

Annual Work Plan

Fiscal Year

2020

Annual Work Plan in support of a long-term adaptive management strategy for the on-going review and evaluation of the regulation plans.

Covering
October 1, 2019 to September
30, 2020

January 28, 2020

WORK PLAN

Project Name:	Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee Annual Work Plan for 2020		
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Blue text identifies other International Joint Commission Board and Committee affiliations

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NOTE: The Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee was established by the International Joint Commission (IJC) and is comprised of an equal number of members from the United States and Canada. Members of the Committee serve at the pleasure of the IJC and are expected to be full participants in all activities of the Committee. As with all IJC Boards and Committees, the GLAM Committee members serve in their personal and professional capacity, not as a representative of their agencies or employers.

Purpose

This work plan includes the priority activities to be carried out or initiated by the GLAM Committee in the period covering October 1, 2019 through September 30, 2020 in support of a long-term adaptive management strategy for the on-going review and evaluation of the regulation plans for the outflows of Lake Superior and Lake Ontario while addressing a priority request from the IJC to initiate an expedited review of Plan 2014.

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Introduction

On January 16, 2015 the International Joint Commission (IJC) issued a Directive establishing the Great Lakes-St. Lawrence River Adaptive Management (GLAM) Committee which reports to the three Great Lakes-St. Lawrence River Boards (Superior, Niagara and St. Lawrence (Boards)). The GLAM Committee is to carry out the required monitoring, modelling and assessment related to on-going evaluation of the regulation plans and address other questions that may arise due to changing conditions, in consultation with the Boards. This document presents the fifth annual work plan of the GLAM Committee covering Fiscal Year 2020 (FY20) from October 1, 2019 through September 30, 2020 and coinciding with the United States fiscal year.

Purpose and Objectives

As outlined in the [January 2015 GLAM Directive](#), the overall objective of the GLAM Committee is to provide information to the Boards and advise them and the IJC regarding the effects that the control structures approved in the Commission's Orders of Approval and Directives have on levels and flows in boundary waters and the impacts the regulation plans have on the affected interests. This includes the on-going review and evaluation of regulation plans related to:

- a) the effectiveness of the existing regulation plans in managing water levels and flows in the Lake Ontario-St. Lawrence River system and Lake Superior.
- b) examining how the system may be changing over time and whether any modifications to the regulation plan(s) may be warranted; and
- c) any other questions requested by the Boards and/or IJC that may affect the Boards' water management decisions over the long-term.

The Directive tasks the GLAM Committee to design a work plan for review and approval by the Great Lakes Control Boards and the IJC that supports long-term efforts to address these questions:

1. How well are the impacts of levels and flows represented by current data and models used in the evaluation?
2. How will future water supplies differ from those used to test the current management of levels and flows?
3. How are other physical, chemical, biological, and/or socio-economic conditions of the system changing over time?
4. How can the management of levels and flows benefit other physical, chemical, biological and/or socio-economic conditions?

The 2019 GLAM Committee work plan builds on activities undertaken since the committee was formed in 2015. The committee is in the process of developing its longer-term strategy to deliver on the requirements in the directive. Figure 1 illustrates the various components of the broader adaptive

management framework. The core components relate to hydroclimate conditions, calculating water levels and flows, developing and using predictive models to assess outcomes, evaluating plan performance, and supporting the IJC and boards in making decisions based on the available information. The feedback components include monitoring and testing changes, validating and improving impact models, and re-considering assessments of plan performance if key objectives change. Overarching components that apply to all aspects of the framework include stakeholder engagement and outreach, peer review, information management, institutional arrangements, and project management.

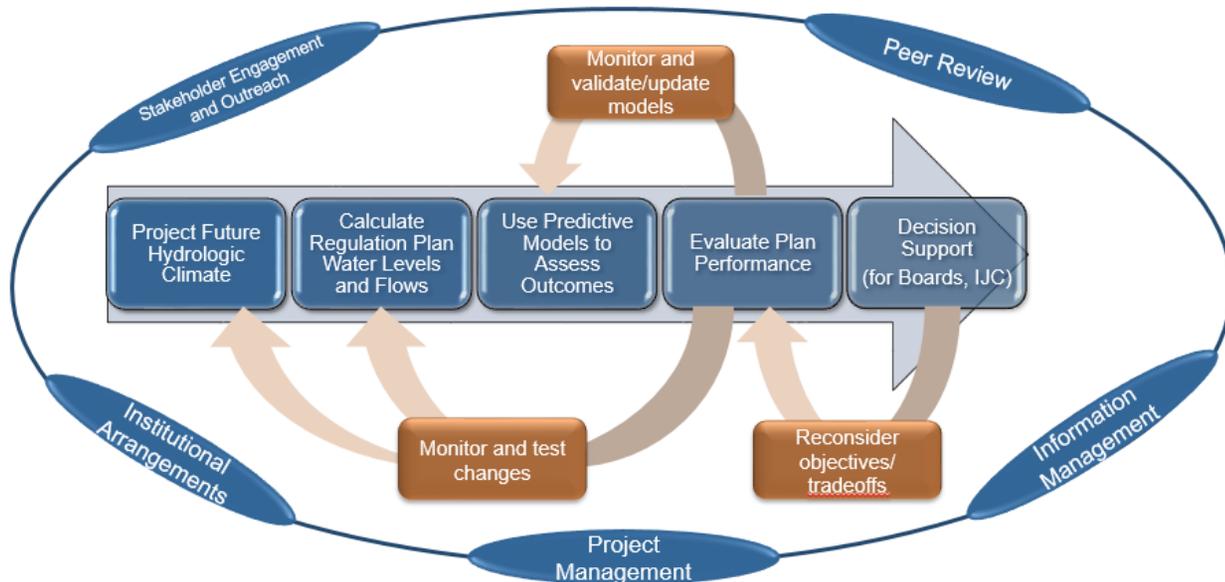


Figure 1: Illustration of the draft adaptive management framework being developed by the GLAM Committee

Scope and Timeline

The adaptive management process undertaken by the GLAM Committee is an on-going effort that recognizes the dynamics of the large and complex Great Lakes – St. Lawrence River system. This work plan is based in the context of a long-term initiative and the 15 year reporting period. This is the fifth work plan prepared by the GLAM Committee and it builds on work initiated and information gained through implementation of the [2016](#) through 2019 work plans. Individual work plan tasks are selected to contribute to a particular aspect of the GLAM Committee’s overall Directive and long-term requirements. Following the 2017 flood event on Lake Ontario, the GLAM Committee conducted an analysis to better assess the potential role of the new outflow regulation plan (Plan 2014) in the observed high water conditions on Lake Ontario. The GLAM Committee analysis showed that the levels under Plan 2014 were not higher than they would have been had ILOSLRB been operating under Plan 1958D with deviations ([GLAM, 2018](#)). Nevertheless, public perception persists that the regulation plan is the cause of the problem, and that there is more the Board could be doing to reduce the water levels on Lake Ontario. As a result, the IJC has asked the Board and GLAM Committee to outline possible options for an expedited review of Plan 2014, with a focus on what might be possible through deviations to reduce the risk of future extremes. The GLAM Committee has incorporated this request into the longer-term adaptive management strategy by developing a phased approach (see AM strategy).

