

Lake Ontario & Drainage Basin

Status as Member in:

Hydrology for Environment, Life, & Policy (HELP) Initiative

United Nations Educational Science and Cultural Organization (UNESCO)

Enclosed Documents include:

1. SUNY ESF Letter (July 12, 2000) and 1st Application nominating the Lake Ontario & Drainage Basin to HELP Basin Status.
2. UNESCO Letter (November 23, 2000) and attachments indicating receipt of Lake Ontario & Drainage Basin application, and request for a new format for second round of applications.
3. SUNY ESF Letter (February 15, 2001) and 2nd Application nominating the Lake Ontario & Drainage Basin to HELP Basin Status, meeting the criteria set out by the UNESCO HELP Interim Management Committee.
4. USEPA Letter from David Ullrich and William J. Muszynski to Dr. Bonell indicating USEPA support for the Lake Ontario nomination.
5. Environment Canada Letter from Harvey Shear indicating EC support for the Lake Ontario nomination.
6. UNESCO Letter (May 21, 2001) and attachments indicating that the Lake Ontario basin was accepted by the HELP Wallingford Group as an 'Operational Basin'. The Operational Basin status indicates the basin has implemented the HELP philosophy and involved most stakeholders but remains short of the need to be classified as a 'World Reference Basin'.

***1. SUNY ESF Letter (July 12, 2000) and 1st Application
nominating the Lake Ontario & Drainage Basin to HELP Basin
Status.***

207 Marshall Hall
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12 July 2000

Dr. Michael Bonell
Attn. HELP Initiative
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Dear Dr. Bonell,

Please find enclosed a response to your request for basin nominations. I am working with the State University of New York, College of Environmental Science & Forestry and the Great Lakes Research Consortium to nominate the Lake Ontario basin. We will continue our efforts to bolster the support base for this nomination, particularly by recruiting additional Canadian and United States agencies, as well as management and scientific collaborators. Any facilitative guidance from your offices toward this goal of building our support base is appreciated.

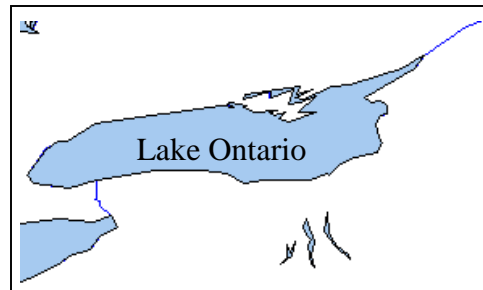
Regards,

Theodore A. Endreny

Enclosure

Basin Nomination for HELP (Hydrology for Environment, Life and Policy) Initiative Registry

Lake Ontario & Drainage Basin United States of America and Canada



Lake Ontario Basin Physical Features

- Total basin area 82,990 km²
 - 18,960 km² of water surface area in Lake Ontario
 - 64,030 km² of surrounding drainage area into Lake Ontario
- Located between 42N and 45N latitude, and 74W and 80W longitude.
- International resource jointly shared by the United States and Canada.

Lake Ontario Physical Features

- Elevation 74 m above sea level
- Length 311 km
- Breadth 85 km
- Average depth 86 m
- Maximum depth 244 m
- Lake Volume 1,640 km³

Major Lakes and Bays in Basin:

1. Lake Ontario, US and Canada
2. Rice Lake, Ontario, Canada
3. Bay of Quinte, Ontario, Canada
4. Finger Lakes, New York State, US
5. Oneida Lake, New York State, US
6. Onondaga Lake, New York State, US

Major Rivers and Waterways in Basin:

1. Niagara River, joint US and Canada; drains Lake Erie into Lake Ontario
2. Welland Canal, joint US and Canada; drains Lake Erie into Lake Ontario
3. Trent River, Ontario, Canada

4. Moira River, Ontario, Canada
5. Black River, New York, US
6. Oswego River, New York, US
7. Genesee River, New York, US
8. New York Barge Canal (Erie Canal System), New York, US
9. St Lawrence Seaway, joint US and Canada; drains from Lake Ontario

Hydrologic Budget:

- Precipitation into Lake ($500 \text{ m}^3 \text{ s}^{-1}$)
- Runoff into Lake Ontario ($6900 \text{ m}^3 \text{ s}^{-1}$)
- Flow out of Lake Ontario ($7000 \text{ m}^3 \text{ s}^{-1}$)
- Evaporation from Lake ($400 \text{ m}^3 \text{ s}^{-1}$)

