky Point (WBNP), Mamawi Lake (WBNP) and Egg Island (Lake Athabasca).   | <ul style="list-style-type: none"> <li>2013–2014 commitment met at Mamawi Lake (WBNP), Egg Island (Lake Athabasca) and Dalmead Reservoir (reference site near Calgary).</li> <li>Completed reconnaissance. Permitting activities are underway in preparation for additional egg collections for 2014 breeding season.</li> </ul>  |
| Insectivorous Bird Health and Contaminants   | Swallows: Eggs collected at least at the following locations: N and S of Fort MacKay, S N of Fort McMurray (reference).  | <ul style="list-style-type: none"> <li>2013–2014 commitment was not met.</li> <li>Collected eggs from the N of Fort Chipewyan. Tremendous effort was made to locate and sample colonies with little success.</li> <li>This work requires a significant effort to locate and sample breeding colonies to ensure a sufficient number of eggs are collected. Considering alternate mechanisms (e.g. monitoring contaminants in swallow food sources) to monitor contaminant uptake to wildlife.</li> </ul> |
| <b>Element – Amphibian Health/Toxicology/Contaminants</b>  |  |   |
| Wild Amphibian Health Contaminants   | Amphibian samples collected from ponds in the Fort McMurray area and from ponds over an expanded geographical area at increasing distances from Fort McMurray with continued monitoring at 2 sites in NWT and various sites in Alberta (up to 40 ponds). | <ul style="list-style-type: none"> <li>2013–2014 commitment met.</li> <li>Wetlands surveyed for potential monitoring, expanded coverage includes 21 core monitoring ponds assessed for wetland health and contaminant levels in biotic and abiotic components.</li> </ul>   |
| Amphibian Laboratory Exposures and Effects   | Assessing impacts of water quality on amphibians using pond water, snow melt, and in situ exposures.   | <ul style="list-style-type: none"> <li>2013–2014 commitment initiated.</li> <li>Exposures completed using field-collected sediment only. Pond water and snow melt exposure deferred.</li> <li>Exposure experiments on sediments completed in laboratories.</li> </ul>   |
| <b>Element – Bird Health and Toxicology</b>  |  |   |
| Laboratory Exposure and Effects – Air Emissions  | Exposures of laboratory birds to VOCs and SO <sub>2</sub> .  | <ul style="list-style-type: none"> <li>2013–2014 commitment met.</li> <li>Data analyzed and report drafted.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES   | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS   |
|--|---|--|
| Field Exposure and Effects – Air Emissions / PAHs  | Nest boxes installed radially around three processing plant and in reference location.  | <ul style="list-style-type: none"> <li>2013–2014 commitment met</li> <li>Monitored air contaminants and tree swallow nestling health and development via nest boxes and passive air samplers at two sites near oil sands industrial activity and one reference site.</li> </ul>  |
| <b>Element – Wild Bird and Hunter/Trapper Harvested Wildlife Toxicology and Contaminants</b> |   |  |
| Dead and Moribund Bird Contaminants and Toxicology   | Birds collected from tailings ponds near Fort McMurray (event-based).   | <ul style="list-style-type: none"> <li>2013–2014 commitment partially met.</li> <li>Finalized an agreement with industry to obtain and assess collected birds.</li> </ul>  |
| Hunter/Trapper Harvested Wildlife Contaminants and Toxicology                                | Mallards, otters harvested/trapped at locations in NWT and northern Alberta. Target sample of 20 animals at each location and up to 100 mallards and 60 otters processed for contaminants and toxicology. | <ul style="list-style-type: none"> <li>2013–2014 commitment met.</li> <li>Harvested mallard ducks at locations upstream and downstream of oil sands operations with semi-aquatic mammals (otters, mink and muskrat) collected at the same sites; terrestrial carnivores (marten, fisher and lynx) obtained from trap lines, for contaminant analyses.</li> </ul> |
| <b>Element – Plant Health and Contaminants</b>   |   |  |
| Laboratory Phytotoxicity and Contaminants  | Greenhouse exposures to $\text{Na}_2\text{SO}_4$ , and naphthenic acids.  | <ul style="list-style-type: none"> <li>2013–2014 commitment partially met.</li> <li>Completed greenhouse exposure experimental work by examining a combination of effects of selenium and <math>\text{Na}_2\text{SO}_4</math>.</li> </ul>  |
| Field Vegetation Assessment/Contaminants   | Vegetation assessments undertaken at up to 10 sites in NWT, northern Alberta and Saskatchewan, including along the Athabasca River and in reference sites.  | <ul style="list-style-type: none"> <li>2013–2014 commitment met</li> <li>Recorded at 12 sites (7 disturbed and 5 more pristine), species composition and diversity and collected soil and plants for contaminants analyses.</li> <li>Established a soil seed bank for all sites.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES  | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|---|---|---|
| <b>Table 4 – Biodiversity and Land Disturbance Monitoring Implementation Plan Activities (p. 25 in the original plan)</b> |   |   |
| <b>Element – Core Terrestrial Biodiversity Monitoring</b>   |   |   |
