

# 2023-2024 OSM WORK PLAN APPLICATION

This form will be used to assess the merits of the proposed work plan and its fit with the Oil Sands Monitoring (OSM) Program mandate and strategic priorities. Applicants must complete the form in its entirety. Applicants that fail to use this form and complete all sections in the timeframe will not be considered.

OSM Work Plan Submission Deadline: The deadline for submission of proposed work plans is <b>October 31, 2022 at 4:30 PM Mountain Standard time</b> . Late submissions will not be accepted.	<b>October 31, 2022</b> 4:30 PM MST
<b>Decision Notification</b>	Mid to Late March 2023

## WORK PLAN COMPLETION

Please **Enable Macros** on the form when prompted.

The applicant is required to provide information in sufficient detail to allow the evaluation team to assess the work plan. Please follow the requirements/instructions carefully while at the same time being concise in substantiating the project's merits. The OSM Program is not responsible for the costs incurred by the applicant in the preparation and submission of any proposed work plan.

**Privacy:** The OSM Program is governed by the Freedom of Information and Protection of Privacy Act (FOIP) and may be required to disclose information received under this Application, or other information delivered to the OSM Program in relation to a Project, when an access request is made by anyone in the public. Applicants are encouraged to familiarize themselves with FOIP. All work plans are public documents.

**Technical Requirements:** When working on this form, please maintain Macros compatibility by always saving your draft and your final submission as a **Microsoft Word Macro-Enabled Document**, failure to do so will result in loss of form functionality. This form was created using Microsoft word 2016 on a PC and may not have functionality on other versions of Microsoft on PC or MACS.

**Government Lead/Coordinator:** All work plans under the OSM Program require either a government lead or a government coordinator. This will ensure that the financial tables (for Alberta Environment and Parks & Environment and Climate Change Canada) are completed accurately for work plan consideration. **However**, if an **Indigenous community, environmental nongovernmental organization** or any other **external partner** is completing a work plan proposal, they would **only** complete the **grant or contract budget component** of the **Human Resources & Financials Section** for their project. The government coordinator within Alberta Environment & Parks would be responsible for completing the remaining components of the Human Resources and Financial Section of this Work Plan Application, as they are responsible for contract and grant facilitation of successful submissions. All other sections outside of **Human Resources & Financials Section** of this work plan proposal are to be completed in full by all applicants.

**Supplemental Materials:** The OSM Program recognizes that majority of work planning submissions are a result of joint effort and monitoring expertise. Should the applicant wish to submit supplemental materials in addition to their application additional resources are available in the Work Planning Package accessible here: [2023-24 Work Planning Package \(Ctrl+CLICK\)](#)

Should you have any **questions** about completing this work planning form or uploading your final submission documents, please send all inquiries by email to: [OSM.Info@gov.ab.ca](mailto:OSM.Info@gov.ab.ca).

## WORK PLAN SUBMISSION

Upon completion of this application, please submit the appropriately named work plan (**Microsoft Word Macro-Enabled Document**) and all supporting documents to the link provided below. Failure to follow the naming convention provided may result in oversight of your application.

Please upload (by drag and dropping) the **WORK PLAN SUBMISSION & ALL SUPPORTING DOCUMENTS** here:

### [WORK PLAN SUBMISSION LINK \(CTRL+CLICK HERE\)](#)

Please use the following file naming convention when submitting your WORK PLAN:

**202324\_wkpln\_WorkPlanTitle\_ProjectLeadLastNameFirstName**

**Example:**

*202324\_wkpln\_OilSandsResiduesinFishTissue\_SmithJoe*

If applicable, please use the following file naming convention when submitting your **supplementary or supporting files**. Please number them according to the guidance and examples provided:

**202324\_sup##\_WorkPlanTitle\_ProjectLeadLastNameFirstName**

**Examples:**

*202324\_sup01\_OilSandsResiduesinFishTissue\_SmithJoe*

*202324\_sup02\_OilSandsResiduesinFishTissue\_SmithJoe*

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*202324\_sup10\_OilSandsResiduesinFishTissue\_SmithJoe*

**Do not resave your work plan or documents under any other naming conventions.** If you need to make revisions and resubmit before the work planning deadline of October 31, 2022, **DO NOT** rename your submission. When resubmitting, simply resubmit with the exact naming convention so that it replaces the original submission. **DO NOT** add any additional components such as versioning or dates to the file naming convention. Please direct any questions regarding the submission or naming of submissions to [OSM.Info@gov.ab.ca](mailto:OSM.Info@gov.ab.ca).

# WORK PLAN APPLICATION

PROJECT INFORMATION	
<b>Project Title:</b>	Integrated Terrestrial Biological Monitoring
<b>Lead Applicant, Organization, or Community:</b>	Kristin Hynes, AEP
<b>Work Plan Identifier Number:</b> <i>If this is an on-going project please fill the identifier number for 22/23 fiscal by adjusting the last four digits: <b>Example:</b> D-1-2223 would become D-1-2324</i>	B-LTM-TB-1-2324
<b>Project Region(s):</b>	Oil Sands Region
<b>Project Start Year:</b> <i>First year funding under the OSM program was received for this project (if applicable)</i>	2019
<b>Project End Year:</b> <i>Last year funding under the OSM program is requested <b>Example:</b> 2024</i>	2024
<b>Total 2023/24 Project Budget:</b> <i>For the 2023/24 fiscal year</i>	\$6,945,848
<b>Requested OSM Program Funding:</b> <i>For the 2023/24 fiscal year</i>	\$6,259,348
<b>Project Type:</b>	Longterm Monitoring
<b>Project Theme:</b>	Terrestrial Biological Monitoring
<b>Anticipated Total Duration of Projects (Core and Focused Study (3 years))</b>	Year 5
<b>Current Year</b>	<b>Focused Study:</b> Choose an item.
	<b>Core Monitoring:</b> Year 4

CONTACT INFORMATION	
<b>Lead Applicant/ Principal Investigator:</b> <i>Every work plan application requires one lead applicant. This lead is accountable for the entire work plan and all deliverables.</i>	Kristin Hynes
<b>Job Title:</b>	Invertebrate Monitoring Biologist
<b>Organization:</b>	Alberta Environment and Protected Areas
<b>Address:</b>	4938 89 St. NW, Edmonton, AB, T6E 5K1
<b>Phone:</b>	780-422-9741
<b>Email:</b>	kristin.hynes@gov.ab.ca

## PROJECT SUMMARY

Should your application be successful, The OSM Program reserves the right to publish this work plan application. Please check the box below to acknowledge you have read and understand:

I acknowledge and understand

In the space below please provide a summary (300 words max) of the proposed project that includes a brief overview of the project drivers and objectives, the proposed approach/methodology, project deliverables, and how the project will deliver to the OSM Program objectives. The summary should be written in plain language.

Terrestrial biological resources support a wide breadth of values to those living in and around the oil sands region (OSR) of Alberta, including cultural and spiritual components, harvesting and subsistence resources, recreational opportunities, access to clean water, and other critical ecosystem services. In addition, there are strong regional regulatory drivers within the OSR, encompassing species-at-risk and cumulative effects assessment, that must be satisfied. From both western science and Indigenous knowledge perspectives, it is important to understand how oil sands development in the region is impacting terrestrial biological resources. This includes understanding impacts both immediately adjacent to development as well as ambient impacts that extend more broadly, including traditional use areas.

This Integrated Terrestrial Biological Monitoring (TBM) workplan focuses on priority indicators either known to be sensitive to oil sands-related stressors, known to be at-risk, or are of specific importance to Indigenous communities. The monitoring continues to follow the Before-After Dose-Response (BADR) monitoring framework (Bayne et al. 2021, <https://open.alberta.ca/publications/9781460151341>).

The 2023-24 TBM workplan has three major components:

1. Terrestrial Monitoring Operations
  - a. Baseline & Trigger Development
  - b. BADR Operationalization
2. Terrestrial Landscape Disturbance Monitoring
  - a. Mammal Distributions
  - b. Landbird Distributions and Demographics
3. Contaminants Monitoring
  - a. Wildlife Health Surveillance
  - b. Investigation of Cause: Mercury in Downstream Receiving Environments
  - c. Focus: Development of an Integrated Wildlife Contaminants Program

Much of the work scoped in this TBM workplan critically depends on a number of geospatial

monitoring efforts scoped in a separate OSM Geospatial Workplan. While this TBM Workplan makes reference to these components, the work to develop these necessary geospatial monitoring products is not scoped or budgeted in this TBM Workplan.

Additional TBM work is included in the following ICBM OSM workplans for 2023-24:

1. Terrestrial Biological Integrated Indigenous Community Based Monitoring (Monica Kohler, ABMI)
2. Community Led Berry Contamination Study (Dianne McIsaac, WBEA)

The TBM TAC and the team of TBM researchers associated with this workplan are aware of these programs and support their approval.

References associated with the in-text citations included within this document can be found either in the attached Sub-Workplan Appendix or in the Supporting Information of Roberts et al. 2021, IEAM, <https://doi.org/10.1002/ieam.4519>.

## 1.0 Merits of the Work Plan

All work plans under the OSM Program must serve the mandate of the program by determining (1) if changes in indicators are occurring in the oil sands region and (2) if the changes are caused by oil sands development activities and (3) the contribution in the context of cumulative effects. In the space below please provide information on the following:

- Describe the key drivers for the project identifying linkages to Adaptive Monitoring framework particularly as it relates to surveillance, confirmation and limits of change (as per OC approved Key Questions).
- Explain the knowledge gap as it relates to the Adaptive Monitoring that is being addressed along with the context and scope of the problem as well as the Source – pathway – Receptor Conceptual Models .
- Describe how the project meets the mandate of the OSM Program or areas of limited knowledge is the work being designed to answer with consideration for the TAC specific Scope of Work Document (attached) and the Key Questions (attached)?
- Discuss results of previous monitoring/studies/development and what has been achieved to date. Please identify potential linkages to relevant sections of the State of Environment Report.

### DESCRIBE THE KEY DRIVERS FOR THE PROJECT IDENTIFYING LINKAGES TO THE ADAPTIVE MONITORING FRAMEWORK PARTICULARLY AS IT RELATES TO SURVEILLANCE, CONFIRMATION AND LIMITS OF CHANGE (AS PER OC APPROVED KEY QUESTIONS).

The foundation for our 2023-24 workplan is the BADR framework, which provides a monitoring design that measures changes in selected indicators, at multiple spatial scales, relative to reference areas, in response to specific oil sands activities. It accomplishes this using two monitoring approaches:

1. Before-After: Monitoring at different phases of oil sands development (currently developed, not yet developed, and undeveloped reference)
2. Dose-Response: Monitoring along a gradient of current oil sands-related disturbance (high to low)

The flexibility of the BADR framework allows us to adapt the monitoring design and prioritize effort as change is observed in oil sands stressors, pathways, and biological responses, and in response to changing oil sands development.

The BADR framework is designed to monitor across gradients of known drivers of change in the OSR (i.e., identified OSM conceptual model pathways), including:

1. Landscape disturbance (e.g., seismic lines, well pads, mines, etc.);
2. Physical infrastructure (e.g., in-situ facilities, including associated noise and light);
3. Chemical contaminants (i.e., known patterns of deposition); and
4. Climate gradients.

The BADR framework is, at its foundation, a surveillance monitoring program for oil sands stressors, collecting monitoring data on a wide breadth of terrestrial indicators using efficient multi-taxa methodologies via tools such as remote cameras, autonomous recording units (ARUs), and capture-mark-recapture (MAPS) banding. This all-in-one terrestrial indicator monitoring is an efficiency of the BADR design, providing data on multiple species for the cost of a single species. The methods being used offer the most cost-effective approach to getting the largest volume and most reliable data out of time spent in the field. In this multi-taxa approach, priority indicators are treated differently only in their analytical focus, rather than in their field monitoring focus (i.e. the data analyses undertaken define priority indicators, not the gathering of data). A critical advantage of wide-breadth, automated monitoring methods like cameras and ARUs is the ability to analytically revisit past years' data to assess other priority indicators should they be identified in the future. For example, if change is observed in an unanticipated indicator (e.g. via Indigenous knowledge), having historic surveillance data across known stressor gradients for multiple taxa that can be retroactively analyzed is a key advantage.

BADR addresses the most comprehensive of the OC Approved Key Questions, namely “How have terrestrial ecosystems changed from baseline?” Within this question, “terrestrial ecosystems” captures a wide breadth of indicator metrics that are addressed by the BADR design, including species distributions (i.e. occupancy and abundance), communities, populations and demography (i.e. large scale distributions), and health (i.e. function and reproduction). Analyses based on data collected under BADR’s hierarchical design can assess these indicators at multiple relevant scales, from local to landscape, and for migratory species, to a continental scale

Change in disturbed landscapes is assessed relative to data acquired from reference locations, using both a spatial (dose-response) and temporal (before-after) stressor gradient. By monitoring along a gradient of known oil sands stressors (as listed above), rather than just under high- and low-stressor conditions, BADR data are also fit-for-purpose for some secondary analyses within the adaptive monitoring framework where warranted for indicators (e.g., subsequent investigation of cause or focused analysis in combination with other datasets). In order to generalize more broadly across landscapes, change can also be assessed relative to modeled hindcasts of species distributions under more intact landscape disturbance conditions. More comprehensive baseline and trigger (i.e. limits of change) development work is also ongoing or planned (see Section 3.4.5 & the Sub-Workplan Appendix).