Expedited Review Phase 1 - An 18-24-month LOSLR-specific effort, starting October 2019, focused on flow releases under **board deviation authority** recognizing current conditions and high lake levels and high inflows in the foreseeable future.

Expedited Review Phase 2 - A 3-5 year assessment of the regulation plan(s) under **many possible extremes**, both high and low, and combinations of extremes to assess the risk and implications of changes to limits, triggers and Board deviations decisions over the longer term (beyond the current/near term conditions). Phase 2 activities are dependent on future funding.

Ongoing - The full 10-12 year strategy covering a full range of conditions and consistent with the time horizon within the IJC Order which will run from now through years 2030 for Plan 2012 and 2032 for Plan 2014

The FY20 work plan includes a mixture of carry over items from previous work plans as well as new and emerging activities in response to requests from the IJC for an expedited review of Plan 2014. The tasks are designed to allow an assessment of critical aspects of plan performance on an as-needed basis in response to observed conditions while developing and improving a broad suite of information and tools in support of the 15 year plan review as outlined in the Directive. ***The number of tasks in the work plan is based on the resources that are expected to be available over the October 1, 2019 to September 30, 2020 period, both in-kind and otherwise. However, actual resources can vary throughout the year based on operational requirements in support of IJC regulation boards and impact overall delivery. A separate table of additional priority tasks specifically contributing to Phase 1 of the expedited review have also been identified within the work plan document. These additional Phase 1 tasks will be initiated with the recently identified United States and Canadian funding (January 2020) authorized to support the expedited review effort.***

GLAM Organization, Roles, and Responsibilities

The GLAM Committee is organized based on the structure outlined in the [3-5 year mid-term strategy](#) in the committee’s first triennial progress report. There are three integrated working groups that lead specific activities (Figure 2). They include the following:

1. **Hydroclimate Working Group** – Focuses on understanding and reducing uncertainty in the primary “driver” of water level changes in the Great Lakes – St. Lawrence system, that being the dynamics of the hydroclimate system including water supplies and other secondary factors (i.e., winds, waves, etc.).
2. **Impact Assessment Working Group** – Structured to ensure outcomes of water level and flow scenarios on the various interests can be

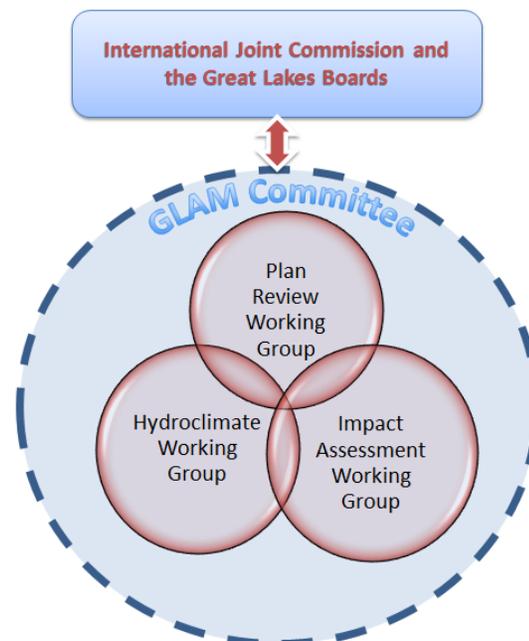


Figure 2: GLAM organizational and reporting structure

measured and assessed (i.e. modelled). These interest categories include commercial navigation, hydropower, municipal and industrial water uses, coastal, recreational boating and tourism, and environmental.

3. **Plan Review Working Group:** An integrating group, pulling together updated hydroclimate science and improved performance indicators along with outflow simulations to review and evaluate regulation plan performance. Collectively, this working group supports the activities necessary to understand whether the management of levels and flows can benefit other physical, chemical, biological, and/or socio-economic conditions.

The GLAM Committee as a whole provides oversight to the working groups as well as guidance and support related to cross-cutting issues including:

- Reporting and communication between the Boards and GLAM, and the IJC and GLAM;
- Providing decision support to the Boards to articulate regulation plan objectives, and understand the implications of GLAM products and findings. This includes providing decision criteria for recommendations on when and how a decision should be made when proposing changes to the regulation plans to the IJC;
- Correspondence related to Great Lakes Water Quality Agreement (GLWQA) activities;
- Supporting external communications with key stakeholders through outreach and engagement, managing information, and ensuring quality control.

Fiscal Year 2020 Work Plan - Product Descriptions, Timelines and Resources

This work plan is divided into two sections as illustrated in Figure 3:

Section A identifies work projects assigned to one of the three working groups described above to support plan review and evaluation. The individual tasks are organized based the working group. There is a basic annual review component for each working groups related to hydroclimate, impact assessment, and plan review information of importance based on conditions in the 2019 calendar year. The majority of work plan tasks contribute to delivery of the core components of the adaptive management framework outlined in Figure 1. In many cases, these targeted projects are identified based on knowledge gained from the review of conditions within the previous calendar year as part of the annual report development.

Section B outlines GLAM oversight and administrative activities needed to manage the GLAM Committee and support all work projects and long-term efficiencies. The tasks support the overarching activities of the adaptive management framework outlined in Figure 1.

