FOCUSED STUDY ACTIVITY WORK PLAN

General Information

Work Plan Unique Identifier:	*WL-PD-5 -2017*
Focused Study Activity Title:	**Design of Deltaic Wetland Ecosystem Health Monitoring Program**
Focused Study Category:	**Monitoring Design, Methods Improvement, and Program Design**
Geographic Location (*choose from drop-down menu. If Project Location is in more than one area choose from second drop-down***)**	Peace-Athabasca Delta

Monitoring Site(s) Coordinates *(latitude and longitude)*

Name	PAD#	N	W
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

Project Leader:	Donald Baird & Daniel Peters (co-leads)
Organization and contact information:	**Environment and Climate Change Canada (Fredericton)**
Date Study initiated:	**April 1, 2011**
Monitoring Category: *(From OSM long-term plan; choose from drop-down menu)*	Wetland Ecosystem Monitoring
Strategic Objective of	Objective WE1: Detect and report changes in wetland ecosystem in relation to

Focused Study: *(From OSM long-term plan; choose from drop-down menu)*	Oil Sands Developments and related Point and Non-point source emissions
Hypotheses: *(Briefly outline the specific hypotheses that your focused study is aiming to address)*	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 & 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. 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). Analysis of the biological samples is being done using traditional visual identification methods. The project is linked to similar work being carried out in the Athabasca River mainstem and tributaries (Culp & Glozier, ECCC). In addition, hydrological 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). In addition, the study would maintain core monitoring activities at 12 established wetland sites. **SPECIFIC HYPOTHESES:** 1. Wetland macroinvertebrates and algae (diatoms) can provide stable signals of wetland ecosystem condition suitable for long-term monitoring of OS contamination. 2. Hydrological connectivity and hydroperiod (wet-dry cycle) are significant drivers of wetland macroinvertebrate community structure. 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.
Deliverables: *What tangible goal (s) and/or product(s) will the monitoring produce and when?*	A completed monitoring design for the Peace-Athabasca Delta which allows separation of multiple stressor effects (ecohydrology from OS contaminants; atmospheric from river-transported contaminants). 3 x draft manuscripts (see below)

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**)

Provide a maximum of 10 key words that describe this project. Use commas to separate them:

Wetland, macroinvertebrate, ecohydrology, river delta, contaminant, multiple stressor, mercury, acidification

Describe how you will test your hypothesis:

With 5 years (2012-2016) 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=12) identified as key to monitoring potential change. We will continue to analyse results obtained from 2012-2016 sampling events and relate in situ and geospatial data collection, which are still being compiled and will be available for more detailed analysis in April 2017. Given that we will be working at reduced set of sites, many of which can be accessed by boat/airboat, we expect to reduce helicopter use significantly, with the result of our required helicopter budget being less than in previous years. However, we anticipate significant lab chemical analysis costs as these costs were previously included in the Water Quality Long-Term Monitoring Activity, and are now included within our budget.

We will analyse a five-year time series (including seasonal sampling) of macroinvertebrate data derived from standard morphotaxonomy and high-throughput DNA sequencing metabarcoding, and algal data from morphotaxonomy 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 (2016-17 Q4 deliverable - on track).

ASSUMPTION: Timely delivery of water chemistry results (a significant constraint in previous years).

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 signifcant 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 liason.

Data Management

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

Deliverables	Timeframe
Data Collection Period: *Field work*	Start : 2017-04-01 End: 2017-09-30
Data Analysis Period: *Laboratory analysis and QA/QC of data*	Start : 2017-04-01 End: 2018-03-31
Data Release Date: *Metadata and data consistent, complete and meet basic standard format for publication in Open Data; on or linked to JOSM portal*	2018-09-30

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 probabilistic analysis of risk of oil sands contaminant effects on wetland biota of the Peace Athabasca Delta	A synthesis of available invertebrate toxicity data and contaminant exposure data using a probabilistic modelling framework (@RISK Software), to derive quantitative estimates of risks of effects from ambient sediment and water concentrations in PAD wetlands.	2018
Seasonal and interannual variation in assemblage composition of wetland macroinvertebrate communities in relation to ecohydrological and water chemistry drivers	A multivariate analysis of 6 years of PAD wetland biomonitoring data (morphotaxonomy and DNA metabarcoding data) to determine stability of baseline ecological condition and responsiveness to non-OS (ecohydrology, water chemistry) and potential OS (contaminant) drivers.	2018