EXPLAIN THE KNOWLEDGE GAP AS IT RELATES TO THE ADAPTIVE MONITORING THAT IS BEING ADDRESSED ALONG WITH THE CONTEXT AND SCOPE OF THE PROBLEM AS WELL AS THE SOURCE – PATHWAY – RECEPTOR CONCEPTUAL MODELS.

While many pathways of change in terrestrial distribution (i.e., non-health) indicators in the OSR are well established (such as general responses to landscape disturbance, facilities, etc.), there exist knowledge gaps within the conceptual model both in terms of our resolution of understanding and mechanisms of effect (i.e., specifics of knowledge required to inform useful management action). In the context of the OC Approved Key Questions for TBM:

- HOW HAVE TERRESTRIAL ECOSYSTEMS CHANGED FROM BASELINE (SPECIES DISTRIBUTIONS, COMMUNITIES, POPULATIONS, HEALTH)? Multiple studies in the peer-reviewed literature have linked changes in terrestrial indicators in the OSR to oil sands development (summarized in Roberts et al. 2021; Saracco et al. 2022). Most of the responses observed are negative (i.e., declining populations), although species that prefer early successional landscapes have benefitted. This evidence spans multiple taxonomic, spatial, and temporal scales, and reflects the complexities and interdependencies of this multi-stressor landscape. Terrestrial biota in the oil sands region are simultaneously subject to habitat alteration, human activity and infrastructure, chemical contaminants from both natural and anthropogenic sources, natural disturbance regimes, and climate gradients. The BADR design has been specifically designed to identify environmental change attributable to oil sands activity against a reference condition by examining indicator response along disturbance and contaminant stressor gradients at various spatial scales. While TBM has provided substantial insight into the effects of oil sands development to date, the continued implementation of the BADR design will more precisely quantify linkages between both the effects of specific development components and broader cumulative impacts on the priority indicators.
- WHAT ARE PATHWAYS OF EFFECT FOR TERRESTRIAL SYSTEMS? The land disturbance pathway is defined as the loss, degradation, restoration and/or natural recovery of habitat resulting from a stressor and being imposed on a receptor. Similarly, dispersion and deposition of contaminants emitted from a source represents the pathway of exposure to terrestrial receptors. These are the primary pathways embodied in current TBM initiatives.
- HAS THE NATURE AND QUALITY OF TERRESTRIAL HABITAT CHANGED? WHAT IS THE EXTENT OF THE HUMAN FOOTPRINT? The rate of change over time and the attribution of change specifically to the oil sands industry, particularly with respect to human footprint, are ongoing areas of geospatial development. This work is critical to TBM and is scoped in the 2023/24 Geospatial Workplan.
- WHAT IS THE EXTENT AND MAGNITUDE OF NOISE? The use of autonomous recording units (ARUs)

under the BADR design provides measurements of soundscapes across a range of oil sands industrial activities. Under BADR, these data are being collected coincidentally (spatially and temporally) with indicator response data, so subsequent analyses on the effect of noise on priority indicators (e.g., specific wildlife species) are possible. Noise mapping with this data is an area of collaboration with the Human Footprint monitoring work proposed in the 2023/24 Integrated Geospatial Work Plan.

- WHAT IS THE EXTENT AND MAGNITUDE OF DEPOSITION? While monitoring the extent and magnitude of deposition is primarily the purview of the Air TAC, The TBM contaminants program directly measures contaminants deposition through the use of passive air samplers, and measures contaminant burdens in abiotic and biotic matrices in receiving environments, often where there are air passive samplers being deployed, both to supply information to the conceptual pathways diagrams and to provide “groundtruthing” to air and deposition models. Providing information to the pathways diagrams allows the work to inform efforts towards attribution of the source of the contaminants measured in receiving environments, to address the core OSM outcomes/vision.
- WHAT IS THE CONTAMINATION BURDEN OF KEY RESOURCES? Partnering with land users and communities, and ICBMPs provide samples of key resources and indicator species to allow an assessment of the potential effects of the contaminants stressor on the quality and quantity of key natural resources.
- WHAT ARE SOCIAL AND CULTURAL BARRIERS TO INCREASED HARVESTING/WHAT ARE BARRIERS TO ACCESSING RESOURCES/ WHAT IS A CRITICAL LEVEL OF DISTURBANCE BEFORE S. 35 RIGHTS CANNOT BE EXERCISED? Wildlife Health surveillance will provide valuable information on the contaminant burden and health of key resources, to aid in addressing this question in collaboration with ICBM programs. The concept of “ecological grief” will be weaved into our program to generate more understanding on how a mistrust in traditional food quality can impair a community’s access to this resource; hampering food security.
- DO OS CONTAMINANTS OF CONCERN REACHING RECEIVING ENVIRONMENTS IMPACT HARVESTING AND OCCUPANCY PATTERNS, HARVESTING VOLUMES (FOOD SECURITY), INTERGENERATIONAL TRANSFER OF KNOWLEDGE, SHARING OF RESOURCES LINKED TO THE REINFORCEMENT OF KINSHIP BONDS, PEOPLE’S RELATIONSHIP AND OBLIGATIONS TO THE LAND? Wildlife Health surveillance will provide valuable information on the contaminant burden and health of key resources, to aid in addressing this question in collaboration with ICBM programs. The concept of “ecological grief” will be weaved into our program to generate more understanding on how a mistrust in traditional food quality can impair a community’s access to this resource; hampering food security.

DESCRIBE HOW THE PROJECT MEETS THE MANDATE OF THE OSM PROGRAM OR AREAS OF LIMITED KNOWLEDGE IS THE WORK IS BEING DESIGNED TO ANSWER WITH CONSIDERATION FOR THE TAC-SPECIFIC SCOPE OF WORK DOCUMENT AND THE KEY QUESTIONS?

The TBM program directly addresses OSM priorities by (1) leveraging monitoring data acquired to date, and (2) implementing new stressor-based terrestrial monitoring and analysis, utilizing existing knowledge in the OSR, via an adaptive monitoring framework. Terrestrial ecological systems within the OSR include a wide breadth of habitats and taxa, so monitoring to address OC Approved Key Questions such as “What are pathways of effect for terrestrial systems?” and “Has the nature and quality of terrestrial habitat changed?” and “How have terrestrial ecosystems changed from baseline?” necessitate the consideration of a wide breadth of indicators from single species through to community composition.

The main stressor indicators of priority within TBM are landscape disturbance, industrial facilities, and contaminants, which provide the basis for the stressor-based BADR design.

The OSM conceptual model outlines environmental stressors, pathways, and resulting responses in addition to identifying Valued Components which represent aspects of the environment that local communities and greater society value and to which oil sands activities have the potential to affect. Within TBM, the priority Valued Components are Biodiversity, Healthy Ecosystems, and Traditional Resources and Cultural Practices (Swanson 2019, Bayne et. al., 2021, Roberts et al. 2021). In addition to the OSM conceptual model, a conceptual model specific to TBM has been developed to provide greater resolution for model components that are relevant to terrestrial ecosystems (Bayne et. al., 2021).



DISCUSS RESULTS OF PREVIOUS MONITORING/STUDIES/DEVELOPMENT AND WHAT HAS BEEN ACHIEVED TO DATE. PLEASE IDENTIFY POTENTIAL LINKAGES TO RELEVANT SECTIONS OF THE STATE OF ENVIRONMENT REPORT.

Information and results generated through the TBM program to date provide critical information to support the OSM State of Environment report, contributing content for Chapters 6: State of Wildlife and Plants; specifically supporting environmental stressors and pathways, and more comprehensive development of baselines and triggers. Within the report the TBM information also supports the identification of the effects of oil sands-related development (e.g., seismic lines, in situ facilities, mines, etc.) within the OSR, answering the OC Approved Key Question “How have terrestrial ecosystems changed from baseline?” and visually outlining and depicting such changing over time from the perspective of reference state, current state, drivers and the potential cumulative effects.

## 2.0 Objectives of the Work Plan

List in point form the Objectives of the 2023/24 work plan below

1. To monitor impacts from oil sands activities on terrestrial biological indicators in different habitats and at different scales using the BADR approach.
2. Address OC Approved Key Questions to support regulators, government, local communities, and the public in assessing change to terrestrial ecosystems from oil sands activities. This will involve integration of geospatial footprint and habitat monitoring into these assessments.
3. Continued implementation of the adaptive monitoring program for terrestrial biodiversity in the oil sands region, founded on the concepts of the BADR design and the adaptive monitoring framework. This will include attribution of change and sensitivity analyses to inform adaptive monitoring;
4. For priority indicators, establish scientifically robust approaches to defining (a) baseline/reference conditions and developing (b) monitoring triggers, including a process of indicator selection based on sensitivity to different oil sands activities, and engagement of key stakeholders on recommended indicators, approaches and outcomes;
5. Enhance efforts on the development of Indigenous-led indicators and community-based or participatory monitoring; working collaboratively with the OSM Indigenous Community-Based Monitoring Advisory Committee (ICBMAC) and the ICBM Facilitation Centre;
6. Continue the transition of monitoring programs into alignment with the BADR design:
  - (a) Continue monitoring to detect change in terrestrial ecosystems in response to landscape disturbance and contaminant loading resulting from oil sands activities;
  - (b) Address monitoring needs within stressor-response-pathways and attribution of change
  - (c) Provide information on terrestrial biological resource outcomes at the temporal and spatial scales that meet OSM needs;
  - (d) Provide data for sensitivity analyses for adaptive monitoring planning and indicator selection.

### 3.0 Scope

#### Evaluation of Scope Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would:

- be in scope of the OSM Program (e.g., regional boundaries, specific to oil sands development, within boundaries of the Oil Sands Environmental Monitoring Program Regulation)
- consider the TAC-specific Scope of Work document and the key questions (integrate western science with Indigenous Community-Based Monitoring)
- address the Adaptive Monitoring particularly as it relates to surveillance, confirmation and limits of change as per approved Key Questions.
- have an experimental design that addresses the Pressure/Stressor, Pathway/Exposure, Response continuum
- produce data/knowledge aligned with OSM Program requirements and is working with Service Alberta
- uses Standard Operating Procedures/ Best Management Practices/ Standard Methods including for Indigenous Community-Based Monitoring

### 3.1 Sub Theme

Please select from the dropdown menu below the theme(s) your monitoring work plan relates to:

Terrestrial Biology

### 3.2 Core Monitoring or Focused study

Please select from the dropdown menu below if the monitoring in the work plan is "core monitoring" and/or a "focused study". Core monitoring are long term monitoring programs that have been in operation for at least 3 years, have been previously designated by the OSM program as core, and will continue to operate into the future. Focused studies are short term projects 1-2 years that address a specific emerging issue. For the purposes of 2023/24 work planning all Community Based Monitoring Projects are Focused Studies.

Core Monitoring

## 3.3 Sub Theme Key Questions

Please select from the dropdown menus below the sub-theme(s) your monitoring work plan relates to and address the Key Questions:

### 3.3.1 Surface Water Theme

#### 3.3.1.1. Sub Themes:

Choose an item.

#### 3.4.1.2 Surface Water Key Questions

Explain how your surface water monitoring program addresses the key questions below.

1. Has baseline been established? Have thresholds or limits of change been identified?

Click or tap here to enter text.

2. Are changes occurring in water quality, biological health (e.g., benthos, fish) and/or water quantity/flows relative to baseline? If yes, is there evidence that the observed change is attributable to oil sands development? (Describe source-pathway-receptor and/or conceptual models and what is the contribution in the context of cumulative effects?)

Click or tap here to enter text.

3. Are there unanticipated results in the data? If yes, is there need for investigation of cause studies?

Click or tap here to enter text.

4. Are changes in water quality and/or water quantity and/or biological health informing Indigenous key questions and concerns?

Click or tap here to enter text.

5. Are data produced following OSM Program requirements and provided into the OSM Program data management system?

Click or tap here to enter text.

6. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

Click or tap here to enter text.

7. How does the monitoring identify integration amongst projects, themes or with communities?

Click or tap here to enter text.

8. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

Click or tap here to enter text.

9. How will this work advance understanding transition towards adaptive monitoring?

Click or tap here to enter text.

10. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

[Click or tap here to enter text.](#)

### 3.3.2 Groundwater Theme

#### 3.3.2.1 Sub Themes:

Choose an item.

#### 3.3.2.2 Groundwater Key Questions

Explain how your groundwater monitoring program addresses the key questions below.

1. Has baseline been established? Have thresholds or limits of change been identified?

[Click or tap here to enter text.](#)

2. Are changes occurring in groundwater quality and/or quantity relative to baseline? If yes, is there evidence that the observed change is attributable to oil sands development? (*Describe source-pathway-receptor and/or conceptual models*) and what is the contribution in the context of cumulative effects?

[Click or tap here to enter text.](#)

3. Are there unanticipated results in the data? If yes, is there need for investigation of cause studies?

[Click or tap here to enter text.](#)

4. Are changes in groundwater quality and/or quantity informing Indigenous key questions and concerns Indigenous concerns and health?

[Click or tap here to enter text.](#)

5. Are data produced following OSM Program requirements and provided into the OSM Program data management system?

[Click or tap here to enter text.](#)

6. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

[Click or tap here to enter text.](#)

7. How does the monitoring identify integration amongst projects, themes or with communities?

[Click or tap here to enter text.](#)

8. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

[Click or tap here to enter text.](#)

9. How will this work advance understanding transition towards adaptive monitoring?

[Click or tap here to enter text.](#)

10. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

[Click or tap here to enter text.](#)

### 3.3.3 Wetlands Theme

#### 3.3.3.1 Sub Themes:

Choose an item.

