2018-19 Work Plan Template

All fields with an * are mandatory

Project Description Summary

Date *	Project/Work Plan Identifier (if applicable)	Program Type and Strategic Alignment *
5/31/2018	E-5-1819	OSM - Focus Study
Program Category *	**Status ***	**Dept. ID**
Environmental Data, Analytics, Prediction	Existing Project	1102

Project Leadership / Contact information

Project Title *	Key Words (max 10) *	
Numerical Modelling in the Lower Athabasca River (LAR) to Support Baseline Water Quality and Quantity Assessments and Regional Plans in Oil Sands Region of Alberta.	instream water quality, hydrological modelling, water quality modelling, land-use change modelling, ecological modelling, cumulative effects, integrated modelling system, decision support system, Oil sands process-affected water, tailing releases, point and nonpoint sources, total load, mixing zone,	
Surname *	**Given Name ***	**Title ***
Gupta	Anil	Director
Organization *	**Department**	**Division**
Alberta Provincial	Environment and Parks	EMSD
Branch *	**Section/Unit (if applicable)**	**Phone ***
IEAP	Integrated Environmental Predictions	4032973930
Email *	**Mailing Address**	**City**
anil.gupta@gov.ab.ca	2938, 11 Street NE	Calgary
Postal Code	**EMSD Executive Owner (If Applicable)**	
T2E 7L7	Monique Dube	

Project Information

Project Objective(s) (Bullet Form) *

Project objectives:
- Hydrological numerical modelling of Athabasca river system for baseline water quantity assessments.
- Water quality numerical modelling of Lower Athabasca River system for baseline water quality assessments.
- Support components of the lower Athabasca Regional Plan particularly within the oil sands region.
- Support the condition of environment reporting for Lower Athabasca River.

Plain Language Overview (100 words) *

As a widely accepted holistic approach, Cumulative Effects Assessment (CEA) focuses on assessing the cumulative effects of human actions on valued ecosystem components at regional or watershed scales over a long-term period. CEA requires assessment of changes in existing environmental condition as well as prediction of future condition. Modelling approaches and this work plan focus on the latter - the predictive compoenent of CEA. In past most of the modelling studies in the LARB were completed with a focus on project-based environmental impact assessment with an isolated focus either on environmental media type or industry sector. An integrated environmental modelling framework is thus required to establish comprehensive predictive capabilities and also to understand and manage the cumulative effects of anthropogenic activities (like oil sands development) on the landscape superimposed by impending changes in climate.
The proposed multi-year work plan involves developing an integrated environmental modelling system (IEMS) to simulate watershed hydrology and river water quality to support water quantity and water quality assessments to support regional plans and condition of environment reporting in the basin.
The integrated modelling system will enable multi-year simulation of historical water quantity and quality changes and prediction of the accumulative effects of both point and non-point source loads on water and sediment quality in the LAR.

Project Duration *	Project Original Start Date *	Estimated Completion Date *
Multi-Year	1/4/2018	31/03/2022

Specify Objectives This Project Will Address in 2018/2019. *

The overall objective of proposed 2018-19 work plan is to develop numerical modelling tools to support water quantity and quality assessments Lower Athabasca River (LAR) basin to support regional plans in oil sands area of Alberta. Following specific objectives will be addressed in FY 2018/19:
- Hydrological model development: Enhance and recalibrate the existing hydrologic model (called Variable Infiltration Capacity, VIC) for the Athabasca River Basin, initially developed by ECCC under the Joint Oil Sands Monitoring (JOSM) program, to support the baseline water quantity assessment in the basin. The developed hydrological model will provide the simulated stream flows from the ungauged watersheds and will be used to fill the data gaps at gauged stations.
- Hydrodynamic, sediment and water quality model development: Reconstruct and recalibrate a water quality models (EFDC) for the Lower Athabasca River, initially developed by ECCC under Oil Sands Monitoring (OSM) program, to support the baseline water quality assessments in the basin. The water quality models will be setup and calibrated for standard water quality parameters.
In spite of lack of a fully coupled ice-cover sub-module and the ability to simulate cross-sectional details, the 1D model will serve two purposes: will allow faster multi-year simulation and provide redundancy in water quality numerical modelling, which will allow comparing model results to the 2D model.
- Redundancy in water quality modelling: Rapid assessment of existing hydrodynamics and water quality model (MIKE 11/ ECO Lab) for the Lower Athabasca River to develop some model redundancy. This task will be performed mainly in-house.
- Interaction with AEP Science Team to better understand the needs of predictive modelling including substances of concern, loadings, chemical profiles of effluent discharges, river flow conditions for load allocation, spatial and temporal resolution etc.