- Average annual precipitation (800 mm)
 - Average annual snowfall (1500 – 3500 mm)
- Average annual runoff (200 mm)
- Average annual evapotranspiration (600 mm)

- Retention Time 6 years

Surficial Hydrogeology

1. Sedimentary (Flat Lying) aquifer $0.5 - 2 \text{ L s}^{-1}$
2. Glacial Till $< 0.5 \text{ L s}^{-1}$

Bedrock Hydrogeology

1. Shale (fractured)) $2 - 8 \text{ L s}^{-1}$
2. Carbonates (limestone/dolomite) $0.5 - 2 \text{ L s}^{-1}$
3. Metamorphic (Canadian shield) $< 0.5 \text{ L s}^{-1}$

Topography

- Terrestrial is mostly flat, ranging from 70 m to 500 m above sea level
- Littoral area gently sloping, with floor extending to 200 m below sea level

Seasons & Climatology

- Four distinct seasons with precipitation distributed evenly through the year.
- Climate is affected by:
 - Air masses from other regions (warm, humid air from the Gulf of Mexico, and cold, dry air from the Arctic).
 - Location of the basin within a large continental landmass (situated within a temperate zone).
 - Moderating influence of the large lakes.

Population

- 2,704,284 US Citizens (1990 Census)
- 5,446,611 Canadian Citizens (1991 Census)

Global Freshwater Policy Issues

1. Water quality and human health
 - e.g. municipal and industrial wastes discharges; non-point source pollution from agriculture management.
2. Water and environment health
 - e.g. loss of wetlands; degraded aquatic habitat in port areas; exotic and nuisance species management.
3. Water and potential conflicts
 - e.g. water management agreements between US & Canada for fishing, tourism, and industrial or agricultural diversions.
4. Impact of climate variability on water resources
 - e.g. predicted decline in lake volume due to global warming and associated increased evaporation.
5. Improved communication between hydrologists and society
 - e.g. fishing advisories, non-point source management; water conservation during droughts.
6. Water related disaster prevention and mitigation
 - e.g. flood plain management along channels and lake; wetland conservation for flood protection; water conservation during drought.
7. Water and socio-economic development
 - e.g. conservation sensitive shoreline development; clean up of industrial wastes.

Meets Criteria for Selection of HELP Catchments

1. Threats to sustainability
 - e.g. concentrated development along shoreline areas; wetland loss; logging; introduction of exotic species; air quality pollution issues.
2. Impact of global scale problems
 - e.g. predicted lower lake water levels under global warming conditions.
3. Trans boundary aspects
 - e.g. coordinated management of resource between US and Canada.
4. Ecological damage
 - e.g. mitigating industrial and municipal pollution damages of harbor and lakeshore earlier development; wetland restoration.
5. Social and political impacts
 - e.g. issues of urban renewal in post-industrial areas.
6. Economic growth/decline
 - e.g. mitigating impact of sub-urban sprawl on shoreline, wetlands, flooding; incentives for business growth in post-industrial areas with aging infrastructure; improving tourism base.
7. Population pressure
 - e.g. managing the ecological impact and water resource needs of nearly 8 million residents within the basin.
8. Risks to human health
 - e.g. mercury poisoned waters and fish and issuing appropriate fishing advisories; managing for aging and absent sewage treatment plants.

Fulfills Attributes of HELP Catchments

- ✓ Provide an opportunity to study a water policy or management issue for which hydrological process studies are needed.
 - See above for listing of illustrative water policy and management issues.
- ✓ Provide a cooperative relationship between relevant national and local agencies and the execution of the HELP program to ensure sustainability of technology transfer.
 - Coordination between New York State Great Lakes Research Consortium, the International Joint Commission (US and Canadian commission with nearly 100 years of cooperative management agreements), and as of yet undetermined Canadian research consortium.
 - US Environmental Protection Agency (US EPA) has lead responsibility for US obligations in current lake management and coordinates with many local municipalities and state agencies.
 - Other relevant US agencies include the US Coast Guard, the US Fish and Wildlife Service, the US National Biological Service, the National Oceanic and Atmospheric Administration, and the US Department of Agriculture.
 - Canada's Environment Canada has lead responsibility for Canadian obligations in current lake management and coordinates with many local municipalities and provincial agencies.
 - Other relevant Canadian agencies include the Ontario Ministry of Environment and Energy (MOEE), Department of Health, Agriculture and Agrifood Canada, Transport Canada, and the Department of Government Services.
- ✓ Provide adequate local capacity to participate in the program.
 - Thousands of research scientists and water resource managers are within the basin and capable of such service.
- ✓ Provide monitoring of a minimum range of key variables and parameters
 - Currently monitoring basic hydrologic water budget and water quality variables, such as chemistry and aquatic indices, and associated parameters.
- ✓ Provide data, information, and technological expertise that is shared openly and adheres to international data standards as well as quality assurance and quality control standards.
 - See no reason why the basin could not fulfill this requirement. This data obligation would become formally incorporated into any HELP projects within the basin.
- ✓ Provide appropriate infrastructure (technical, institutional, and societal) within the catchment for support of the HELP initiative.
 - The wealth of technical, institutional, and societal resources within the basin, contributed by both the US and Canadian government, industry, and people, will fulfill this requirement.

