

Lake Ontario – St. Lawrence River Framework Data Project Application Narrative

Project Background

On 11 December 2000, the International Joint Commission (IJC) formed the International Lake Ontario - St Lawrence River Study Board to evaluate resource impacts due to changes in the regulation of water levels and flows in the hydrologic system bearing the same name. The Study Board formed a number of technical working groups (TWG) and non-technical groups to perform this work. The first, Hydrologic and Hydraulic TWG, predicts the effects of new regulation plans on water levels and flows. Several other TWGs receive output from the first to evaluate impacts to particular resource sectors: the Recreational Boating and Tourism TWG, Hydropower TWG, Commercial Navigation TWG, Coastal Processes TWG, Environment/Wetlands TWG, and the Municipal, Industrial, and Domestic Water Uses TWG. The Plan Formulation and Evaluation Group integrates output into a decision support framework for the Study Board, and the public, to consider.

In order for the public to have confidence in this process and trust the Study results, the Study needs to be made transparent at all levels. The Public Interest Advisory Group ensures that Study information is passed to the public as it become available. This information includes the plethora of geospatial data used as inputs to models, as well as the outputs from those models. Hence, the Study needs to provide for the capacity to discover, evaluate, and access (download) these datasets. Data visualization in a web-based map server will facilitate the evaluation phase of this process.

A final TWG was formed, Common Data Needs, with the charge of ensuring efficient information management and minimization of redundancy. The CDNTWG developed a list of “Common GIS Base Layers” – essentially the Study’s framework data – for which a number of TWGs had indicated as necessary to perform their analyses (see Appendix I for details):

- | | |
|----------------------------|---|
| 1. Shoreline | 5. Tributaries |
| 2. Political Units | 6. Elevation (Topometric and Bathymetric) |
| 3. Transportation Features | 7. Conservation Management Areas |
| 4. Watersheds | |

The CNDTWG also has developed (final report due 31 March) an Information Management (IM) Strategy for the Study. *In examining the Study’s needs and the CAP Category IV Grant RFP, it became apparent that extensive overlap exists between the goals of the CAP grant and the Study’s IM strategy.* As such, the CDNTWG has decided to enter into an agreement with a number of partners in the Great Lakes geospatial data community. This partnership now proposes a project that would expand the Study IM goals to include the development of a framework for geospatial data essential for research, management, and business operations in the Great Lakes watershed. As a starting point in the development of this framework, we will integrate, afford discovery, and begin to provide for the long-term storage, maintenance, and flexible accessibility for the data layers listed above and described in Appendix I below.

Specific Project Objectives:

- Provide certified, seamless geospatial data with the best practicable horizontal and vertical integration.
- Generate FGDC-compliant metadata for each framework dataset, and policies to ensure that quality metadata is written for all other Study datasets.
- Provide for data discovery via the metadata served from a Z39.50 compliant clearinghouse node that is part of the global SDI.
- Design and implement a regionally distributed system of data storage and access for Study Participants and, moreover, the public.
- Develop consensus-based, standardized maintenance procedures for individual datasets, yet allow for as much regional flexibility in storage policy as possible.
- Enhance the public’s perception of an open and accessible Study, and increase confidence that high quality geodata is being used in the Study.
- Provide for use of these framework data after the end of the Study (FY2005).

- Provide a system to build upon with respect to data types (i.e., new themes), and geographies (e.g., other Great Lakes).
- Design a system with the flexibility and interoperability for existing (WMS) and next-generation web-based services (WFS).
- Leverage knowledge bases (KB), technical expertise, financial assistance, and existing technologies and infrastructure whenever helpful in meeting the preceding objectives.
- Add to the growing KB by documenting all procedures, policies, and lessons learned, and making these widely available.

Project Significance

We believe that this project will make a significant contribution to the development of a joint U.S. – Canadian geospatial framework for several reasons. First, other trans-boundary projects have extended this Framework for areas with a terrestrial or riverine focus, and coastal areas appear to present a logical next step in geospatial framework development. Second, data integration efforts in coastal areas have unique problems to address and challenges to overcome, especially those with a bi-national focus. Third, while we will build on the work of others, we will also contribute something new that can be applied to a large part of the shared U.S. – Canada boundary. It is worthwhile to note that a considerable portion of the U.S. – Canada boundary falls within the Great Lakes / St. Lawrence Seaway system. Fourth, this area is home to 40 million people, giving rise to a high population density relative to other border regions, with the potential for geodata use commensurate with this population density.

That the IJC makes substantial investments in the collection of data with a geospatial component should also be considered, especially in light of the fact that the IJC has no mandate to provide for long-term geo-spatial data maintenance and access, nor does it have the resources to do so. This project provides an opportunity to demonstrate a cooperative and sustainable vehicle for this service, and to develop the IJC's role in a Great Lakes geospatial framework user community. In the case of the Study associated with the proposed project, the IJC requires the production of detailed geo-spatial datasets for the specific purpose of conducting analysis on the effects of water level and flow regulations on the lake and river system. It is likely that the International Lake Ontario – St. Lawrence River Study will become a relatively high-profile endeavor with few unaffected potential stakeholders in the region. Hence, the FGDC and GeoConnections geospatial framework development program stands to gain considerable exposure and momentum through this initial Great Lakes project.