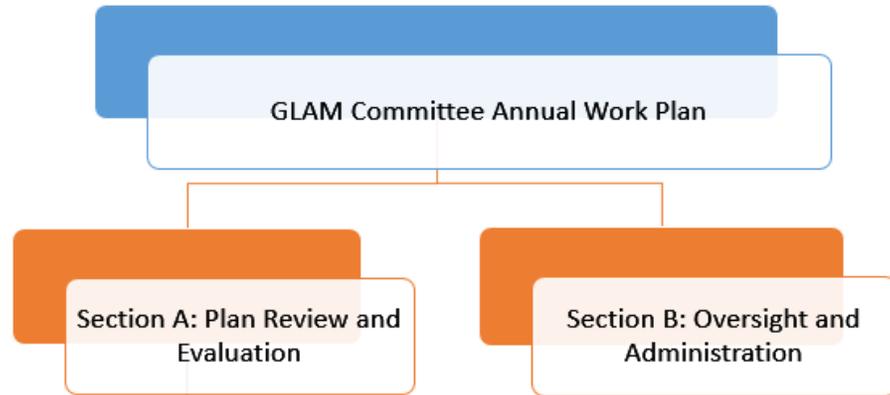


Figure 3: Organization of GLAM annual work plan

Specific tasks identified in the work plan represent activities the GLAM Committee has identified as priorities and which the GLAM Committee believes can be resourced with one of the following options:

- 1) Available committee membership, IJC staff and/or assigned agency resources given current expectations for the coming year, or
- 2) Are already receiving financial support through the International Watershed Initiative (IWI), or
- 3) Are the highest priority for seeking funding support through the IWI or other funding opportunities and are therefore dependent on the GLAM Committee’s ability to secure those funds.

In addition to the tasks falling within the previous three categories, there are a few specific projects being undertaken and resourced directly through partner agencies that are identified in the work plan. These projects are included in the work plan because their products directly support GLAM Committee objectives. However, the projects are primarily being managed, resourced and undertaken outside of the GLAM Committee and in support of other agency priorities. GLAM Committee members felt it was important to highlight these additional items in the work plan because of the relevance of the work to longer-term efforts but they are flagged because the committee has limited control on their overall delivery.

Table 1 shows expected resources available to the GLAM Committee in FY20. The resource levels include a number of IWI projects continuing from FY19 that were previously reported in the FY19 work plan. The table also includes recently identified funding to support Phase 1 of the expedited review. On the Canadian side, these funds will carry over into the GLAM Committee’s FY21 work plan. Table 1 does not include agencies in-kind staff contributions, nor does it include additional resources that may yet be acquired through the IWI program.

Table 1: Summary of currently identified resources (\$) for GLAM activities in FY20 (includes full support for tasks that may have been partially completed in FY19. Therefore these totals include support that was previously in FY19 work plan and not just the incremental FY20 component)**

Agency	\$US	\$CAN
IJC support (includes proposals already submitted and endorsed under the International Watersheds Initiative (IWI) ***)	\$360K	\$121.5K
Federal government funding to support Phase 1 of the expedited review (confirmed January 2020)	\$1,500K	\$1,500K (which will carry into FY21)

Section A – Plan Review and Evaluation

The GLAM Committee’s priority Plan Review and Evaluation work plan tasks are identified in Table 2. The highest priority activities are the ones that contribute directly to Phase 1 of the expedited review and were resourced prior to the end of the FY19 work plan in September 2019. In addition, there are a number of ongoing activities to support the long-term adaptive management requirements for both Lake Ontario and the upper Great Lakes that are being maintained with in-kind contributions. These include undertaking targeted projects to validate or improve existing impact assessment tools such as a detailed review of existing performance indicators based on what was learned from the record high water levels in 2017 and 2019. The GLAM Committee has also identified a series of additional Phase 1 expedited review tasks that were not funded as of October 2019. These additional Phase 1 tasks are reported separately within this work plan document and will be initiated using the United States and Canadian funding identified for the effort in January 2020.

Section B – GLAM Oversight and Administration

The GLAM Committee’s oversight and administration activities focus on overall management of committee and its activities. This includes guidance and implementation of overarching GLAM functions including information management as well as communications, outreach, and engagement activities. Specific oversight and administration tasks are identified in Table 3.

Possible Additional Tasks

The activities outlined in Tables 2 and 3 represent ones that were resourced by the GLAM Committee as of October 2019. There are additional priority items identified in the committee’s Phase 1 plan for an expedited review of Plan 2014 that were not resourced as of October 2019. These tasks are identified in Table 4, and will be initiated using funding from the United States and Canadian federal governments confirmed in January 2020. In addition, there are a few tasks that support longer-term plan review requirements that are also not resourced. They are identified in Table 5.

Table 2: Summary of GLAM FY20 Section A – Plan review and evaluation work plan activities

SECTION A: Plan Review and Evaluation					
Summary of 2019 conditions					
Task	Task Title	Proposed Products	Description	Expected Resources	Estimated Delivery
Hydroclimate Working Group					
FY20-1.1	Prepare routine report material required for hydroclimate assessments	1) Draft year-end hydroclimate summary to be incorporated into report for 2019 for Board review.	The summary will discuss relevant hydroclimate information that supports long-term GLAM plan review activities. The summary will cover the 2019 calendar year as well as relevant surveillance information reported on during the year. The committee expects to report on this information as part of the triennial report due in 2020.	In-kind	Sept-20
Impact Assessment Working Group					
FY20-1.2	Prepare routine report material required for understanding baseline conditions and benefits of observed water levels and flows	1) Draft year-end impact assessment summary to be incorporated into report for 2019 for Board review.	The summary will discuss relevant impact assessment information that supports long-term GLAM plan review activities. The summary will cover the 2019 calendar year as well as relevant surveillance information reported on during the year. The committee expects to report on this information as part of the triennial report due in 2020.	In-kind	Sept-20
Plan Review Working Group					
FY20-1.3	Prepare routine report material required for ongoing evaluations of existing regulation plan performance	1) Draft year-end plan review and evaluation summary to be incorporated into report for 2019 for Board review.	The summary will discuss relevant plan review information that supports long-term GLAM activities to assess regulation plan performance. The summary will cover the 2019 calendar year and include simulations of alternative outflow management strategies based on 2019 conditions and identified plan review activities in the work plan. The committee expects to report on this information as part of the triennial report due in 2020.	In-kind	Sept-20