#### 3.3.3.2 Wetlands - Key Questions

Explain how your wetlands monitoring program addresses the key questions below.

1. Has baseline been established? Have thresholds or limits of change been identified?

[Click or tap here to enter text.](#)

2. Are changes occurring in wetlands due to contaminants and hydrological processes? If yes, is there evidence that the observed change is attributable to oil sands development? (Describe source-pathway-receptor and/or conceptual models) and what is the contribution in the context of cumulative effects?

[Click or tap here to enter text.](#)

3. Are there unanticipated results in the data? If yes, is there need for investigation of cause studies?

[Click or tap here to enter text.](#)

4. Are changes in wetlands informing Indigenous key questions and concerns?

[Click or tap here to enter text.](#)

5. Are data produced following OSM Program requirements and provided into the OSM Program data management system?

[Click or tap here to enter text.](#)

6. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

[Click or tap here to enter text.](#)

7. How does the monitoring identify integration amongst projects, themes or with communities?

[Click or tap here to enter text.](#)

8. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

[Click or tap here to enter text.](#)

9. How will this work advance understanding transition towards adaptive monitoring?

[Click or tap here to enter text.](#)

10. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

[Click or tap here to enter text.](#)

### 3.3.4 Air Theme

#### 3.3.4.1 Sub Themes:

Choose an item.

#### 3.3.4.2 Air & Deposition - Key Questions

Explain how your air & deposition monitoring program addresses the key questions below.

1. Has baseline been established? Have thresholds or limits of change been identified?

[Click or tap here to enter text.](#)

2. Are changes occurring in air quality? If yes, is there evidence that the observed change is attributable to oil sands development? (Describe source-pathway-receptor and/or conceptual models) and what is the contribution in the context of cumulative effects?

[Click or tap here to enter text.](#)

3. Are there unanticipated results in the data? If yes, is there need for investigation of cause studies

[Click or tap here to enter text.](#)

4. Are changes in air quality informing Indigenous key questions and concerns?

[Click or tap here to enter text.](#)

5. Are data produced following OSM Program requirements and provided into the OSM Program data management system?

[Click or tap here to enter text.](#)

6. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

[Click or tap here to enter text.](#)

7. How does the monitoring identify integration amongst projects, themes or with communities?

[Click or tap here to enter text.](#)

8. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

[Click or tap here to enter text.](#)

9. How will this work advance understanding transition towards adaptive monitoring?

[Click or tap here to enter text.](#)

10. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

[Click or tap here to enter text.](#)

### 3.3.5 Terrestrial Biology Theme

#### 3.3.5.1 Sub Themes:

Cross-Cutting

#### 3.3.5.2 Terrestrial Biology - Key Questions

Explain how your terrestrial biological monitoring program addresses the key questions below.

1. Has baseline been established? Have thresholds or limits of change been identified?

To date, baselines and triggers (aka, thresholds or limits of change) have not been well established within the field of terrestrial ecology in general, so development within the TBM program has been ongoing (recent TBM work has included focused literature reviews and data gap analyses). The ongoing development of TBM baselines and triggers is supported both by historic and recent (i.e. BADR) surveillance monitoring data via purely statistical approaches, but may also consider Indigenous indicators and ways of life such as ability to exercise s. 35 rights, Species at Risk listing criteria; proposed Biodiversity Management Framework indicators and triggers under Alberta's Land Use Framework; EPEA approval conditions; toxicity thresholds such as embryonic mortality in birds; or Canadian Council of Ministers of the Environment (CCME) guidelines.

Over the past two years, work within the TBM TAC has produced knowledge and guidance on approaches to baseline and trigger development in the form of comprehensive reviews of other monitoring programs (completed in 2021/22), implementation feasibility assessments and initial evaluation of potential approaches (ongoing in 2022/23, the availability of fit for purpose data for baseline and trigger development is being assessed). As discussed in the workshops leading to BADR, quantitative assessments (landbirds) using the best available statistical models are being used. BADR helps us measure deviation from expected.

In 2023/24, we plan to undertake baseline development for a selection of terrestrial indicators across taxa groups. The specific selection of terrestrial indicators for which to pilot baseline development will be created based (1) on discussions to date with the TBM TAC; and (2) contingent on results from ongoing feasibility assessment work (i.e., data availability and methodological practicality). The intention is to leverage publicly available data produced through OSM and to follow the methodological recommendations generated in 2022/23. This project will rely heavily on datasets generated by PIs working within TBM.

The terms "baseline" and "reference" require clarification. The efforts described in this workplan to develop baselines are not efforts to describe a pre-colonial state of environment. Such characterizations require not only ecological but also sociocultural considerations, including extensive consultation with Indigenous communities. This work is important but is not within the scope of this core monitoring workplan. Rather, the baseline characterization undertaken here is to establish a state of comparison (or reference state) to analogous contemporary habitats experiencing minimal development to enable assessments of change. This comparative baseline is critical to monitoring and management and is built into the BADR framework.

More details on baseline and trigger/limit of change development are provided in the Sub-Workplan Appendix.

2. Are changes occurring in terrestrial ecosystems due to contaminants and landscape alteration? If yes, is there evidence that the observed change is attributable to oil sands development? (Describe source-pathway-receptor and/or conceptual models) and what is the contribution in the context of cumulative effects?

Multiple studies in the peer-reviewed literature have linked changes in terrestrial indicators in the OSR to oil sands development (summarized by Roberts et al. 2021). This evidence spans multiple taxonomic, spatial, and temporal scales, and reflects the complexities and interdependencies of this multi-stressor landscape. Terrestrial biota in the oil sands region is simultaneously subject to habitat alteration, human activity and



infrastructure, chemical contaminants from both natural and anthropogenic sources, natural disturbance regimes, and climate gradients.

The BADR design has been specifically designed to identify environmental change attributable to oil sands activity against a reference condition by examining indicator response along disturbance and contaminant stressor gradients at various spatial scales. While TBM has provided substantial insight into the effects of oil sands development to date, the continued implementation of the BADR design will provide data that more precisely defines linkages between the effects of specific development components and broader cumulative impacts on the priority indicators.

#### CONTAMINANTS

Baseline contaminant burdens in these animals have not been established and so change relative to baseline is not possible. Rather, contaminant burdens and health assessments are conducted across the BADR landscape and in “reference areas” which provides a “treatment versus reference” comparison. To accomplish this, these key indicator species are monitored across the region, within northern Alberta, and into the Peace-Athabasca Delta following a gradient of exposure approach from higher to lower contaminant exposure. Further, since it is not possible to establish baseline because pre-development wildlife samples are not available for study of contaminant burdens, changes relative to baseline are approached through a “treatment versus reference” sampling design. Also, rather than baseline, the results of the contaminant monitoring program can be compared to established guidelines, where available. As an example, guidelines are available from the Canadian Council of Ministers of the Environment for certain chemicals of concern. Another approach includes quantile regression approaches, an approach that matches contaminant burdens in wildlife against provincial baseline information. A demonstration of this approach, based on information generated using land-user harvested animals can be found on the kotawan portal ([kotawanportal.ca](http://kotawanportal.ca)).

Very few species-specific triggers or limits of change exist. This is an on-going effort of the TBM program. In the contaminants program of TBM it is possible to measure contaminant burdens in particular species against established limits of change in a very limited number of species. An example of this is the established limits of change for embryotoxicity due to mercury exposure of the embryos of common terns.

Using our chosen indicator species, the results follow patterns and pathways established by other species-specific contaminants monitoring programs in the vicinity of large industrial operations.

Studies have assessed changes in contaminant burdens and wildlife health across many taxa in the OSR, and a list of key priority indicators has been developed and continues to be refined. Over years of monitoring in northern Alberta contaminants in receiving environments and contaminant burdens and health metrics in wildlife across spatial and temporal gradients, more recently following the BADR design, along with investigations of pathways and efforts towards establishing source or cause, represents a large and ongoing contaminants assessment effort towards state of the environment reporting in the oil sands region. A large part of this effort has been directed at the establishment and validation of the appropriate indicator species. Briefly, the indicator species being monitored in the TBM contaminants program, and included in this contaminants scope of work, are those that have well known life histories, have a large literature database available on their response to contaminant exposure with known or predictable responses to chemicals of concern, allow measurement of contaminants that have accumulated in their tissues from local sources, have peer-reviewed literature concerning their response to OS chemicals of concern and are known to be responsive and sensitive to this stressor, and/or are of importance to land users and communities. These priority indicator species are listed below, with information on how they contribute to the assessment of the contaminants stressor.

Key indicator species for the contaminants stressor and monitoring results (priority species noted with \*asterix):

\*Birds. Gulls and terns (colonial waterbirds). Research has shown higher mercury concentrations in the eggs

of colonial waterbirds in downstream receiving environments of the Athabasca River (Dolgova et al. 2018; Hebert et al. 2011, 2013), and the critical role of riverine transport processes in regulating mercury availability to waterbirds in downstream receiving environments (Hebert, 2019). In the Athabasca Oil Sands Region (AOSR), research has shown that tree swallow nestlings reared near OS development sites will divert resources and energy to contend with contaminant exposure (Luis Cruz-Martinez et al. 2015), compared to birds developing away from development, and field exposure to and accumulation of polycyclic aromatic compounds (PACs) near OS development can influence tree swallows' reproduction, development, and thyroid function (Ferne et al. 2018; Godwin, Barclay, & Smits 2019; Fernie et al. 2019).

\*Mammals. River Otters, furbearers, traditionally harvested mammals, bats. Contaminant burdens in tissues and health responses have been measured in semi-aquatic mammals. PACs, trace elements (including heavy metals) and anticoagulant rodenticides are more elevated in wildlife collected on trap lines near OS industrial operations and in downstream environments (Peace Athabasca Delta; PAD). Changes in wildlife health biomarkers (such as river otter and mink baculum bone material properties) as well as incidence of wildlife diseases and parasites correlate with some of the identified contaminants in the region (see for example Thomas et al. 2020). Other priority mammals provide information from surveillance or regional monitoring – developing a further list of priority indicators will involve closer coordination with Indigenous partners to identify species and define traditional wildlife markers of health that could be adapted to the larger regional monitoring program; this effort will be aided by the development of new conceptual framework and pathway diagrams, as above.

\*Plants. Berries. Berries collected near upgraders and open pit mines were shown to have a greater abundance of dust-supplied trace elements, including lead, aluminium, and uranium, on their outer surfaces, relative to berries collected outside of the OSR (Stachiw et al., 2019). Efforts to monitor the potential effects of deposition on medicinal plants are being initiated. Other plant and lichen monitoring for contaminant effects is important for input to the pathway diagrams and conceptual models.

One unanticipated result that might be mentioned is the finding that furbearers trapped near OS development projects/in high disturbance areas had unhealthy (above threshold for effects) burdens of second-generation anticoagulant rodenticides in their tissues. An original observation through traditional knowledge led to a study to determine the cause, which was revealed to be the use of these products for pest control on site and around camps. (A simple solution was employed through the reduction of the use of these compounds.) Other results from the program that might include unanticipated results are being published.

#### LANDSCAPE DISTURBANCE

Many taxa respond to landscape disturbance and habitat alteration, and differences in observed change may depend on the type and character of disturbances (e.g., linear vs. polygonal, small vs. large, vegetated vs. non-vegetated), the habitat preferences of the individual species, or the spatial scale of measurement (Venier et al. 2014; Fisher and Burton 2018; Toews et al. 2018). Briefly:

Landbirds. Statistical analyses and modelling of a number of bird species have identified cumulative effects and many analyses attribute these to specific oil sands (OS) activities, including clear evidence of response to land disturbance (Foster et al. 2017, Wilson et al. 2018, Pyle et al. 2020, Saracco et al. 2022), including from wells (Bayne et al. 2016), seismic lines (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013) and other linear features (Ball et al. 2009, Bayne et al. 2016). In general, habitat specialists are more likely to be negatively impacted by anthropogenic disturbances, while habitat generalists are more likely to benefit (Mahon et al. 2019). Footprint mapping coupled with scenario modelling approaches have been used to assess bird population responses to habitat change caused by oil sands and other anthropogenic development (e.g., Mahon et al. 2014). Scale of analysis and the metric of abundance influence the magnitude but not the direction of effects.

Mammals. Extensive field monitoring and multi-taxa analyses have linked oil sands industrial activities to changes in the health, behaviour, distribution, populations, and communities of many mammal species (Fuller et al. 2022, Darlington et al. 2022, Fisher et al. 2021, Wittische et al. 2021, Fisher and Burton 2021, Fisher et al. 2020). Many specific species responses to specific stressors can vary in direction and magnitude among landscapes and in response to different underlying ecological conditions (Fisher and Ladle 2022, Fisher et al. 2021, Fisher & Burton 2018, Toews et al. 2018).

## CUMULATIVE EFFECTS

The assessment of oil sands activity contributions in the context of cumulative effects have been partially addressed with existing datasets; more thoroughly for some taxonomic indicator groups than others. Species habitat models which describe relative abundance in response to oil sands activities (e.g., seismic lines, mines, in-situ facilities, etc.) and other stressors have been established with varying degrees of detail for species within all indicator groups. Refinements to achieve greater clarity on linkages between observed changes in terrestrial indicators and cumulative oil sands-related stressors are included in the sub-workplans for birds, and mammals (details in the Sub-Workplan Appendix).