Other Important Information

Early Exploitation of the Great Lakes and the Lake Ontario basin:

In the 1600's Europeans settled in the Lake Ontario basin. The system evolved during 10,000 years since the retreat of the last glacier maximum. Early settlement impacts on the ecosystem included fur trading, fishing, agricultural activities, and clear cutting of mature forests. The exploitive impact of these activities was severe and the basin the management decisions are available for the basin to serve as a demonstration basin for other areas in these stages of resource development.

Industrialization & Commerce:

- At the turn of the century, industrial processes introduced new chemical substances into the basin, including PCBs (polychlorinated biphenyls) in the 1920s and DDT (dichloro-diphenyl-trichloroethane) in the 1940s. Non-organic fertilizers were used to enhance agricultural production. Untreated wastes from cities, including phosphate detergents, accelerated eutrophication.
- Industrial structure within the basin includes:
 - Public administration and defense
 - Primary industry (agriculture, forestry, mining)
 - Construction
 - Manufacturing
 - Transportation and communications
 - Trade (retail and wholesale)
 - Finance, insurance, and real estate
 - Personal services (recreation, repairs, hotels)
 - Community services (health, education, religion)
- Waterborne commerce includes:
 - Coal, iron ore, cement, chemicals, limestone, metals, petroleum, fishing, grains.

Water Diversions and Consumptive Use in the Basin

- Water Withdrawals
 - Municipal: $927 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$
 - Manufacturing: $2,935 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$
 - Power production: $13,282 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$
- Water Consumed
 - Municipal: $152 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$
 - Manufacturing: $125 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$
 - Power production: $174 \text{ E}+06 \text{ m}^3 \text{ yr}^{-1}$

Lake Management

- In 1905 the International Waterways Commission was created to advise both Canada and the US about water levels and flows in the Great Lakes, particularly in relation to hydropower development.
- In 1909 the Boundary Waters Treaty was signed, creating the International Joint Commission. The IJC's authority includes resolving trans boundary water resource disputes, and the commission has access to numerous scientists and governmental agencies for technical guidance.

- IJC water quality studies, spanning from 1912 to the 1960's, identified phosphorous as the principal cause of eutrophication water quality problems in the basin.
- Active public involvement in abating the contamination of the basin's water resources in the late 1960s lead to the Great Lakes Water Quality Agreement between Canada and the US in 1972. This agreement has been updated in 1978 and 1987, focusing now on an ecosystem type approach to management.

National Institutional Arrangements for Basin Management

Environment Canada and the US Environmental Protection Agency are the lead agencies responsible for management of the basin.

Categories of Water Resource Use Impairments

- Ecological Health and Reproduction
 - Degradation of fish and wildlife populations
 - Degradation of benthic populations
 - Degradation of phytoplankton and zooplankton
 - Undesireable algae/eutrophication and low dissolved oxygen
 - Fish tumors and other deformities
 - Bird or animal deformities or reproduction problems
- Human Health
 - Restrictions on fish and wildlife consumption
 - Beach closings (bacteria)
- Human Use (Welfare)
 - Taste and odor in drinking water
 - Tainting of fish and wildlife flavor
 - Restrictions on dredging
 - Degradation of aesthetics
 - Added costs for agriculture and industry

Geographic Areas of Concern

- Buffalo River, NY, US
- Eighteen Mile Creek
- Rochester, NY US embayment
- Oswego River, NY US
- Bay of Quinte, Ontario, Canada
- Port Hope, Ontario, Canada
- Metro Toronto, Ontario, Canada
- Hamilton Harbor, Ontario, Canada

Summary

The wealth of institutional support as well as the commitment of incorporating science into water resource management makes for a compelling argument to include the Lake Ontario basin in the HELP Initiative registry. The basin has many resource needs that will require advances in science and well-planned management, and sharing these lessons with other international basins would be a great opportunity for the basin. Further, utilizing the networks within the HELP initiative to collaborate with other international basins and coordinate science, policy and management will maximize the benefits of any needs driven research within this basin.