Specify Objectives This Project Will Address Beyond 2018/19 (if multi-year). *

- Further development of toxic (contaminant) module of the water quality models (MIKE 11 and 2D-EFDC) for heavy metals, NAs, and PAHs.
- Near-field (mixing zone) water quality studies for the potential effluents.
- Ground water modelling including solute transport and fate.
- Development of aquatic and ecological models for the integrated modelling framework
- Development of an integrtaed modelling system by combining hydrology, water quality, ground water, aquatic, ecology models for cumulative effects assessments
- Studies for impact of Landuse/landcover changes in the basin
- Studies for impact of climate change in the basin
- Application of integrated modelling system for scenario analysis (e.g. evaluating impacts of sources loading contributions - load allocation, cumulative effects of climate and land use changes, anthropogenic activities, assessment of the impacts of various management/policy options - on the water quality/quantity, sediment quality and aquatic health in the LAR.
- Creating a user-friendly decision support system to support environmental policy development and decision making in the oil sands region.

List Key Questions/Hypotheses Related to Each Objective Stated Above. *

- What are the existing models developed for the LARB? Are they suitable to be used in an integrated modelling system? Could they be further enhanced?
- What are the most appropriate models for each system component such as hydrology, hydrodynamic, groundwater, and aquatic health in the LARB? Are they suitable to be used in an integrated modelling system?
- What is the most suitable integrated modelling system for cumulative effects assessment and management in the LARB?
- What are the flow estimates (historical and future) along the main stem of the LARB and it's tributaries? What is the current and future seasonal/annual water balance in the LARB? What are the condition of the historical and future hydrological processes such as streamflow, actual evapotranspiration, baseflow, infiltration, recharge.
- What is the current state and historical trend of the water quality of the Athabasca River basin? Which year or period will be defined as baseline (reference) for assessing the change?
- What are the point and non-point sources, substances of potential concern, and historical and forecast loads in the LARB? What are the relative contributions of loads from anthropogenic activities and natural background? What are the impacts of oil sands processed water (OSPW) releases to the ambient receiving streams (i.e. Athabasca River and its tributaries)? What could be safely released (i.e. treated OSPW) without compromising health of aquatics ecosystem and human health?
- What are cumulative effects of past, present and potential future human activities and natural processes in the LARB?
- How could the integrated modelling system support the environmental management frameworks (EMFs) for understanding of the environmental components, and facilitate integrated management to balance anticipated development and environmental protection?

Main Assumptions, Constraints, Dependencies. *

1. The success and progress of the project will be greatly affected by the availability of required data, human and financial resources.
2. It has been assumed that the capital cost of required "high end computing infrastructure" is captured in other OSM workplans and the infrastructure will be made available in the first quarter of 2018-19 fiscal year.
3. For the numerical modelling (including hydrologic, hydrodynamic, sediment transport and standard water quality) in 2018-19 fiscal year, the various data gaps will be addressed using several techniques including model simplification, best estimation, mass balance, or using parameters value reported in the literature.

Partner Categories (select all that apply) * A partner is an individual, group, agency, community etc. that is an active participant in the project and in achieving the project deliverables.	Knowledge System *	Location (select all that apply) *
☐ Federal Government	Both	☐ Office or Laboratory
☑ Another AEP Division		☐ Sub-regional
☐ Another GoA Department		☐ Transboundary (provincial/territorial)
☑ University/Academic Institution		☐ Lower Peace Region
☐ Solely delivered by GoA		☐ Upper Peace Region
☐ Citizen Science		☐ North Saskatchewan Region
☐ Indigenous Community or Organization		☐ Red Deer Region
☐ ENGO		☑ Lower Athabasca Region
☑ Other		☑ Upper Athabasca Region

AEP ONLY: Strategic Alignment to EMSD Outcomes

AEP ONLY: Strategic Alignment to EMSD Science Plan, select 1-2 areas that apply (If Applicable)
Ecosystems and Predicting Change
Human Relationship with the Environment
Sustainability of Water Resources for Human Use

AEP ONLY: Strategic Alignment to AEP Departmental Outcomes

AEP ONLY: Environmental and Ecosystem Health and Integrity	**AEP ONLY:** Sustainable Economic Diversity	**AEP ONLY:** Social Well-Being
Water (Surface and Ground)	No	No
Land, Air, Bio-div.		

AEP ONLY: Protected Public Health and Safety from Environmental
Yes

Co-Chair Decision (March 8, 2018)

*** Decision Pool A: Workplan approved but at a reduced funding level.**

*** Approved at $530,000 (an increase of $180,000 over the original decision) to focus on revised deliverables.**

* Funding in 2018/19 for Phase 3 is dependent upon key project members participating in Oil Sands Process Water release discussions occurring provincially and federally. The Oil Sands Monitoring Program Secretariat will coordinate a meeting with the lead of the Alberta Environment and Parks OSPW Science Team for discussion. Scope of Phase 3 needs to be determined in collaboration with the OSPW science team. Note- this discussion has occurred and this revised workplan reflects those discussions.
All other decision items remain the same.