The BADR framework is designed to monitor across gradients of known drivers of change in the OSR (i.e., identified OSM conceptual model pathways), including landscape disturbance, physical infrastructure, chemical contaminants and climate gradients; it is stratified across key oil sands disturbance types/features in specific habitat types. Currently, joint environmental monitoring (JEM) sites avoid impacts from other industries and control for natural disturbance to the extent possible, to facilitate the separation of oil sands effects via robust statistical approaches. Monitoring sites incorporate multi-stressor sites that include a range of anthropogenic or natural disturbance (e.g., different stand ages result from forest harvest or wildfire) to investigate cumulative effects and parse apart the relative contributions of OS stressors. Future decisions of whether, when, and where to add sites will be guided by the analytics proposed in these workplans, to identify source-pathway-receptor relationships.

Geospatial data and analyses that are suitable for accurately identifying source-pathway-receptor relationships are critical tools for cumulative effects assessment, including establishing and measuring against baselines, understanding pathways of effects, and accurately attributing changes in indicators to OS stressors. Stressor monitoring to date has captured the amount and distribution of oil sands footprint. However, to understand and manage cumulative effects, trends in land surface trajectories with a targeted evaluation of drivers of change are needed at multiple temporal and spatial scales. The human footprint data development proposed within the separate 2023/24 Geospatial Workplan supports the assessment of cumulative effects that are already present, enables assessment of the incremental cumulative effects, and improves cumulative effects assessment over time.

### 3. Are there unanticipated results in the data? If yes, is there need for investigation of cause studies?

Detecting unanticipated responses is what the BADR design and its multi-indicator approach to monitoring was meant to achieve. No new IOC studies are herein proposed because inferences about causal mechanisms between OS stressors and indicators are one of the products of the BADR design, delivered annually through this workplan.

### 4. Are changes in terrestrial ecosystems informing Indigenous key questions and concerns?

The TBM program occurs across the OSR, and thus overlaps with the traditional territories of multiple Indigenous communities. The data and knowledge generated can provide information on the landscapes and species that Indigenous communities rely on to support their rights to hunt, trap, fish, and gather, and maintain a traditional way of life. Exercising these rights requires: (1) healthy populations of all valued species, including birds, mammals, amphibians, and vascular plants; (2) sufficient quality habitat to support

these species into the future; and (3) sufficient land that is safely and freely accessible for Indigenous community members. Footprint and biodiversity monitoring contained in this workplan provides robust data that can inform these three aspects of exercising Treaty rights and can be enhanced or customized to address local priorities in partnership with communities.

Population monitoring under the BADR design will efficiently and simultaneously collect multi-species data that can be evaluated by Indigenous communities for priority species, such as medicinal plants and animals, berry producing plants, furbearers and hunted ungulates like moose (Fisher et al. 2021), birds (Saracco et al. 2022), and their habitats. This information can be summarized and presented using customized approaches and at scales in line with community interests. The monitoring of human footprint proposed in the Integrated Geospatial Workplan enables the assessment of cumulative effects in contexts meaningful to Indigenous communities. Specifically, it can serve as a foundation for assessing the cumulative loss of the priority Valued Components, Biodiversity, Healthy Ecosystems, and Traditional Resources and Cultural Practices (Swanson 2019, Bayne et. al., 2021, Roberts et al. 2021) such as land and access issues that community members face.

Multiple Indigenous communities are also actively involved in tissue collection to monitor contaminant burdens in the biotic environment, including from harvested mammals. This work directly addresses community concerns over the safety of traditional foods for human consumption.

Engagement, capacity building, and field monitoring partnerships with multiple local Indigenous communities, specifically to identify and pilot opportunities to increase community involvement in data collection, will now occur under a separate 2022-23 workplan submitted to the Terrestrial TAC (workplan number forthcoming). This workplan is scoped and delivered, in consultation with the ICBM Facilitation Centre, by TBM PIs who are also involved in core terrestrial monitoring activities. Areas of focus with interested communities include capacity building via training on the use of wildlife cameras and autonomous recording units (ARUs), on the collection of animals and tissue samples for wildlife health and contaminants analyses, and on the implementation of vegetation protocols. Consistency of project participants in both the terrestrial core monitoring and ICBM work plans ensures that integration of new ICBM projects based on Western science methods is aligned to the greatest extent possible.

5. Are data produced following OSM Program requirements and provided into the OSM Program data management system?

YES. The TBM Theme is committed to alignment with OSM data requirements as these requirements are developed and distributed. Further, TBM PIs have been and will continue to be active with respect to identifying and utilizing cross-party data repositories, with some already well established (e.g., WildTrax). TBM PIs continue to collaborate with Service Alberta as requested in the development of the OSM Data Catalogue, providing data asset inventories and feedback on catalogue structure and organization. Additionally, existing standards developed by ECCC and/or Government of Alberta will be considered.

6. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

YES. Standard Operating Procedures and protocol documents are available for data collection, management, and analysis. Many of these have been developed and established by the various project PIs themselves; some have been carried over or adopted from well-established international monitoring programs. The specific field monitoring methodologies used represent the most up-to-date monitoring methods available for biological data collections. The proposed work combines state-of-the-art field methodologies (e.g., remote camera arrays, autonomous recording units) and other long-proven approaches (e.g., capture-mark-recapture methods, vegetation quadrats) within the recently developed BADR design to establish standard methodological approaches for monitoring the terrestrial environment in the OSR. Many of these methodologies are used in complementary monitoring programs, including site-specific monitoring conducted by industry, allowing for future interoperability and pooling of data.

## 7. How does the monitoring identify integration amongst projects, themes or with communities?

This workplan integrates all of TBM's activities into a single, cohesive program that follows the BADR framework. Integration is a foundational principle of TBM work, and is occurring in the following ways:

Within the TBM team:

- Data collection is aligned under an integrated monitoring design (BADR) grounded in the OSM conceptual model, and adaptive monitoring framework;
- Data collection protocols are integrated and co-delivered, where feasible and sensible, to maximize efficiency across the TBM team;
- Data collection is co-located at JEM sites when feasible;
- Analytical efforts are collaborative or divided based on strengths of team members within the sub-workplan groups; and
- Housing data in shared repositories and managing data in common data platforms (e.g., WildTrax), including the integration of data pipelines, analysis, and co-deliverables both within TBM and across the various OSM theme areas.

With other Themes:

- Collaborative deliverables with the Wetland Theme on surveillance wetland monitoring – protocols, data collection, and analysis;
- Continued effort on scoping joint areas of work with the Surface Water and Groundwater Themes, including an integrated project to monitor Groundwater Dependent Ecosystems (scoped and proposed in the Geospatial Workplan for 2023/24).
- Active collaboration on the scoping, implementation, and use of human footprint and habitat monitoring work within the Geospatial Workplan; and
- Collaboration among relevant TACs on integrated wildlife contaminants surveillance is ongoing and will be further developed during the proposed 1 year focus study.

With communities and other partners:

- Involvement of local communities in contaminant monitoring of Traditional Resources and with the reporting and outreach activities with the data;
- Identifying and building opportunities for Indigenous involvement in data collection, e.g., via engagement led by the ICBM Facilitation Centre; and
- Scoping opportunities to integrate on-site industry data, where available, into regional datasets.

## 8. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

BADR is a stressor-pathway-indicator response monitoring design, intended to facilitate efficient and integrated (i.e., coincidental in space and time) data collection on multiple indicators along major OS-related stressor gradients. By controlling for habitat, by operating at different hierarchical spatial scales, and by incorporating temporal before-after monitoring, the design also informs pathways. In these respects, the proposed monitoring falls both on the frame of the terrestrial conceptual model (i.e., stressors and responses) as well as down the middle (i.e., pathways). It must be emphasized that the ability of the BADR design to function as a stressor-based program is contingent on the continued development of timely and informative geospatial products—work scoped in the 2023/24 Geospatial Workplan. Other theme areas (e.g., Air and Water) also inform the conceptual model pathways to contaminant stressors that we consider here, as well as contributing to measurement of change in the context of cumulative effects.

The conceptual model is fundamental to integration because it provides a consistent framework for all monitoring within and among OSM Themes. This TBM workplan uses the conceptual model to:

- Prioritize key linkages with oil sands-related stressors which have the potential to affect indicators at

local, sub-regional, and/or regional scales over various time scales;

- Ensure that monitoring addresses complete linkages across the model from stressors through pathways to responses which, in turn, affect the indicators;
- Assist in identifying linkages which may contribute to cumulative effects of multiple stressors or cumulative effects of individual stressors distributed across various spatial scales;
- Provide clarity regarding the required points of integration with other OSM Themes (e.g., connecting work on atmospheric deposition with TBM work on responses in vegetation and wildlife); and
- Explicitly illustrate the linkages to Indigenous Valued Components.

The TBM Theme has prioritized the stressor-pathway-response linkages as identified in the conceptual model (see the Sub-Workplan Appendix) through a qualitative examination of risk completed collaboratively by the TAC and principal investigators.

9. How will this work advance understanding transition towards adaptive monitoring?

The BADR design is adaptive, in that sampling can evolve iteratively as new information is attained at either the landscape or the local scale to answer modified or new questions. This allows us to adapt monitoring to where it is most needed to capture information required to assess ongoing surveillance, develop focused studies, and/or implement investigation of cause. By aligning monitoring of various stressor-pathway-response linkages in time and space, questions related to identification of cause and cumulative effects can be better addressed in a more efficient and economical manner. TBM will continue to provide ongoing surveillance monitoring and provide an effective monitoring design (BADR) to contribute to investigation of cause where possible for indicators that are confirmed to be changing.

The BADR design is also responsive to the needs of the adaptive monitoring framework, as baseline and trigger development is completed, learnings can be used to optimize the design. In 2023-24, continued effort will focus on the identification of baselines and monitoring triggers for priority indicators, which will include:

- Continuing a process of indicator selection based on sensitivity to different oil sands activities, where sufficient data are available. This rests on the continued collection of data for multiple indicators under the BADR design.
- Implementing recommendations on approaches to baseline and trigger development completed in 2022/23 for select indicators with appropriate data and expanding the approach piloted in 2022/23 for bird data.
- Developing additional recommendations and identifying any challenges and data gaps observed during implementation.
- Engaging key stakeholders as part of these processes to ensure awareness and solicit input and feedback.

10. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

YES.

Information and results generated through the TBM program have and will provide critical information to support the OSM State of Environment report, contributing content for Chapters 6: State of Wildlife and Plants; specifically supporting environmental stressors and pathways, and more comprehensive development of baselines and triggers.

### 3.3.6 Cross-Cutting Across Theme Areas

#### 3.3.6.1 Sub Themes:

Choose an item.

If "Other" was selected from the drop down list above please describe below:

[Click or tap here to enter text.](#)

#### 3.3.6.2 Cross-Cutting - Key Questions

Explain how your cross-cutting monitoring program addresses the key questions below.

1. Is data produced following OSM Program requirements and provided into the OSM Program data management system?

[Click or tap here to enter text.](#)

2. Do methodologies use relevant Standard Operating Procedures/ Best Management Practices/ Standard Methods?

[Click or tap here to enter text.](#)

3. How does the monitoring identify integration amongst projects, themes or with communities?

[Click or tap here to enter text.](#)

4. With consideration for adaptive monitoring, where does the proposed monitoring fit on the conceptual model for the theme area relative to the conceptual model for the OSM Program?

[Click or tap here to enter text.](#)

5. How will this work advance understanding transition towards adaptive monitoring?

[Click or tap here to enter text.](#)

6. Is the work plan contributing to Programmatic State of Environment Reporting? If yes, please identify potential linkages to relevant sections of the State of Environment Report.

[Click or tap here to enter text.](#)

## 4.0 Mitigation

### Evaluation of Mitigation Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would potentially inform:

- efficacy of an existing regulation or policy
- an EPEA approval condition
- a regional framework (i.e., LARP)
- an emerging issue

Explain how your monitoring program informs management, policy and regulatory compliance. As relevant consider adaptive monitoring and the approved Key Questions in your response.

While it is not within the purview of the TBM TAC or monitoring partners of OSM to determine whether oil sands companies are in regulatory compliance, there are recurring terrestrial approval conditions that appear in most of the mining EPEA deemed compliance documents, and that fall within the scope of OSM. These include:

1. Long-term monitoring of cumulative effects on biodiversity and wildlife;
2. Long-term monitoring of species at risk; and
3. Analysis & collection of regional data to validate Habitat Suitability Index (HSI) models.

#### 1 - LONG-TERM MONITORING OF CUMULATIVE EFFECTS ON BIODIVERSITY AND WILDLIFE

Regional monitoring of biodiversity is a required activity for oil sands operators under EPEA approval conditions. The exact wording of this requirement varies across operators but generally refers to the requirement to monitor the long-term cumulative effects on biodiversity and wildlife. In some cases, these conditions make reference to specific programs or organizations such as ABMI and the former Ecological Monitoring Committee for the Lower Athabasca (EMCLA). In other cases, the approval-holder is to select appropriate monitoring methods and actions and demonstrate that these are adequate. The BADR design will contribute scientific information to assess the efficacy of existing regulations and compliance with approvals as they apply to ambient responses to oil sands stressors at local, sub-regional, and regional scales.

#### 2 - LONG-TERM MONITORING OF SPECIES AT RISK

The bird monitoring component of the TBM workplan provides data for several federally and provincially listed species, including demographics for species monitored within the MAPS program.

#### 3 - REGIONAL DATA TO VALIDATE HABITAT SUITABILITY INDEX (HSI) MODELS

Data collected under the TBM workplan to date have been used to generate multiple species-habitat models (i.e., HSI models) which are available at the regional scale. These models can be used to build maps for specific areas of concern, or for comparison with site-specific models to determine the appropriateness of a regional approach to model construction. Models for many terrestrial indicator species are built from existing data and can be used to adaptively change our sampling design to identify the habitat conditions for which we need additional information.

