5- YEAR LONG-TERM MONITORING OR OPERATIONAL ACTIVITY WORK PLAN

Changes to this Work Plan are only accepted via an Approved Addendum.

General Information		
Monitoring Category: *(From OSM long-term plan; choose from drop-down menu)*	Biotic Response Monitoring	
Strategic Monitoring Objective: *(From OSM long-term plan; choose from drop-down menu)*	Objective: Detect and report biotic response in relation to Oil Sands Developments	
Work Plan Unique Identifier:	*B-LTM-S-1-1718*	
Monitoring Activity Title:	Regional Terrestrial/Aquatic Monitoring - Status and Trends	
Geographic Location (*choose from drop-down menu, if Project Location is in more than one area choose from second drop-down***)**	Other Region (Described in Monitoring Schedule)	More than 2 Locations (Described in Monitoring Schedule
Monitoring Site(s) Coordinates *(latitude and longitude)*	Described in Monitoring Schedule	
Monitoring Organization and Responsible Manager:	Alberta Environment and Parks	Dan Farr
Date Monitoring initiated:	**2007**	
Specific Monitoring Objective: *(State the monitoring objective addressed through this monitoring)*	The objective of this project is to monitor, evaluate and report on the status and trends of biotic communities and species in terrestrial and wetland ecosystems throughout all 3 oil sands deposits (Athabasca, Cold Lake, Peace River).	

Deliverables (Annual):

What Data Reports will be produced and when?

Year	PLEASE REVIEW AND PROPOSE REVISIONS IF DESIRED
2017-18	Roy, M-C, & D. Locke. Effect of adjacent industrial development on wetlands. (for submission to a peer-reviewed journal). December 31, 2017 Solymos, P., D. Huggard & J. Schieck. Estimating the degree to which different industrial sectors effect biota in Alberta's boreal forest. (for submission to a peer-reviewed journal). March 31, 2018
2018-19	Solymos, P., E. Bayne, & J. Schieck. How does sub-sampling of bird recordings influence species detection? (for submission to a peer-reviewed journal). December 31, 2018 Topic for 2nd publication to be determined at the start of the 2018-19 fiscal year (for submission to a peer-reviewed journal). March 31, 2019
2019-20	New Post-doc, & S. Boutin. Is there redundancy among taxa in human disturbance relationships? (for submission to a peer-reviewed journal). December 31, 2019 Topic for 2nd publication to be determined at the start of the 2019-20 fiscal year (for submission to a peer-reviewed journal). March 31, 2020
2020-21	Azeria, E., & P. Solymos. Can species co-occurrence be used to identify ecological guilds? (for submission to a peer-reviewed journal). December 31, 2020 Topic for 2nd publication to be determined at the start of the 2020-21 fiscal year (for submission to a peer-reviewed journal). March 31, 2021
2021-22	New Post-doc, J. Schieck, D. Huggard, & S. Boutin. Optimal sampling design to monitor changes in species distribution and abundance. (for submission to a peer-reviewed journal). December 31, 2021 Topic for 2nd publication to be determined at the start of the 2021-22 fiscal year (for submission to a peer-reviewed journal). March 31, 2021

	Annual	• Annual report summarizing monitoring activities and findings from the prior year; print and online versions, with links to uploaded data. November 30th each year. • Presentation at an international scientific conference. • Updates to the ABMI data portal to disseminate relationships between species abundance and industrial development.

Monitoring Plan Summary: *Please summarize the monitoring including relevant information such as background, objectives, monitoring area, methods/monitoring design, assumptions, outcomes, and references. These should align with the information provided in Appendix 1: Annual Monitoring Schedule.*

1. **Background**

The status and trends of biodiversity in the oil sands region will be monitored using a suite of protocols deployed throughout Alberta since 2007 (ABMI 2014). Monitoring history to date is summarized in Table 1.

Table 1. History of biodiversity monitoring at provincial network (on-grid) sites in the Oil Sands Region, 2007 - 2016.

	Terrestrial Protocol		Wetland Protocol	
	Round 1	Round 2	Round 1	Round 2
2007	45	0	45	0
2008	27	0	24	0
2009	36	0	35	0
2010	25	0	25	0
2011	40	0	41	0
2012	59	0	57	0
2013	97	0	96	0
2014	79	0	79	0
2015	10	63	3	70
2016	1	90	1	90
Total	419	153	406	160

Data have been used to estimate the relative abundance of 425 species detected at 186 sites (ABMI 2014a). Taxonomic representation includes 10 species of mammals, 80 native birds, 183 native plants, 90 bryophytes, and 62 armoured mites. Estimates of relative abundance have been released via an online portal that is update annually. These estimates account for natural covariates (e.g., natural region, latitude, climate) and anthropogenic factors such as industrial footprint. For 390 additional species detected at fewer than 20 monitoring stations, small sample size precludes the calculation of relative abundance; only detection frequency has been calculated.

Results suggest that 81 species have become more common in the region since industrial development began around 1950, while 331 species are likely less common, and the abundance of 13 species has likely remained unchanged (ABMI 2014b). These findings are based on a reference condition approach to calculate the difference between observed abundance vs abundance predicted in the absence of industrial footprint (Nielsen et al. 2007, Burton et. al. 2014).

Relative abundance of each species in each habitat type, and cumulative effects of human development (difference between reference and present condition) for each species have been estimated based on the stratified and targeted sampling completed by ABMI to date (see Figures 1-4 below). Results from these analyses are presented for each species on the ABMI website

(ABMI 2016e). In addition, cumulative effects have been partitioned to estimate the individual effects of each sector on each species (ABMI 2016e). Estimates of temporal change for species in the Oil Sands region are presently being determined, with results updated each year based on information collected during the previous year. Reliability of results will improve over time as more and more sites are revisited. By 2020, by all sites in the eastern Oil Sands region will have been surveyed twice, with that data cleaned, verified, and incorporated into ABMI analyses. At that time, reliable estimates of trend are expected for common species that have high detectability and low inter-annual variability (Neilson et al. 2009, AITF 2012, Huggard 2013). For species that are less common, have moderate detectability, and have moderate inter-annual variability, reliable estimates of trend are expected after the third round of surveys are completed at Oil Sands sites (completion in the eastern Oil Sands region is anticipated by 2025). For rare species, and species with high inter-annual variability, additional monitoring cycles will be required to determine reliable estimates of trend. Reliable results for common species in the western Oil Sand region are expected once sites there have been surveyed twice (anticipated by 2026).