SECTION A: Plan Review and Evaluation					
Priority Projects					
Task	Task Title	Proposed Products	Description	Expected Resources	Estimated Delivery
Hydroclimate Working Group					
FY20-2.1	Completion of NWS Multi-Precipitation Estimates (MPE)/CaPA merged baseline climatology development	1) Technical documentation presenting the method used to compute the climatology of a merged CaPA/MPE product and how to access on website	This is a continuation of a portion of FY18-2.1 and FY19-2.2. Funding arrangements were finalized through the IJC as of September 2018 and a no cost extension was provided to October 31, 2019. The project is basically completed, pending final documentation. The project develops a long-term climatology using the merged CaPA/MPE precipitation product to support comparisons of current rainfall conditions to past conditions. The project will also include website access to the data. The data is critical to better understand the contribution of overlake precipitation in the historical water balance of the Great Lakes and to support longer-term GLAM efforts to ensure appropriate water supply sequences are available to test regulation plans.	IWI	Nov-19
FY20-2.2	Application of Machine Learning (ML) and Artificial Intelligence (AI) to Lake Ontario Regulation Decisions	1) Summary report on the utility of ML and AI application to regulation decisions and recommendations for further research.	The project explores machine learning and artificial intelligence as applied to making regulation decisions for the Lake Ontario-St. Lawrence River system water levels and outflows. The researcher will work with an existing training set of 50,000 years (quarter-monthly timestep) to develop algorithms to assist human decision-makers.	In-kind	Dec-20
FY20-2.3	Identification of research priorities linking hydroclimate and plan review requirements	1) List of key hydroclimate questions specific to GLAM Committee needs	There is a wide range of hydroclimate research undertaken in the Great Lakes basin by federal and state agencies as well as academic institutions. As part of efforts to review IJC regulation plans in the basin, there are some targeted projects that need attention. This task would involve developing that priority list in consultation with the hydroclimate and plan review groups to identify critical tasks and knowledge gaps to improve outflow regulation.	In-kind	Sept-20
**FY20-2.4 ¹	Updating Future Lake Level Projections	1) Projections of Great Lakes Water Levels under a Range of Climate Change Scenarios available for the Great Lakes	<i>This is part of an ECCC funded 5 year project (2017-2022) titled "Assessing and Enhancing the Resilience of Great Lakes Coastal Wetlands to Climate Change". This portion of the project includes the development of historical (base line) and multiple climate change water supply and water level scenarios for testing wetland vulnerability and to drive the impact assessment models. The project will obtain as many available</i>	<i>In-kind through ECCC funded</i>	Mar-20

¹ The project is being undertaken and directed through partner agencies but outcomes will contribute to long-term GLAM Committee objectives

		<i>Region</i>	<i>regional climate change scenarios as possible and use them to determine a range of plausible future lake levels and basic hydroclimate variables.</i>	<i>project</i>	
Impact Assessment Working Group – Basin-wide					
FY20-2.5	Performance Indicator review and prioritization assessment	1) Initiation of multi-phased review of existing Performance Indicators, and prioritization for mid to long-term Performance Indicator and model improvements	<p>Since its inception in 2015, the GLAM Committee has been looking at how to use existing performance indicators in the long-term assessment of the Lake Superior and Lake Ontario regulation plans. In preparing the annual report for 2017, it became evident that in addition to the ongoing work in support of a few priority indicators, a broader status assessment of the additional ecosystem and socio-economic indicators was required to determine which ones were priority for monitoring, validating, updating, and integration into a long-term adaptive management process. Given limited resources, the GLAM Committee cannot monitor all indicators and it is important to assess how the existing indicators can best be tracked, what external efforts are ongoing related to individual indicators, and how the GLAM Committee can best fill priority gaps.</p> <p>The GLAM Committee considers this a priority activity for FY2020 and will build on priorities and issues identified in the development of the report on 2017 conditions. It is expected that external resources will be required to support this review for some stakeholder groups. Coordination with the upper Great Lakes Performance Indicator review will also be required. It is anticipated that this effort may carry over into future years and work plans. Only preliminary work will be able to be completed in 2020 and will build on priorities and issues identified in the development of the report on 2017 conditions. There is an ongoing need for learning, training, and simulations using existing models, which will be part of this effort. As well, some initial validation work may be undertaken to identify possible gaps. Some IWI support has already been identified in spring 2019 to move the ecosystem component of this task forward.</p>	Managed through in-kind resources but specific aspects may require submission for IWI support. For example, IWI support may be possible for some of the ecosystem indicators	Sept-20
Impact Assessment Working Group – Lake Ontario and St. Lawrence River (Ecosystem)					
FY20-2.6	Continued Evaluation of Meadow Marsh Algorithm	1) An updated report integrating 2017 through 2019 field data into the comparison of the wetlands algorithm along with a response to 2017 peer review	This is a carry-over item from FY18 and FY19 and is critical to support updating and validating the meadow marsh Performance Indicator. The GLAM Committee delayed work on this FY19 task until additional field data was acquired and processed. That data was delivered in the late spring of 2019 and GLAM Committee resources are expected to be available for follow-up in FY20.	In-kind	Sept-20

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		2) Preliminary development of a longer-term coastal wetland monitoring strategy to support GLAM efforts along with implementation requirements.	Given the importance of the meadow marsh indicator to longer-term plan evaluation, the GLAM Committee will use the updated information to support the development of a monitoring strategy. To date, funding has been acquired through the IJC's IWI but a more strategic plan is required to ensure long-term sustainability. This includes identifying monitoring requirements including frequency and sample size, the contribution of remote sensing approaches, and potential resources to support the effort over the long-term. This task is critical for developing a monitoring and validation protocol .		
FY20-2.7	Monitoring of Lake Ontario Coastal Wetlands on the Canadian Shoreline	1) Summary report and monitoring data for use in long-term model validation efforts	This is a new item, but relates to past field sampling tasks. It is field monitoring of 16 Canadian wetland sites in late summer of 2019 by the Canadian Wildlife Service to support model validation of the meadow marsh Performance Indicator .	IWI	Mar-20
**FY20-2.8 ²	<i>Wetland monitoring and ecosystem indicator development (muskrat and Northern Pike)</i>	<i>1) This is part of a multi-year effort with only interim products expected in FY19</i>	<i>This is a multi-year item initiated in FY18 (was FY18-2.8) and contributes to ongoing efforts to support Performance Indicator monitoring and validation related to the wetlands, muskrat dens and Northern Pike indicators in the upper St. Lawrence River.</i>	<i>In-kind through partner agency activities</i>	<i>Multi-year</i>
**FY20-2.9 ³	<i>Wetland imagery interpretation</i>	<i>1) Distribution of processed and interpreted of high resolution aerial imagery for up to 17 Canadian wetland sites (e.g. vegetation delineation) done by the Ontario Ministry of Natural Resources</i>	<i>This is a multi-year item initiated in FY18 (was FY18-2.9) and contributes to the ongoing efforts to support Performance Indicator monitoring and validation related to the wetland indicator for Lake Ontario.</i>	<i>In-kind through partner agency activities</i>	<i>Multi-year</i>
**FY20-2.10 ⁴	<i>Wetlands modelling to assess wetlands vulnerability to climate change</i>	<i>1) Integrated Ecological Response Model (IERM) Development for 25 Great Lakes wetlands</i>	<i>Ecohydraulic modelling known as the Integrated Ecosystem Response Model (IERM) are being developed by ECCC as part of project titled "Assessing and Enhancing the Resilience of Great Lakes Coastal Wetlands to Climate Change" to assess wetland vegetation and wetland habitat vulnerability to climate change. This model will use data gathered by the Canadian Wildlife Service of ECCC and</i>	<i>In-kind through ECCC funded project</i>	<i>Mar-22</i>