#### OTHER LINKS TO MANAGEMENT AND REGULATORY COMPLIANCE

In addition to these three areas related to regulatory compliance, TBM outcomes will provide an understanding of the effects of oil sands development, by type, on a range of terrestrial indicators. These results will have implications for company management programs and regulatory agency policy decisions such as industry environmental management procedures, regulatory limits on disturbance, disturbance-



buffer selection, and restoration management requirements.

The protocols used by TBM are also used by other research and monitoring groups funded by forestry companies. This expands the ability to develop and validate HSI models at a regional scale, bringing in data from parallel programs to expand the scope of questions and analyses that can be conducted in support of indicator responses to regional stresses, at a cumulative effects scale. For example, landbird use of well pads can be compared to use of harvest blocks to provide an alternative reference comparison related to time since disturbance, using data collected in collaboration with numerous forestry companies in Alberta.

The BADR design incorporates spatial stratification based on land use, allowing the monitoring to contribute directly relevant information to regional frameworks such as LARP regarding observed changes in response to oil sands stressors and cumulative effects.

Industry makes a significant investment each year in “within fence line” wildlife monitoring and mitigation planning, often using the same or similar data collection techniques to TBM, such as MAPS, wildlife cameras, and acoustic surveys. Operators often also hold information on detailed land use and management decisions that occur within site boundaries. These data have the potential to contribute to regional monitoring efforts and help better inform the pathways of biodiversity change. TBM is interested in exploring integration with this and other available industry-operated programs and datasets.

## 5.0 Indigenous Issues

### Evaluation of Indigenous Issues Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would potentially:

- Investigate Indigenous communities key questions and concerns
- Includes culturally relevant receptor(s) and indicator(s)
- Include or be driven by Indigenous communities (participatory or collaborative)
- Develop capacity in Indigenous communities
- Include a Council Resolution or Letter of Support from one or more Indigenous communities
- Describe how ethics protocols and best practices regarding involvement of Indigenous peoples will be adhered to
- Provide information on how Indigenous Knowledge will be collected, interpreted, validated, and used in a way that meets community Indigenous Knowledge protocols

Explain how your monitoring activities are inclusive and respond to Indigenous key questions and concerns and inform the ability to understand impacts on concerns and inform Section 35 Rights

The work described in this workplan can inform whether changes in terrestrial ecosystems inform Indigenous concerns and Section 35 rights. Monitoring of contaminants in traditional foods informs the safety of foods for human consumption and relies on Indigenous involvement for delivery. Section 35 rights also require sustainable populations of plants and animals in critical local areas of harvest, as well as physical access for communities to traditional use areas. Data collected and analyses performed under this workplan can inform these issues by reporting on status and change of harvested species in spatially explicit formats.

Ongoing engagement with Indigenous communities is required on a long-term basis to ensure alignment between the BADR monitoring framework and ICBM workplans based on Western science methods. Through 2022-23, TBM PIs maintained and established partnerships with a number of Indigenous communities on wildlife health and population monitoring. We anticipate continuing these long-term partnerships and using feedback from these projects to inform protocols and approaches for future ICBM and TBM work.

Does this project include an Integrated Community Based Monitoring Component?

Yes

If YES, please complete the [ICBM Abbreviated Work Plan Forms](#) and submit using the link below

[ICBM WORK PLAN SUBMISSION LINK \(CTRL+CLICK HERE\)](#)

## 5.1 Alignment with Interim Ethical Guidelines for ICBM in the OSM Program

1. Are there any community specific protocols that will be followed?

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. Community-specific protocols around the collection of semi-aquatic furbearers and prey species (including fish) will be follow consultation with community partners.

2. Does the work plan involve methods for Indigenous participants to share information or knowledge (e.g. interview, focus group, survey/structured interview), or any other Indigenous participation? If yes, describe how risks and harms will be assessed, and the consent process that will be used.

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. Methods to share information or knowledge are not involved in a formal setting. Semi-structured interview questions might be used as a guide to lead discussions in the field (for example: at the muskrat camp), but there are at the moment no plans to collect and record proprietary Indigenous knowledge. Should the need arise, we would abide by the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans (TCPS 2, 2014) and would consult with relevant social science experts in the field who are also project participants (including Dr Janelle Marie Baker and Ave Dersch).

3. Do the activities include any other collecting/sharing, interpreting, or applying Indigenous knowledge? Please describe how these activities will be conducted in alignment with the Interim Ethical Guidelines, and any community-based protocols and/or guidelines that may also apply.

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. The activities do not include any other collecting/sharing, interpreting, or applying Indigenous knowledge, see #2 response for more detail.

4. Indicate how Indigenous communities / Indigenous knowledge holders will be involved to ensure appropriate analysis, interpretation and application of data and knowledge.

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. As in previous years, Indigenous knowledge holders will be involved in designing the research and monitoring around questions and priorities in each respective community. The “what”, “where”, “when”, and “why” questions will be answered for the most part by the braiding of Indigenous knowledge with the western science generated over the last decade. The integration of other ICBM data (for example: MCFN CBM water quality and quantity datasets) will provide more context and will guide sample analysis and generation of new knowledge on the cumulative effects of multiple stressors on wildlife “health” (also defined through traditional wildlife health indicators).

5. How are Indigenous communities involved in identifying or confirming the appropriateness of approach, methods, and/or indicators?

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. Indigenous communities are involved in identifying or confirming the appropriateness of approach, methods, and/or indicators through frequent and early consultations. For example, on October 18th, 2022, Phil Thomas met local elders and land users in Fort Chipewyan to provide an update on some of the latest results in muskrats, and to discuss more holistic definitions of muskrat “health” grounded in Indigenous knowledge and confirmed changes by land users.

6. How does this work plan directly benefit your community? How does it support capacity building in your community?

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. This work plan directly benefits communities and supports capacity building through the training and subsequent hiring of competent CBM technicians who can assist land users and elders in collecting relevant samples, intermediate storage, shipping and analysis. All of this training and capacity enhancing exercises are continuously provided by the Wildlife Health program (incl. Phil Thomas).

7. How is the information from this work plan going to be reported back to your community in a way that is accessible, transparent and easy to understand?

Community Based Monitoring within this work plan submission is limited to the Wildlife Health Program. This information is reported back to communities through ongoing dialogue and community visits, through the drafting and circulation of plan language reports to project participants, and through the Kotawan Data Portal ([www.kotawanportal.ca](http://www.kotawanportal.ca)).

## 6.0 Measuring Change

### **Evaluation of Measuring Change Criteria (Information Box Only- No action required)**

Your workplan will be evaluated against the criteria below. A successful workplan would potentially:

- assess changes in environmental conditions compared to baseline (e.g., validation of EIA predictions)
- report uncertainty in estimates and monitoring is of sufficient power to detect change due to oil sands development on reasonable temporal or spatial scales
- include indicators along the spectrum of response (e.g., individual, population, community)
- focus on areas of highest risk (where change is detected, where change is greater than expected, where development is expected to expand (collection of baseline)
- measure change along a stressor gradient or a stressor/reference comparison

Explain how your monitoring identifies environmental changes and how can be assessed against a baseline condition. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

The BADR design has been developed and implemented to collect multi-taxa data allowing for attribution of environmental change in response to oil sands industrial activity. It achieves this by:

1. Using ecologically relevant spatial units that align with other TACs;
2. Examining environmental response along stressor gradients at various spatial scales;
3. Including reference sampling units in both space and time;
4. Including ecologically relevant indicators at the individual, population, and community level, while preserving the ability to detect unexpected biological responses;
5. Incorporating areas of planned oil sands expansions; and
6. Producing results which can be used for model validation and forecasting purposes.

This approach requires both on the ground data collection related to terrestrial biological response indicators combined with up to date, detailed human footprint and habitat monitoring in order to implement a meaningful and robust monitoring program.

#### BADR BASICS

Details on the approach used under the BADR design are provided in Bayne et al. 2021. The two key elements of this design that contribute to measuring change against a baseline are:

1. Before-After: Monitoring at different phases of oil sands development (before and after development occurs); and
2. Dose-Response: Monitoring along a gradient of current oil sands disturbance (high to low).

Both of these elements require highly detailed stressor monitoring across time and space as the foundation for the program design.

#### MEASURING CHANGE ALONG STRESSOR GRADIENTS

Habitat degradation and loss is a known outcome of oil sands development. The BADR framework is designed to assess whether any observed change is greater in magnitude than expected from habitat loss alone. This

effectively tests for functional habitat loss due to fragmentation, edge effects, avoidance of light/noise, contamination, etc. Within the adaptive monitoring framework, this determination of “is a change expected or observed?” drives whether such observations necessitate focused monitoring/investigation of cause (if the source of the change needs to be determined), or whether monitoring returns to a surveillance approach (if the change is expected). The dose-response used under the BADR design ensures balanced sampling of individual stressors and combinations of stressors (i.e., cumulative effects). This is achieved by targeting monitoring along a gradient of spatially-defined disturbance strata:

1. Reference: a site with low energy sector disturbance;
2. Soft linear: a site with high density of seismic lines, pipelines, etc.;
3. Road: a site with high density of energy sector roads;
4. Low activity: a site with energy sector disturbance without light or noise impacts (e.g., exploration well pads);
5. High intensity: sites with high intensity disturbances (varying combinations of high human activity, light, noise and atmospheric deposition).

It is important to recognize that the BADR design permits stratification of monitoring across environmental and disturbance gradients, but that the analyses of data acquired through monitoring within the BADR design is dependent on accurate, up-to-date and explicit geospatial data that precisely define disturbances.

Adding contaminants, including from aerial deposition, on top of the spatially-defined disturbance strata allows cumulative effects and the relative influence of different stressors to be investigated.

#### ASSESSING CHANGE AGAINST BASELINE

Observed data quantifying pre-disturbance condition in the oil sands region does not exist for most priority indicators, necessitating either a space-for-time substitution or back-cast modeling approach to assessing change against baseline based on habitat models or based on emission backcasting approaches or historical contaminants release reporting. We note that Indigenous Knowledge should play an important role in defining baseline conditions (see Section 10.4).

Historically, western science biological monitoring in the oil sands region has defined terrestrial biological baseline as the ecological conditions present, or those that would be present, in the absence of human footprint. This was typically calculated by (1) monitoring sites free from human footprint; (2) empirically predicting landscape habitat conditions if footprint was not present; and (3) completion of multi-indicator surveys at random, systematic sites throughout the entire OSR. The field component of ABMI’s systematic grid is now effectively complete and, in combination with collated data from other research and monitoring, has resulted in baseline species-habitat models for multiple species groups that should be validated and/or improved by adaptive sampling in areas with higher model uncertainty.

The BADR framework further develops baseline specific to oil sands footprint (and different types of oil sands footprint) by monitoring along a gradient of oil sands stressors in three contexts:

1. Landscape units where oil sands development (surface mining and in-situ) is already extensive, providing the high end of a dose-response gradient and contaminant loads;
2. Landscape units where oil sands exploration has occurred, but development has not yet occurred, providing (in short term) both the middle of the dose-response gradient and (in long term if developed) validation of dose-response models by confirming biodiversity changes over time as development proceeds; and
3. Landscape units where oil sands activities are minimal and unlikely to occur in the future, providing reference sites to observe any changes associated with non-oil sands pressures such as climate change, extra-regional effects, forest fire, forest harvest, etc.

Dose-response models developed from such data can also be used in backcasting and forecasting what

species distributions looked like in the past or might be under future development scenarios based on the availability of habitat or emission modeling at different time periods; numerous examples of such models exist for areas within the OSR (see Leston et. al. 2020). Such models can be used to assess the range of natural variability in relation to natural disturbances like fire and hydrological cycles. By combining data collected under the BADR design with historical datasets, we will further improve habitat models for use in backcasting and forecasting scenarios to estimate the magnitude of change based on known species-habitat relationships. Data from future field collections can be compared to these forecast triggers to monitor for unexpected change, magnitude of change, or when development is reaching a point where an ecological threshold is being reached (i.e. the number of individuals of a species based on habitat models and/or trend estimates reach a minimum acceptable level).

#### STATISTICALLY DRIVEN CHANGE DETECTION

Effect size is a statistical concept that measures the strength of the relationship between stressors and responses. Effect size, statistical power, sample size, and critical significance are essential components of the BADR design. In other words, sampling must be designed so that there is sufficient confidence that we can detect a change from baseline, analyze correlations between oil sands stressors and responses, report measured exceedances of critical significance levels, and produce validated model predictions of exceedances of critical significance levels. Sensitivity and power (precision) analyses are used to determine the level of monitoring effort required to confidently detect change using the BADR design. These analyses are also used to identify the most efficient approach to return interval and replicates for monitoring.

For most taxa, we have an emerging understanding of spatial variation but need more information on spatial and inter-annual variation in order to attribute stressor-induced effects. This year's data collection will contribute substantially to the overall approach and will fill some known gaps in monitoring on oil and gas-related footprint in space and time. Future monitoring plans will take into account all data collected to date along with recommendations arising from the sensitivity analysis. The flexibility of the BADR design allows for year-to-year changes while incorporating all data collected previously under the design.

#### CONTROLLING FOR CONFOUNDING FACTORS

The BADR design minimizes the impacts of potential confounding factors through habitat and disturbance stratification. Stratification of this nature controls for unwanted sources of variation which could impact our ability to detect change due to oil sands activity.