2. Objectives

The objective of this project is to monitor, evaluate and report on the status and trends of biotic communities and species in terrestrial and wetland ecosystems throughout all 3 oil sands deposits (Athabasca, Cold Lake, Peace River).

3. Monitoring Area

The monitoring area includes all three Oil Sands Deposits (Athabasca, Cold Lake, Peace River) plus an additional area north of the Athabasca Deposit to enable full representation of the Lower Athabasca Region for regional biodiversity management framework reporting (Government of Alberta 2012).

4. Methods and Monitoring Design

Standardized monitoring protocols will be deployed at approximately 20% of the 565 permanent monitoring sites in the monitoring area each year (Table 2; Figure 2). Annual adjustments may be required to accommodate the disruption of monitoring activities due to wildfire and other unforeseen circumstances. In the case of disruptions, backup sites are selected and assessed. However, this impacts the number sites that are fully monitored in the following year given the original site and backup sites need to be revisited to complete protocols not completed in the previous year. For example, due to forest fires in 2016, 16 sites were only partially surveyed for spring and summer protocols and need to be completed in 2017. Further, the 16 backup sites selected in 2016 will need cameras and ARUs installed given they were not deployed in 2016.

Terrestrial monitoring protocols will be deployed during 3 visits in a given year (ABMI 2016a, Lankau 2015). Monitored parameters include:

- % cover of water, bare soil, and low vegetation, shrubs, trees
- Tree density (live, dead, down)
- Soil parameters (LFH, organic, mineral)
- Vascular plant diversity
- Bryophyte diversity

- Lichen diversity
- Bird diversity
- Mammal diversity
- Mite diversity

One open-water wetland site near every terrestrial site will be monitored during a single visit (ABMI 2016b). Monitored parameters include:

- Water chemistry, nutrient content, and isotopic signature
- Wetland classes (mineral or organic)
- Area covered by open water, emergent vegetation, graminoid and wooded vegetation.
- % cover of water, bare soil, low vegetation, shrubs, and trees around the wetland
- Area and type of natural and human created disturbance in an around the wetland
- Vascular plant diversity
- Aquatic invertebrate diversity

Table 2. Planned biodiversity monitoring at provincial network (on-grid) sites in the Oil Sands Region, 2017-2021.

	Terrestrial Protocol			Wetland Protocol		
	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
2017	0	66	0	0	66	0
2018	0	77	0	0	77	0
2019	66	35	0	66	35	0
2020	4	38	79	7	53	61
2021	0	53	56	1	52	56
Total	123	260	135	128	273	117

Specimens of vascular plant, bryophyte, lichen, and mite species will be sorted and identified after the field season is complete, under the supervision of taxonomists at the Royal Alberta Museum (ABMI 2010, ABMI 2011a, ABMI 2011b, ABMI 2015, ABMI 2016a). Audio recordings will be processed at the University of Alberta (Bioacoustic Unit 2015), and remote camera images will be processed by ABMI staff (ABMI 2016d).

A quality management plan (ABMI 2016a) is implemented to ensure data produced by the ABMI meet the quality standards required for defensible environmental decisions (Houston and Hiederer 2009, Ferretti 2009, 2011, Sólymos et al. 2015). Field data are collected by trained field staff using standardized monitoring protocols (2016b, c). Throughout the field season, collected specimens are shipped to the Royal Alberta Museum for processing, while field data is verified in-field (ABMI 2013a) by Field Coordinators and then sent to the Information Centre (IC) for post-field verification (ABMI 2013b). In the IC, the data undergoes one round of data quality control prior to loading into the database, and then one final round of data and metadata quality control prior to use for analyses and public release (ABMI 2012, ABMI 2013d). To support data management, several pieces of software are used such as the species data portal for collected specimen identification and entry, taxonomic workbench, site summary workbench, and a metadata workbench.

Assumptions

1. The Government of Alberta will continue to support the ABMI with in-kind support in the

form of spatial base features information (maps of anthropogenic features) and remote-sensing imagery.
2. Funding will be made available in a timely manner.
3. Our key delivery partners continue to support this program area including InnoTech Alberta (formerly Alberta Innovates Technology Futures), The Government of Alberta (Royal Alberta Museum), and the University of Alberta.

Linkages to other OSM projects

Adaptive monitoring of focal plant species in the oil sands region (Nielsen)

- The Alberta Biodiversity Monitoring Institute (ABMI)'s core biodiversity monitoring program is designed to track changes in groups of common plants and animals to understand how their populations might be changing over time. The program wasn't optimized for rare or elusive species. The focal plants project can fill in these gaps and continue to build on the ABMI's Rare Plants Project which was established in 2010 and led by Dr. Scott Nielson, who designed protocols to monitor rare plants in northeastern Alberta.

Biotic response of focal wildlife species to oil sands activity (Toms/Bayne)

- The Alberta Biodiversity Monitoring Institute (ABMI)'s core biodiversity monitoring program is designed to track changes in groups of common plants and animals to understand how their populations might be changing over time. The program wasn't optimized for rare or elusive species. The focal wildlife project will fill in these gaps and continue to build on the ABMI's Rare Animals Project which was established in 2010 and led by Dr. Erin Bayne, who designed protocols to monitor rare vocalizing species in northeastern Alberta.

Biotic response of ungulates to oil sands activity (Farr)

- The ABMI deploys remote camera traps at core sites throughout OSM region to detect mid- to large-sized mammals, such as ungulates. This provides an alternative to aerial surveys, to monitor ungulate species within specific wildlife management units. The ABMI's camera trap data provides supplemental raw data for this project.

Forest health monitoring (WBEA)

- The ABMI has 565 terrestrial core sites in the OSM region, 406 of which have been currently surveyed. Of these surveyed sites, approximately 53 sites have an associated Jack Pine/Lichen ecosite class. Both habitat and species data are recorded at these sites. Based on the findings of WBEA, results may be applied to these ABMI sites and their corresponding data to assess forest ecosystem health.

Long-term wetland monitoring (Cobbaert)

- The ABMI monitors 565 core wetlands in the OSM region. Since monitoring began in 2007, 406 wetlands have been surveyed, 106 of which have been revisited. At each site, the ABMI monitors both habitat and species elements such as water physiochemistry and vascular plants, respectively. Given multiple projects are conducting monitoring in similar ecosystems, integration and alignment of programs is essential to ensure data is comparable, consistent, and accessible.