² The project is being undertaken and directed through partner agencies but outcomes will contribute to long-term GLAM Committee objectives

³ The project is being undertaken and directed through partner agencies but outcomes will contribute to long-term GLAM Committee objectives

⁴ The project is being undertaken and directed through partner agencies but outcomes will contribute to long-term GLAM Committee objectives

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			<i>other sources to generate algorithms relating water levels and other climate drivers to wetlands response and produce geospatial datasets of results over a number of years (~30 yrs), covering the historical sequence and numerous future climate change projections developed.</i>		
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Impact Assessment Working Group – Lake Ontario and St. Lawrence River (Socio-Economic)					
FY20-2.11	Revisit shore protection that was surveyed by either NYDEC (2011) or USACE (2015) to assess response to high water conditions	1) An assessment of a subset of shore protection structures previously surveyed by NYDEC and/or USACE to determine condition following 2017 high water levels.	This is a carry-over item from FY18 and FY19 in support of Performance Indicator validation and potential future updating . It involves an assessment of a subset of shore protection structures previously surveyed by NYDEC and/or USACE to determine their conditions following 2017 and 2019 high water conditions. IWI funds have been identified to support the effort and the funds have been appropriated to the USACE to carry out the work in FY19, finished in December 2019.	IWI	Dec-19
FY20-2.12 (Phase 1)	Implementation of self-reporting damage questionnaire for Great Lakes-St. Lawrence River shoreline (2019)	1) Make 2019 questionnaire available online 2) Promote questionnaire to maximize responses 3) Summarize the questionnaire responses for the Boards and IJC purposes	An online, self-reporting questionnaire is available for shoreline property owners along the Great Lakes- St. Lawrence River to report high water impacts. The questionnaire will be promoted through the fall of 2019 and material summarized for reporting to the IJC in 2020. The information will also be used for comparison to previous impact models. The work support surveillance that ties back in to PI validation and potential future updating .	In-kind	Sept-20
FY20-2.13 (Phase 1)	Seaway Navigation Economic Analysis	1) Summary analysis for the ILOSLRB regarding economic impacts of flows exceeding seaway maximums	Further analysis of the economic impacts of high flows exceeding seaway maximum limits (under deviation authority of the ILOSLRB). The analysis will look at the economic impacts of early shutdown, delayed opening, or mid-year temporary shutdowns.	IWI (US)	Apr-20
FY20-2.14 (Phase 1)	Municipal meetings within NY State, Ontario, and Quebec	1) Host meetings with shoreline municipalities to gather further information on 2019 high water impacts to support reporting and model comparison	Shoreline municipalities and their residents were directly impacted by high water levels on Lake Ontario and the St. Lawrence River in 2019. These meetings will seek to provide a forum for municipalities to report on local high water impacts so that information can be summarized and reported back to the Board and the IJC. IWI funding is already confirmed for the US meetings. The GLAM Committee is seeking funding to support similar work on the Canadian shoreline in Ontario	IWI (US) confirmed. Funding is being sought for a similar Canadian component	Apr-20

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			and Quebec.		
FY20-2.15 (Phase 1)	Review of Lake St. Lawrence I Limit	1) update critical low water levels on Lake St. Lawrence related to I limit	This project will look at critical low water thresholds on Lake St. Lawrence associated with winter ice operations (e.g. municipal/industrial intakes). The goal is to better define vulnerabilities that guide the I limit operations.	IWI (US)	Apr-20
FY20-2.16 (Phase 1)	Review of Lake St. Lawrence Ice Integrity	1) analysis of risks/possibilities related to further drawing down Lake St. Lawrence under ice conditions (related to I limit operations)	This project will look at critical ice management requirements on Lake St. Lawrence associated with winter operations in an attempt to determine the stability of the ice cover under additional drawdown from what has been applied in the past.	IWI (US)	Apr-20
**FY20-2.17 ⁵	<i>Erosion and inundation vulnerability assessment along the lower St. Lawrence River</i>	<i>1) This is part of a multi-year effort with only interim products expected in FY19</i>	<i>This is a multi-year item being undertaken through partner agencies. The project results will contribute to ongoing efforts to support Performance Indicator monitoring and validation related shoreline erosion and inundation vulnerability along the lower St. Lawrence River between Montréal and Trois Rivières and will include a climate change component.</i>	<i>In-kind through partner agency activities</i>	<i>Multi-year</i>
Impact Assessment Working Group – Upper Great Lakes					
FY20-2.18	St. Marys River IERM Rapids Data	1) Improved substrate data for the St. Marys Rapids to support IERM2D model development. 2) Review of new data in the context of potential IERM2D enhancements	This is a carry-over item from previous work plans and supports Performance Indicator and model development within the St. Marys River IERM. The project involves collection of substrate data in the St. Marys Rapids area to support IERM validation. The USACE and IJC (through IWI) are contributing to the project, through April 2020. The data collection occurred in June and September 2019 and data processing will occur through April 2020. Once the 2019 data has been collected and processed (so after April 2020), the next step will be to for USACE and ECCC staff to collectively review the substrate and plant data and define the next steps for the modelling effort in terms of validating and improving the model and possibly expanding the model domain. This second component will be initiated after April 2020.	IWI and in-kind	Apr-20 for item 1, Sept-20 for item 2
FY20-2.19	Development of initial flooding performance indicator for the St. Marys River	1) Preliminary development of flooding performance indicator for the St. Marys River.	This is a carry-over item from previous work plans. During high flows through the St. Marys River, local flooding can occur at various locations in the river. No performance indicator was developed during the IUGLS for this area and one is now required. This effort will initiate the Performance Indicator and model	In-kind	Sept-19