For the first phase of BADR, habitat stratification will focus on the two dominant habitat types in the OSR: 1) upland deciduous/mixedwood at least 40 yrs old, and 2) treed lowlands at least 20 yrs old. These two habitat types represent groupings of finer habitat and age types that are common across the majority of the oil sands region. Both these habitat strata have been mapped across the entire OSR.

Rare habitats of focus (supplementary to BADR) will include 1) graminoid fen/meadow marsh, 2) old-growth forest, 3) shallow open water wetlands, and 4) pine forest. The rare habitats are important components of the biological landscape with limited areas that are home to rare, sensitive, and at-risk species. Where possible, these habitats will be sampled within LUs but may require that we sample more broadly across the entire OSR to ensure sufficient replication to document change and ensure the entire disturbance gradient is sampled.

#### STATISTICAL MODELING

The use of spatially defined disturbance and habitat strata allows us to statistically model responses in unsampled areas of these strata within each LU and across the broader OSR. We will use observations from monitoring sites as a stratified sample of the LU to make LU-level estimates of effects of oil sands disturbance. The total cover of treatment strata across the OSR will be used to infer the overall regional

effect of oil sands disturbance and how this changes over time, allowing extension of results throughout the OSR.

In addition, dose-response regression models created from JEM site data can be mapped at larger regional extents to predict the abundance of species at un-sampled locations to estimate regional population sizes. The level of accuracy in these spatial predictions will increase over time as we collect additional data. It is anticipated that multiple years of data collection will be required to complete this task.



## 7.0 Accounting for Scale

### **Evaluation of Accounting for Scale Criteria (Information Box Only- No action required)**

Your workplan will be evaluated against the criteria below. A successful workplan would potentially be:

- appropriate to the key question and indicator of interest
- relevant to sub-regional and regional questions
- relevant to organism, population and/or community levels of biological organization
- where modelled results are validated with monitored data
- where monitoring informs on environmental processes that occur at a regional scale. e.g. Characterizing individual sources to gain a regional estimate of acid deposition and understand signal from individual contributing sources.

Explain how your monitoring tracks regional and sub-regional state of the environment, including cumulative effects. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

### RELEVANT MONITORING SCALES

We address two types of scale within the TBM workplan:

1. Scale of ecological organization. Data are collected on individual behaviour and health as well as species' distributions and populations, and their communities. The details on the selected levels of biological organization are provided in Section 10.5 Indicators.
2. Spatial scale. Monitoring locations were intentionally selected to represent local and regional disturbance, such that program data and analyses provide knowledge relevant to local, landscape, and regional questions, efficiently addressing indicators at several relevant organizational scales (organisms, communities, and populations). The BADR design integrates data across scales and address regional and sub-regional questions by using two levels of disturbance gradient:
  - a. First, a regional disturbance gradient is generated by dividing the OSR into watershed or landscape units and assigning them a score based on cumulative oil sands footprint. Sub-sampling occurs across the region to ensure balanced dose-response sampling at the landscape level. Four landscape units will be added to the program in 2023-24 (see the Landscape Unit figure in the Sub-Workplan Appendix), with monitoring activity in these and in a subset of LUs incorporated in the program to-date included in the 2023/2024 workplan.
  - b. Second, within each landscape unit, sites are selected to fill in a local disturbance gradient within each targeted habitat type. This local gradient is a set of spatially mapped disturbance strata which are described in brief under Section 6.0.

Details on implementation for different taxa are provided in the sub-workplans. Further details on the BADR design are presented in Bayne et al. 2021.

### MODEL VALIDATION

As noted above, species habitat models that describe relative abundance in response to oil sands disturbance and other stressors have been established with varying degrees of detail for species within all indicator groups. Results generated by the BADR design will validate and advance existing predictive models. Within an adaptive monitoring framework, discrepancies between predicted and observed impacts on indicators (i.e., forecast triggers) may trigger focused monitoring and/or investigation of cause.



## 8.0 Transparency

### Evaluation of Transparency Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would potentially include:

- a plan for dissemination of monitoring data, including appropriate timing, format, and aligns with OSM program data management plan
- demonstrated transparency in past performance
- identified an annual progress report as a deliverable
- reporting of monitoring results occurs at timing and format that is appropriate for recipient audience.

Explain how your monitoring generates data and reporting that is accessible, credible and useful. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

#### OVERALL

Based on guidance from the OSM Program Office, TBM PIs will prepare raw, QAQC'ed and derived data products generated from this workplan for dissemination through priority venues and platforms, such as the OSM data portal. As part of the process, TBM PIs will confirm the target audience of each product to ensure content is delivered in an appropriate format and with meaningful documentation, to support its active uptake by end users. Data will be made available on an annual basis, although timing may be adjusted based on user input and data processing timelines. TBM PIs will also provide access to these data and information products through their own organizational websites, and guide users to the location of OSM-program related content.

#### DATA

Currently, many TBM project collaborators (e.g., ABMI, ECCC, OMEI) host and distribute data in a variety of formats via their own publicly accessible repositories, interactive portals, and through regulatory databases which provide access to a significant accumulated data asset. The TBM team also continues to work with OSM Program staff, AEP geospatial staff and Service Alberta to make data accessible and discoverable in a timely manner through the OSM data portal. Service Alberta is leading discussions on data standards and metadata requirements with TBM PIs to ensure data can be effectively integrated and support OSM data objectives and processes.

#### PUBLICATIONS AND REPORTING

Results generated by this workplan will be compiled, analyzed, and shared in multiple formats to reach target OSM program audiences. In 2023-24, this will include manuscripts intended for scientific publication, technical reports to advance results of relevance to decision-makers, and annual reports generated by TBM program PIs.

#### PUBLIC DISSEMINATION

Some members of the TBM team have access to expertise in the production of lay language products within their organizations (notably ABMI, ECCC, and OMEI). These organizations will continue to generate content

for public release to enhance awareness of the activities and outcomes of the OSM program overall, but also for specific purposes including outreach to communities.

## 9.0 Efficiency

### Evaluation of Efficiency Criteria (Information Box Only- No action required)

Your workplan will be evaluated against the criteria below. A successful workplan would include:

- appropriately addressed a risk-informed allocation of resources
- identified the role and justification for each staff member on the proposed work plan
- identified in-kind and leveraged resources (e.g., resources and approaches are appropriately shared with other OSM projects where possible)
- established partnerships (value-added) and demonstrated examples of coordinated efficiencies (e.g., field, analytical)
- identified co-location of monitoring effort
- demonstrated monitoring activities and information collected are not duplicative
- considered sampling/measurement/methods compatibility to other data

Explain how your monitoring is integrated with other OSM projects and incorporates community-based participation and/or engagement in proposed monitoring activities. As relevant, consider adaptive monitoring, the TAC specific Scope of Work document and the Key Questions in your response.

Within the TBM Theme, the BADR design integrates all the core terrestrial monitoring efforts under a unifying framework, along consistent disturbance gradients. The design facilitates co-location of monitoring efforts at nested spatial scales, which further facilitates integrated data analysis to support effective investigation of cause and cumulative effects assessment. Our approach to data collection is integrated at the sub-workplan level to maximize efficiency, share resources, and capitalize on the strengths of the individual organizations involved.

The TBM team continues to engage with other OSM Theme areas to identify integration opportunities. These include:

- Groundwater Dependent Ecosystems monitoring in collaboration with the Groundwater TAC. This work is scoped within the 2023/24 Geospatial Workplan;
- Wetlands monitoring group collaborating on vegetation and integration of vegetation protocols;
- Active collaboration on human footprint and habitat monitoring with the Integrated Geospatial Workplan;
- Water TAC collections in collaboration with the Investigation of Cause: Mercury in Downstream Receiving Environments;
- Collaboration with the Air TAC on the Berry ICBM Program; and
- Air, Water, Wetlands, Groundwater and Data integration TAC coordination on the Integrated Wildlife Contaminants Program (under development)

In addition to the collaborations with the Wetlands, Air, and Groundwater theme areas (e.g., exploration of alignment of study design and data collection protocols), the TBM team also has several ongoing, established partnerships outside of OSM, that contribute to the overall value of the OSM program. These include (1) Participation in broader research collaborations such as the Boreal Ecological Recovery Assessment (BERA), Alberta Biodiversity Chairs (ABC) and the Boreal Avian Modelling (BAM) project; (2) Organization-level partnerships with delivery agencies and collaborators that contribute value such as InnoTech Alberta, and the University of Alberta, and University of Victoria, among numerous other universities; and (3) Industrial 'within fence line' monitoring programs that align with TBM protocols, supporting industrial environmental management.

Indigenous communities and land users have been involved in wildlife contaminants and toxicology monitoring since the initiation of the JOSM monitoring program in 2012 and continue to be highly integrated into sample and data collection and reporting both individually and through CBM programs. Additional engagement will be done with interested communities via the ICBM Facilitation Centre to facilitate consistency in terrestrial monitoring approaches where appropriate.

## 10.0 Work Plan Approach/Methods

### 10.1 List the Key Project Phases and Provide Bullets for Each Major Task under Each Project Phase \*

#### PHASE 1 - Terrestrial monitoring in alignment with adaptive framework using the BADR design

- Task 1 - Site selection & logistics planning
  - Site selection for upcoming monitoring year(s): Monitoring sites will be selected within the identified LUs, stratified by habitat and local disturbance strata. Individual protocol locations will then be selected by relevant PIs within those JEMs.
  - Site access permissions: PIs will communicate with industry to gain access to identified sites. Note that some sites will occur on lease, and that specified industry safety and training requirements will be followed by all staff accessing sites on lease.
  - Logistics planning: coordinate field efforts to conduct terrestrial monitoring on the landscape in an efficient manner. This includes lodgings, transportation, field scheduling to align terrestrial monitoring being completed, etc.
  - Protocol review and finalization: All SOPs will be reviewed before and after use and updated as necessary. Some protocols will be digitized in 2023/24 to allow for efficient and standardized data collection.
  - Indigenous engagement: consult with local Indigenous communities to determine sites, species, and indicators of health that include Indigenous knowledge for the wildlife health contaminants program.
  
- Task 2 - Field data collection
  - Timing and methodologies specific to each sub-workplan/indicator: Field methodologies (e.g., remote camera arrays, autonomous recording units, mark-recapture surveys etc.) will be implemented between May and March to monitor the terrestrial environment in the OSR. Alignment in timing of fieldwork among the TBM sub-workplans as well as with other OSM Themes will be achieved where feasible and reasonable to do so.
  
- Task 3 - Data management
  - Data processing and QAQC: Standard Operating Procedures and protocol documents are available for data collection and management. Collected data (i.e., digital data, tissue samples) will be processed as per specified lab protocols and/or standard operating procedures (e.g., OSM Camera Trap Image Processing). Paper or tablet collected data will undergo QAQC procedures to ensure data is complete and accurate. MAPS data will continue to undergo rigorous QAQC through established processes used across the continent by MAPS operators. All data processing and QAQC documentation will be updated as necessary.
  - Engaging with Service Alberta on development of the OSM Data Catalogue: TBM PIs will continue to be active collaborators with Service Alberta in the development of the OSM Data Catalogue, providing data asset inventories and feedback on catalogue structure and organization.
  - Compliance with OSM Program data management framework: All terrestrial monitoring data, technical reports, and peer-reviewed literature will be submitted to the OSM data catalogue or be made publicly available through other mechanisms (e.g., established CWS, AEP databases). Further, PIs will continue to be active with respect to identifying and utilizing cross-party data repositories (e.g., WildTrax). Additionally, existing standards developed by ECCC and/or Government of Alberta will be incorporated wherever possible.

#### PHASE 2 - Analysis and evaluation of change

- Task 1 - Analysis of historical and new data as available
  - Ongoing analysis of existing datasets to address identified questions. Details of annual questions by indicator are provided in the sub-workplan supporting material. Questions largely focus on (1) Evaluating change in response to OS stressors; (2) Integrated analytical approaches; and (3) Assessing and refining approach. These activities will leverage the historical datasets available through the PI team and the new

data being collected under BADR.

- Task 2- Stressor and habitat monitoring
  - Leverage updated geospatial resources to assess changes in stressors & habitats. The ability of the BADR design to function as a stressor-based program is contingent on the continued development of timely and informative geospatial products—work scoped in the 2023/24 Geospatial Workplan.
  - Assessing the spatial variability and temporal change in receptors.
  - Supporting clarification of the ecological pathways that link stressors to receptors.

#### PHASE 3 - Adaptive implementation of the integrated monitoring framework

- Task 1 - Baseline and trigger development
  - Gap analysis: Ongoing data assessment for priority terrestrial indicators.
  - Baseline development: Develop statistical/empirical baselines and monitoring triggers for a subset of priority terrestrial indicators with adequate data, expand approach developed for bird indicators.
- Task 2 - Consideration of updated/new habitat and stressor monitoring data
  - Scoping and development of coarse-filter habitat and landscape indicators.
  - Evaluation of options for incorporation of natural disturbance factors such as wildfire.
  - Collaborative review of disturbance and habitat categories and updated footprint layers.
- Task 3 - Integrated planning for 2024-2025
  - Identify successes and challenges from field monitoring efforts and update protocols and/or approaches as necessary. Protocols and methodologies can evolve iteratively, as new information is attained, at either the landscape or the local scale to answer new or modified questions.
  - Addressing results of ongoing precision analyses and incorporating new or modified questions as they relate to the identified OSM priorities for 2024-25 or program positions within the adaptive monitoring framework.
  - Incorporate priorities and input from ongoing TAC discussions and Indigenous partnerships into the direction of the program.
  - Initiate collaborative site selection for 2024-2025 monitoring with TBM PIs to identify LUs for subsequent JEM site selection to occur in 2024-25.
  - Evaluation of calculated baselines with new field data.