Waterfowl effects-based assessment (Slattery)

- The ABMI monitors 565 core wetlands in the OSM region. Since monitoring began in 2007, 406 wetlands have been surveyed, 106 of which have been revisited. At each site the ABMI monitors both habitat and species elements such as site disturbance (e.g. Seismic Lines, Pipelines, etc.), and invertebrate and vertebrate (e.g. ducks, shorebirds, etc.) species, respectively. This data may provide supplementary raw data to support this project.

2017-18 Outcomes

Data

All raw data is available via the online data portal, which is updated in October with the previous year's (i.e. 2017 data is released in 2018) field collected habitat and species data.

Terrestrial Data (Name & Description)		Completion Date
T01	Ecosite: broadly describes site physical characteristics, ecological habitat potential using dominant vegetation, current habitat conditions, ground cover and human-caused site disturbance.	October2018
T02	Surface Substrate and Surface Substrate Disturbances	October 2018
T07/T08	Downed Woody Material –Small and Fine, and Coarse	October 2018
T09	Trees, Snags, and Stumps	October 2018
T10	Tree Ages and Damages	October 2018
T11	Canopy Closure	October 2018
T15	Vascular Plants Identification	October 2018
T19	Bryophyte Identification	October 2018
T20	Lichen Identification	October 2018
T24	Mite Identification	October 2018
T26	Breeding Bird Identifications	October 2018
T29	Camera Trap Species Identification	October 2018
Wetland Data (Name & Description)		**Completion Date**
W01	Physical Characteristics: characterization of wetland elevation and bathymetry	October 2018
W02	Site Capability: broadly describes the ecological habitat potential using dominant vegetative communities, and characterizes wetland zones, dominant vegetation, and disturbance	October 2018
W03	Riparian Cover: Broadly describe the natural habitat cover characteristics, and disturbances.	October 2018
W04	Water Physiochemistry	October 2018
W05	Vascular Plant Identification	October 2018
W07/W08	Invertebrate Coarse and Fine Identification	October 2018

Standard Operating Procedure Updates

Alberta Biodiversity Monitoring Institute. 2010. Processing Lichens. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca <July 2017>.

Alberta Biodiversity Monitoring Institute. 2011. Processing Bryophytes. Alberta Biodiversity

Monitoring Institute, Alberta, Canada. Report available at: abmi.ca <July 2017>.

Alberta Biodiversity Monitoring Institute. 2011. Processing Vascular Plants. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca <July 2017>.

Alberta Biodiversity Monitoring Institute. 2009. Processing Mites and Springtails. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca <July 2017>.

Alberta Biodiversity Monitoring Institute. 2016. Camera Trap Processing Protocol 2016-06-02. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: abmi.ca <July 2017>.

Peer-reviewed scientific publications

Please refer to page 2 Deliverables (Annual) for list of peer-reviewed publications and their respective submission dates.

Other information products

Occurrence maps of each species monitored in the region updated to include 2017-18 findings <February 2019>. Please see http://species.abmi.ca/ for species occurrence maps.

Derived Data Products	Completion Date
1. Data Analytics Portal:	Fall 2017
a. *Biodiversity Browser:* outlines species profiles, habitat, and human footprint associations, impacts of human footprint, and predicted relative abundance.	
b. *Data Download:* Downloadable raw data.	
c. *Mapping Portal:* Allows users to map and download spatial data such as land cover, intactness, richness, and uniqueness for various species and species guilds.	
d. *Custom Reporting:* Reports containing information on land cover, and biodiversity metrics can be generated for a user's area of interest in Alberta. ABMI generated reports will include status of biodiversity and human footprint reports.	Fall 2017
2. Naturelynx: Version 2.0 will be launched for use by the public.	Spring 2016

References

Alberta Biodiversity Monitoring Institute. 2010. Processing Lichens. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2011a. Processing Bryophytes. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2011b. Processing Vascular Plants. Alberta Biodiversity

Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2012. Updating Metadata. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2013a. In-Season Data Verification for Terrestrial and Aquatic Protocols 2013-11-18. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2013b. Post-Season Data Verification for Terrestrial and Aquatic Protocols 2013-12-04. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2013c. Tablet Data Receiving, Data Verification and Cleaning, and Data Loading 2013-07-13. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2014a. Status of Biodiversity in the Oil Sands Region. http://www.abmi.ca/home/publications/1-50/40.html?mode=detail&documenttype=Status+of+Biodiversity+Reports.

Alberta Biodiversity Monitoring Institute. 2014b. Status of Biodiversity in the Oil Sands Region Supplementary Data. http://www.abmi.ca/home/publications/1-50/40.html?mode=detail&documenttype=Status+of+Biodiversity+Reports.

Alberta Biodiversity Monitoring Institute. 2015. Processing Aquatic Invertebrates (10017), 2015-07-23. Alberta Biodiversity Monitoring Institute, Alberta, Canada. http://www.abmi.ca/home/publications/351-400/396.html;jsessionid=3780A7424D1940EBC5E77F5C266543BB?mode=detail&subject=aquatic.

Alberta Biodiversity Monitoring Institute. 2016a. Quality Management Plan. 2016-10. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: http://www.abmi.ca/home/publications/401-450/441.html;jsessionid=7314A37513F1A630E96FAC2131E05BF4?mode=detail.

Alberta Biodiversity Monitoring Institute. 2016b. Terrestrial field data collection protocols (Abridged Version) 2016-05-18. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: http://www.abmi.ca/home/publications/401-450/432.html?mode=detail&documenttype=Protocols.

Alberta Biodiversity Monitoring Institute. 2016c. Wetland Field Data Collection Protocols (Abridged Version) 2016-05-26. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Report available at: http://www.abmi.ca/home/publications/401-450/433.html?mode=detail&documenttype=Protocols.

Alberta Biodiversity Monitoring Institute. 2016d. Camera Trap Processing Protocol 2016-06-02. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available upon request.

Alberta Biodiversity Monitoring Institute. 2016e. Biodiversity Browser. Alberta Biodiversity Monitoring Institute, Alberta, Canada. Available at http://www.abmi.ca/home/data-analytics/biobrowser-home.

Alberta Innovates – Technology Futures et al. 2012. Assessment of Existing and Alternative Landbird Monitoring Programs for the Oil Sands Areas in Alberta and Saskatchewan. Unpublished report produced for Environment Canada.