⁵ The project is being undertaken and directed through partner agencies but outcomes will contribute to long-term GLAM Committee objectives

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			development for application in future plan review activities.		
FY20-2-20	Development of flow change smoothness performance indicator for St. Marys Rapids	1) Develop plan and schedule for developing PI	Eventually it may be possible for the IERM to be used to quantify benefits of smooth month to month flow changes in the rapids. However, it may still be years before the IERM is fully calibrated to be used for this purpose, and it may not ever be able to be used for this purpose. In the meantime, the development of a more qualitative PI should be discussed.	In-kind	Mar-20
Plan Review Working Group					
FY20-2.21 (Phase 1)	Review and documentation of Lake Ontario and Lake Superior outflow operations in 2018 and 2019	1) Narrative of differences between 58DD and Plan 2014 from 2017 through 2019 2) Narrative of differences between 77A and Plan 2012 from 2017 through 2019 3) Documentation of possible changes to deviation assumptions required for updates to simulation models	This is a Board requirement, but needed for GLAM too. As part of ongoing board operations requirements, the regulation representative offices are already initiating efforts to look at the operation of the current regulation plans (Plan 2014 and Plan 2012), the previous regulation plans (1958DD and 77A), and preproject conditions from 2018 through 2019. This is also a requirement for the GLAM Committee. On Lake Ontario, the regulation representative offices are starting with a narrative description of the differences between Plan 2014 and 1958DD and that will support further documentation by the GLAM Committee, possibly as part of the triennial report. There are similarities between this task and FY20-2.3.	In-kind	May-20
FY20-2.22	Development of regulation plan simulations into new regulation and routing model	1) Development of the new coordinated simulation model for Plan 2014, 1958DD, Plan 2012, 77A, and preproject	This is a Board requirement, but needed for GLAM too. The regulation representative offices in Cornwall, Buffalo, and Detroit are working on a new regulation and routing model for the Great Lakes, in collaboration with the Coordinating Committee on Great Lakes Basic Hydrologic and Hydraulic Data. The new simulation model will incorporate updated regulation rules (and deviation assumptions) for Plan 2014, 1958DD, Plan 2012, 77A, and preproject conditions. Some of this work will build off the narrative descriptions of the differences between operational regulation plans and previous regulation plans undertaken in task FY20-2.17.	In-kind	Sept-20
FY20-2.23	Maintenance and application of existing water level and flow quarter-monthly simulation tools	1) Ongoing updates, version control, documentation, and application of <u>existing</u> water level and flow simulation models	The regulation representative offices maintain older versions of simulation models of water levels and flows using various regulation plan rules including Plan 2014 and Plan 1958DD. While these models are expected to be replaced operationally by the new coordinated regulation and routing model, there may still be simulation requirements using the older models. This task involves the maintenance updates, updates to deviation assumptions, version control,	In-kind	Sept-20

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			documentation, and in some cases application of existing water level and flow simulation models for Plan 2014, pre-project, 1958DD, 77A, and Plan 2014 that will support GLAM simulations in the short-term.		
FY20-2.24	Updated input datasets for simulation models	1) Updated input datasets necessary to simulate regulation plan operations for 2017 through 2019	<p>For long-term plan evaluation efforts, standard input datasets are required to use water level and flow simulation models. These include things like:</p> <ul style="list-style-type: none"> - channel roughness factors, - ice conditions, - tributary inflows, etc. <p>Regular work is required to make sure these datasets are coordinated and finalized on a regular basis to allow for use within the simulation models. This immediate priority is 2017 through 2019.</p>	In-kind	Aug-20
FY20-2.25	Plan Review gap analysis	<p>1) A gap analysis of critical plan review issues</p> <p>2) Prioritization and scoping of identified issues, in consultation with the Boards.</p> <p>3) Initiation of follow up to priority plan items identified in the gap analysis</p>	<p>The report on 2017 conditions identified a number of short and long-term plan review requirements, with varying levels of priority. As well, there may be further plan review components raised from the review of 2018 and 2019 operations that require further investigation. However, the GLAM Committee must also consider longer-term requirements to perform a broader review of plan performance, integrating multiple individual components.</p> <p>As a priority and to help make the best use of limited available resources, the GLAM Committee needs to do a gap analysis and prioritization of the gaps found to ensure critical issues are identified and discuss with the Boards (possibly at the Spring 2020 meetings). In some cases, it may be possible to address these issues with available information (e.g. from the Lake Ontario – St. Lawrence River Study) relatively quickly. In other cases, further simulations or more detailed analysis may be required.</p>	In-kind	May-20

Table 3: Summary of GLAM FY19 Section B – oversight and administration work plan activities

Section B: GLAM Oversight and Administration					
Task	Task Title	Proposed Products	Description	Expected Resources	Estimated Delivery
FY20-3.1	GLAM Committee Coordination, Management, and Reporting	1) Annual work plan for FY20 for submission to the Boards. 2) Semi-annual progress reports for submission to the Boards in March 2020 and September 2020. 3) Coordination and oversight of draft annual report for 2018 and 2019 preparation.	<p>This is an on-going task that includes the coordination, management operation and oversight of GLAM Committee activities and working groups. It includes primarily the work of the co-chairs, secretaries and their staff who help support the operation of the GLAM Committee. This activity is supported primarily through USACE and ECCC with some operation and maintenance funds provided by IJC-Ottawa.</p> <p>There are three specific products for this task including the development of an annual work plan for submission to the boards, semi-annual progress reports in March and September of 2020, and coordination and oversight of the annual reporting as necessary. The first two items are requirements of the IJC Directive to the GLAM Committee.</p>	In-kind	Sept-20
FY20-3.2	Monitoring of Work Plan Delivery	1) Task descriptions and periodic updates on progress that contribute to semi-annual reporting.	The GLAM Committee secretaries in conjunction with the GLAM Co-chairs will track work plan progress. This is an ongoing committee requirement and contributes to semi-annual progress reporting.	In-kind	Sept-20
FY20-3.3	GLAM Information Management Needs including file sharing and data/model management strategies.	1) Analysis of GLAM IM/IT opportunities and needs within the context of available IJC IM/IT resources and capacity.	<p>This is a carry-over items from previous work plans. While it is considered a high priority, work was deferred due to resource limitations while completing the annual report for 2017. The GLAM Committee currently relies on IJC support for a high level website as well as file transfer systems such as Sharepoint and File Transfer Protocol (FTP) resources to communicate internally and manage products and information. GLAM continues to face challenges collaborating between agencies when using larger datasets and models as well as some files and documents already managed through existing IM/IT infrastructure. Further direction is needed to identify appropriate approaches for handling future IM requirements and data acquired through the development of the annual report for 2017 will be utilized as test material to develop appropriate standards and approaches (e.g. oblique imagery analysis, wetland monitoring data, etc.) The GLAM Committee hopes to make further progress on defining IM/IT needs and solutions in the coming FY and will</p>	In-kind	Sept-20