#### 10.2 Describe how changes in environmental Condition will be assessed \*

Changes in environmental conditions will be assessed along multi-stressor gradients which include reference conditions. Multiple analytical tools will be used to assess the results such as regression and multivariate analysis. The main assessment approach of BADR will be the use of dose-response curves, which plot environmental response against an increasing gradient of oil sands disturbance. Such models will be used to assess how species are likely to change in the future to assess risk (see Section 6.0). Similarly, the data will be used in conjunction with ongoing efforts to understand the natural range of variation caused by natural disturbances, such as fire, through academic partnerships (e.g., the Boreal Avian Modelling project; BAM) and through the Alberta Land-Use Framework planning process.

#### 10.3 Are There Benchmarks Being Used to Assess Changes in Environmental Condition? If So, Please Describe, If Not, State "NONE" \*



The proposed terrestrial monitoring design includes monitoring in low-disturbance areas to establish a comparative reference condition against which to assess monitoring data from higher stress regions and locations. Implementation of the design will include consideration of effect size (i.e., what constitutes a significant change from reference) and the sample sizes needed to detect the effect size within a specified degree of confidence. Work to develop baselines and triggers for terrestrial indicators is ongoing with an objective in 2023/24 of producing preliminary baselines for select indicators with adequate data resources. Engagement of key stakeholders will be completed as part of these processes to ensure awareness and solicit input and feedback from all OSM caucuses.

(e.g., objectives, tiers, triggers, limits, reference conditions, thresholds, etc.)

#### 10.4 Provide a Brief Description of the Western Science or Community-Based Monitoring Indigenous Community-Based Monitoring Methods by Project Phase \*

Further details are provided in the indicator descriptions in the Sub-Workplan Appendix.

PHASE 1 - Terrestrial monitoring in alignment with adaptive framework using the BADR design

- Most field monitoring and data analysis will be implemented as described in the BADR framework, which represents a western science approach, including standardized data collection protocols using remote sensing, wildlife cameras, autonomous recording units (ARUs), plant transect sampling, capture-mark-recapture (mist-netting and bird banding), contaminant passive samplers, and tissue samples.
- Indigenous community involvement in the collection of animal and tissue samples for contaminant analysis.

PHASE 2 - Analysis and evaluation of change

- A number of quantitative statistical approaches will be employed on Western science data, such as species-habitat modelling, regression modelling, structural equation modelling, and multivariate analysis.

PHASE 3 - Adaptive implementation of the integrated monitoring framework

- Western science evaluation of BADR including approaches such as sensitivity analyses, community analysis, trigger development, and literature review.
- Western science methods for knowledge and data inventory (systematic or comprehensive review of peer-reviewed and other grey literature).
- Western science (statistical/quantitative/modelling) approaches to guide baseline and trigger development.

#### 10.5 List the Key Indicators Measured, If Not Applicable, State N/A \*

See the Sub-Workplan Appendix for additional details, including indicator species lists.

Stressor Indicators:

- Landscape disturbance: human footprint inventories, land use, and land cover data
- Physical infrastructure: off lease above-ground pipelines, noise, light
- Contaminants: Emissions of SO<sub>2</sub>, NO<sub>2</sub>, base cations; Trace elements; PACs; Nitrogen; Phosphorus; Mercury; and VOCs; Snowpack measures: Inorganic/organic contaminants; Nutrients, trace elements, mercury, PACs, naphthenic acids; sediment trace elements, PACs
- Natural disturbance: Indices of fire, disease, drought

Pathway Indicators:

- Habitat loss

- Habitat degradation
- Habitat recovery
- Periphyton PACs; Aquatic macrophytes, benthic invertebrates: metals, PACs
- Mammal contaminant burdens: PAC and trace metal concentrations in tissue, fur, feces.
- Mammal Health: endocrine responses, population genetics
- Bird contaminant burdens
- Amphibian contaminant burdens
- Increased frequency and severity of wildfire with deposition of contaminants
- Changes in habitat due to climate change

Response Indicators:

- Landbird demographics (Adult survival, adult population, population growth rate, post-fledging productivity), and distributions (Occupancy/density, habitat selection, functional group or guild abundance, species richness/diversity)
- Mammal distributions (Occupancy, abundance, density)

## 11.0 Knowledge Translation

*In the space below, please provide the following:*

- Describe the plan for knowledge transfer and distribution of learnings from the project. This could include workshops, publications, best practice documentation, marketing plan, etc.
- Demonstrate that the knowledge transfer plan is appropriate for the intended end-users.

There are a number of end-users of TBM monitoring data and information products, including members of the oil sands industry, the Governments of Alberta and Canada, Indigenous communities, and the general public. Organizations participating in OSM also utilize program data and information to adjust scopes of annual workplans under an adaptive monitoring framework. To ensure that data and information effectively reach the intended end-users and are used to meet their own needs, appropriate knowledge translation tactics will be employed. These include:

### FOR THE WESTERN SCIENTIFIC COMMUNITY

To mobilize TBM monitoring results, PIs constantly prepare and release conference and workshop presentations, technical reports, and peer-reviewed publications. Data will become available, as per the OSM Program data management framework, via Service Alberta's Data Catalogue, as well as via individual agency/institution websites (e.g., ABMI, WBEA).

### FOR THE GENERAL PUBLIC

The TBM team will provide materials and products in support of the OSM program-level communications plan and/or in response to direct requests from the OSM Program Office. Support for State-of-Environment reporting is an ongoing activity. TBM PIs will develop lay summaries of monitoring findings and results as part of required program annual reporting, and for use as website content, if requested. When feasible and with OSM program oversight, monitoring activities and outcomes will be communicated in public-friendly formats such as blogs, social media, and multimedia reports. These formats support deeper engagement and appreciation of the OSM program goals and objectives, and findings. Individual agency/institution websites will also host this content to further share TBM program results.

### FOR INDIGENOUS COMMUNITIES

Many TBM PIs are already involved in the development and implementation of Indigenous community-based monitoring programs, as scoped both within this work plan and in separate 2023/24 ICBM workplans. TBM partners have also been actively engaged with the ICBMAC and the ICBM Facilitation Centre.

### FOR INDUSTRY, THE REGULATOR AND GOVERNMENT

TBMI PIs are keen to deliver data and information to industry members that can inform their own operational activities in the OSR. Currently, TBM activities generate data and information that can support land management decision making, such as: species distributions, locations of rare habitats, and the current status of species and habitats, indicating those that are predicted to have decreased or increased abundance relative to reference conditions. Furthermore, TBM activities and data may satisfy various regional-scale regulatory approval conditions. Data derived from ambient (i.e., outside fence line) monitoring activities can be compared and contrasted against data collected from within fence line monitoring activities to identify biodiversity risks and management opportunities. As data accrues from implementation of the BADR design, TBM PIs will work with the appropriate parties (industry representatives or associations, such as COSIA) to develop additional products and tools that meet industry needs. Data collected using the BADR design can also be used to generate predictive models to assess foreseeable risks and opportunities for biodiversity (See Section 6.0).

Terrestrial monitoring data has multiple potential applications to government, including providing information on species at risk, status of species and habitats that can inform regional land use plans, and baselines/ranges of natural variation to support policy development around limits of change and/or triggers. Data from all OSM (non-CBM) partners is open by default, and TBM partners also provide data to government branches as requested, as well as through established mechanisms including online data portals, peer-reviewed publications, and technical papers.

#### FOR THE TECHNICAL ADVISORY COMMITTEE (TAC)

The TAC and PI team will meet regularly over the course of the year to review the status of different components of TBM work and discuss next steps. The TAC Terms of Reference identifies that the TBM TAC has a leadership role to play in the development of technical design and reporting. These meetings will help ensure their guidance is captured and reflected in associated deliverables.

## 12.0 External Partners

List by project or project phase each component that will be delivered by an external party (including analytical laboratories) and name the party. Describe and name the associate work plan/grant/contract for these services. \* state none if not required

#### TERRESTRIAL MONITORING OPERATIONS

- Alberta Biodiversity Monitoring Institute (ABMI) - Existing grant (#23GRRSD37)
- InnoTech Alberta - Existing grant (#23GRRSD46)

#### Wildlife Health

- Environment and Climate Change Canada (ECCC Pauli) - No grant or contract required

#### LANDBIRDS

- Bayne Lab at the University of Alberta (UofA Bayne)- Existing grant (#23GRRSD25)
- Owl Moon Environmental Inc. (OMEI) – New contract to be established for 2023-24
- Alberta Biodiversity Monitoring Institute (ABMI) - Existing grant (#23GRRSD37)

#### MAMMALS

- University of Victoria (UVic Fisher) - Existing grant (#23GRRSD27)
- Alberta Biodiversity Monitoring Institute (ABMI) - Existing grant (#23GRRSD37)

\*To ensure complete work plan proposal submission, all grants and contracts listed in this section should also be captured in Grants & Contracts.

## 13.0 Data Sharing and Data Management

For 2022-23 the following approach will be taken by the OSM Program related to data sharing.

For all work plans of a **western science** nature funded under the OSM Program, data sharing is a condition of funding and must align with the principle of "**Open by Default**". In this case, all data is to be shared with the OSM Program as directed by the OSM Program Data Management work plan.

For all work plans involving **Indigenous Knowledge** as defined below and funded under the OSM Program, data sharing is a condition of funding and the Indigenous Knowledge components of the work plan must align with the principle of "**Protected by Default**". In this case, all data as defined as Indigenous Knowledge, are to be retained by the Indigenous community to which the Indigenous Knowledge is held.

*Indigenous Knowledge is defined as:*

"The knowledge held by First Nations, Inuit and Métis peoples, the Aboriginal peoples of Canada. Traditional knowledge is specific to place, usually transmitted orally, and rooted in the experience of multiple generations. It is determined by an Aboriginal community's land, environment, region, culture and language. Traditional knowledge is usually described by Aboriginal peoples as holistic, involving body, mind, feelings and spirit. Knowledge may be expressed in symbols, arts, ceremonial and everyday practices, narratives and, especially, in relationships. The word tradition is not necessarily synonymous with old. Traditional knowledge is held collectively by all members of a community, although some members may have particular responsibility for its transmission. It includes preserved knowledge created by, and received from, past generations and innovations and new knowledge transmitted to subsequent generations. In international or scholarly discourse, the terms traditional knowledge and Indigenous knowledge are sometimes used interchangeably."

*This definition was taken from the Canadian Government's Tri-council Policy Statement for Ethical Research involving Humans (Chapter 9, pg. 113) and is an interim definition specific to the Oil Sands Monitoring Program.*

## Data Sharing and Data Management *Continued*

13.1 Has there, or will there be, a Data Sharing agreement established through this Project? \*

NO

13.2 Type of Quantitative Data Variables:

Both

13.3 Frequency of Collection:

Other

13.4 Estimated Data Collection Start Date:

2023-04-01

13.5 Estimated Data Collection End Date:

2024-03-31

13.6 Estimated Timeline For Upload Start Date:

2024-09-01

13.7 Estimated Timeline For Upload End Date:

2024-12-31

13.8 Will the data Include traditional knowledge as defined by and provided by an Indigenous representative, Community or Organization?

YES

### TABLE 13.9 Please describe below the Location of Data and Data Type:

Add a Data Source by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table

Name of Dataset	Location of Dataset (E.g.: Path, Website, Database, etc.)	Data File Formats (E.g.: csv, txt, API, accdb, xlsx, etc.)	Security Classification
See SUPPLEMENTARY FILE 4 for data descriptions	Click or tap here to enter text.	Click or tap here to enter text.	Choose an item.

## 14.0 2023/24 Deliverables

Add an additional deliverable by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table.

Type of Deliverable	Delivery Date	Description
Choose an item.	Choose an item.	See SUPPLEMENTARY FILE 5 for deliverables and descriptions

## 15.0 Project Team & Partners

**In the space below please provide information on the following:**

- Describe key members of the project team, including roles, responsibilities and expertise relevant to the proposed project.
- Describe the competency of this team to complete the project.
- Identify any personnel or expertise gaps for successful completion of the project relative to the OSM Program mandate and discuss how these gaps will be addressed.
- Describe the project management approach and the management structure.

See SUPPLEMENTARY FILE #6 for complete list of personnel by sub-project and partner organization.



## 16.0 Project Human Resources & Financing

### Section 16.1 Human Resource Estimates

Building off of the competencies listed in the previous section, please complete the table below. Add additional rows as necessary. This table must include **ALL staff involved** in the project, their role and the % of that staff's time allocated to this work plan. The AEP calculated amount is based on an estimate of \$120,000/year for FTEs. This number cannot be changed. The OSM program recognizes that this is an estimate.

#### Table 16.1.1 AEP

Add an additional AEP Staff member by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table. The total FTE (Full Time Equivalent) is Auto Summed (in Table 16.2.1) and converted to a dollar amount.