AEP ONLY: IMAG/IMSC Information Needs, Please Specify Which Need(s) is Being Addressed. File location M:\EMSD\Common\Portfolio Mgmt System Shared Docs	During the modelling need assessment discussions, AEP's Policy and Planning Division has explicitly identified the need of numerical modelling in the Athabasca River Basin to support following priorities: (i) support implementation of Tailings Management Framework in Alberta including potential OSPW releases (ii) amendment to Lower Athabasca Region Surface Water Quality Management Framework (SWQMF) for the Lower Athabasca River -- including review and revision of monitoring locations, parameter lists, and thresholds; assessments of indicator conditions under various development scenarios, including the amount of (iii) complete a Surface Water Quality Management Framework (SWQMF) for the Upper Athabasca River -- including identification of monitoring locations, parameter lists, and thresholds. (iv) advancement of CEMS decision-support tools for water management within the Athabasca River Basin (v) support Groundwater Management Framework for Lower Athabasca River. However, above needs were not clearly communicated through the EMSD's IMAG/IMSC process. Besides this, the workplan also support the following IMAG/IMSC information needs: Ref #2; 3; 7; 8; 9; 12;18; 20; 32
AEP ONLY: How This Project Will Address Each Strategic Theme Selected Above.	The developed integrated modelling system will assist in quantifying changes of environmental conditions from past to present; and predict future potential alternate outcomes under different development trajectories and climate change scenarios in the province to support cumulative effects assessments (CEA) on Alberta's water, land, air, and ecological/terrestrial systems. It will also support in simulating the OSPW release scenarios to understand the impact on river water quality, sediment quality and aquatic health (structure and function).
Project Methodology	
List the Key Project Phases and Provide Bullets for Each Major Task Under Each Project Phase. *	**Phase 1 (2018-2019):** • The VIC hydrological model for the ARB will be enhanced with the following refinements: (a) Improving the spatial resolution of grid cells from 1/16 degree (6~7 km) to 1/32 degree (2~3 km). (b) Improving the model calibration and validation by including additional monitoring stations (current 7 hydrometric stations to 19 hydrometric stations and 20 snow courses data sets). (c) Incorporating the best available meteorological data combined with multiple historical high-resolution gridded climate datasets based on the accuracy of climate datasets by comparing with the Adjusted and Homogenized Canadian Climate Data (AHCCD). • The existing EFDC water quality model will require several refinements before it can be applied to assess the baseline water quality conditions in LAR: (a) Extension of model domain to cover the entire Lower Athabasca River main stem. This will require extending the u/s and d/s model boundaries. (b) Reconstruction of model grid using the high-resolution bathymetry and LiDAR data (i.e. DEM work completed by IEP team in EMSD). The generated grid needs to be reviewed, corrected and optimized to improve computational burden that will allow longer period simulations in reasonable run-time. (c) Compilation, review and analyses of flow, water levels, climate, snow, sediment, water chemistry, point source loading (i.e. wastewater discharges) data in Lower Athabasca River watershed for model development including establishing boundary conditions, initial conditions and loadings (tributary loadings will be estimated based on the flow dependent loading rating curves for all the major tributaries to the Lower Athabasca River). (d) Set up, calibration and validation of hydrodynamic and sediment transport models based on historical monitoring data. (e) Set up, calibration and validation of standard water quality model (CBOD, DO, nutrients, algae/aquatic vegetation including phytoplankton, epileptic algae, and macrophyte) models based on historical monitoring data. (f) Setup and calibration of a preliminary toxic (contaminant) module of the 2D-EFDC model for a few selected heavy metals, NAs, and PAHs. • The existing one-dimensional water quality model (MIKE 11/ECO Lab) for redundancy in water quality modelling will be reconstructed, extended and improved in a similar way to 2D-EFDC model using in-house technical resources. • Interaction with Science Advisory Panel (SAP) to better understand the needs of predictive modelling including substances of concern, loadings, chemical profiles of effluent discharges, river flow conditions for load allocation, spatial and temporal resolution etc. **Phase 2 (2019-2020):** • Setup and calibration of toxic (contaminant) modules of the MIKE 11/ECO Lab and 2D-EFDC model for more selected heavy metals, NAs, and PAHs. • Near-field (mixing zone) water quality studies for the potential effluents. - This task will be revisted in Q3 (2018-19) to determine the additional funding. • Selecting the appropriate water quality/quantity/ecological models for the integrated modelling framework; based on (i) Modelling objective for the study, (ii) evaluation of the existing (developed) models for the region, and (iii) evaluating widely-used (accepted) models in the literature (Fit for Purpose). • Designing and/or confirming an integrated modelling framework for the LARB. •Evaluating data availability, completeness, data quality and data gaps • Gathering additional required data and information for each individual modelling system • Conducting data pre-processing and data preparation; e.g., formatting, spatial and temporal scaling • Complete model set up, calibration and validation of selected models: • Groundwater quantity and quality model • Watershed hydrologic and water quality model • In-stream toxic contaminant transport and fate model • Land-use and land-cover model • Aquatic biotic/ecological model • Incorporating air deposition to the components of designed watershed hydrologic-water quality-LULC-modelling system **Phase 3 (2020-2021):** • Conduct simulations for the planned scenarios of OSPW release to assess the impact on sediment and water quality (only selected key parameters only) in lower Athabasca River. • Conduct scenario modelling to gain insight in the past and future environmental conditions using other developed models; e.g., (surface water quantity, ground water quantity and quality, ecology, aquatic, etc.). •Start integrating all the individual developed models to create an integrated modelling system. **Phase 4 (2021-2022):** •Developing and testing the integrated modelling system • Simulating the scenarios for cumulative effects assessments using the developed integrated modelling system.
Describe How Changes in Environmental Condition Will Be Assessed. *	Changes in environmental conditions will be captured by the integrated modelling system, and will be evaluated relative to a baseline (reference) environmental condition. System will also be used for predicting alternate outcomes in future under different development trajectories and climate change scenarios.
Are There Benchmarks (e.g., objectives, tiers, triggers, limits, reference conditions, thresholds, etc.) Being Used to Assess Changes in Environmental Condition? If So, Please Describe, If Not, State "NONE". *	In general, reference/baseline condition will be defined to assess changes in environmental conditions. Besides this, the triggers and limits identified in Surface Water Quality/Quantity Management Framework of LARP will be used to assess the deviation from the intended outcome for the water quality/quantity of Lower Athabasca River. Once the similar triggers and limits have been developed for groundwater, they will also be applied.
Provide a Brief Description of the Methods By Project Phase. *	The project methodology for developing an integrated modelling system has the following main characteristics: 1) capable of simulating major environmental processes by considering both short- and long-time steps along with a detailed dynamic of the system, 2) capable of predicting environmental processes at different time intervals in a spatially explicit context, 3) capable of tracking the transport and fate in water column, bed sediment and aquatic biota and predict the long-term accumulative effects.
List the Key Indicators Measured. *	The project will not directly measure any environmental indicators but many environmental indicators will be assessed and predicted in future. • Water quantity: streamflow, overland flow, infiltration, recharge, baseflow, actual evapotranspiration. • Water quality & ecology: organic matters, nutrients (nitrogen and phosphorus), DO, toxic contaminants, and variety of state variables and processes in aquatic environments. • Atmospheric deposition: dry and wet deposition rates of particulate matters, nitrate, sulphate and contaminants of potential concern.
Describe Sample Handling Procedures, If Not Applicable, State N/A. *	N/A
List SOPs that Will Be Used, If Not Applicable, State N/A.*	Best modelling practices will be applied.
Describe the QA/QC Plan, If Not Applicable, State N/A. *	Peer review through scientific publications will provide the required QA/QC.
Describe How Indigenous Communities are Involved in the Project Design, Data Collection, and Analysis (Knowledge Co-creation) and How is their Consent Sought. If Not Applicable, State N/A.*	There is a potential in engaging indigenous communities in knowledge co-creation - this requires further exploration working with Gleb Raygorodetsky's team.
Components Delivered by Others	
List by Project or Project Phase Each Component That Will Be Delivered by An External Party (including analytical laboratories) and Name the Party. State None if Not Required. *	Phase 1: - Contract support for enhancing the existing 2D-EFDC hydrodynamic and water quality model (e.g. reconstructing the model grid, setup and calibrate the hydrodynamic and water quality modules) - In-house (Planning Branch & EMSD-IEAP) enhancement of the existing 1D-MIKE 11/ECO Lab hydrodynamic and water quality model (e.g. reconstructing the model cross-sections, setup and calibrate the hydrodynamic and water quality modules) - In-house (Planning Branch & EMSD-IEAP) rapid assessment of developed hydrodynamics and water quality model (MIKE 11/ ECO Lab) for the Lower Athabasca River to predict river water/sediment quality for given hypothetical municipal and industrial loadings and flow scenarios. Phase 2 to 4: TBD
Will These Components be Delivered Under Grant or Contract or Both? Please Describe and Name the Associate Work Plan/Grant/Contract for These Services if Not Included Within This Work Plan. *	**Contracts** - Contracts will be awarded based on the Open tendering or limited competition. Enhancement to existing models or development of new models related to watershed hydrology, ground water and water quality models for the Lower Athabasca River to predict the river water quality/sediment quality under different scenarios of effluent release. - incorporating 1D Ice-modelling in MIKE 11, and comparison of industry ARM model with a physically based numerical model like MIKE 11.
Monitoring Site Locations and Coordinates (for all sites, please add them to the Monitoring Site Location tab - a separate excel sheet)	
Attach Map of Locations. Distinguish Indicators by Station if Necessary. Distinguish Sampling Frequency by Station if Necessary.	Not Applicable as this workplan is not about collecting ambient monitoring data.
Project Schedule	