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			leverage other IJC opportunities where appropriate.		
FY20-3.4	Maintain engagement with GLWQA activities	1) Ongoing GLAM co-chair participation in meetings of the IJC's WQB and SAB. 2) Interaction with GLWQA annexes to further potential common objectives.	The IJC Directive to the GLAM Committee specifically highlights the importance of ensuring coordination and liaison between the Great Lakes Control Boards and the Boards created by the Great Lakes Water Quality Agreement (GLWQA) – the Great Lakes Water Quality Board (WQB) and Science Advisory Board (SAB). To better link water levels and flows regulation with water quality considerations, the GLAM Committee is requested to engage in outreach activities with the WQB and SAB. The GLAM Committee co-chairs are participating in joint meetings of the WQB and SAB.	In-kind	Sept-20
FY20-3.5	Develop and initiate an engagement plan for advisory networks	1) Proposed engagement strategy of GLAM advisory networks.	This is a carry-over item from previous work plans. The GLAM Committee will continue efforts to develop a long-term communication and engagement strategy to support its work. The GLAM Co-chairs and secretaries participate on the International Lake Ontario – St. Lawrence River Board Communications Committee to support coordination where necessary.	Will be submitting for IWI	Sept-20
FY20-3.6	Update GLAM communications/engagement strategy	1) Updated communication/engagement strategy	The GLAM Committee developed an initial communication/engagement strategy in 2015. The strategy needs to be updated in consultation with the ILOSLRB Communications Committee and also ensuring it support ILSBC needs.	In-kind	Mar-20
FY20-3.7	Finalize 12-year strategy	2) An overview strategy document outlining a longer term strategy for ensuring 15 year review of regulation plans	Both the Lake Superior and Lake Ontario outflow strategies must be reviewed within 15 years of implementation. The GLAM Committee has initiated the preparation of an overall framework of critical activities that must take place prior to the 15 year review date to guide efforts over the next number of years. The strategy will also identify potential resource gaps.	In-kind	June-20
FY20-3.8	Triennial report	1) Triennial report to the boards and IJC covering 2017 through 2019	As part of the GLAM Directive, there is a requirement to report to the IJC on a triennial basis, consistent with the timing of the Triennial Assessment of Progress related to the Great Lakes Water Quality Agreement. The Triennial report of the GLAM Committee will pull together what GLAM has learned over the three year reporting period of 2017 through 2019. The committee does not expect to complete this report until later in 2020	In-kind	Dec-20

Table 4: GLAM Committee Phase 1 Expedited Review Activities (To be finalized and resourced using federal funding identified in January 2020 to support the expedited review)

Action	Phase	Description	Funding Requirement	Product	Lead	Funding Sources	US Phase 1 estimate (\$K)	CDN Phase 1 estimate (\$K)
Understanding and Projecting Future Water Supplies								
Short-term (1-2 year) water supply scenarios based on current conditions	Phase 1	Develop a range of plausible scenarios including extreme combinations of climate factors, over the next 3 years	Short-term staff to help support the development of the range of plausible conditions over the next 3 years	Extreme water supply sequences running now to 3 years from now	Hydroclimate WG	New funds required	\$20	\$15
Impact Assessment								
Gather information for critical locations related to elevation and damage data - field surveys (LOSLR)	Phase 1 and 2	Update baseline information on number of properties, property values, etc. Verify 1st floor flooding elevations, land elevations and characterize impacts and critical thresholds	Contract or agency	Updated elevation and cost data for specific sensitive locations and critical thresholds	Impact Assessment WG	New funds required	\$100	\$100
Analysis and reporting of Shoreline survey responses (LOSLR)	Phase 1	Provide analyses of survey results on a county by county basis for input to the Triennial Report	Agency staff	Summary of survey results in triennial report and in fact sheets	Impact Assessment WG	ECCC and USACE		
LIDAR data analyses (LO)	Phase 1 and 2	Full processing and analysis of 2017 LIDAR data	Contract or agency	Updated elevation data	Impact Assessment WG	New funds required	\$100	\$100
Recreational Boating	Phase 1	Assess damages to tourism	Contract to assess damages	Updated and/or new rec	Impact	New	\$100	\$100

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and Tourism new PIs (LOSLR)	and 2	and recreational boating based on 2017 and 2019 data and information to gain an understanding of critical thresholds by location	to tourism and recreational boating and benefits of reduced levels	boating and tourism PI for Lake Ontario and the upper River	Assessment WG	funds required		
Shoreline resiliency assessment (LOSLR)	Phase 1 and 2	Assessment of the level of shoreline resiliency by location in US and Canada based on shoreline management policies and practices implemented by shoreline communities	Contract or agency	GIS based analysis of shoreline resiliency based on a risk factor	Impact Assessment WG	New funds required	\$50	\$50
Recreational Boating analysis (Lake St. Lawrence)	Phase 1	Assessment of the number of boaters and types of impacts particularly related to low water conditions on the forebay	Contract or agency	New rec boating PI for Lake St. Lawrence	Impact Assessment WG	New funds required	\$50	\$30
Ecosystem impacts of low levels (Lake St. Lawrence)	Phase 1	Develop on or more ecosystem PIs for Lake St. Lawrence if applicable	Contract	New ecosystem PI for LSL	Impact Assessment WG	New funds required		\$50
Coastal Impact Analyses Lower St. Lawrence River – updated stage damage curves	Phase 1	Based on 2017 and 2019 conditions and information and data gathered, update the stage damage curves for the lower river	Contract or agency	Updated stage damage curves to test Board deviation strategies	Impact Assessment WG	New funds required		\$110
Hydropower critical thresholds	Phase 1	Update critical high and low flow and levels thresholds for the safety and integrity of the	Hydropower companies	Confirmed thresholds	Impacts Assessment WG	Possible In-kind	\$30	\$30