Contact Information

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2. UNESCO Letter (November 23, 2000) and attachments indicating receipt of Lake Ontario & Drainage Basin application, and request for a new format for second round of applications.



United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture

Ref: SC/hyd/ 884 (574/510.2)

INTERNATIONAL HYDROLOGICAL PROGRAMME
PROGRAMME HYDROLOGIQUE INTERNATIONAL



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23 November 2000

Subject: Outcome of HELP Interim Management Committee (IMC) Meeting, Dublin, 6-8/11/2000

Dear Sir,

On behalf of the HELP IMC, I would like to thank you for responding to our request for more details, in a standardized format, for the HELP project. These details provided an important platform, as part of the IMC's development of a HELP implementation plan for 2001/2002 and beyond. The key decision from the IMC meeting was to move forward with the self-selection of a small number (~10) of the submitted basins to act as Pilot Basins for testing the implementation of HELP. The results from these early experiences of HELP implementation will be presented as case studies at the HELP Symposium, Stockholm, August 2002. The same reports will also be of great benefit to other HELP basins which are either being planned or are in the early stages of being established. Some of the submitted basins also coincide with those of interest to the World Water Assessment Programme (WWAP) of the UN Administrative Coordination Committee (ACC) Subcommittee on Water Resources (SWR). A representative of the WWAP invited HELP to contribute towards the provision of inventory inputs by April 2001. So the latter deadline adds some urgency to commencing the HELP Pilot basin phase.

As part of the self-selection of Pilot basins, the IMC reviewed the Selection and Attribute criteria as set down by the HELP Task Force. It was decided that some further strengthening of the Attribute criteria was required in the form of guidelines to ensure implementation of key HELP principles. It was also decided that these additional guidelines be relayed to you with a request for your submitting the required information by 15 February 2001 and these guidelines are in **Attachment A**. The deadline of 15 February is to allow time to secure the necessary involvement and commitments from stakeholders and agencies under the Statements of Commitment and Statements of Proposed Activities. Following receipt of the additional information, these will be quickly reviewed by the IMC to assess the likelihood of achieving early successes within the framework of HELP goals and the tight implementation period up to August 2002. For those basin studies that are not able to achieve these strict requirements, they will continue to be involved in the pilot basin exercise by receiving updates of progress from elsewhere to act as a guide in the continued establishment of HELP.

Attachment B provides a schedule for the implementation of HELP. The annual University of Dundee, UK Conference on Water and Law (August 2001) will also provide a forum for a HELP IMC meeting to review progress reports from the Pilot basins. Following this there will be a meeting in February 2002 when interim project reports received from the HELP Pilot basins will be assessed in preparation for the Stockholm HELP Symposium. The February 2002 meeting will provide an opportunity to provide feedback from the IMC on progress with the preparation of pilot basins for presentation at the Stockholm HELP Symposium. If financial resources permit, we are considering supporting a representative from each of the selected Pilot basins to orally summarize their interim project report.

Letter addressed to :

18 Nominators of Drainage Basins for HELP Project as listed over



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The Pilot basin phase is very critical in implementing HELP, and will provide a key learning platform for the wider global establishment of HELP basins. So your potential participation in this exercise is very important. In that regard, the IMC were aware that HELP type projects were already being established drawing upon existing, national, regional or international financial resources; and it was these projects in particular that could potentially contribute towards the Pilot phase. For the moment, there are no additional financial resources available; but by being involved in the Pilot scheme, such basins would receive global endorsement within the HELP project. This endorsement could assist the further search for additional support at a national or regional level. In addition, the Pilot phase will facilitate global networking of information and technology-transfer between the HELP basins.

I look forward to receiving your additional inputs and participation in this Pilot basin scheme.

Yours sincerely,

M. Bonell
Chief of Section: Hydrological Processes and Climate
Division of Water Sciences



"Attribute/Criteria" for Drainage Basins for the HELP Project
Guidelines

The following guidelines are suggested:

Problem Statement (1-2 pages)

What are the issues, in terms of policy, management, hydrology, environment, socio-economic variables?

Expected project outcomes and deliverables

Who buys in? Who benefits? How is the HELP process anticipated to yield improved decisions as compared with more traditional decision making? What is the value added from this project?

What innovative techniques/methods are anticipated to be used that would improve conditions through changes in water management?

Statements of Commitment (1-2 pages)

By the relevant government agencies, by way of endorsement

By the institutions conducting the research, committed to interdisciplinary collaboration.