FOR OIL SANDS MONITORING PROJECTS ONLY- A coordinated field monitoring schedule for the OSM Program is required. Please complete the attached document named "OSM Program Field Monitoring Schedule" in addition to this work plan. Fill as much as you can recognizing that scheduling changes will occur and the scheduling document will be updated regularly. Please note the scheduling document will be shared with stakeholders.	Not Applicable
FOR OIL SANDS MONITORING PROJECTS ONLY: Have You Coordinated With Other Project Leads On Field Logistics? If So, Please Specify. *	Not applicable

Other

Additional Details.	None
Will Capacity Building and Training be a Component of the Project and If So, Explain How. If Not, State N/A. *	N/A
Environmental Impact and Considerations.	N/A

Data Management and Digital Assets

Will Data be Produced as a Result Of This Project? *	Type of Quantitative Data Variables	Frequency Of Collection
Yes	Continuous	Other

Modelling Outputs

Data Collection Period: Start Date - End Date	Timeline For Upload Period: Start Date - End Date
N/A	N/A

Is There a Data Sharing Agreement? (Yes or No).	Data sharing agreements will be signed with the researchers/contractors.
Will the Data Include Traditional Knowledge as Defined by and Provided by an Indigenous Representative, Community or Organization (Yes / No).	No
Platform/Location of Data Storage.	All the modelling data and software will be stored on the high end modelling computing infrastructure - to be established by Q1 of 2018-19.