Bioacoustic Unit. 2015. Acoustic Recording Analysis Protocol. Bioacoustic Unit, University of Alberta. Report available at: http://bioacoustic.abmi.ca/wp-content/uploads/2015/11/BU_Acoustic_Recording_Analysis_Protocol-V10-23Nov2015-2.pdf

Burton, A.C., Huggard, D., Bayne, E., Schieck, J., Sólymos, P., Muhly, T., Farr, D. and Boutin, S., 2014. A framework for adaptive monitoring of the cumulative effects of human footprint on biodiversity. Environmental monitoring and assessment, 186(6), pp.3605-3617.

Ferretti, M. 2009. Quality assurance in ecological monitoring – towards a unifying perspective. Journal of Environmental Monitoring 11: 726-729.

Ferretti, M. 2011. Quality Assurance: a vital need in ecological monitoring. CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition, and Natural Resources 6 (011): 1-14.

Government of Alberta. 2012. Lower Athabasca Regional Plan 2012 – 2022.

Governments of Canada and Alberta. 2012. Joint Canada/Alberta implementation plan for oil sands monitoring. Canada. Environment Canada.

Houston, T.D. and R. Hiederer. 2009. Applying quality assurance procedures to environmental monitoring data: a case study. Journal of Environmental Monitoring 11:774-781.

Huggard, D. 2013. Expected Precision of Trends from Bird Monitoring in the Oil Sands Area. Update. Unpublished report produced for Environment Canada.

Lankau, H. 2015. Autonomous Recording Unit (ARU) Deployment Protocol Version: 1 May 2015. Contents: ARU testing, activation, deactivation, field deployment, and field-to-office data transfer. Bioacoustic Unit, University of Alberta. Report available at: http://bioacoustic.abmi.ca/wp-content/uploads/2015/09/Lankau_2015_ARU_Deployment_Protocol.pdf.

Nielsen, S., Bayne, E., Schieck, J., Herbers, J., and Boutin, S. 2007. A new method to estimate species and biodiversity intactness using empirically derived reference conditions. Biological Conservation 137:403-414.

Nielsen, S.E., Haughland, D.L., Bayne, E., and Schieck, J. 2009. Capacity of large-scale, long-term biodiversity monitoring programmes to detect trends in species occurrence. Biodiversity & Conservation. 18:2961-2978.

Sólymos, P., Morrison, S. F., Kariyeva, J., Schieck, J., Haughland, D. L., Azeria, E. T., Cobb, T., Hinchcliffe, R., Kittson, J., McIntosh, A., Narwani, T., Piersossi, P., Roy, M.C., Sandybayev, T., Boutin, S., Bayne, E. 2015. Data and information management for the monitoring of biodiversity in Alberta. Wildlife Society Bulletin, 39(3), 472-479.

Appendix 1 – Annual Monitoring Schedule

(Please provide detailed information on the specifics of your monitoring schedule including – **locations, schedule, methods, SOPs, QA/QC data release, references**)

Sampling Locations/Sites	Sampling Schedule (*timing/frequency*)	Compounds to be Analyzed	SOPs to be Consulted (*hyperlinks accepted*)	QA/QC Complete & Date Data to be Released

In 2017, 222 sites within the OSM region will be visited. This number includes sites that will be fully (132 sites) and partially (57 sites) sampled. Table 1 provides a breakdown of these sites based on sampling protocol. A total of 66 systematic grid sites will be fully sampled (i.e. 66 terrestrial and 66 wetland sites) in 2017. Details regarding sampling locations, sampling schedule and compounds to be analyzed are outlined below.

Table 1. *Summary of 2017 ABMI sampling sites, by protocol, within the OSM region. Items correspond to the below detailed Annual Monitoring Schedule. Partially sampled 2017 ABMI systematic grid sites (i.e. Partial Protocol) in general entail the deployment/retrieval of Cameras and ARUs at 2016 sites that replaced original sites made inaccessible by fire. These original 2016 sites will be sampled in 2017 (see Full Protocol #2).*

	Terrestrial			Wetland	
	Winter (Cameras/ARUs)	Spring	Summer	Summer	# Sites
Full Protocol					
Site Group 1	✓	✓	✓	✓	100
Site Group 2		✓	✓	✓	32
Total (Full Protocol)	***59***	***75***	***75***	***75***	***132***
Partial Protocol					
Site Group 3	✓				16
Site Group 4	✓				9
Site Group 5			✓	✓	2
Total (Partial Protocol)	***25***	***0***	***1***	***1***	***27***

Site Group 1. **(Total Sites = 100; 50 Terrestrial and 50 Wetland sites):** Full terrestrial and wetland protocols will be completed at these sites. This includes the deployment of cameras and ARUs at terrestrial sites in the winter. **Sites:** 4, 5, 6, 16, 17, 18, 35, 36, 37, 152, 153, 154, 181, 182, 183, 210, 211, 212, 332, 361, 362, 391, 392, 415, 416, 417, 445, 446, 447, 475, 476, 477, 500, 501, 502, 531, 532, 533, 562, 563, 564, 602, 603, 604, 634, 635, 636, 666, 667, 668 Public site coordinates at	**Terrestrial:** Winter/Spring/ Summer **Wetland:** Summer	**Terrestrial:** <u>*Winter:*</u> - Breeding Birds (ARUs) - Mammals (Cameras) <u>*Spring:*</u> - Bryophytes and Lichen - Soil Cores (mineral and LFH; soil arthropods – springtails and mites) - Trees, snags, and stumps - Downed woody material - Site photographs - Incidental <u>*Summer:*</u> - Vascular Plants - Tree ages - Shrub and canopy cover - Surface substrate - Incidental species	ABMI 2016a *Chapter 3: Monitoring Centre QMP*; Sections 3.2 & 3.3 *Chapter 4: Processing Centre QMP*; Section 4.2 & 4.3 *Chapter 5: Information Centre QMP*; Section 5.2.	**Field Sampling** ***Habitat Data*** 1. QA/QC: February 2018 2. Release: October 2018 ***Species Data*** 1. QA/QC: August 2018 2. Release: October 2018

