

## FOCUSED STUDY ACTIVITY WORK PLAN

### General Information

<p>* <b>Decision Pool A: Workplan approved.</b></p> <p>* <b>Approved at \$400,000</b></p> <p>* It is a requirement of funding that key members of the project team participate in a Deposition Monitoring Integration Workshop and the Water Integration Workshop to be informed by the Oil Sands Monitoring Secretariat.</p> <p>* It is a requirement of funding that this project be integrated within the wetland program (project WL-PD-10-1819). This project will not be funded as a stand alone project beyond 18/19.</p> <p>* The project lead and key project members are to meet with the Oil Sands Monitoring Program leadership as coordinated by the OSM Secretariat to discuss this project; specifically how this project links to oil sands stressors.</p> <p>*Funding expectations: as a minimum an annual progress report is required by February 28, 2019. All publications or products resulting from this work requires acknowledgement of funding from the Oil Sands Monitoring Program and are to be provided to the Oil Sands Monitoring Secretariat for tracking and any programmatic communications purposes. Work funded through the Oil Sands Program will be available for public dissemination.</p>				
<b>Work Plan Unique Identifier:</b>	<i>Internal use only</i>			
<b>Focused Study Activity Title:</b>	<b>Design of Deltaic Wetland Ecosystem Health Monitoring Program</b>			
<b>Focused Study Category:</b>	<b>Monitoring Design and Methods Improvement</b>			
<b>Geographic Location</b> (choose from drop-down menu. If Project Location is in more than one area choose from second drop-down)	Peace-Athabasca Delta			
<b>Monitoring Site(s) Coordinates</b> (latitude and longitude)	<b>Name</b>	<b>PAD#</b>	<b>N</b>	<b>W</b>
	North of Otter Creek	1.1	58.60394	111.54214
	Mamawi Bay	3	58.56475	111.51079
	Mamawi Creek Pond	4	58.50773	111.51802
	Child's River	11	58.6384	111.59653
	Rat Lake	14	58.87465	111.32484
	Egg Lake	33*	58.886697	111.414557
	Rocher River	37	58.83234	111.28074
	Horseshoe Slough	38	58.86389	111.58159
	Mamawi Lake	74	58.66605	111.486

	Johnny Cabin Pond	99	58.496893	111.516574
<b>Project Leader:</b>	Donald Baird & Daniel Peters (co-leads)			
<b>Organization and contact information:</b>	<b>Environment and Climate Change Canada (Fredericton)</b>			
<b>Date Study initiated:</b>	<b>April 1, 2011</b>			
<b>Monitoring Category:</b> <i>(From OSM long-term plan; choose from drop-down menu)</i>	Wetland Ecosystem Monitoring			
<b>Strategic Objective of Focused Study:</b> <i>(From OSM long-term plan; choose from drop-down menu)</i>	Objective WE1: Detect and report changes in wetland ecosystem in relation to Oil Sands Developments and related Point and Non-point source emissions			
<b>Hypotheses:</b> <i>(Briefly outline the specific hypotheses that your focused study is aiming to address)</i>	<p>The objective of this work is to continue to monitor against baseline environmental conditions (water quality; water quantity and surface water connectivity; invertebrate health) in deltaic wetlands/lakes located downstream and downwind of the oil-sands mining region. The work will result in the enhanced understanding and development of a predictive relationship between water levels/depth/connectivity (climate &amp; hydrology), toxic substances (PACs, metals), nutrients and ecological characteristics and status (including biodiversity) of monitoring sites, to develop biocriteria for future monitoring/surveillance in the region, with an explicitly multi-stressor focus.</p> <p>The project includes the collection of geophysical data (including climatic and hydrometric), water chemistry (including nutrients, contaminants and isotopes) and biodiversity samples from multiple wetland habitat types along a gradient of surface connectivity to the main flow system which it has been shown to be sensitive to natural (i.e., climate variability; erosion/deposition leading to channel migration) and anthropogenic alterations (i.e., climate change, flow regulation, water abstraction). Analysis of wetland hydroperiod (water balance) will be done using a combined hydro-climatic and isotopic analysis and remote sensing approach. Wetland connectivity to the main flow system (i.e., Athabasca River water in downstream delta channels) is assessed via ground- and remote sensing-based surveying methods and the use of a 3-D model of the delta. The study is linked to a study focused on assessing climate variability/change and flow regulation effect on the delta hydrology (Peters, ECCC).</p> <p>Analysis of the biological samples is being done using a combination of traditional visual identification methods and new DNA-based biodiversity discovery techniques. Taking an explicitly multi-stressor approach, hydrological</p>			