Agency commitment to define in-kind services, e.g. data, technical expertise, instrumentation, and/or implementation

By the funding agency(s) supporting the project and or proposed arrangements for funding

By the team, including the member expertise, experience, infrastructure, operating principles or mission statement of affiliated institutions, and interdisciplinary composition

Statement of Proposed Activities (1-3 pages)

Outline of the project design

Schedule of proposed activities which are expected to include

- timelines – define milestones
- baselines conditions (where are you starting from, i.e. benchmarks, including past studies and history of water management/policy?)
- identification of stakeholders
- involvement of stakeholders
- anticipated stakeholder meetings (with objectives)
- planned workshops (with objectives)
- dissemination of information/technology transfer plans

Anticipated Impacts

Possible indicators/measures of success



SCHEDULE

Date	Activity	Product
November 2000	UNESCO to send letter to Proposal contacts seeking additional information according to revised guidelines	
15 February 2001	Receipt of additional information	Additional information
March 2001	Review of additional information by Interim Management Committee	Comments on individual proposals w/r likelihood of success and HELP goals
August 2001	Dundee Conference possible meeting of HELP policy representatives and HELP IMC Meeting	Networking and preparation for Stockholm
February 2002	Interim project report including assessments, methodology, confirmation of commitments from all stakeholders Preparatory meeting for Stockholm Conference, participants from HELP basins	Baseline assessments of HELP pilot basins
August 2002	Stockholm HELP Meeting	Update of lessons learned from establishment of HELP pilot basins.



United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture

List of Contact Persons for Nominated HELP Basin

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3. SUNY ESF Letter (February 15, 2001) and 2nd Application nominating the Lake Ontario & Drainage Basin to HELP Basin Status, meeting the criteria set out by the UNESCO HELP Interim Management Committee.

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15 February 2001

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Dear Dr. Bonell,

We were gratified to learn of the UNESCO HELP Initiative encouragement to our first HELP nomination for the Lake Ontario & Drainage Basin. We have responded to the comments made in your November 23, 2000 letter, stating the new application format determined by the HELP Interim Management Committee (IMC) Meeting in Dublin (6-8/11/2000).

Please find enclosed our updated nomination.

Regards,

Theodore A. Endreny

Enclosure

Nomination of Lake Ontario Drainage Basin for HELP Initiative Pilot Listing

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Summary of Lake Ontario HELP Pilot Listing

The Lake Ontario basin is home to numerous scientific investigations probing components of the basin's hydrological, ecological, and socio-economic systems. The Lake Ontario basin also contains multiple regional, federal, and international management agencies directing, coordinating, and integrating these research efforts to improve the basin's overall health and function. Considering this wealth of scientific and management experience in Lake Ontario in light of the United Nation's goal to facilitate dialogue and learning between a diverse collection of Hydrology for Life, Environment, and Policy (HELP) demonstration and application research basins, this proposal recommends the Lake Ontario basin serve as a HELP demonstration basin. The mission of the Lake Ontario Nominating Task Force is twofold. First, there are feasibility and coordination efforts, funded by the Great Lakes Research Consortium¹, to identify completed and ongoing research projects for which the Lake Ontario basin could demonstrate success and failure of management plans that integrate hydrologic, ecologic, and socio-economic objectives. Second, an interdisciplinary team of Lake Ontario researchers is requesting UN endorsement as a HELP Pilot basin before coordinating a response to new research initiatives and requests for proposals that would advance HELP research objectives.

Introduction to the Lake Ontario Basin

The Great Lakes Research Consortium HELP Task Force is nominating the Lake Ontario drainage basin for inclusion in the United Nations Hydrology for Environment, Life, and Policy (HELP) Pilot Program. The Lake Ontario drainage basin is home to 2,704,284 United States (US) citizens and 5,446,611 Canadian citizens. It receives the runoff from all four upstream Great Lakes as well as surrounding land areas and empties into the Atlantic Ocean through the St. Lawrence Seaway. The drainage basin is situated between 42N and 45N latitude, and -074W and -080W longitude, has a total basin area of 82,990 km², of which 18,960 km² is the lake surface, which has a volume of 1,640 km³.