http://www.abmi.ca/home/publications/151-200/169.html) Please see the attached maps (Figures 1 & 2) with sampling sites.		- Camera/ARU retrieval **Wetland:** *Summer:* - Vertebrate species - Wetland characteristics - Water physiochemistry and nutrients - Aquatic invertebrates - Vascular plants - Incidental species		
Site Group 2. **(Total Sites = 32; 16 Terrestrial and 16 Wetland sites):** In 2016, spring and summer access to these sites was restricted by fire. Thus, full spring and summer protocols were not completed and will be completed in 2017. Cameras and ARUs were however deployed and retrieved. Those units not surviving the fire were redeployed in the fall of 2016 and will be collected in the summer. **Sites:** 421, 422, 451, 452, 481, 482, 483, 506, 507, 508, 537, 538, 539, 568, 569, 570	**Terrestrial:** Spring/ Summer **Wetland:** Summer	As above	As above	As above
Site Group 3. **(Total Sites = 16):** These sites were backup sites selected in 2016 to compensate for those sites that were inaccessible due to fire (See 2). Full spring and summer protocols were completed in 2016, however cameras and ARUs were not deployed. These units will be deployed in 2017 at these sites. **Sites:** 555, 587, 588, 589, 619, 620, 621, 651, 652, 653, 826, 827, 828, 858, 859, 860	**Terrestrial:** Winter/Summer	As above.	As above	As above
Site Group 4. **(Total Sites = 9)** These sites will only have cameras and ARU units deployed in 2017 to monitor birds and mid- to	**Terrestrial:** Winter/Summer	As above	As above	As above

large-sized mammals. **Sites:** 317, 318, 319, 346, 347, 348, 376, 377, 378				
Site Group 5. Summer terrestrial and wetland access to site 120 was restricted in 2016 due to fire. Cameras and ARUs were deployed in the winter, however full summer terrestrial and wetland protocols were not completed. These protocols will be completed in 2017. **Site:** 120	**Terrestrial:** Summer **Wetland:** Summer	As above.	As above	As above

Appendix 2 – Detailed Multi-Year Financial Breakdown: if changes are to be made then an Addendum must be Complete and Approved.

(Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (2017- 2018)		Year 2 (2018- 2019)		Year 3 (2019- 2020)		Year 4 (2020- 2021)		Year 5 (2021- 2022)	
	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
1) Salaries and benefits										
a) Appendix 3 - Totals	$2,627,045	$110,000	$2,721,013	$110,000	$2,748,223	$110,000	$2,775,705	$110,000	$2,803,462	$110,000
2) Operations and Maintenance										
a) Equipment (Field maintenance and replacement) includes field related equipment, Cameras, ARU, quads, snowmobiles,	$100,000		$125,000		$126,250		$127,513		$128,788	
b) Helicopter (106 sites)	$692,748		$923,314		$932,547		$941,873		$951,291	
c) Lab analysis and Lab Equipment (Includes water and soil analyses for all sites, external species verification, etc.)	$117,139	$230,000[1]	$137,341	$230,000	$138,714	$230,000	$140,102	$230,000	$141,503	$230,000
d) Data management	$39,000		$41,600		$42,016		$42,436		$42,861	
• GIS Software, tablet software, cloud storage, system hosting, • Hardware for 5 business units.	~$26,000 ~$15,000		~$26,000 ~$15,000		~$27,000 ~$15,000		~$27,000 ~$15,000		~$27,000 ~$16,000	
e) Field work	$494,923	$50,000[2]	$767,819	$50,000	$775,497	$50,000	$783,252	$50,000	$791,085	$50,000
• Cam/ARU Deployment (77 Sites) o External	~$360,000 (~$70,000)		~$573,000 (~$70,000)		~$600,000 (~$50,000)		~$637,000 (~$20,000)		~$663,000 (~$0)	

[1] In-kind contribution, Royal Alberta Museum
[2] In-kind contribution, InnoTech Alberta, Vegreville office

Contract (decreased contract involvement over time) • Training (comprehensive safety training program, ATV, defensive driving and data collection	~$30,000		~$34,000		~$34,500		~$34,845		~$35,250	
• Storage (6400 sqft covered storage, 1250 sqft heated storage, 2500 sqft office spaces. Pro-rated percentage of total ABMI cost	~$98,000		~$90,000		~$91,000		~$92,000		~$93,000	
f) Access Management	$4,136		$4,136		$4,177		$4,219		$4,261	
g) Communications	$197,500		$197,500		$199,475		$201,470		$203,484	
• Reporting (Online report [2017-18 Human Footprint]; ABMI Science Letters, Species Profiles for ABMI Data & Analytics Portal)	~$72,000									
• Website (NatureNetworks front-end development, Mapping Portal Phase 2)	~$55,500									
• Stakeholder Engagement (Front-end development based on user feedback; deployment of Naturelynx in OSM to aboriginal stakeholder [note: one type of stakeholder group amongst many] such	~$70,000									

as McMurray Metis [engagement session in community to develop community-based Groups and Missions])										
h) Science Operations	$48,000		$88,400		$89,284		$90,177		$91,079	
• Camera and Recorder Testing • Protocol Development and refinement • Computer equipment • International Science Committee	~$30,000 ~$3,000 ~$9,000 ~$6,000									
3) Consumable Materials and supplies										
a) Disposable Field Equipment (ie. batteries, ribbons, etc.)	$10,000		$20,000		$20,200		$20,402		$20,606	
4) Travel										
a) Conferences and meetings (ABMI *internal meetings, meetings with AEP, meetings with stakeholders, Science staff conferences)*	$22,181		$36,081		$36,442		$36,806		$37,174	
b) Field work – Travel (Fuel, Accommodations, Food) • Field Data Collection (truck lease/rental, fuel, satellite phones, charter flights, etc.) • Accommodation and	$492,328 ~$302,000 ~$190,000		$677,429 ~$377,000 ~$300,000		$684,203 ~$380,000 ~$304,000		$691,045 ~$384,000 ~$307,000		$697,956 ~$388,000 ~$309,000	

living expense (Portage College, Lister Hall, food, additional accommodations [hotels/camping], etc.)										
c) Access Management Travel	$5,000		$10,000		$10,100		$10,201		$10,303	
5) External Contracts										
a) External Contracts – 10-year Science Review	$150,000		$100,000		$50,000		$50,000		$50,000	
Grand Total	$5,000,000	$390,000	$5,849,633	$390,000	$5,857,129	$390,000	$5,915,201	$390,000	$5,973,853	$390,000

Appendix 3 – Staffing Plan

(Complete the following detailed staffing plan; add or delete categories as required)