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		structures and the system						
Ecosystem critical levels and flows on lower river (Lower St. Lawrence River)	Phase 1	Validate with observed data critical ecosystem thresholds and timing	Contract or short-term agency support to validate lower river critical ecosystem thresholds and timing	New ecosystem PI for LSL	Impact Assessment WG	New funds required		\$50
Integrated Models								
Review and document current state of all SVM models and components including the modelling platforms	Phase 1		Agency staff	Spreadsheet of model status	Impact Assessment/Plan Review WGs	New funds required	\$50	
Update impact predictive models where possible	Phase 1, 2 & Ongoing	If any of the above studies provides information that could be easily incorporated into the existing SVM then those updates will be made	Agency staff	Model updates for Board use and reported on in the 2020 Triennial Report	Impact Assessment/Plan Review WGs	New funds required	\$150	\$100
Calculate levels and flows by testing various deviation decision strategies including								
Exceeding traditional limits for safe navigation (the <u>L</u> limit);	Phase 1	Based the impact information gathered and using a series of plausible conditions, assess the implications of Board decisions to exceed the L-limit	Agency staff	Graphs and write-up	Plan Review WG/Reg Rep offices	New funds required	\$100	\$100
Lowering or changing from trigger levels over the next 3 years;	Phase 1	Explore the extent that is possible with deviations if the triggers were to be changed	Agency staff	Graphs and write-up	Plan Review WG/Reg Rep offices	New funds required		
Modifying F limits in	Phase 1	Explore the extent that is	Agency staff	Graphs and write-up	Plan Review	New		

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spring and exceeding I limits during winter		possible with deviations if the triggers were to be changed (or if levels above existing triggers)			WG/Reg Rep offices	funds required		
Document results	Phase 1 and 2	Visualize results for use by the Board and summarize results in the 2020 Triennial Report	Agency staff	Report	Plan Review WG/Reg Rep offices			
Plan Evaluation								
Visualize results/tradeoffs from impact assessment	Phase 1	Visualize results for use by the Board and summarize results in the 2020 Triennial Report	Agency or contract	Graphs, tables, maps and Webinars with Board and input to triennial report	GLAM secretariat/Plan Review WG		\$20	\$20
Decision Support								
Work with the Board to clearly articulate, individually and collectively, their key objectives and concerns in their deviation strategies.	Phase 1 and 2	Interview Board members to document their individual and collective decision criteria	Short-term staff support	Spreadsheet of Board decision criteria	GLAM secretariat	ECCC and USACE		
To the degree possible, present information on economic and environmental tradeoffs between deviation decisions and how they are consistent with plan objectives	Phase 1	Document to the degree possible how outcomes meet plan objectives	Agency	Webinar/presentation with Board	GLAM secretariat	ECCC and USACE		\$25
Cross-Cutting Components (Apply to all phases)								

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Project Management	Phase 1, 2 & Ongoing		Agency	Annual work plan, semi-annual progress report, triennial report	GLAM secretariat		\$50	\$50
Communication and stakeholder engagement	Phase 1, 2 & Ongoing	Communication products (most of this funding would go to Board's communication committee)	Contract and agency	Communication products	Board Communications Committee	New funds required	\$100	\$100
Stakeholder engagement		Stakeholder advisory group	Contract or agency for Coordinator	Stakeholder engagement	Stakeholder advisory group/IJC	New funds required	\$100	\$100
Peer Review	Phase 1, 2 & Ongoing	Peer review of GLAM products and improved connection with research community and linking with related research	Contract or agency for Coordinator	Expert feedback / connection to related work	Peer review team	New funds required	\$100	\$100
Information management	Phase 1, 2 & Ongoing			IM system	IJC	New funds required	\$50	\$50

Table 5: Possible GLAM Committee Task To Support Longer-Term Requirements (Should further resources be made available)

Other Identified Tasks (non-expedited review items) – not currently resourced					
Task	Task Title	Proposed Products	Description	Expected Resources	Estimated Delivery
FY20-2.XX	Follow up to State of Science Assessment of Remote Sensing for Great Lakes Coastal Wetlands - possible collaboration from Mar 2018 workshop	Specific products are TBD but relate to the testing of drone and high resolution satellite imagery to support wetland vegetation delineation.	In March 2018, a workshop was held to discuss a draft paper prepared on the application of remote sensing to support the delineation of wetland vegetation in support of validating the wetland vegetation model and associate meadow marsh performance indicator. There were a few items that come out of the remote sensing workshop that require follow up including the testing of high resolution optical imagery from drones coordinated with ongoing field vegetation sampling as well as testing of the use of high resolution satellite data and newly acquired (summer 2018) USACE hyperspectral data. In all cases, the tasks support performance indicator monitoring and validation .	TBD	TBD
FY20-2.XX	Packaged Lake Ontario-St. Lawrence River water level data	A packaged product of Lake Ontario-St. Lawrence River water level simulations	There is a lot of interest in the simulated historical water levels under Plan 2014 and Plan 1958DD. They should be packaged, with documentation, to allow a range of stakeholders to make use of the numbers for planning and management purposes.	TBD	TBD

Work Plan Prerequisites and External Dependencies

Prerequisites required to ensure the success of this work plan include the on-going annual support of the agencies represented on the GLAM Committee along with additional staff support as identified by those agencies. It also assumes that necessary implementation and contract arrangements can be made for IWI-endorsed projects.

As this is an on-going effort, the priorities set and commitments made are estimates based on what the committee understands to be the resources available. The expertise available through the partner agencies continues to be evaluated relative to the priorities identified. There may in fact be a need to readjust proposed products depending on the expertise required and available to complete the task. These assessments will occur throughout the year as the work plan progresses. The GLAM Committee will keep the Boards aware of progress through semi-annual reporting.

Revision History

Date of next revision:

Revision Date	Previous Revision Date	Summary of Changes	Changes Marked