Native American inhabitants of the Lake Ontario basin arrived 10,000 years ago, after the retreat of the last glacier maximum. In the 1600's when Europeans settled in the Lake Ontario basin, the Native American population was widely distributed and totaled between 60,000 and 117,000 people. These peoples were primarily agriculturalists and

¹ See <http://www.esf.edu/glrc/>

hunters, growing corn, squash, and bean crops that had little impact on the ecosystem. Early European settlements were divided between cities and farms, and impacts on the ecosystem included intensified fur trading, fishing, agricultural activities, clear cutting, road construction, canal building, and hydro-power generation. In the early 20th Century, industrial processes introduced new ecologic changes in the form of chemical substances, including PCBs (polychlorinated biphenyls) in the 1920s and DDT (dichloro-diphenyl-trichloroethane) in the 1940s. During this same period runoff from agricultural fertilizers coupled with untreated city wastewater led to episodes of accelerated lake eutrophication.

Lake Ontario has an average water surface elevation 74 m above sea level, a length of 311 km and breadth of 85 km, and has an average depth of 86 m and maximum depth of 244 m. The lake's terrestrial contributing area is mostly flat, ranging from 74 m to 500 m above sea level, and the littoral shore area gently slopes down to the lake bottom at 200 m below sea level. Rivers draining into Lake Ontario include the Niagara River and the Welland Canal, which connects with Lake Erie, the Trent River, the Moira River, the Black River, the Oswego River, the Genesee River, and the Oneida River. York, US, New York Barge Canal (Erie Canal System), New York, US, St Lawrence Seaway, joint US and Canada; drains from Lake Ontario. The hydrologic budget for Lake Ontario includes 800 mm of precipitation (comprised of between 20 to 40% snowfall), 200 mm of runoff, and 600 mm of evaporation. Lake Ontario has an average outflow of $7000 \text{ m}^3 \text{ s}^{-1}$, and a retention time of approximately 7.4 years.

Land use is generally distributed between 45% low intensity farming pasture, 35% intensive general farming, 5% urban areas, and 20% mixed-wood and deciduous forest. The industrial structure within the urban areas includes public administration and defense, primary industry, construction, manufacturing, transportation and communications, trade, finance, insurance, and real estate, personal services, and community services. Waterborne commerce across the lake includes shipments of coal, iron ore, cement, chemicals, limestone, metals, petroleum, meats, and grains.

Cooperative international management of Lake Ontario reaches back to the beginning of the 20th Century. In 1905 the International Waterways Commission was created to advise both Canada and the US about water levels and flows in the Great Lakes, particularly in relation to hydropower development. In 1909 the Boundary Waters Treaty was signed, creating the International Joint Commission management authority. The IJC's authority includes resolving trans-boundary water resource disputes through scientific and policy analysis performed by numerous affiliated scientists and governmental agencies for. Water quality management has been a focus of IJC activity, and in studies spanning from 1912 to the 1960's, phosphorous was identified as the principal cause of Lake Ontario eutrophication problems. Active public involvement in abating the contamination of the basin's water resources in the late 1960s lead to the 1972 Great Lakes Water Quality Agreement between Canada and the US, which has been updated in 1978 and 1987 to focus on an ecosystem based approach to management.

Responding to IJC advice as well as setting separate, but complementary management objectives are numerous federal, state, and regional management agencies in the US and

Canada. Principal management agencies include the US Environmental Protection Agency and Environment Canada, while the New York State Department of Environmental Conservation and the Ontario Ministry of Natural Resources are also regularly involved. The Great Lakes Research Consortium (GLRC), which has supported the development of this application for Pilot HELP status, serves as a clearinghouse and coordinator of research studies carried out in the Lake Ontario basin. It is anticipated that the GLRC will play a key role in the coordination of Lake Ontario research with the other HELP Pilot basins, both alerting HELP Pilot basins of key findings from Lake Ontario research as well as soliciting research needs from these participating HELP basins.

Problem Statement

The physical, socio-economic, and historical complexity of the Lake Ontario basin, as described above, coupled with the numerous hydrological, environmental, social, and management research projects conducted in this basin, suggest that the Lake Ontario basin would provide unique and important contributions to the UN's HELP Pilot study. It is the hope of the Lake Ontario HELP Pilot basin nomination committee that lessons learned in this watershed can be shared with other scientists by way of the United Nations HELP forum. The challenges currently limiting Lake Ontario participation in the HELP Pilot project involve 1) selection of the most pertinent research to share with other HELP Pilot basins, 2) design, development, and implementation of a searchable Internet based clearinghouse of the pertinent research data, findings, and lessons learned, and 3) listing as a HELP Pilot basin so that an integrated team of Lake Ontario researchers have UN endorsement to respond to research opportunities that build on existing, proposed, or new research to refine advanced technologies and management approaches for achieving the fundamental HELP goals of needs based hydrology.