Name (Last, First)	Role	% Time Allocated to Project
Hynes, Kristin	Interim support staff for OS TBM programs and workplan, TBM TAC, and management of TBM grants and contract.	0%
TBD – new TBM Scientist to be hired	Workplan lead, TBM TAC co-lead, support (coordination, analysis) for TBM programs, management of TBM grants and contract.	100%

#### Table 16.1.2 ECCC

Add an additional ECCC Staff member by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table. The total FTE (Full Time Equivalent) is Auto Summed in Table 16.2.2

Name (Last, First)	Role	% Time Allocated to Project
Pauli, Bruce	Wildlife Health: Principal investigator	50%
Freemark, Maureen	Wildlife Health: Project oversight, technical support, liason with OSM	75%
Mundy, Lukas	Wildlife Health: Technical lead	60%
Thomas, Philippe	Wildlife Health: Technical lead	75%

Chételat, John	Wildlife Health- IOC Hg Downstream Receiving Environments: Principal Investigator	50%
Dolgova, Svetlana	Wildlife Health: Field support, sample preparation and analysis	100%
McClelland, Christine	Wildlife Health: Field support, sample preparation and analysis	100%
Technician TBD	Wildlife Health- IOC Hg Downstream Receiving Environments: sample processing, analyses	100%
Technician TBD	Wildlife Health- Integrated Contaminants: oversight, technical support	100%

The tables below are the financial tables for Alberta Environment & Parks (AEP) and Environment & Climate Change Canada. All work plans under the OSM Program require either a government lead or a government coordinator.

## Section 16.2 Financing

The OSM Program recognizes that many of these submissions are a result of joint effort and monitoring initiatives. A detailed "PROJECT FINANCE BREAKDOWN" must be provided using the Project Finance Breakdown Template provided, accessible here (ctrl + click the link below). Please note that completion of this Project Finance Breakdown Template is mandatory and must be submitted along with each workplan.

### [PROJECT FINANCE BREAKDOWN TEMPLATE \(CTRL+CLICK HERE\)](#)

**Table 16.2.1 Funding Requested BY ALBERTA ENVIRONMENT & PARKS**

Organization – Alberta Environment & Parks ONLY	Total % time allocated to project for AEP staff	Total Funding Requested from OSM
<b>Salaries and Benefits</b> <i>(Calculated from Table 16.1.1 above)</i>	<b>100.00%</b>	<b>\$120,000.00</b>
<b>Operations and Maintenance</b>		
Consumable materials and supplies		\$1,000.00
Conferences and meetings travel		\$1,500.00
Project-related travel		\$1,500.00
Engagement		\$500.00
Reporting		\$3,000.00
Overhead		\$0.00
<b>Total All Grants</b> <i>(Calculated from Table 16.4 below)</i>		<b>\$4,072,000.00</b>
<b>Total All Contracts</b> <i>(Calculated from Table 16.5 below)</i>		<b>\$1,260,000.00</b>
<b>Sub- TOTAL</b> <i>(Calculated)</i>		<b>\$5,459,500.00</b>
Capital*		\$0.00
<b>AEP TOTAL</b> <i>(Calculated)</i>		<b>\$5,459,500.00</b>

\* The Government of Alberta Financial Policies (Policy # A600) requires that all **capital asset** purchases comply with governmental and departmental legislation, policies, procedures, directives and guidelines. **Capital assets** (Financial Policy # A100, Government of Alberta, January 2014) are tangible assets that: have economic life greater than one year; are acquired, constructed, or developed for use on a continuing basis; are not held for sale in ordinary course of operations; are recorded and tracked centrally; have a cost greater than \$5,000.

Some **examples of capital asset equipment include:** laboratory equipment, appliances, boats, motors, field equipment, ATV's/snowmobiles, stationary equipment (pier/sign/weather), fire/safety equipment, pumps/tanks, heavy equipment, irrigation systems, furniture, trailers, vehicles, etc. (Financial Policy # A100, Government of Alberta, January 2014).

**Table 16.2.2 Funding Requested BY ENVIRONMENT & CLIMATE CHANGE CANADA**

Organization – Environment & Climate Change Canada ONLY	Total % time allocated to project for ECCC staff	Total Funding Requested from OSM
<b>Salaries and Benefits FTE</b> <i>(Please manually provide the number in the space below)</i>		
Salaries and Benefits		\$1,058,297.00
<b>Operations and Maintenance</b>		
Consumable materials and supplies		\$388,323.00
Conferences and meetings travel		\$0.00
Project-related travel		\$33,000.00
Engagement		\$300,000.00
Reporting		\$0.00
Overhead		\$124,103.00
<b>ECCC TOTAL</b> <i>(Calculated)</i>		<b>\$1,903,723.00</b>

\* ECCC cannot request capital under the OSM program. Any capital requirements to support long-term monitoring under the OSM program should be procured by Alberta and captured in that budget table.

**Table 16.3**

**Complete ONE table per Grant recipient.**

**Add a Recipient by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table. The total of all Grants is Auto Summed in Table 16.2.1**

GRANT RECIPIENT - ONLY: Name	Monica Kohler
GRANT RECIPIENT - ONLY: Organization	Alberta Biodiversity Monitoring Institute (ABMI)
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$1,470,000.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$5,000.00
Conferences and meetings travel	\$11,000.00
Project-related travel	\$300,000.00
Engagement	\$0.00
Reporting	\$77,000.00
Overhead	\$186,300.00
GRANT TOTAL (Calculated)	<b>\$2,049,300.00</b>
GRANT RECIPIENT - ONLY: Name	Emily Herdman, Neal Tanna
GRANT RECIPIENT - ONLY: Organization	InnoTech Alberta
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$98,000.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$0.00
Conferences and meetings travel	\$0.00
Project-related travel	\$2,000.00
Engagement	\$5,000.00
Reporting	\$15,000.00
Overhead	\$0.00
GRANT TOTAL (Calculated)	<b>\$120,000.00</b>
GRANT RECIPIENT - ONLY: Name	Dr. Erin Bayne
GRANT RECIPIENT - ONLY: Organization	University of Alberta
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$126,834.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$5,000.00
Conferences and meetings travel	\$0.00
Project-related travel	\$30,000.00
Engagement	\$0.00
Reporting	\$1,500.00
Overhead	\$32,666.00
GRANT TOTAL (Calculated)	<b>\$196,000.00</b>

GRANT RECIPIENT - ONLY: Name	Dr. Scott Nielsen
GRANT RECIPIENT - ONLY: Organization	University of Alberta
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$0.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$0.00
Conferences and meetings travel	\$0.00
Project-related travel	\$0.00
Engagement	\$0.00
Reporting	\$0.00
Overhead	\$0.00
<b>GRANT TOTAL</b> <i>(Calculated)</i>	<b>\$0.00</b>
GRANT RECIPIENT - ONLY: Name	Dr. Jason T Fisher
GRANT RECIPIENT - ONLY: Organization	University of Victoria
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$254,000.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$160,800.00
Conferences and meetings travel	\$11,500.00
Project-related travel	\$55,960.00
Engagement	\$0.00
Reporting	\$0.00
Overhead	\$120,565.00
<b>GRANT TOTAL</b> <i>(Calculated)</i>	<b>\$602,825.00</b>

## Table 16.4

### Complete ONE table per Contract recipient.

Add a Recipient by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table. This section is only to be completed should the applicant intend to contract components or stages of the project out to external organizations. The total of all Contracts is Auto Summed in Table 16.2.1

CONTRACT RECIPIENT - ONLY: Name	Dr. Kenneth Foster, Christine Godwin
CONTRACT RECIPIENT - ONLY: Organization	Owl Moon Environmental Inc. (OMEI)
<b>Category</b>	<b>Total Funding Requested from OSM</b>
Salaries and Benefits	\$905,500.00
<b>Operations and Maintenance</b>	
Consumable materials and supplies	\$24,600.00
Conferences and meetings travel	\$19,600.00
Project-related travel	\$244,000.00
Engagement	\$0.00
Reporting	\$6,200.00
Overhead	\$60,100.00
<b>CONTRACT TOTAL</b> <i>(Calculated)</i>	<b>\$1,260,000.00</b>

**Table 16.5 GRAND TOTAL Project Funding Requested from OSM Program**

The table below is auto calculated, please do not try to manually manipulate these contents.

Category	Total Funding Requested from OSM
<b>Salaries and Benefits</b> <i>Sums totals for salaries and benefits from AEP and ECCC ONLY</i>	\$1,178,297.00
<b>Operations and Maintenance</b>	
<b>Consumable materials and supplies</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$389,323.00
<b>Conferences and meetings travel</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$1,500.00
<b>Project-related travel</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$34,500.00
<b>Engagement</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$300,500.00
<b>Reporting</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$3,000.00
<b>Overhead</b> <i>Sums totals for AEP and ECCC ONLY</i>	\$124,103.00
<b>Total All Grants (from table 16.2.1 above)</b> <i>Sums totals for AEP Tables ONLY</i>	\$2,968,125.00
<b>Total All Contracts (from table 16.2.1 above)</b> <i>Sums totals for AEP Tables ONLY</i>	\$1,260,000.00
<b>Sub- TOTAL</b>	\$6,259,348.00
<b>Capital*</b> <i>Sums total for AEP</i>	\$0.00
<b>GRAND PROJECT TOTAL</b>	\$6,259,348.00

Some **examples of capital asset equipment include:** laboratory equipment, appliances, boats, motors, field equipment, ATV's/snowmobiles, stationary equipment (pier/sign/weather), fire/safety equipment, pumps/tanks, heavy equipment, irrigation systems, furniture, trailers, vehicles, etc. (*Financial Policy # A100, Government of Alberta, January 2014*).



## 17.0 FINANCIAL MANAGEMENT

**The OSM Program reserves the right to reallocate project funding during the current fiscal year on the basis of project performance and financial overspend or underspend.**

Please check this box to acknowledge you have read and understand

**In the space below please describe the following:**

- Discuss how potential cost overruns and cost underruns will be managed.
- If this is a continuing project from last year, identify if this project was overspent or underspent in the previous year and explain why.
- Describe what risks and/or barriers may affect this project.

All partners will follow good financial management practices as required by their agencies, institutions, or corporations, and will submit quarterly (or more frequent) financial reports to the OSM Program Office as per OSM requirements and schedule.

Determining precise financial over/underspending of the 2022/23 Terrestrial Biological Workplan is difficult as not all contracts are in place and thus invoicing is not yet complete and up to date. That said, we anticipate no major cost over/underruns from 2022/23 and all invoicing and reporting to date has been on schedule and on budget.

The major risks to this project include but are not limited to unforeseen barriers to fieldwork completion, including actions of non-stakeholders or natural incidents such as wildfires or floods or public health measures.

## 18.0 Alternate Sources of Project Financing – In-Kind Contributions

**Table 18.1 In-kind Contributions**

Add an In Kind Contribution by clicking on the table and then clicking on the blue "+" symbol on the bottom right side of table.

DESCRIPTION	SOURCE	EQUIVALENT AMOUNT (\$CAD)
ECCC Wildlife Health: Salary	ECCC	\$200,000.00
ECCC Wildlife Health: lab analysis and sample archiving and retrieval	ECCC	\$40,000.00
ECCC Wildlife Health: Parks Canada salary, sharing of logistics costs, field support	Parks Canada	\$10,000.00
NSERC Scholarships to UVIC students working on OSM	NSERC / UVIC	\$40,000.00
UVIC scholarships to Rebecca Smith, MSC candidate	UVIC	\$15,000.00
ECCC Wildlife Health: Honorarium paid inkind	Participating communities (n=10)	\$50,000.00
ECCC Wildlife Health: Salary for project coordinator at Alberta Trappers Association	Alberta Trappers Association	\$17,000.00
ECCC Wildlife Health: Student stipends	NSERC Discovery	\$12,000.00
ECCC Wildlife Health: Shipping costs	University of Alberta	\$2,500.00

ECCC Wildlife Health: Chemical analyses (POPs)	Alberta Conservation Association	\$7,000.00
ECCC Wildlife Health: Hazardous and biological waste disposal	University of Alberta	\$8,000.00
ABMI equipment (trailers, sensors etc.)	Alberta Biodiversity Monitoring Institute	\$75,000.00
ABMI computing and data infrastructure	Alberta Biodiversity Monitoring Institute	\$100,000.00
ABMI leveraged research	Alberta Biodiversity Monitoring Institute	\$20,000.00
UofA Bayne salary	University of Alberta	\$40,000.00
UofA equipment (eg. ARUs)	University of Alberta	\$50,000.00
<b>TOTAL</b>		<b>\$686,500.00</b>

## 19.0 Consent & Declaration of Completion

**Lead Applicant Name**

Kristin Hynes

**Title/Organization**

Invertebrate Monitoring Biologist, Alberta Environment and Protected Areas

**Signature**

Kristin Hynes

**Date**

2023-05-31

**Government Lead / Government Coordinator Name** (if different from lead applicant)

Click or tap here to enter text.

**Title/Organization**

Click or tap here to enter text.

**Signature**

Click or tap here to enter text.

**Date**

Click or tap to enter a date.

# PROGRAM OFFICE USE ONLY

## **Governance Review & Decision Process**

*this phase follows submission and triggers the Governance Review*

**TAC Review (Date):**

Click or tap to enter a date.

**ICBMAC Review (Date):**

Click or tap to enter a date.

**SIKIC Review (Date):**

Click or tap to enter a date.

**OC Review (Date):**

Click or tap to enter a date.

**Final Recommendations:**

**Decision Pool:**

Choose an item.

**Notes:**

Click or tap here to enter text.

## **Post Decision: Submission Work Plan Revisions Follow-up Process**

*This phase will only be implemented if the final recommendation requires revisions and follow-up from governance*

**ICBMAC Review (Date):**

Click or tap to enter a date.

**SIKIC Review (Date):**

Click or tap to enter a date.

**OC Review (Date):**

Click or tap to enter a date.

**Comments:**

**Decision Pool:**

Choose an item.

**Notes & Additional Actions for Successful Work Plan Implementation:**

Click or tap here to enter text.