	Year 1 – Budget Allocation		Year 2 – Budget Allocation		Year 3 – Budget Allocation		Year 4 – Budget Allocation		Year 5 – Budget Allocation	
Responsible Role	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding	OSM Funding	External Funding
Scientists - Biodiversity	Manage and maintain excellence for all scientific and technical aspects of the ABMI, including developing and testing data collection methods, conducting data analyses and interpretation, and testing methods to integrate ABMI information into management and planning initiatives.									
•Mathematician 0.6 FTE •Ecologist 0.6 FTE •Statistician 0.6 FTE •Wetland Ecologist 0.6 FTE •GIS Expert 0.6 FTE •Quality Controller 0.6 FTE	$339,000	$110,000[3]	$339,000	$110,000	$342,390	$110,000	$345,814	$110,000	$349,272	$110,000
Scientists - Geospatial	Management support (budget/work-plans); data management support; supporting geospatial and mapping needs.									
•Director 0.2 FTE •Geospatial Analyst 0.2 FTE	$42,000		$42,000		$42,420		$42,844		$43,273	
Taxonomists (all at 0.49 FTE)	Taxonomists are GOA Temporary Salary position that provides taxonomic scientific support to the ABMI. These highly specialized taxonomic scientists are responsible for the ABMI's species level identifications and the research needed to achieve this goal. Technicians are GOA temporary Salary position that provides technical support to the taxonomic scientists.									
- Processing Assistant 0.49 FTE - Aquatic Invertebrates 0.49 FTE - Acarologist 0.49 FTE - Lichenologist 0.49 FTE - Vascular Plant Specialist 0.49 FTE - Bryologist 0.49 FTE - Laboratory Techs 9 @ 0.49 FTE	$482,380		$494,430		$499,374		$504,368		$509,412	

[3] Science Centre Director's salary

Technical/Field Staff	Technical/Field staff are comprised of a variety of operational staff focused on the organization and collection of field based data.									
- Monitoring Director 0.6 FTE - Team Lead Field Ops 0.7 FTE - Field Coord. (5 FTE's) - Technicians (4 FTE's) - Data Entry Coord (0.5 FTE) - Seasonal Staff (7 FTE's – 21 students for 4 mos.) - Access Manager 0.25 FTE	$1,118,082		$1,200,000		$1,212,000		$1,224,120		$1,236,361	
MANAGEMENT AND ADMINISTRATION	The coordination and administration of the delivery of the project.									
- Executive Director 0.2 FTE - Program Manager 0.25 FTE - Finance Assistance 0.35 FTE - Accountant 0.35 FTE - Operations Director 0.45 FTE - Regulatory Efficiencies Coordinator – 0.5 FTE	$223,855		$223,855		$226,094		$228,354		$230,638	
DATA MANAGEMENT	Data management activities include from data storage (server and cloud-based storage), maintenance of software license fees and upgrades (e.g. GIS software), and development of data sharing and data QA/QC platforms.									
- Information Director 0.5 FTE - Website Applications 0.5 FTE - Programmer 0.6 FTE - Database Manager 0.56 FTE - Database Programmer 0.6 FTE - Information Coordinator 0.6 FTE	$258,968		$258,968		$261,558		$264,173		$266,815	
COMMUNICATION	Communication activities are essential for disseminating ABMI data and data products and include production of publications, development and maintenance of public-facing web-based communications platforms, and collateral/events to support stakeholder engagement.									

- Information Director 0.5 FTE - Communication Specialist 0.5 FTE - Communication Coord 0.5 FTE - Reporting Analytics Coord 0.5 FTE	$162,760		$162,760		$164,388		$166,031		$167,692	
Grand Total (*inserted into Appendix 2*)	**$2,627,045**	**$110,000**	**$2,721,013**	**$110,000**	**$2,748,223**	**$110,000**	**$2,775,705**	**$110,000**	**$2,803,462**	**$110,000**

Appendix 4 – Approvals

Project Submitted by:		
Name:		
Organization:	Signature:	Date:

Project Approved by:		
Dr. Monique Dubé (AEP)		**Dr. Kevin Cash (ECCC)**
Signature 		Signature 
Date		Date