Lake Ontario hydrological, environmental, social, and management research efforts are extensive and rigorous, however there is only one currently funded project that is under the title of a HELP project. This project is feasibility research, funded by the Great Lakes Research Consortium², to generate a list of potential Lake Ontario research projects and identify appropriate solicitations for new research that could match HELP objectives with funding opportunities, as well as identify existing research results that could be demonstrated to other HELP Pilot basins. This work is ongoing, and the results are expected in the summer of 2001. Additional research depends in part on the UN HELP committee decision to include Lake Ontario in the HELP Pilot program. Lake Ontario researchers involved with the HELP nomination anticipate that HELP Pilot status will provide new research opportunities and partnerships to design and conduct additional research that targets specific research needs identified by the larger UN HELP initiative.

² See <http://www.esf.edu/glrc/>

Specific policy, management, hydrologic, ecologic, and socio-economic problems facing the Lake Ontario basin include:

1. Threats to sustainability, as demonstrated by, among other things, historical and new industrial and urban development along shoreline areas and losses in biodiversity due to habitat destruction, introduction of toxic chemicals, and exotic species.
2. Impact of global scale problems, as demonstrated by, among other things, newly predicted lowering of lake water levels under global warming conditions, the potential failure of water resource excess and delivery control structures, and impairment of hydropower and navigation facilities.
3. Trans boundary aspects, as demonstrated by, among other things, new quantity, quality, and access issues facing the internationally coordinated management teams that involve multiple local, state, regional, and federal US and Canada agencies and institutions.
4. Ecological damage, as demonstrated by, among other things, historical and new industrial and municipal pollution damages of terrestrial and aquatic resources from such sources as chemical companies (e.g. Love Canal toxic waste and associated industries in the basin's Niagara River headwaters), nuclear power plants, and wastewater treatment plants.
5. Social and political impacts, as demonstrated by, among other things, the need to examine and offset the siting and construction of unwanted hydrologic and industrial infrastructure, such as wastewater treatment plants, nuclear power plants, and flood mitigation basins, in under-represented socio-economic areas. Also important is the representation of the rural constituency in this mixed land use basin, including the challenge of controlling urban sprawl to preserve the hydrologic, ecologic, and socio-economic benefits of undeveloped areas.
6. Economic growth/decline, which closely couples with the above social/political aspects, as demonstrated by, the need to rejuvenate and rehabilitate obsolete industrial facilities, redesign aging and failing urban infrastructure, and specifically replace numerous combined sewer overflows dumping sewage into aquatic systems. Also of importance is the introduction of new economic service and high-tech industries to replace post-industrial manufacturing facilities as well as ensure that longterm hydrologic management will benefit natural resource and tourism based industries such as fishing.
7. Population pressure, as demonstrated by, among other things, responding to trends in rapid population growth and development in rural areas, which creates new drinking water, wastewater, stormwater management challenges, and encouraging smart growth in urban centers where hydrologic infrastructure already exists. Given the basins nearly 8 million residents, these challenges are pressing.
8. Risks to human health, as demonstrated by, among other things, restoring mercury and other metal poisoned waters and issuing appropriate health risk advisories for fish consumption as well as publicly reporting how management toward ecologic goals may benefit human health. Other risks include those that are perceived, such as reducing taste and odor problems in drinking water, as well as those that may be unnoticed, such as dangerous bacteria levels at local beaches.

Expected project outcomes

Lake Ontario basin research archives and management agencies currently contain numerous results from earlier research that demonstrate important outcomes regarding the integration of hydrologic, ecologic, and socio-economic objectives. As indicated above, however, there are new issues and problems facing the basin and opportunities to demonstrate innovative technologies and management partnerships can address these issues in a holistic framework. Examples of outcomes that may arise from future HELP oriented research are outlined below. In addition to these potential outcomes, the ongoing research to identify potential HELP research projects, identify appropriate funding opportunities for new research, as well as identify existing research results that could be demonstrated to other HELP Pilot basins will generate interesting initial outcomes by the summer of 2001.

The following list of ongoing Lake Ontario research provides some indication of potential outcomes that could be shared with other HELP Pilot basins.