Project Deliverables

Proposed 2018-19 Deliverable Type (for each deliverable outline document, presentation, meeting, etc.)

☐ Peer-reviewed Journal Publication	☐ Peer-reviewed Conference Proceeding	☐ Non-peer reviewed Conference Proceeding
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
☑ Technical Report	☐ Book Chapter	☐ Public Dissemination Document
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
Technical reports: on Hydrology and water quality modelling for the Lower Athabasca River		
☑ Conference Presentation(s)	☐ Stakeholder Presentation	☐ Key Engagement/Participation Meeting *
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
Platform	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Development of the 2D-EFDC hydrodynamic and water quality model for the Lower Athabasca River. Rapid assessment and scenario analysis in Lower Athabasca River using MIKE 11-ECO Lab modelling.		
☐ EMSD Strategic & Operational Publication	☐ Other Documents	
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	

Proposed Deliverables After 2018/2019 for the project funds received in 2018/2019

☑ Peer-reviewed Journal Publication	☐ Peer-reviewed Conference Proceeding	☐ Non-peer reviewed Conference Proceeding
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
Manuscripts: - 2D EFDC hydrodynamic and water quality modelling in Lower Athabasca River - Rapid assessment and scenario analysis in Lower Athabasca River using MIKE 11-ECO Lab modelling.		
☐ Technical Report	☐ Book Chapter	☐ Public Dissemination Document
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments

Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
☐ **Conference Presentation(s)**	☐ **Stakeholder Presentation**	☐ **Key Engagement/Participation Meeting ***
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	Q1 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	Q2 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	Q3 - Deliverable, Comments
Choose one	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	Q4 - Deliverable, Comments
None	Choose one	Name of Meeting, Year, Location, Dates, Participant Groups and Number of Participants.
☐ **EMSD Strategic & Operational Publication**	☐ **Other Documents**	
Q1 - Deliverable, Comments	Q1 - Deliverable, Comments	
Q2 - Deliverable, Comments	Q2 - Deliverable, Comments	
Q3 - Deliverable, Comments	Q3 - Deliverable, Comments	
Q4 - Deliverable, Comments	Q4 - Deliverable, Comments	

All Completed Products — **If a multi-year project, specify all completed products to date (consistent format for the fields below). Add rows as required.**

Journal Paper

Required Format: Author (follow APA citation format), Year, Title, Journal, Volume, Page Numbers, Open or Closed and Document Location

Example: Jacoby, W. G. (1994). Public Attitudes Toward Government Spending. American Journal of Political Science, 38(2), 336-361.
Fearon, J. D., & Laitin, D. D. (2003). Ethnicity, Insurgency, and Civil War. American Political Science Review, 97(01), 75. doi: 10.1017/S0003055403000534

1) Chowdhury, E.H., Q.K. Hassan, G. Achari, and A. Gupta. 2016. Use of Bathymetric and LIDAR Data in Generating Digital Elevation Model over the Lower Athabasca River Watershed in Alberta, Canada. Water, 2017, 9(1), 19; doi:10.3390/w9010019.

2) Eum, H.-I., Dibike, Y., Prowse, T., Bonsal, B. (2014) Inter comparison of high-resolution gridded climate data sets and their implication on hydrological model simulation over the Athabasca Watershed, Canada, Hydrological Processes, 28, 4250-4271.

3) Eum, H.-I., Dibike, Y., Prowse, T. (2014). Uncertainty in modelling the hydrologic responses of a large watershed, Hydrological Processes, 28, 4272-4293.

4) Eum, H.-I., Dibike, Y., Prowse, T. (2017) Climate-induced alteration of hydrologic indicators in the Athabasca River Basin, Alberta, Canada, Journal of Hydrology, 544, 327-342.

5) Eum, H.-I., Dibike, Y., Prowse, T. (2016) Comparative evaluation of the effects of climate and land-cover changes on hydrologic responses of the Muskeg River, Alberta, Canada, Journal of Hydrology: Regional Studies, 8, 198-221.

6) Kashyap S., Y. Dibike, A. Shakibaeinia, T. Prowse, and I. Droppo. 2017. Two-dimensional numerical modelling of sediment and chemical constituent transport within the lower reaches of the Athabasca River. Environ Sci Pollut Res, 2017 (24): 2286–2303.

7) Shakibaeinia A, Kashyap S, Dibike Y, Prowse T. 2016. An integrated numerical framework for water quality modelling in cold-region rivers: a case of the lower Athabasca River. Sci Total Environ, 569–570: 634–646.