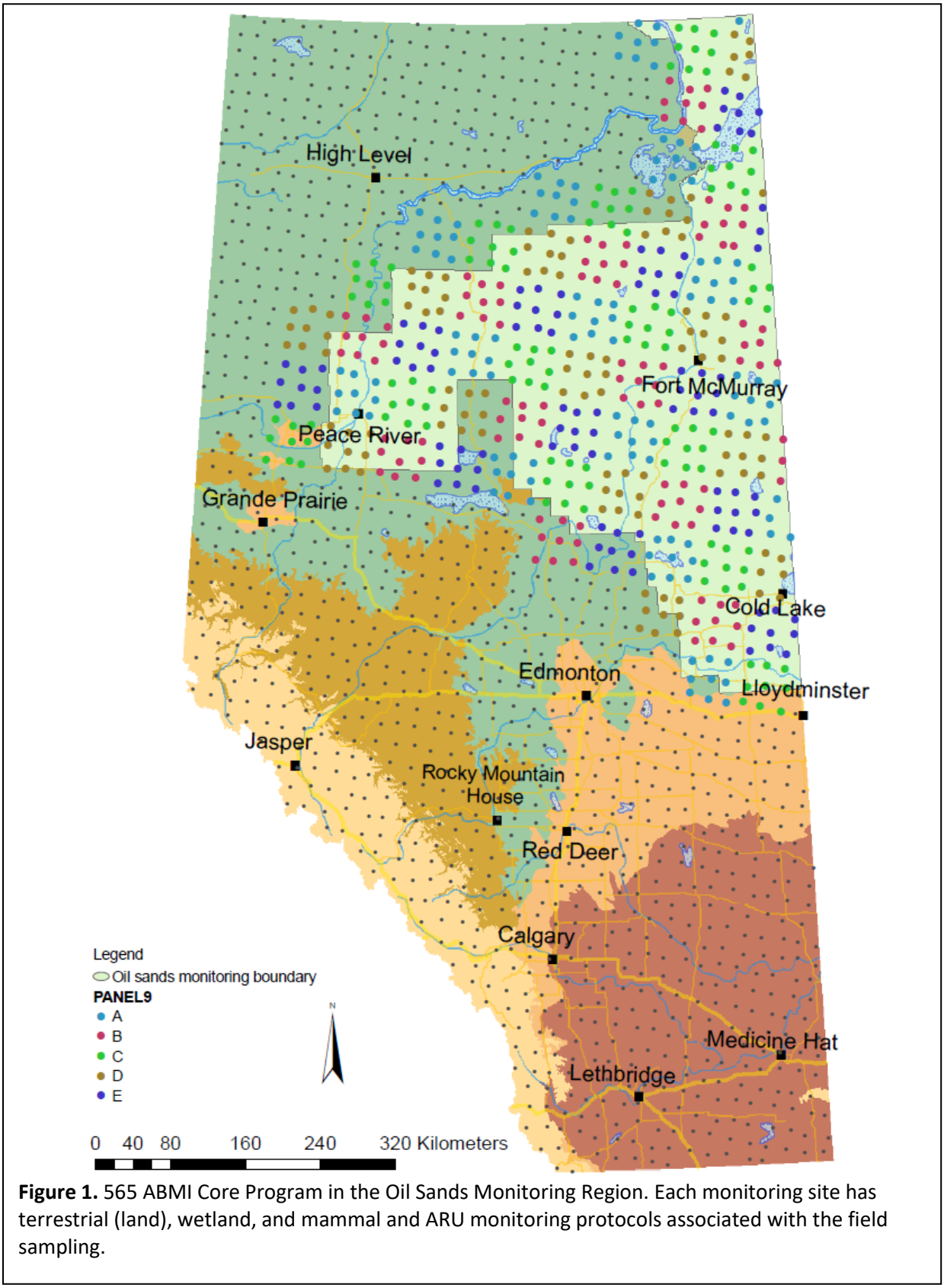

Figure 1. 565 ABMI Core Program in the Oil Sands Monitoring Region. Each monitoring site has terrestrial (land), wetland, and mammal and ARU monitoring protocols associated with the field sampling.

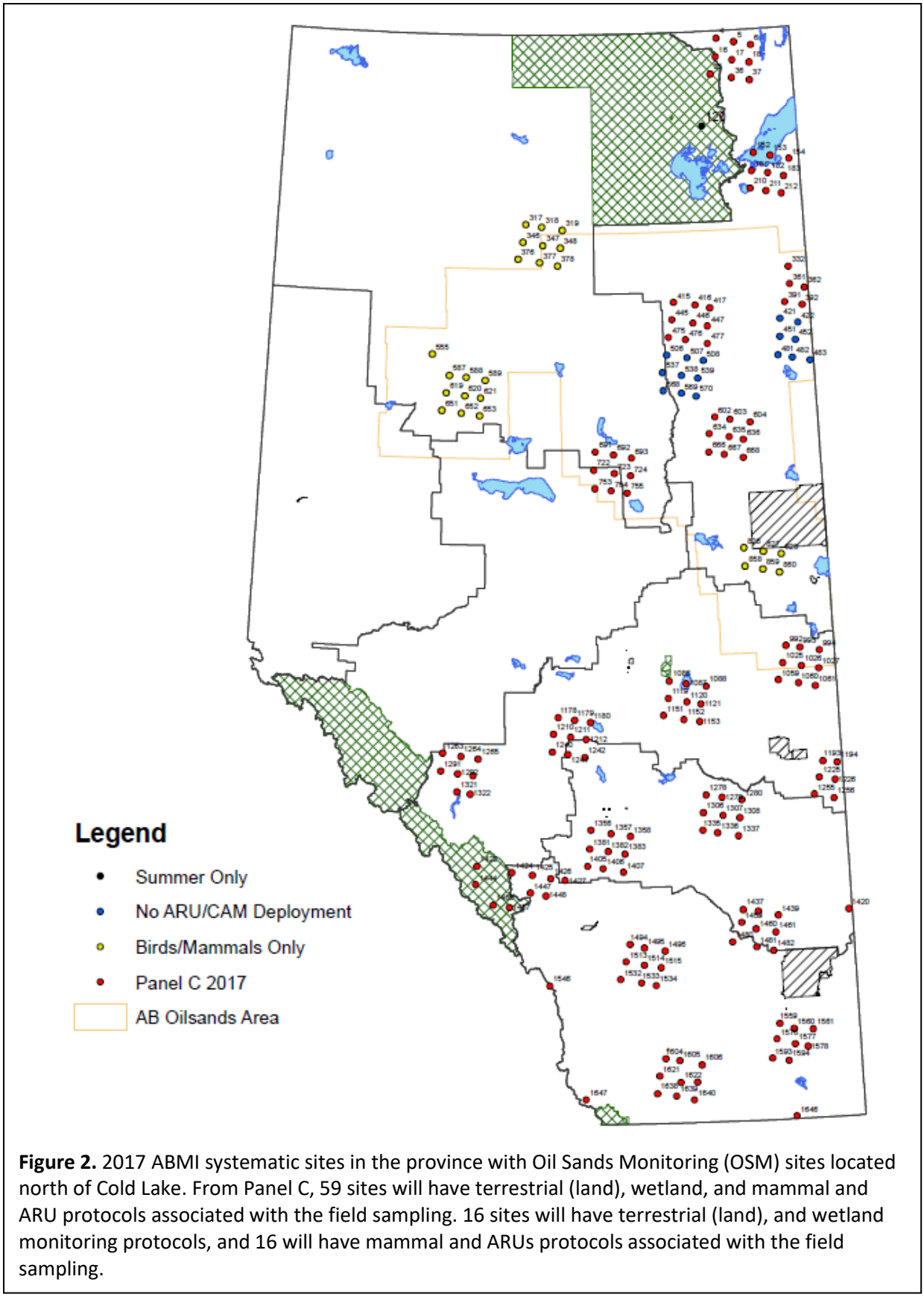

Figure 2. 2017 ABMI systematic sites in the province with Oil Sands Monitoring (OSM) sites located north of Cold Lake. From Panel C, 59 sites will have terrestrial (land), wetland, and mammal and ARU protocols associated with the field sampling. 16 sites will have terrestrial (land), and wetland monitoring protocols, and 16 will have mammal and ARUs protocols associated with the field sampling.