Project Approach

To complete these overall goals for the Lake Ontario – St. Lawrence River Study (LOSLR), we have assembled a team of public and private sector partners from the United States and Canada, including:

United States

- The International Joint Commission
- U.S. Army Corps of Engineers, Detroit District
- The Great Lakes Commission
- Pangaea Information Technologies

Canada

- The International Joint Commission
- Environment Canada (Ontario and Quebec)
- Ontario Ministry of Natural Resources
- Baird and Associates
- Christian J. Stewart Consulting

Together, these entities are among the most qualified and experienced parties working to apply geospatial technologies to environmental issues in the Lake Ontario region. Tables 1 and 2 below briefly describe the roles of each of the partners involved along with their constituent individuals.

Table 1: Personnel

Organization	Human Resources	Role	Contribution
U.S. Army Corps of Engineers – Detroit District	Roger L. Gauthier	Project Manager	- Workshops & Presentation Development - Technical Documentation - Research
	James R. Hoff	GIS Analyst	- Strategic Developer - Research
Great Lakes Commission des Grands Lacs	Julie Wagemakers	Project Manager	- Research - Labor
	Derek Moy	GIS Analyst	- Technical Documentation
	Richard Garcia	GIS Analyst	- Strategic Implementation
	Stuart Eddy	GIS Specialist	- Framework Design & Implementation
Pangaea Information Technologies	Jerry J. Johnston	Project Manager	- Strategic Implementation
	Jeffrey Lee Ehman	Project Manager	- Data Integration - Presentation Development - Report Generation
	Steven B. Shumaker	GIS Technician	- Labor
	Shon Doseck	GIS Analyst	- Research - Data Analysis
Environment Canada	Ian Gillespie	Project Manager	- Strategic Development - Conduct Workshops
	Wendy Leger	GIS Specialist	- Research - Strategic Development - Technical Documentation
	André Plante	GIS Analyst	- Data Analysis - Documentation - Strategic Development & Implementation
	Robert Jason Reed	GIS Technician	- Research - Labor
	Aaron F. Thompson	GIS Technician	- Strategic Development
Ontario Ministry of Natural Resources	Michael S. Robertson	Project Manager	- Research - Design & Development
Baird	Peter J. Zuzek	Project Manager	- Research - Documentation
	Steve Langendyk	GIS Analyst	- Documentation - Design
Christian J. Stewart Consulting	Christian J. Stewart	Project Manager	- Documentation - Design - Workshops
	James Duyndam	GIS Technician	- Documentation

Table 2: Deliverables (United States)

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 1 Orientation and Framework Strategy Development	Research LOSLR Framework from Technical Standpoint	PIT - Ehman PIT - Doseck USACE - Hoff	2 4 10		May 15/02
	Research LOSLR Framework from Policy Standpoint	PIT - Ehman PIT - Doseck USACE - Gauthier USACE - Hoff GLC - Wagemakers	2 4 3 5 2		May 15/02
	Identify and Contact Potential (Additional) Participants	PIT - Doseck	2		May 1/02
	Prepare for Orientation Meeting	USACE - Gauthier USACE - Hoff	1 3		May 22/02
	Prepare for Data Integration Workshop	PIT - Ehman PIT - Doseck	1 3		May 22/02
	Conduct Orientation Meeting	USACE - Hoff USACE - Gauthier GLC - Wagemakers PIT - Ehman PIT - Johnston PIT - Doseck	1 0.5 0.5 0.5 0.5 0.5	Orientation Meeting	May 22/02
	Conduct Data Integration Workshop	USACE - Hoff USACE - Gauthier GLC - Wagemakers PIT - Ehman PIT - Johnston PIT - Doseck	3 3 2.5 2.5 2.5 2.5		May 24/02
	Write LOSLR Framework Strategy Plan	PIT - Ehman PIT - Johnston PIT - Doseck	1 2 3	LOSLR Framework Data Strategy Development Workshop LOSLR Framework Data Strategy Report	June 7/02
	Write LOSLR Framework Data Integration Guidelines	PIT - Ehman PIT - Doseck	1 2		June 7/02
	Generate LOSLR Framework Data Dictionary and Data Schema	PIT - Doseck	1		June 7/02
Milestone 2 Implement LOSLR Framework Data Integration Guidelines	Integrate Data	PIT - Ehman PIT - Doseck PIT - GIS Technicians	1.5 20 50	Integrated Data Layers: transportation, elevation, ...	Aug 15/02
	Conduct Data Quality Audit	N/A	N/A		N/A
	Report on Data Quality	PIT - Ehman	0.5	LOSLR Framework Data – Report on Data Quality	Sep 7/02
	Report on Data Integration Procedures	PIT - Ehman PIT - Doseck	1.5 3	LOSLR Framework Data Integration – Technical Manual	Sep 15/02