8) Shakibaeinia, A, S. Kashyap, Y. Dibike, and T. Prowse. 2017. A numerical framework for modelling sediment and chemical constituents transport in the Lower Athabasca River. J. Soils Sediments, 2017 (17):1140–1159.

9) Dibike, Y., Eum, H., and Prowse, T. (2018). Modelling the Athabasca watershed snow response to a changing climate. Journal of Hydrology: Regional Studies 15, 134-148, doi.org/10.1016/j.ejrh.2018.01.003.

10)

Technical Report

Required Format: Author, Year, Title, Publisher Location, Name of Publisher, Publisher, Document Location

Example: Author, F.M. (Publication Year). Title of Report (Report No. XXX). Publisher City, State: Publisher

1) Hassan, Q.K., G. Achari, and E.H. Chowdhury. 2017. Use of Bathymetric and LIDAR Data in Generating Digital Elevation Model over the Lower Athabasca River Watershed. Prepared for Environmental Monitoring, Evaluation and Reporting Agency, University of Calgary, Calgary, Alberta, January 12, 2017.

2) Chowdhury, E.H. 2017. Extending a High Resolution DEM for the Lower Athabasca River from the Firebag River Confluence to Old Fort. Prepared for Environmental Monitoring and Science Division, Alberta Environment and Parks, Calgary, Alberta, November 23, 2017.

3) Shakibaeinia, A. 2016. Guideline on 1D and 2D Numerical Modelling of Flow, Sediment,/Chemical Transport and Water Quality for Lower Athabasca River. Water & Climate Impact Research Centre, Environment Canada, July 22, 2016.

4)

5)

Book Chapter

Required Format: Author, Year, Title of Paper, Editors, Title of Book, Page Numbers, Location of Publisher, Name of Publisher, Document Location

Example: Hemingway, E. (1999). The Killers. In J. Updike & K. Kenison (Eds.), The Best American Short Stories of the Century (pp.78-80). Boston, MA: Houghton Mifflin)

1)

2)

3)

4)

5)

Conference Proceeding

Required Format: Author, Year, Title of Paper, Editors, Title of Proceedings, Name of Conference Location of Conference, Publisher Location, Name of Publisher, Document Location

Example: Author of Paper, A., & Author of Paper, B. (Year, Month date). Title of Paper. In A. Editor, B. Editor, & C. Editor. Title of Published Proceedings. Paper Presented at Title of Conference: Subtitle of Conference, Location (inclusive page numbers). Place of Publication: Publisher.)

1)

2)

3)

4)

5)

Public Dissemination Document

Required Format: Author, Year, Title, Journal / Report, Volume, Publisher, Page Number, Number of Pages, Document Location

1)

2)

3)

4)

5)

AEP ONLY: EMSD Strategic and Operational Publication

Required Format: Author, Year, Title, Publisher Location, Name of Publisher, Publisher, Document Location

1)

2)

3)

4)

5)

Other Documents

Detailed Information of Other Documents

1)

2)

3)

4)

5)

Conference Presentation

Required Format: Presenter, Date, Location, Title, Platform or Poster, Conference Name

1)

2)

3)

4)

5)

Stakeholder Presentation	
Required Format: Presenter, Date, Location, Title, Platform or Poster, Name of Meeting	
1)	
2)	
3)	
4)	
5)	

Key Engagement/Participation Meeting	
Required Format: Meeting Host, Date, Location	
1)	
2)	
3)	
4)	
5)	

Human Resources / Staffing Plan (roles and responsibilities)

Name & Role	Organization	Responsibilities
Anil Gupta - Project Lead	IEAP/EMSD/AEP	Provide strategic oversight, advise and leadership; coordination with SAP and AEP Science Team.
Sarah Depoe - Planning branch co-lead	Planning Branch/Policy and Planning Division/AEP	Provide advise on modelling components important to planning branch (i.e. rapid assessment of MIKE 11 - ECO Lab model). Ensure the identified staffing request from planning branch is available for this project.
Shalini Kashyap - Water quality/hydrodynamic modelling (MIKE 11 - ECO Lab).	Planning Branch/Policy and Planning Division/AEP	Rapid assessment of existing hydrodynamic/water quality (1D) model and scenario analysis.
Kim Westcott - Water Policy co-lead	Water Policy Branch/Policy and Planning Division/AEP	Provide advise and oversee the modelling components important to water policy branch.
Kusumakar Sharma - Water Policy component Support	Water Policy Branch/Policy and Planning Division/AEP	Assist with stakeholder consultation to validate the model selection, modelling objectives; Identify priority substances of concern etc. ; provide model inputs (for example, loadings, chemistry profiles, rate, timing, etc.) collected through other core projects related to Integrated Water Management Initiatives.
Babak Farjad - Hydrology, Land and Climate Change Modeller	IEAP/EMSD/AEP	Modelling/Data support as required
Hyung Il Eum - Surface Water and Climate Change Modeller	IEAP/EMSD/AEP	Hydrologic modeller
George Wang - Water Quality Modeller	IEAP/EMSD/AEP	Water quality modeller