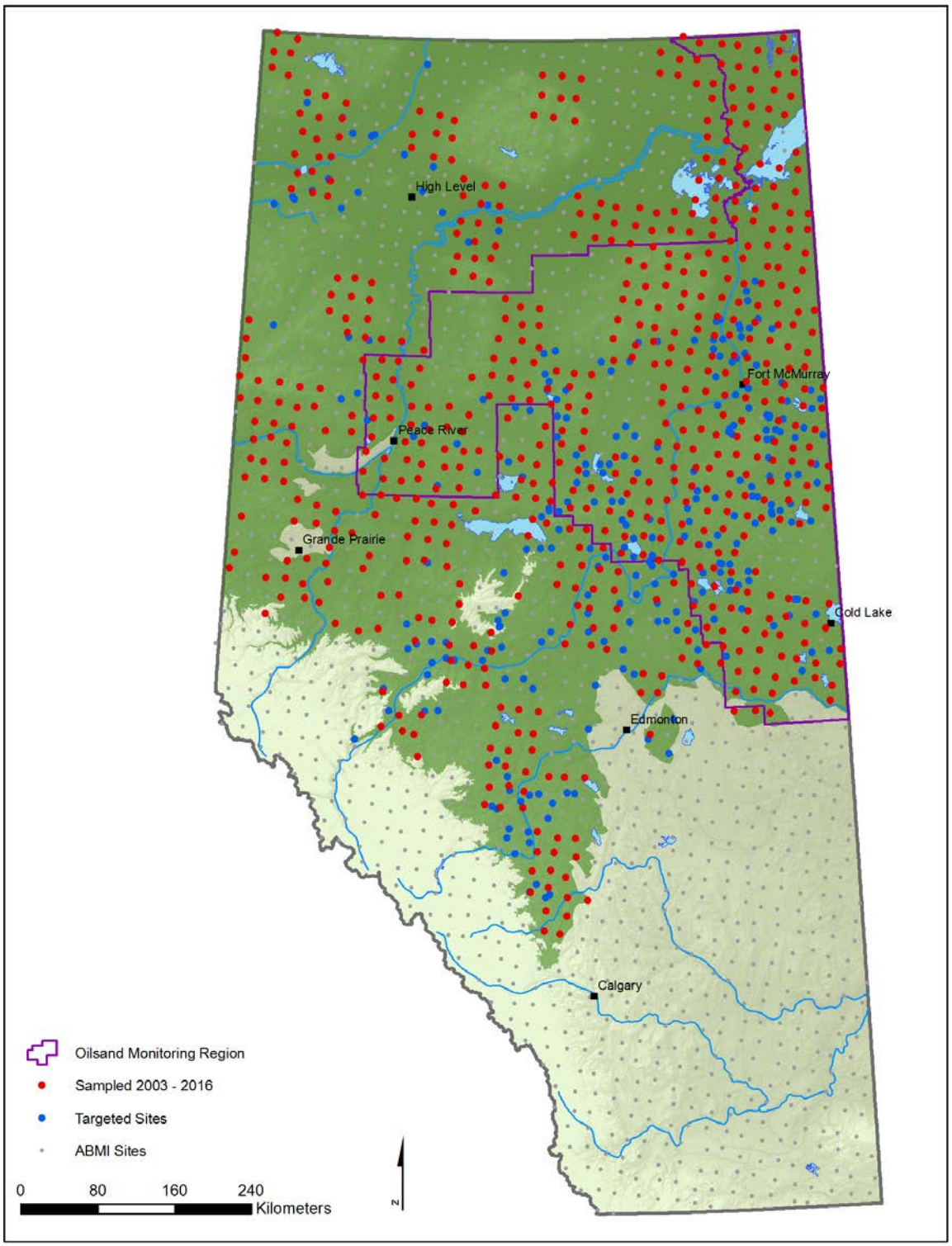

Figure 3. To date, 634 systematic sites and 299 targeted sites have been surveyed throughout the forested regions of Alberta, including 449 systematic sites in the OSM region. Information from these samples are used to assess cumulative effects, trend and to model habitat associations. Information from the targeted sites is combined with information from the systematic sites (total N=1033) to create models of species habitat associations.

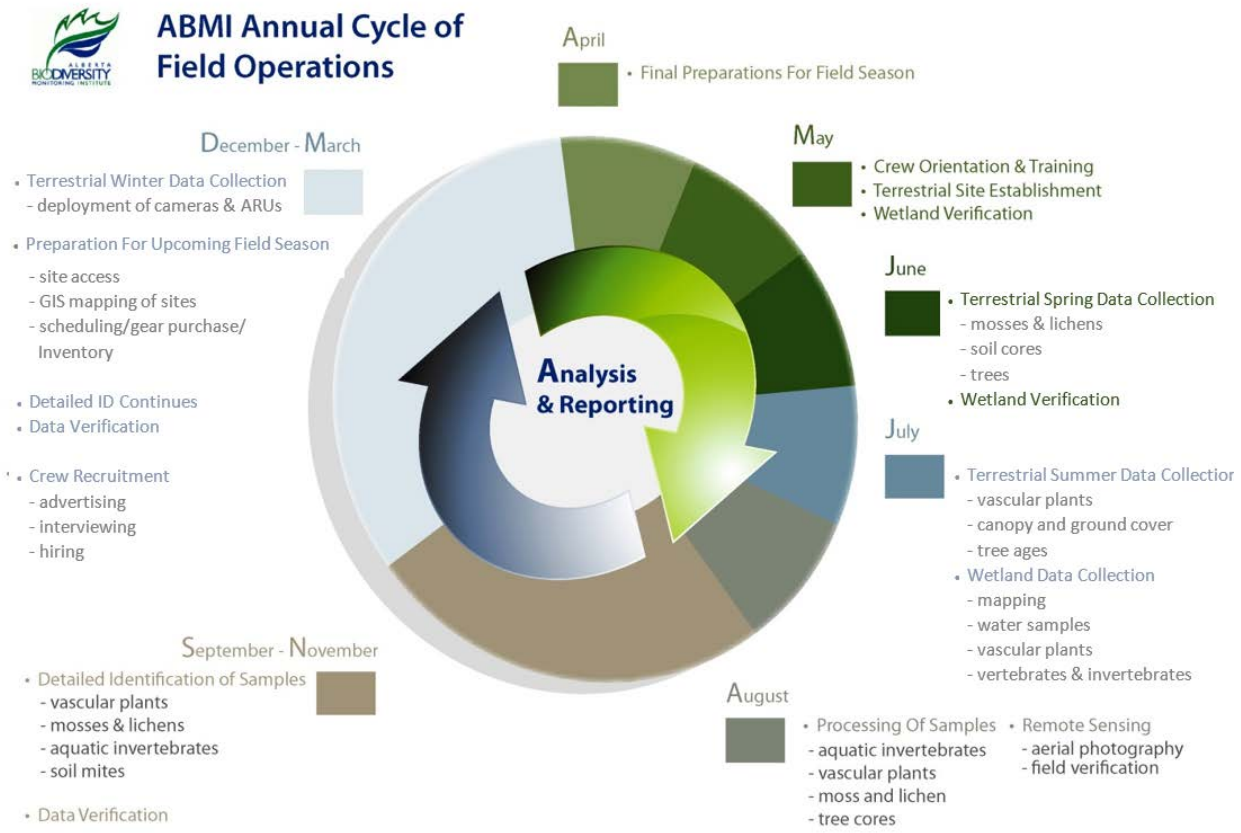

Figure 4. A schematic representation of the ABMI's annual cycle of field operations.