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 3 LOSLR Framework Metadata and Data Discovery	Establish Framework Metadata Review Team and Process	USACE - Hoff PIT - Doseck	5 1		June 14/02
	Assemble Training Material	PIT - Doseck	2		June 19/02
	Conduct Metadata Workshop	USACE - Hoff PIT - Doseck	1 1	Metadata Workshop for Study's Data Development Community	June 20/02
	Write Metadata	USACE - Hoff PIT - Doseck	5.5 2	FGDC Compliant Metadata for LOSLR Framework Data	Sep 15/02
	Review and Revise Metadata	Review Team	N/A		Sep 30/02
	Evaluate Process, Revise Review Team Procedures	USACE - Hoff PIT - Doseck	2 1		Oct 1/02
	Report on Review Team Policies and Procedures	PIT - Doseck	2		Oct 8/02
	Publish Metadata to GLINDA	GLC - Moy	2	Load Metadata for LOSLR Framework Data on registered clearinghouse	Oct 15/02
Milestone 4 LOSLR Framework Data Storage, Maintenance and Distribution	Develop Strategy	USACE - Hoff GLC - Wagemakers GLC - Moy PIT - Johnston	4 10 3 5	Data custodians/stewards identified Data owners (non-IJC) identified wherever possible	June 30/02
	Develop Data Maintenance Mechanisms, Processes, and Schedules	GLC - Eddy GLC - Moy PIT - Johnston	5 5 1.5		July 15/02
	Implement Strategy	GLC - Eddy GLC - Wagemakers GLC - Moy GLC - Garcia PIT - Johnston	10 2 10 5 2.5	Implementation of OGC-compliant WMS capabilities Assurance of (allowance for) flexibility for future WFS capabilities on each server	Aug 30/02
	Initial Publishing; Formatted Data to Clearinghouse	GLC - Garcia	2	Data stored on regional host sites, with access through or to mirrored locations outside of firewalls	Sep 15/02
	Document System Architecture, Policies and Procedures	PIT - Johnston PIT - Doseck	1 2		Sep 21/02
	Prepare for Interim Meeting and Write Interim Review Report	USACE - Gauthier USACE - Hoff	1 2		Oct 14/02
	Interim Review Meeting	USACE - Hoff USACE - Gauthier GLC - Wagemakers PIT - Ehman PIT - Johnston PIT - Doseck	2 2 1 1 1 1		Oct 15/02

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 5 LOSLR Framework Data Public Outreach	Develop Public Outreach Strategy	USACE - Hoff PIT - Johnston PIAG Member	2 0.5 N/A		Oct 14/02
	Design and Implement Framework Data Project Website	N/A	N/A		N/A
	Design Framework Data Web Mapping Service	PIT - Johnston GLC - Eddy	3 2.5		Nov 15/02
	Implement Framework Data Web Mapping Service	PIT - Johnston GLC - Eddy	3 5	OGC compliant WMS: Map server with LOSLR Framework Data	Dec 6/02
	Develop Public Outreach Documentation	N/A	N/A		N/A
	Develop Framework Data Presentation and Present at Conference	USACE - Gauthier PIT - Ehman	2 0.5		Mar 31/03?
Milestone 6 LOSLR Framework Data Project Conclusion	Prepare for Great Lakes Framework Data Workshop	USACE - Gauthier USACE - Hoff PIT - Ehman PIT - Doseck	1 2 1 3		Feb 19/03
	Conduct Great Lakes Framework Data Workshop	USACE - Hoff USACE - Gauthier GLC - Wagemakers PIT - Ehman PIT - Johnston PIT - Doseck	3 2 2 2 2 2	Workshop on improving geospatial data resource preservation and accessibility	Feb 21/03
	Write Spatial Data Framework Report for IJC	USACE - Gauthier PIT - Ehman PIT - Doseck	2 1 1		Mar 31/03
	Write LOSLR Framework Data Project Report	USACE - Gauthier PIT - Ehman PIT - Doseck	1 1 3	Provide formal recommendations to IJC and associated agencies/organizations for future framework development, and experiences with geospatial information management in general	Mar 31/03

Table 2: Deliverables (Canada)

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 1 Orientation and Framework Strategy Development	Research LOSLR Framework from Technical Standpoint	EC - Gillespie EC - Read EC - Plante OMNR - Robertson	10 15 5 2		May 15/02
	Research LOSLR Framework from Policy Standpoint	EC - Leger EC - Gillespie OMNR - Robertson	12.5 10 2		May 15/02
	Identify and Contact Potential (Additional) Participants	EC - Gillespie	3		May 1/02
	Prepare for Orientation Meeting	EC - Leger EC - Read	3 2		May 22/02
	Prepare for Data Integration Workshop	N/A	N/A		N/A
	Conduct Orientation Meeting	EC - Leger EC - Gillespie EC - Plante OMNR - Robertson Baird - Zuzek Baird - Langendyk CJSC - Stewart	0.5 0.5 0.5 0.5 0.5 0.5 0.5	Orientation Meeting	May 22/02
	Conduct Data Integration Workshop	EC - Leger EC - Gillespie EC - Plante OMNR - Robertson Baird - Zuzek Baird - Langendyk CJSC - Stewart	2.5 2.5 2.5 2.5 2.5 2.5 2.5		May 24/02
	Write LOSLR Framework Strategy Plan	N/A	N/A	LOSLR Framework Data Strategy Development Workshop LOSLR Framework Data Strategy Report	N/A
	Write LOSLR Framework Data Integration Guidelines	Baird - Langendyk	6		June 7/02
	Generate LOSLR Framework Data Dictionary and Data Schema	OMNR - Robertson EC - Gillespie EC - Plante	1 1 7.5		June 7/02
Milestone 2 Implement LOSLR Framework Data Integration Guidelines	Integrate Data	N/A	N/A	Integrated Data Layers: transportation, elevation, ...	N/A
	Conduct Data Quality Audit	Baird - Langendyk Baird - Zuzek	13 5		Aug 30/02
	Report on Data Quality	Baird - Langendyk Baird - Zuzek	5 1	LOSLR Framework Data – Report on Data Quality	Sep 7/02
	Report on Data Integration Procedures	N/A	N/A	LOSLR Framework Data Integration – Technical Manual	N/A