	<p>monitoring techniques will be implemented, focusing on the drivers of aquatic ecosystem change, and their relationships with key oil sands stressors (hydrocarbons, metals, nutrients, hydroperiod alteration) and climatic stressors (drought and floods).</p> <p>In addition, the study would maintain core monitoring activities at 10 established wetland sites.</p> <p><b>SPECIFIC HYPOTHESES:</b></p> <ol style="list-style-type: none"> <li>1. Wetland macroinvertebrates and algae (diatoms) can provide stable signals of wetland ecosystem condition suitable for long-term monitoring of OS contamination.</li> <li>2. Hydrological connectivity and hydroperiod (wet-dry cycle) are significant drivers of wetland macroinvertebrate community structure.</li> <li>3. It is possible to create a wetland monitoring network employing a series of wetland complexes with different levels of connectivity (closed, seasonally open, perennially open) which can track inputs and subsequent ecological impairment arising from atmospheric and riverine sources of OS-derived contaminants.</li> <li>4. It is possible to transfer the delta wetland monitoring approach to wetlands situated in the broader Oil-Sands region, facilitated through direct co-operation with Alberta Environment and Parks.</li> </ol>
<p><b>Deliverables:</b></p> <p><i>What tangible goal (s) and/or product(s) will the monitoring produce and when?</i></p>	<p>Further integration of the Peace-Athabasca Delta deltaic monitoring component within the larger OS Wetlands Monitoring program currently being led by ECCC &amp; AEP.</p> <p>Transfer of SOPs and study designs.</p>

## Detailed Study Plan

(Please provide detailed information on the specifics of your focused study including – **(keywords, hypothesis and the assumptions and constraints behind your hypothesis)**)

<p>Provide a maximum of 10 key words that describe this project. Use commas to separate them:</p> <p>Wetland, macroinvertebrate, ecohydrology, river delta, contaminant, multiple stressor, mercury, acidification</p> <p>Describe how you will test your hypothesis:</p>
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With 6 years (2012-2017) of unique/innovative bio-geo-physical data collection at a core set of wetland sites within the Peace, Athabasca and Birch deltas, which was expanded to a network of 40 wetland sites, we now have sufficient spatio-temporal baseline data to implement a standardised protocol at a subset of sites (n=10) identified as key to monitoring potential change. We will continue to analyse results obtained from 2012-2017 sampling events and relate in situ and geospatial data collection.

We will analyse macroinvertebrate data and algal data derived from standard morphotaxonomy and high-throughput DNA sequencing metabarcoding, to discover how major environmental drivers related to oil sands (water and sediment chemistry) and ecohydrological change (connectivity, water level, hydroperiod, basin area) influence community structure and ecosystem health.

ASSUMPTION: Availability of connectivity and basin- area calculations for all sites through derived digital elevation model (2017-18 Q4 deliverable - on track).

ASSUMPTION: Timely delivery of water chemistry results.

ASSUMPTION: Timely availability of funds to conduct the work, and timely processing and award of contracts for related external analysis

ASSUMPTION: Parks Canada continue to provide significant logistic support for PAD fieldwork (boat / airboat access and field help from Fort Chipewyan office).

ASSUMPTION: Local community involvement in biomonitoring and water quality sampling can be successfully facilitated via PADEMP & Parks Canada liaison.