|   | Fully implemented biodiversity program across 20x20km regularized grid with site visits every 5 years. Fully monitored area includes 3 oil sands areas (Athabasca, Cold Lake, and Peace) and all areas within the Lower Athabasca regional planning area (up to 90–100 sites/yr). | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met.</li> <li>• ABMI terrestrial and wetland protocols were completed at approximately 80 sites in the 3 oil sands areas.</li> <li>• ABMI did not operate at full capacity in the oil sands area due to reduced funding and challenges gaining access to the Cold Lake Air Weapons Range.</li> </ul>  |
|   | Periodic population or trend assessments of key provincial species (e.g., moose, deer, wolf).   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met               <ul style="list-style-type: none"> <li>- Conducted three aerial moose and deer surveys in Wildlife Management Units (WMU) 511, 515/651/841 and 726. An additional survey was to be completed in WMU 527 however weather and snow conditions did not allow survey to be completed. WMU 527 has been added to the 2014–2015.</li> <li>- Population and trend assessment of wolves not undertaken based on cost and technical feasibility considerations.</li> </ul> </li> </ul> |
| <b>Element – Cause-effects Monitoring</b>   |   |   |
|   | Cause-effects monitoring of key migratory songbirds and wetland-associated birds.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met for migratory forest songbirds but not for wetlands-associated birds as this was screened out during project prioritization.</li> <li>• Collected data on boreal landbirds at 3,615 point count sites across 39 habitat classes where data have been lacking.</li> </ul>  |
|   | Initial predictions of avian response to current and future land-use.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met.</li> <li>• Completed initial predictions of avian response to habitat supply based on current land use and pre-industrial (de-footprinted) landscape using models for 77 passerine species.</li> </ul>   |
| <b>Element – Measurement Harmonization</b>  |   |   |
|   | On-going system to coordinate biodiversity monitoring efforts by industry and other stakeholders into the core biodiversity monitoring program.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Deployed automated recording units (ARUs) by 6 energy companies in on-lease monitoring programs.</li> <li>• Piloted ARUs at 70 core biodiversity monitoring sites.</li> <li>• Tested ARUs in a community-led monitoring program.</li> <li>• Evaluated importance of survey length and observer effects on rare plant surveys.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES  | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|---|---|---|
|   | Development of standard protocols and processes for monitoring efforts in the oil sands areas for boreal songbirds. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Developed protocols for training and surveying of boreal songbirds, and standards for point count surveys of boreal songbirds.</li> </ul>   |
| <p><b>Element – Species at Risk (SAR) and Rare/Difficult Species Monitoring</b></p> <p>Surveys of boreal woodland caribou.</p> <p>Monitoring of Whooping Crane.</p> <p>Full implementation of status and trends and cause-effects monitoring for other key provincially and federally listed species and improved monitoring for rare/difficult to detect species.</p> <p>Implementation of specialized protocols for collecting data on key provincially and federally listed species.</p> |   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment partially met.</li> <li>• In coordination with ESRD’s provincial caribou program, 925 caribou fecal pellet samples were collected from 98 sites for DNA analysis from the Cold Lake caribou range. Samples have been sent to DNA lab for processing and analysis.</li> <li>• Completed required program elements to address assessment of boreal woodland caribou demographic rates and distribution. Work included: <ul style="list-style-type: none"> <li>- Capture and radio-collaring of 120 boreal caribou in oil sands region.</li> <li>- Recording of adult female caribou survival and estimation of annual mortality rates.</li> <li>- Determination of female calf caribou survival to 9 months of age.</li> <li>- Calculation of annual population growth rates for each boreal caribou population, including all populations overlapping with oil sands region.</li> </ul> </li> <li>• Continued monitoring of boreal caribou distribution in relation to delineated local population range.</li> <li>• 2013–2014 commitment met.</li> <li>• Monitored movement patterns and habitat use of 44 individually marked whooping cranes during fall 2013 migration.</li> <li>• 2013–2014 commitment met.</li> <li>• Sampled 15 terrestrial sites and 15 wetlands with various levels of human footprint to better understand its impact on biodiversity and assess trends.</li> <li>• Conducted Barred owl occupancy surveys at 495 sites across the oil sands region. Twelve owls were captured in 2013–2014 and GPS dataloggers attached to track their movements over the breeding season. Technical difficulties were encountered with data downloads from some the dataloggers. The manufacturer was contacted to resolve those issues.</li> <li>• 2013–2014 commitment met.</li> <li>• Surveyed 200 rare plant sites.</li> <li>• Surveyed 42 owl sites, 65 yellow rail sites, and 27 amphibian sites; developed automatic recognizers for barred owl and yellow rail sonograms using specialized protocols.</li> </ul> |