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 3 LOSLR Framework Metadata and Data Discovery	Establish Framework Metadata Review Team and Process	EC - Leger	5		June 14/02
	Assemble Training Material	N/A	N/A		N/A
	Conduct Metadata Workshop	N/A	N/A	Metadata Workshop for Study's Data Development Community	N/A
	Write Metadata	N/A	N/A	FGDC Compliant Metadata for LOSLR Framework Data	N/A
	Review and Revise Metadata	Review Team	N/A		Sep 30/02
	Evaluate Process, Revise Review Team Procedures	EC - Leger	2		Oct 1/02
	Report on Review Team Policies and Procedures	N/A	N/A		N/A
	Publish Metadata to GLINDA	N/A	N/A	Load Metadata for LOSLR Framework Data on registered clearinghouse	N/A
Milestone 4 LOSLR Framework Data Storage, Maintenance and Distribution	Develop Strategy	EC - Leger EC - Plante EC - Gillespie OMNR - Robertson	2.5 15 5 4	Data custodians/stewards identified Data owners (non-IJC) identified wherever possible	June 30/02
	Develop Data Maintenance Mechanisms, Processes, and Schedules	EC - Gillespie EC - Plante OMNR - Robertson	2.5 12.5 4		July 15/02
	Implement Strategy	EC - Plante OMNR - Robertson	20 3	Implementation of OGC-compliant WMS capabilities Assurance of (allowance for) flexibility for future WFS capabilities on each server	Aug 30/02
	Initial Publishing; Formatted Data to Clearinghouse	EC - Plante OMNR - Robertson	3 2	Data stored on regional host sites, with access through or to mirrored locations outside of firewalls	Sep 15/02
	Document System Architecture, Policies and Procedures	N/A	N/A		N/A
	Prepare for Interim Meeting and Write Interim Review Report	EC - Leger EC - Read	2 2		Oct 14/02
	Interim Review Meeting	EC - Leger EC - Gillespie EC - Plante OMNR - Robertson Baird - Zuzek Baird - Langendyk CJSC - Stewart	1 1 1 1 1 1 1		Oct 15/02

Phase	Task	Organization - Member	Level of Effort (Days)	Deliverables	Date Due
Milestone 5 LOSLR Framework Data Public Outreach	Develop Public Outreach Strategy	EC - Thompson CJSC - Stewart Baird - Zuzek	3 10 2.5		Oct 14/02
	Design and Implement Framework Data Project Website	CJSC - Stewart CJSC - Duyndam	5 5		Nov 8/02
	Design Framework Data Web Mapping Service	EC- Plante CJSC - Stewart Baird - Langendyk Baird - Zuzek OMNR - Robertson	7.5 5 10 1 1.5		Nov 15/02
	Implement Framework Data Web Mapping Service	Baird - Langendyk EC- Plante OMNR - Robertson	25 12.5 2.5	OGC compliant WMS: Map server with LOSLR Framework Data	Dec 6/02
	Develop Public Outreach Documentation	CJSC - Stewart CJSC - Duyndam	10 5		Jan 1/03
	Develop Framework Data Presentation and Present at Conference	EC - Leger	3		Mar 31/03?
Milestone 6 LOSLR Framework Data Project Conclusion	Prepare for Great Lakes Framework Data Workshop	EC - Leger EC - Thompson	2 2		Feb 19/03
	Conduct Great Lakes Framework Data Workshop	EC - Leger EC - Gillespie EC - Plante OMNR - Robertson Baird - Zuzek Baird - Langendyk CJSC - Stewart	2 2 2 2 2 2 2	Workshop on improving geospatial data resource preservation and accessibility	Mar 31/03
	Write Spatial Data Framework Report for IJC	EC - Leger	5		Mar 31/03
	Write LOSLR Framework Data Project Report	EC - Leger	10	Provide formal recommendations to IJC and associated agencies/organizations for future framework development, and experiences with geospatial information management in general	

As shown in the tables above, a number of critical milestones have been identified towards reaching the overall project goal of providing consistent, integrated spatial data and metadata across the international boundaries in the study area. Each of these milestones is described briefly below, along with the component tasks and deliverables associated with each. As required, our project budget and disbursements will be linked to completion of the milestones and delivery of products. The major milestones identified for the LOSLR Framework study are as follows:

- Milestone 1:* Orientation and Framework Strategy Development
- Milestone 2:* Implement LOSLR Framework Data Integration Guidelines
- Milestone 3:* LOSLR Framework Metadata and Data Discovery
- Milestone 4:* LOSLR Framework Data Storage, Maintenance, and Distribution
- Milestone 5:* LOSLR Framework Data Public Outreach
- Milestone 6:* LOSLR Framework Data Project Conclusion

Project Phases, Corresponding Milestones, and Deliverables

Milestone 1: Orientation and Framework Strategy Development

A major component of this milestone will be to organize and hold meetings for overall project orientation, and framework strategy development. This will include the development of both strategic and operational approaches for the overall project, as well as approaches for addressing the issue of data integration, and providing an overall framework (including schema and data dictionary) so that data shared by US and Canadian counterparts on the LOSLR can be fully compatible into the future.