## References:

## Data Management

If this work generates data please summarize your project-level data management plan.

Deliverables	Timeframe
Data Collection Period: <i>Field work</i>	Start : 2018-04-01      End: 2018-09-30
Data Analysis Period: <i>Laboratory analysis and QA/QC of data</i>	Start : 2018-04-01      End: 2019-03-31
Data Release Date: <i>Metadata and data consistent, complete and meet basic standard format for publication in Open Data; on or linked to JOSM portal</i>	2019-09-30

## Reporting and Publications

Provide information on the anticipated reports / publications. (Insert additional rows if needed)

Expected Subject/Titles of Publications or Reports	Short Description of Publication or Report	Expected Year of Publication
A review of macroinvertebrate wetland indicators for use in OS wetlands monitoring	A synthesis of international wetlands macroinvertebrate studies to support generation of new metrics for oil sands monitoring.	2019
A standard operating procedure for the collection and use of DNA metabarcoding data for routine monitoring of oil sands wetland macroinvertebrate communities	A synthesis of existing knowledge from previous Peace-Athabasca wetland studies, together with a review of the international literature in this area, in the form of a methods manual.	2019

A standard operating procedure for the collection and use of DNA metabarcoding data for routine monitoring of oil sands wetland diatom communities	Synthesis of results from ongoing field collection of diatoms from wetland sites within and outside the Peace-Athabasca Delta using standard microscopy-based taxonomic analysis and DNA metabarcoding, including DNA marker development.	2020
A standard operating procedure for rapid assessment of wetland plants including belowground seedbanks.	Synthesis of results from trialing a new protocol for wetland plants assessment using a combination of field plant observation and collection supplemented by DNA barcode identification.	2020

## Technical / Professional Roles and Responsibilities

Identify members of the monitoring team/organization, their roles and responsibilities. Identify monitoring organization leads if different from overall monitoring activity lead. (Insert additional rows if needed)

Role	Responsibilities	Resource Name/Organization
Donald Baird	Co-lead, study design, co-ordination of biomonitoring analysis.	ECCC
Daniel Peters	Co-lead, study design, co-ordination of hydrological analysis.	ECCC
Wendy Monk	Data analytics, geospatial analysis	ECCC
Alexa Alexander	Analysis of water chemistry data, report and manuscript preparation for mercury study.	ECCC
Zacchaeus Compton	Data analysis, statistical modelling, biomonitoring analysis, report and manuscript preparation.	ECCC

Kristie Heard	Technical support, fieldwork, taxonomic analysis, logistics.	ECCC
Tom Carter	Field technical support, data processing	ECCC
Daryl Halliwell	Field technical support, data processing	ECCC
Mark Russell	Field technical support, data processing	ECCC
Casual 1 & 2 (PC-02)	Biomonitoring sampling, sorting and ID; hydrological data analysis support.	ECCC

DRAFT

**Deliverables (Year 1)** If your Focus Study is longer than 1 year then complete **Appendix C** for multi-year deliverables breakdown

Provide a summary of tangible quarterly deliverables. Identify major project areas (deliverables) and results that can be identified as a tangible goal. This could include: field work, lab work/ analysis, evaluation, data, reports, publications, SOPs etc. Do not define process as your Deliverable e.g. ‘fly to Ft. McMurray to conduct fieldwork’ or ‘seek Director approval for report’.

Deliverable(s) (please provide enough information to support status reporting)
Q1 – April to June
May-June 2018 deployment of sensors (water level/depth, temperature, dissolved oxygen).
Q2 – July to September
August 2018: biomonitoring sampling at 10 PAD sites (macroinvertebrates, plants (diatoms));
September 2018: Fieldwork to i) Retrieve water level/temperature sensors from PAD wetlands and channels; ii) sample water sources for stable isotope signatures.
Q3 – October to December
October to December 2018: Process hydrological and geophysical data to support biomonitoring components of the study
October 2018: DNA metabarcoding SOP draft completed & entered for review.
Q4 – January to March
January to March 2018: Continue processing hydrological and geophysical data to support biomonitoring components of the study
March 2018: Wetland macroinvertebrate study review completed & entered for review.