Seasonal and interannual variation in diatom communities in relation to water chemistry	Exploration of the use of diatom community data as indicators of long-term water chemistry shifts.	2018

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
Donald Baird (Environment and Climate Change Canada)	Co-lead, study design, co-ordination of biomonitoring analysis.
Daniel Peters (Environment and Climate Change Canada	Co-lead, study design, co-ordination of hydrological analysis.
Technical and Professional Assistant (Environment and Climate Change Canada)	Analysis of water chemistry data, report and manuscript preparation for mercury study.
Technical and Professional Assistant (Environment and Climate Change Canada)	Data analysis, statistical modelling, geospatial analysis, biomonitoring analysis, report and manuscript preparation.
Technical and Professional Assistant (Environment and Climate Change Canada)	Technical support, fieldwork, taxonomic analysis, logistics.

Technical and Professional Assistant (Environment and Climate Change Canada)	Field technical support, data processing
Technical and Professional Assistant (Environment and Climate Change Canada)	Biomonitoring sampling, sorting and ID; hydrological data analysis support.

Deliverables **(Year 1)** If your Focus Study is longer than 1 year then complete **Appendix 3** 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 2017 work towards completion of GPS and bathymetric surveys of wetland monitoring sites.
Q2 – July to September
August 2017: biomonitoring sampling at 10 PAD sites;
September 2017: 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 2017: Process hydrological and geophysical data to support biomonitoring components of the study
October 2017: Probabilistic ERA paper 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: Seasonal / interannual variability in PAD macrobenthos (morphotaxonomy and DNA) completed and entered for review; seasonal / interannual variability in PAD diatom communities completed and entered for review

Detailed Financial Breakdown – Year 1 of 1 (2017-2018)

Also complete **Appendix 2** 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*)
O&M - Operations and Maintenance:		
Helicopter Costs	**$48,000**	**$**
Field Costs (inc training)	**$11,865**	**$**
Internal Lab Analysis	**$13,306**	**$**
Consumable Materials & Supplies	**$ 5,000**	**$**
Students (inc OT)	**$24,000**	**$**
Sub-Total	**$102,171**	**$**
O&M - Travel		
Field Work	**$20,000**	**$**
Meeting (*e.g AEP*)	**$10,000**	**$**
Sub-Total	**$30,000**	**$**
O&M - External Contracts :		
Goods and Services Contract (ERA manuscript author contract)	**$10,000**	**$**
External Lab Analysis	**$30,000**	**$**
Sub-Total	**$40,000**	**$**
Salaries:		
Principal Investigator	**$81,000**	**$**
Technical / Professional Assistants	**$32,000**	**$**
Internal Analytical Support Services	**$20,000**	
Field Staff (inc OT)	**$15,000**	**$**
Sub-Total	**$148,000**	**$166,708**
2017-2018 GRAND TOTAL* (Before other related costs)	**$320,171**	**$166,708**

*The Total Salary costs for ECCC (148,000) in 2017-2018 with other related costs is $203,530. The Total O&M costs for ECCC (172,171) with other related costs is $198,470. The Grand total for ECCC ($320,171) with other related costs is **$402,000.**

Appendix 1 - Approvals

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

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

APPENDIX 2 – Detailed Multi-year Financial Breakdown (Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (2017-2018) APPROVED		Year 2 (2018-2019) NOT APPROVED		Year 3 (2019-2020) NOT APPROVED	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
1) Salaries and benefits						
a) Investigators	81,000					
b) Technical/professional assistants	32,000					
c) Students (Including Overtime)	24,000					
d) Field Staff Including OT	15,000					
e) Internal Analytical Support	20,000					
2) Operations and maintenance						
a) Facilities						
b) Helicopter Costs	48,000					
c) Lab analysis	13,306					
d) Data management						
e) Field work (including training)	11,865					
3) Consumable Materials and supplies						
a) Consumable Materials and supplies	5,000					
b)						
4) Travel						
a) Conferences and meetings	10,000					

b) Field work	20,000					
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) ERA Manuscript author contract	10,000					
b) External lab analysis	30,000					
Grand Total * (Before other related costs)	320,171					

*The Total Salary costs for ECCC (148,000) in 2017-2018 with other related costs is $203,530. The Total O&M costs for ECCC (172,171) with other related costs is $198,470. **The Grand total for ECCC ($320,171) with other related costs is $402,000.**