We intend to start the process of the LOSLR framework development by first fully researching and evaluating technical procedures established by others working with similar issues. This includes the Yellowstone to Yukon trans-boundary geodata project previously funded by the CAP program. It is important to note that during the development of the framework we intend to utilize existing and available knowledge bases from this, and other similar projects to the greatest extent possible. We also will research and evaluate policy issues and potential solutions to any likely problems with the framework itself at this time.

After research in these areas has been complete, the project orientation and framework strategy development workshops will be held in Burlington, ON. All study participants will take place in this meeting to ensure that all parties have input to the process of formulating our initial framework strategy at the earliest stages of this process. Based on our team's current and past efforts working together in the Lake Ontario region, we have made a tremendous investment in terms of both financial and intellectual resources into the development of an information management strategy. Many of the findings from this strategy, and the recommendations therein, could be applied directly to the framework developed and applied under the proposed work.

Milestone 1 Deliverables:

- Orientation Meeting
- LOSLR Framework Data Strategy Development Workshop
- LOSLR Framework Data Strategy Report

Milestone 2: Implement LOSLR Framework Data Integration Guideline

Milestone two represents the application of the framework guidelines developed under milestone one. This will require the actual physical integration of US and Canadian baseline data layers from the LOSLR work to the extent that is recommended during the Framework development phase. We anticipate that this will involve taking data layers produced by all US and Canadian partners in the region, and converting all data into a common schema using a common data dictionary. After this integration is complete, team members will prepare a report describing the overall data quality of all framework data layers, as well as technical documentation that describes the data after conversion is complete. The main deliverable produced under this milestone will be the integrated framework data itself, which will serve to benefit those interested in geospatial, trans-boundary issues in the Lake Ontario region considerably.

Milestone 2 Deliverables:

- Integrated Data Layers
- LOSLR Framework Data Integration – Technical Manual
- LOSLR Framework Data – Report on Data Quality

Milestone 3: LOSLR Framework Metadata and Data Discovery

The advantages of data integration described in Milestone 2, however, are only marginal if they serve to only benefit the study group itself, comprised mainly of the applicants of this proposal. The greatest benefit of integrating all geospatial LOSLR data under a common framework will be through our enhanced ability to make this data available to the wider user community.

An important first step in this process is creating and publishing a consistent set of metadata describing the key characteristics of all LOSLR framework data. To begin this process, we intend to establish an independent metadata review team who will serve to evaluate metadata standards and recommendations developed from work within our own group. We will strive to ensure that this independent team is comprised of experts in the geospatial field,

particularly any who have expertise and interest in metadata issues as they apply to trans-boundary studies. The review team will make recommendations based on the submitted draft metadata standards developed by the project team. Once final metadata standards are developed by the project team, a workshop will be held for all of those involved with the LOSLR Study's geospatial data development processes to inform them of the new standards, and provide training in their application.

After this workshop, FGDC-compliant metadata in the recommended format will be developed for each of the framework data layers for the LOSLR. After a review and QA/QC process, these metadata files will be loaded on the GLINDA system, a registered node of the global SDI. Mechanisms will be put in place at that time to ensure that as changes are made locally to any of the framework data layers that would require metadata updates, these changes are reflected in the GLINDA, and available to the user community.

Milestone 3 Deliverables:

- Metadata Workshop for Study's Data Development Community
- FGDC Compliant Metadata for LOSLR Framework Data
- Load Metadata for LOSLR Framework Data on registered clearinghouse

Milestone 4: LOSLR Framework Data Storage, Maintenance, and Distribution

It is our understanding that the IJC, at present, does not desire to be in a data ownership or stewardship role in the long-term (i.e., after completion of the Study). Thus, partnerships with agencies and organizations that can provide for long-term data ownership and stewardship should be utilized. Organizations possessing the necessary interest or motivation to ensure the long-term storage, maintenance, and accessibility of data (e.g., state or federal agencies) should be identified as potential data owners. Data stewards should be identified (by the data owner) as entities with the necessary technical and operational capabilities to conduct and document data maintenance activities. In most but not necessarily all cases, the data steward would belong to the organization that is the data owner. In many cases, the data host will not be the data owner (and thus, not the appointed steward).

While the transfer of ownership will occur at the completion of a particular phase of the Study after which the necessary evaluation of the data has been completed, transfer of data stewardship should occur as soon as possible after the creation of the data. Experiences crucial for a thorough understanding of a dataset and its successful maintenance in the long-term occur within the beginning stages of that dataset's life cycle. In the interest of establishing quality stewardship for data, transfer of stewardship responsibilities should occur as soon as possible in the life of a dataset. The transitional phase for data stewardship will require that Study Participants have access to data without compromising their ability to conduct their business activities (i.e., analyses).