## Detailed Financial Breakdown – Year 1 of 1 (2018-19)

Also complete **Appendix B** for the multi-year financial breakdown

Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED)	OS Funding	External Funding (outside JOSM)
<b>O&amp;M - Operations and Maintenance:</b>		
Helicopter Costs	\$45,000	\$
Field Costs (inc training)	\$12,476	\$
Internal Lab Analysis	\$13,306	\$
Consumable Materials & Supplies	\$ 5,000	\$
NSERC Visiting Fellow	\$26,539	\$
Students (inc OT)	\$48,000	\$
<b>Sub-Total</b>	<b>\$150,321</b>	<b>\$</b>
<b>O&amp;M - Travel</b>		
Field Work	\$30,000	\$
Meeting (e.g AEP)	\$15,000	\$
<b>Sub-Total</b>	<b>\$45,000</b>	<b>\$</b>
<b>O&amp;M - External Contracts :</b>		
External Lab Analysis	\$85,742	\$
<b>Sub-Total</b>	<b>\$85,742</b>	<b>\$</b>
<b>Salaries:</b>		
Technical / Professional Assistants	\$33,235	\$
Field Staff (inc OT)	\$15,000	\$
Other mandatory O&M-related employment costs	\$20,691	\$
<b>Sub-Total</b>	<b>\$68,926</b>	<b>\$191,104</b>
<b>Total Salaries</b>	<b>\$68,926</b>	<b>\$</b>
<b>Total O&amp;M</b>	<b>\$281,062</b>	<b>\$</b>
<b>Mandatory Administrative Costs</b>	<b>\$50,012</b>	<b>\$</b>
<b>2018-2019 GRAND TOTAL*</b>	<b>\$400,000</b>	<b>\$191,104</b>

## Appendix A - Approvals

<b>Project Submitted by:</b>		
Name:		
Organization:	Signature:	Date:
<b>Project Approved by:</b>		
Fred Wrona		Kevin Cash
Signature		Signature
Date		Date

## Activity Planning Review and Evaluation

*To be completed by OSM Administration*

Date Completed	Review type	Validated by (insert name and title)
	Program Management review completed	

**APPENDIX B – Detailed Multi-year Financial Breakdown** (Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (201X- 201Y)		Year 2 (201X- 201Y)		Year 3 (201X- 201Y)	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
1) Salaries and benefits						
a) Investigators						
b) Technical/professional assistants						
c) Field Staff						
d)						
2) Operations and maintenance						
a) Facilities						
b) Equipment						
c) Lab analysis						
d) Data management						
e) Field work						
3) Consumable Materials and supplies						
a)						
b)						
4) Travel						
a) Conferences and meetings						
b) Field work						
c) Project-related travel						

5) Dissemination & Engagement						
a) Publications/Reports						
b) Translation (if required)						
c) Communications						
d) Stakeholder Engagement						
e) Indigenous Peoples Engagement						
6) External Contracts						
a)						
<b>Grand Total</b>						

**APPENDIX C –Years 2 and 3 Deliverables** (Complete the following detailed breakdown. Provide a summary of tangible quarterly deliverables and your anticipated expenditures. Identify major project areas (deliverables) and results that can be identified as a tangible goal.)

Year 2 (201X- 201Y)	
Deliverable(s) (please provide enough information to support status reporting)	Budget
Q1 – April to June	
Q2 – July to September	
Q3 – October to December	
Q4 – January to March	
<b>Total Annual Budget</b>	

Year 3 (201X- 201Y)	
Deliverable(s) (please provide enough information to support status reporting)	Budget
Q1 - April to June	
Q2 - July to September	
Q3 - October to December	
Q4 - January to March	
<b>Total Annual Budget</b>	