AEP ONLY: Additional Human Resources Required from EMSD

Name & Role	Branch - Section	Estimated time (% of annual FTE)
Anil Gupta	IEAP/EMSD/AEP	50
Hyung Eum	IEAP/EMSD/AEP	50
George Wang	IEAP/EMSD/AEP	50

Financial Details and Budget Request

Source of Funding Requested Year 1 - 2018/19

	AEP ONLY: EMSD	OSM
Salaries and Benefits - AEP Chargeback		180000
Salaries and Benefits - New OSM Staff		0
Salaries and Benefits- non AEP		0
Operations and Maintenance		0
Consumable materials and supplies		0
Conferences and meetings travel		15,000
Field work travel		0
Project-related travel		0
Engagement		0
Reporting		10,000
External Contracts - Organization/Vendor/Suppliers		325,000
Overhead		0
Grants		0
Capital		0
Total budget request for the year	0	**530,000**
Total budget approved		

Source of Funding Requested Year 2 - 2019/20 - TBD

	AEP ONLY: EMSD	OSM
Salaries and Benefits - AEP Chargeback		
Salaries and Benefits - New OSM Staff		
Salaries and Benefits- non AEP		
Operations and Maintenance		
Consumable materials and supplies		
Conferences and meetings travel		
Field work travel		
Project-related travel		
Engagement		
Reporting		
External Contracts - Organization/Vendor/Suppliers		
Overhead		
Grants		
Capital		
Total budget request for the year		
Total budget approved		

Source of Funding Requested Year 3 - 2020/21 - TBD

	AEP ONLY: EMSD	OSM
Salaries and Benefits - AEP Chargeback		
Salaries and Benefits - New OSM Staff		
Salaries and Benefits- non AEP		
Operations and Maintenance		
Consumable materials and supplies		
Conferences and meetings travel		
Field work travel		
Project-related travel		
Engagement		
Reporting		
External Contracts - Organization/Vendor/Suppliers		
Overhead		
Grants		
Capital		
Total budget request for the year		
Total budget approved		

Source of Funding Requested Year 4 - 2021/22 - TBD

	AEP ONLY: EMSD	OSM
Salaries and Benefits - AEP Chargeback		
Salaries and Benefits - New OSM Staff		
Salaries and Benefits- non AEP		
Operations and Maintenance		
Consumable materials and supplies		
Conferences and meetings travel		
Field work travel		
Project-related travel		
Engagement		
Reporting		
External Contracts - Organization/Vendor/Suppliers		
Overhead		
Grants		
Capital		
Total budget request for the year		
Total budget approved		
Budget Request for the Entire Project		

Project Approval(s)

Proposal Submitted by

Surname	Given Name	Organization
Gupta	Anil	AEP/EMSD
Signature	Date	

X Anil Gupta Director		05/31/2018

Proposal for OSM Reviewed by		
EMSD Executive Director	Signature	Date
Monique Dube	X Monique Dube Exec Director	12-Feb-18
AEP Administrator/Coordinator - Review	Signature	Date
ECCC Administrator/Coordinator - Review	Signature	Date

OSM Project Approved by		
AEP Co-Lead for OSM	Signature	Date
Monique Dube		23-Jan-18
ECCC Co-Lead for OSM	Signature	Date

AEP ONLY: Proposal for EMSD Reviewed by		
EMSD Director	Signature	Date

AEP ONLY: EMSD Project Approved by		
EMSD Executive Director	Signature	Date
EMSD Chief Scientist	Signature	Date

OSM / EMSD Project Has Not Been Approved		
Project Status	Date Notified	Date Required
The project is conditionally approved. The following conditions are required before approval is granted.		
List the Condition(s)		

Condition(s) Addressed / Approval Granted
Yes

OSM / EMSD Approval Post Removal of Condition(s)		
Name & Title	Signature	Date

Year 1

AEP ONLY: Additional Human Resources Required from EMSD			
Name & Role	Branch - Section	Estimated time (% of annual FTE)	Salary Cost
Anil Gupta	IEAP/EMSD/AEP	30	40000
Hyung Il Eum	IEAP/EMSD/AEP	50	60000
George Wang	IEAP/EMSD/AEP	50	60000
			0
			0
			160000

Other Cost (not included in Grants, Contracts, Capital)

	Operations and Maintenance	Consumable materials and supplies	Conferences and meetings travel	Field work travel	Project-related travel	Engagement	Reporting	External Contracts - Organization/ Vendor/Suppliers	Overhead	Grants	Capital
Source of Funding Requested Year 1 - 2018/19											
• Enhancing existing VIC hydrological model for the ARB.			$5,000		$0		$5,000				
• Enhancing 2D-EFDC hydrodynamic and water quality model			$10,000		$0		$5,000				
TOTAL	$0	$0	$15,000	$0	$0	$0	$10,000	$0	$0	$0	$0
Source of Funding Requested Year 2 to 4 - TBD											