For many datasets, the IJC will need to provide for data storage and accessibility through the life of the Study. As long as Study needs are provided for, and it is economical to do so, it makes sense to identify data hosts that could serve in a longer term capacity. A preliminary survey of organizations to function as potential data hosts has lead us to a distributed, regional approach to data storage and access for Study Participants and the public. At present, dividing the datasets by the geo-political regions of the Study (i.e., Ontario, Quebec, and New York State) appears to have the greatest potential in matching data and information content to those agencies/organizations with the mission and operational capabilities to function as long-term data storage locations. While not yet formalized or committed to, Land Information Ontario (OMNR), Environment Canada-Ste. Foy, and a yet to be determined organization on the U.S. side (perhaps GLC-GLIN, or a New York state agency or organization) will constitute the regional data hosts. Details concerning the system designs for implementing data access and maintenance would be left largely to the discretion of the individual host organization. Stewardship and publishing specifications will require considerably more coordination.

Milestone 4 Deliverables:

- Data stored on regional host sites, with access through or to mirrored locations outside of firewalls.
- Data custodians/stewards identified.
- Data owners (non-IJC) identified wherever possible.
- Implementation of OGC-compliant WMS capabilities.
- Assurance of (allowance for) flexibility for future WFS capabilities on each server.

Milestone 5: LOSLR Framework Data Public Outreach

In order to fully leverage the integrated dataset, and inform the wider user community and general public of its existence, we intend to carry out a concentrated public outreach strategy. This strategy will be highlighted by the development of a project web mapping server (WMS) with the LOSLR Framework Data available for viewing in a wide variety of combinations and scales. This website will provide an excellent opportunity for public outreach, and we hope that the site eventually becomes a logical "jumping-off" point where the public can learn more about various processes of the Lake Ontario system, and its current and anticipated future states. The WMS will be developed using an open-source, GML-compliant server application. Links from the IJC and other central stores of information about the Lake Ontario region will be made to publicize the existence of the site to the greatest extent possible.

Aside from this outreach to the general public, we will also attempt to publicize our efforts within the academic and government research communities. This will be accomplished through the presentation of our results at an international conference. This will not only help spread awareness of the LOSLR Framework Data and the efforts carried out under the CAP program, but will also serve to alert the research and academic communities to the availability of a very important set of data on the Lake Ontario region.

Milestone 5 Deliverables:

- OGC compliant WMS: Map server with LOSLR Framework Data.

Milestone 6: LOSLR Framework Data Project Conclusion

In this final phase of the proposed work, we intend to hold a summary workshop, designed to focus on advancing the geospatial user community's ability to apply methods and strategies like those developed for this work in creating the LOSLR Framework Data. We intend to focus on strategies and lessons learned through this process that will help other similar efforts establish permanent, long-term archives of geospatial data. The critical deliverables from this milestone will include a comprehensive project report containing formal recommendations for future framework development, and describing our experiences with this process.

Deliverables:

- Workshop on improving geospatial data resource preservation and accessibility.
- Provide formal recommendations to IJC and associated agencies/organizations for future framework development, and experiences with geospatial information management in general.
- Oral presentation of final report.
- Final Report.

In the next section of this proposal, a Gantt chart is shown that presents our overall project schedule at this time. While the exact dates shown in this chart are, of course, subject to some change upon project award and commencement, we feel that this gives a good general indication of the order we intend to address the project's component tasks in, and the duration of time that will be required to complete each.

Milestone/Activity	2002									2003		
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1. Orientation and Framework Strategy Development												
Research Technical Standpoint	██████████	██████████										
Research Policy Standpoint	██████████	██████████										
Identify and Contact Potential Participants	████											
Prepare for Orientation Meeting		██										
Prepare for Data Integration Workshop		██										
Conduct Orientation Meeting		▪										
Conduct Data Integration Workshop		▪										
Write LOSLR Framework Strategy Plan			██									
Write Framework Data Integration Guidelines			██									
Generate Framework Data Dictionary and Schema			██									
2. Implement LOSLR Framework Data Integration Guidelines												
Integrate Data			██████████	██████████	██████████							
Conduct Data Quality Audit				██████████	██████████	██████████						
Report on Data Quality					██████████	██████████						
Report on Data Integration Procedures						██						
3. LOSLR Framework Metadata and Data Discovery												
Establish Metadata Review Team and Process		██████████	██████████									
Assemble Training Material			██████████	██████████								
Conduct Metadata Workshop			▪									
Write Metadata					██████████	██████████	██████████					
Review and Revise Metadata					██████████	██████████	██████████					
Evaluate Process, Revise Review Team Procedures						██						
Report on Review Team Policies and Procedures							██					
Publish Metadata to GLINDA					██████████	██████████	██████████					