| IMPLEMENTATION PLAN ACTIVITIES                          | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015  | PROGRESS AGAINST COMMITMENTS  |
|---|---|---|
|   | Coordinated data collection of priority provincially and federally listed species.                                  | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met.</li> <li>● Coordinated among federal &amp; provincial governments and monitoring organizations responsibility for monitoring activities and ensured coordination and integration.</li> <li>● Established a Yellow Rail working group with both governments and industry to prioritize monitoring sites for Yellow Rail and coordinate surveys.</li> </ul>  |
| <b>Element – Human Disturbance Footprint Monitoring</b> |   |   |
|   | Development and implementation of wall-to-wall footprint mapping (extension from panels) with continued refinement. | <ul style="list-style-type: none"> <li>● 2013–2014 commitment met with ongoing activities for 2014–2015               <ul style="list-style-type: none"> <li>- Updates to the 2010 wall-to-wall human footprint GIS layer to 2012 conditions is ongoing, with a website release planned for late 2014.</li> <li>- Enhanced accuracy of GoA base features (cutline, pipelines, roads) in human footprint layer for the oil sands region to be included in the 2012 wall-to-wall human footprint layer.</li> <li>- Provided information to report on status of human footprint in oil sands region including change in human footprint between 2000 and 2012 based on the 3x7 km samples throughout the JOSM region.</li> </ul> </li> <li>● Initiated protocol refinement and QC better track trends in human footprint.</li> </ul> |
|   | Refinement of footprint types for key provincial species, forest songbirds and species at risk.                     | <ul style="list-style-type: none"> <li>● 2013–2014 commitment partially met               <ul style="list-style-type: none"> <li>- Detailed classes of human footprint was determined/summarized for field sites. visited during 2013–2014, and for all quarter sections in the JOSM region.</li> <li>- Some incorrect cutblock boundaries in the 2010 human footprint layer were corrected during 2013–2014 and cutblock age was completed June 2014.</li> </ul> </li> <li>● Developed a NSERC collaborative research and development project to test methods for monitoring vegetation recovery in 2013–2014.</li> </ul>  |

| IMPLEMENTATION PLAN ACTIVITIES | COMMITMENTS MADE IN THE IMPLEMENTATION PLAN FOR FY 2013–2015   | PROGRESS AGAINST COMMITMENTS  |
|--------------------------------|--|---|
| Element – Habitat Monitoring   | On-going augmented program to collect vegetation and other ground-based habitat data.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Developed PLVI request for 56 townships, awarded contract and had inventory completed.</li> <li>• On the ground habitat data collected at 95 ABMI sites.</li> </ul>   |
|                                | On-going augmented wall-to-wall land cover mapping.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met.</li> <li>• Combined existing wetland layers to create a province-wide wetland map based on the best information available.</li> <li>• Combined existing vegetation layers to create a province-wide vegetation map based on the best information available.</li> <li>• Vegetation map will be updated as new information becomes available.</li> </ul>                                       |
|                                | Continue work to assess potential of remote-sensed and high-resolution photo data for biodiversity prediction. Assess ability to interpret and classify data sources to provide key habitat features relevant to key species that are the focus of cause-effects monitoring. | <ul style="list-style-type: none"> <li>• 2013–2014 commitment met, with ongoing activities for 2014–2015.</li> <li>• Initiated discussion with organizations in Alberta to develop a vegetation monitoring initiative that builds on new remote sensing imagery.</li> <li>• Tested methods to extract ecosite information based digital elevation models. Further refinement of predictive ecosite mapping is occurring during 2014–2015.</li> </ul>            |
|                                | Through species-habitat modelling, identify key sources and sets of land cover, productivity, climate and other biophysical variables required for biodiversity prediction.  | <ul style="list-style-type: none"> <li>• 2013–2014 commitment ongoing.</li> <li>• Modeled species-habitat relationships to identify land cover and biophysical information that need to be included in the analyses. Modeling was conducted for more than 200 species: mammals, birds, vascular plants, mosses, lichens and mites.</li> <li>• Modeling will continue in 2014–2015 and if appropriate additional biophysical variables will be added.</li> </ul> |
|                                | Continue building library of land cover, productivity, climate and other biophysical data layers required for biodiversity prediction.   | <ul style="list-style-type: none"> <li>• 2013–2014 commitment completed, with ongoing activities for 2014–2015.</li> <li>• Used GIS information available on the internet to create GIS layers describing climate, topography, and soils throughout Alberta.</li> <li>• Converted the biophysical information into rasters that are perfectly aligned, and stored them on the ABMI website.</li> </ul>  |



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