Contracts - Detail

	External Contracts - Organization/Vendor/Suppliers	Remarks (contracts will be identified through GOA Open tendering process)
Contracts Funding Requested Year 1 - 2018/19		
• Enhancing and recalibrating existing hydrodynamic and water quality models in the LARB	$325,000	
(a) 2D-EFDC hydrodynamic and water quality model development		
(b) Integration of ice module with hydrodynamic model		
TOTAL	$325,000	
Contracts Funding Requested Year 2 to 4 - TBD		

Grants - Detail

Line Items	Post Doc or Research Associate at U of C (River Bathymetric data collection and data Processing)	PhD student at U of C (Cellular Automata Modelling, Landuse/Landcover data analysis/maps)	PhD student at U of C (air deposition, modelling integration, advance literature reviw, improvements to modelling alogrithms, computational techniques etc.)
Grants Funding Requested Year 1 - 2018/19			
Salaries and Benefits	$0	$0	$0
Operations and Maintenance	$0	$0	$0
Consumable materials and supplies (including software, hardware etc).	$0	$0	$0
Conferences and meetings travel	$0	$0	$0
Field work travel	$0	$0	$0
Project-related travel	$0	$0	$0
Engagement	$0	$0	$0
Reporting	$0	$0	$0
External Contracts - Organization/Vendor/Suppliers	$0	$0	$0
Capital	$0	$0	$0
Overhead	$0	$0	$0
TOTAL	$0	$0	$0

Total Grants	$0

Grants Funding Requested Year 2 to 4 - TBD

Capital Funding - Detail

Capital Funding Requested Year 2 - 2018/19	Total Capital Cost	Capital (Request through OSM)	Capital requested through NSERC Research Tools and Instruments (RTI) Grants Program

Note:
No capital funding is being requested for Year 1 but funding for year 2, 3 and 4 will be determind in future.

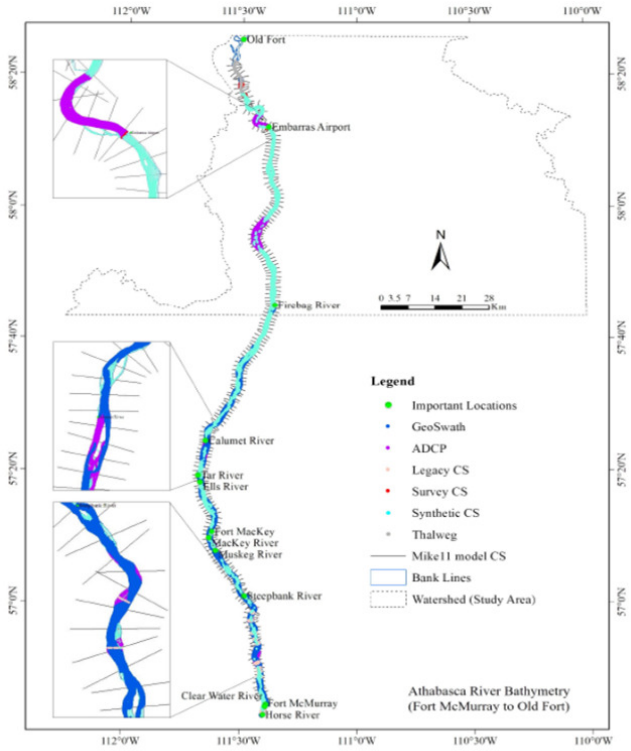

Figure 2: River bathymetry data availability within the study area.

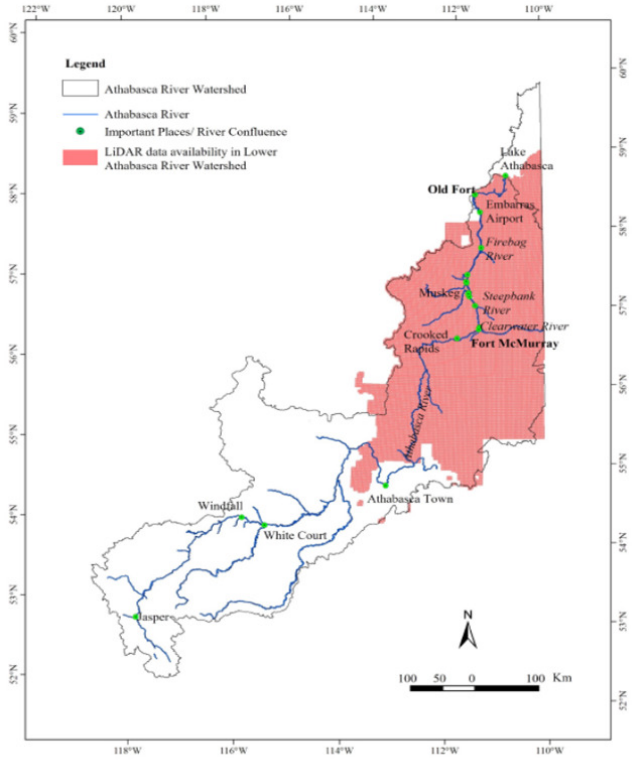

Figure 3: The extent of the LiDAR data availability in the LAR watershed.