Technical / Operational Context

Data Integration and Common Framework Concepts

Framework data produced by the IJC and its partner agencies will be integrated across space and among themes. Integration of framework data will require substantial cooperation between data producers, particularly across the national border. The geo-spatial framework data concepts and approaches taken by the United States and Canada are in large measure consistent with each other; however any inconsistencies identified throughout the development and implementation processes will need to be considered jointly by all partner agencies involved. Procedures defined by the agencies involved to address discrepancies in the national framework data approaches will need to be documented and presented to the FGDC and GeoConnections. A coordinated approach to data integration is necessary to ensure the needs of the Study participants and the user community are fully taken into consideration during the development and implementation processes. The production of seamless data across the Study area will need to consider the ability of data integration procedures to more accurately determine feature location than data production produces. Realizing the need for “logical seamlessness” at a minimum where a feature crosses a boundary at different locations, “geometric seamlessness” will be attempted where possible given the availability of appropriate reference data. To address data integration throughout the study at the level of production, the Common Data Needs TWG has defined a set of GIS Guidelines defining common projection, datum (horizontal and vertical), measurement unit, and basic metadata standards

Projection

All raster data for the International Lake Ontario – St. Lawrence River Study will be stored in Lambert Conformal Conic projection. Given this, and because vector data is easily transferable between projections, at present it makes sense to also store all vector (line) data in the same projection. This policy will be scrutinized during the first phase of this project, and prior to beginning data integration.

Horizontal Datum

The study will use a horizontal datum of NAD 83 with an ellipsoid of GRS 80 as the horizontal datum. For live GPS, WGS 84 will be used, and transformed out to NAD 83.

Vertical Datum

Two common vertical datums for North America have been identified for this Study. The North American Vertical Datum of 1988 (NAVD 88) and the International Great Lakes Datum of 1985 (IGLD 85). For a new general adjustment of the North American Vertical Datum of 1988 (NAVD 88), a minimum-constraint adjustment of Canadian-Mexican-U.S. leveling observations was performed holding fixed the height of the primary tidal benchmark, referenced to the new International Great Lakes Datum of 1985 (IGLD 85) local mean sea level height value, at Pointe-au-Père /Rimouski, Quebec, Canada. IGLD 85 and NAVD 88 are now one and the same with the only difference between IGLD 85 and NAVD 88 is that IGLD 85 benchmark values are given in dynamic height units, and NAVD 88 values are given in Helmert orthometric height units. The geopotential numbers of benchmarks are the same in both systems.

Measurement Units

Since Canada and the U.S. use different measurement systems (the U.S. uses the imperial system and Canada uses the metric system), it is important to standardize the measurement units to ensure consistency and avoid confusion. For this study it has been decided that all data will be gathered and stored using metric units. Data produced in the study will also use metric units.

Data Maintenance Procedures

The maintenance responsibilities for framework data will be assigned by the data owner to a willing data steward having the necessary interest, motivation, and capacity to perform data maintenance in the long-term. In a coordinated effort between the Study participants and partner agencies involved in the framework project, the data maintenance system will be established and documented, defining the roles, responsibilities and procedures regarding data maintenance. In developing such procedures, the framework project participants will make considerations for future challenges and technical capabilities, allowing for an adequate degree of flexibility to be incorporated in the procedures and systems. The data update processes will need to be developed in as much detail as possible to the level of data feature transactions. It will again be necessary for the developers of these procedures to incorporate an adequate degree of flexibility in the system to account for change and variation in the many possible relationships between data owners, stewards, host and users. Updates to framework data will need to be

appropriately logged into the system and all relevant information should be incorporated into metadata for updated data.

Data Standards and Quality Certification

To ensure the framework data is trustworthy, rigorous application of data standards, quality assurance and metadata is required. A clear benefit of the framework data effort, the Study's association with trustworthy framework data will promote the overall credibility of its results. The use of non-proprietary data transfer formats (SDTS) in conjunction with data formats identified by the known user community as being most useful promotes the use of the framework data produced by the Study and added to the overall transparency of the Study. As a result of the Study's involvement with the framework project, both credibility and transparency in the data used to evaluate the identified performance indicators are promoted, which in turn enhances the overall success of the public's acceptance of Study results.

Utilize Existing Tools and Services

The LOSLR Framework project will make optimal use of existing tools, services and knowledge that exist for framework activities as they are applicable to LOSLR data. Metadata generated by the Study for framework and non-framework datasets will be loaded into the Great Lakes Commission's (GLC) Great Lakes Information Network Data Access (GLINDA) metadata clearinghouse node. Identified as the most sensible location from which to provide searchable access to LOSLR metadata in the context of the entire Great Lakes watershed, GLINDA has already invested the necessary resources in implementing a NSDI metadata clearinghouse node. The LOSLR Cooperative will take full advantage of FGDC and GeoConnections resources and experience when developing and implementing the LOSLR Framework Data strategy. Participation of the LOSLR Framework project in related programs of the FGDC, GeoConnections, or other agencies will be evaluated throughout the development and implementation process. In addition to utilizing the services and knowledge of outside agencies, the Framework Cooperative makes-up a significant resource through the knowledge base of all the represented organizations. The LOSLR Framework project recognizes the need to utilize the services and preserve the knowledge of all agencies and organizations having experience and interest in framework activities.

Long-term Sustainability of the Framework Project

Considerations for the long-term sustainability of the framework project are necessary during the development and implementation phases. Openness to future challenges and technical capabilities will need to be incorporated into the policies, standards and procedures defined by the framework data partners. The inevitable need for periodic adjustments of roles, responsibilities and procedures will have to be accommodated by the organizational structure and policies developed. In promoting the long-term sustainability of the framework data, the formalization of relationships and procedures should be encouraged, along with any possible extensions of the framework project to other areas within the Great Lakes system. Promoting the involvement of the IJC, EC and USACE at institutional levels will begin to address the need for executive guidance in defining direction and maintaining the share vision of the framework concept. While the resources defined for this project are limited to the extent of the Study area (Lake Ontario and the St Lawrence River), pursuing other funding opportunities and involving similar projects and initiatives located in other parts of the Great Lakes system should be encouraged as a way to extend the framework concept.

Business Context

Avoid Restrictive Practices

Development of the procedures and systems defining the LOSLR Framework Cooperative will make all necessary considerations in avoiding restrictive business practices that would inhibit the use of framework data. The LOSLR Framework cooperative is committed to the providing public access to all framework data layers identified in our proposal to the extent that federal costing rules and regulations do not restrict such activities. The LOSLR Framework Cooperative will work closely with the federal, provincial/state, and local data owners to promote the inclusion of data with as large a scale as possible. Concerns of cost recovery mechanisms and data licensing agreements will be addressed in so far as the inclusion of data in the LOSLR distribution system is feasible. While the commitment to provide public access applies to only the framework datasets explicitly stated, it is the intention of the LOSLR Framework Cooperative to develop the system to allow for the inclusion of other data generated by the study or contributed from outside data producers.

Copyrights and Data Restrictions

All caveats and copyright information pertaining to framework datasets will be made visible to the data user upon viewing or download. The mechanism for display and any required acknowledgement will most likely be handled in a manner similar to the standard software licensing dialogue encountered when installing licensed software applications.

Public and Non-proprietary Formats

Data made available through distribution points of the LOSLR Framework project will be in the non-proprietary data transfer standards (SDTS/SAIF) in addition to any proprietary format identified by the known user community as being most easily accessible.

Increasing Framework Data Activities

The investment being made by the LOSLR Framework Cooperative necessitates that attention be given to developing business practices and procedures which promote the increased use of framework data. The Framework system and cooperative must be able to evolve with changing needs and capabilities of data contributors and users. A specific example of accommodating future technical developments is the framework cooperative's consideration of OGC compliant data services which would make possible the development of Web Feature Services in the future. Opportunities for web-based application development will be encouraged by the Framework Cooperative, and the utilization of additional funding potentials to this end will be evaluated.

The public outreach component needed to promote use and involvement in framework activities is of mutual benefit to the LOSLR Framework project and the LOSLR Study. Leveraging the public outreach resources of the IJC and PIAG of the Study in publicizing the LOSLR Framework project will facilitate greater awareness of the Framework's existence and promote its use by the public. Consistent with the objectives of the Study in promoting public involvement and acceptance, publicizing the LOSLR Framework project will increase the overall visibility and transparency of the LOSLR Study process.

The feasibility of a greater institutional commitment by the IJC, EC and USACE to LOSLR Framework project and framework activities across the Great Lakes will be evaluated. The LOSLR Framework Cooperative will evaluate the potential benefits to these agencies in having a fully functional framework system in the Great Lakes. In implementing a data repository for the Great Lakes, data will be able to be preserved in a system and format open to the public, thereby facilitating increased interest and involvement in Great Lakes concerns, increasing the overall value of the Framework system.

Defining the organizational structure and procedures should be addressed in the orientation meeting, but also throughout the process. At the conclusion meeting these concerns should be addressed more explicitly as the groups look to the future in providing for long-term sustainability and growth of the framework.

Appendix I: Common GIS Base Layers

Base Layer	Coverage	Ontario	Quebec	U.S.
1. Shoreline	Lake Ontario and St. Lawrence R. to Trois Riviere.	1:10:000 OBM upstream to single line format 5km buffer	1:10,000 from MSC Modeleur (not always 5km upland)	1:24,000-scale IJC and possible USGS feature
2. Political Units	Municipal/county boundaries	From Ontario NRVIS database 1:10,000	Need to check with province	From USGS 1:24,000
3. Transportation Feature	Roads within 5 km buffer of shoreline.	From Ontario NRVIS database 1:10,000	From NRCAN 1:50,000 NTDB	From USGS 1:24,000
4. Watersheds	All sub-watersheds within the L.Ont and St. Lawrence R. basins.	Derived from Ontario 25m DEM	From EC 1:1M national watershed coverage	Need to check with USGS/State of New York
5. Tributaries	All tributaries within the above watersheds	From Ontario NRVIS database 1:10,000	From NRCAN 1:50,000 NTDB	From USGS 1:24,000
6. Half metre elevation contours	CDN 1 and 7 and U.S. 2, 4 and 7	DEM created from SHOALS mapping and FDRP maps	DEM created from acoustic sounding and topographic LIDAR	DEM created from SHOALS and topographic LIDAR
7. Conservation Management Boundaries	Unknown	Conservation Authority Boundaries from OMNR	Unknown	Land Stewardship Layer (NY GAP, FWS & USGS)