1. Water quality and human health - e.g. Research on the water quality impact of municipal and industrial wastes discharges and innovative technologies for mitigating these impacts; Research on the estimation of the load and abatement of the impacts of non-point source nutrient loading from the headwater agricultural activities; Research on health risk and fate and transport of toxic chemicals, metals, and nutrients through bed sediment, river channels, lake mixing, and food webs.
2. Water and environment health - e.g. Research on the fisheries impact of alteration of wetland hydrology and the loss of wetlands; Research on novel and advanced technologies to restore degraded aquatic habitats in port and industrial areas; Research on the introduction, monitoring, and control of exotic and nuisance plant and animal species.
3. Water and potential conflicts - e.g. Research on regulation of hydropower flows to accommodate multi-objective basin needs, including flood management, navigation, recreation, and ecosystem sustainability; Research on the design and implementation of complex water management agreements between US & Canada for water rights, navigation, fishing, tourism, and industrial or agricultural diversions.
4. Impact of climate variability on water resources - e.g. Research on the predicted decline in lake volume due to global warming and how water withdrawals and water delivery infrastructure will respond; Research on how increased evaporation and precipitation rates will stress existing reservoir and detention basin management, as well as agricultural irrigation needs.
5. Improved communication between hydrologists and society - e.g. Research on the effectiveness of various means of posting fishing advisories, and management plans for basin-wide non-point source reduction to meet total maximum daily load requirements for basins; Research on effective and innovative means to plan, announce, and conserve water during periods of drought.

6. Water related disaster prevention and mitigation - e.g. Research on smart flood plain development that integrates flood risk objectives with ecosystem restoration objectives.
7. Water and socio-economic development - e.g. Research on the design of integrated basin management plans that balance conservation needs of shoreline and riparian ecosystems with development pressures, as well as advance industrial site restoration.

Demonstration projects are available in many of the above categories to share with other HELP Pilot basins. Additionally, new research projects are continually developed and executed, addressing the above needs and integrating the latest technologies. Some of these advanced technologies include partnerships with the National Aeronautic and Space Administration (NASA) research and development teams to demonstrate benefits of remote sensing tools in monitoring ecosystem health, assessing demographic trends, and parameterizing hydrologic models.

Benefits of HELP Project

There are numerous project participants and beneficiaries involved in any future HELP Pilot basin study, including the nearly 8 million basin residents, the hundreds of thousands of interested students attending schools and universities in the basin, the thousands of university and agency researchers working on basin issues, and the hundreds of management agencies and municipalities attempting to balance, what often appears as competing, hydrologic, ecologic, and socio-economic objectives. Additionally, research findings from a Lake Ontario research, which has been conducted across complex physical regions and historical episodes, are likely to benefit scientific and management researchers in other parts of the world. The value added from the project, as such, will be great. There are opportunities for benefits to: management by demonstrating novel partnerships between hydrologic, ecologic, and socio-economic sectors; industry by demonstrating needs for new technologies and novel applications of existing tools; and citizens by creating a more holistic and working basin management plan.

Statements of Endorsement

Endorsement of this proposal to list Lake Ontario as a Pilot HELP Basin have been formally requested from numerous regional, state, federal, and international agencies. One statement of commitment, in-kind services, and funding has been provided by the Great Lakes Research Consortium (GLRC), an organization of sixteen colleges and universities in New York, USA and nine affiliate campuses in Ontario, Canada, to demonstrate their interest in the HELP designation for Lake Ontario. The GLRC has provided a small \$2500 grant in addition to numerous staff hours to support coordination among Lake Ontario researchers and formulation of this HELP Pilot nomination. The Ontario Ministry of Natural Resources and the New York Department of Environmental Conservation have promised other statements of endorsement.

Additionally, as of February 15, 2001, the following agencies and ministries have been contacted and asked to consider an endorsement of the Lake Ontario HELP Pilot listing:

- U.S. Environmental Protection Agency; this agency lead responsibility for US obligations for US lake management and coordinates with local municipalities, state agencies, and other international partners.
- Environment Canada; this agency has lead responsibility for Canadian obligations in current lake management and coordinates with many local municipalities, provincial agencies, and international partners.
- Internal Joint Commission; this group advises the US and Canadian governments on broad issues of Great Lakes management.

Although formal endorsement from these groups is pending, it is highly likely that the broad ecosystem and public health goals of HELP will appeal to the management objectives of these agencies. The IJC, however, is likely to abstain from a formal endorsement, which is their general response to similar requests. The author of this basin nomination will inform the HELP committee on basin selection of endorsement decisions made by the above agencies.

Statement of Proposed Activities

The Lake Ontario HELP Nomination Task Force, funded by the Great Lakes Research Consortium (GLRC), will continue to carry out the feasibility and opportunity studies indicated above. The first component of this work is research into the feasibility and necessary coordination efforts for Lake Ontario's HELP participation, which will identify key science and management players as well as research projects that demonstrate success and failure of integrated hydrologic, ecologic, and socio-economic management plans. The second component is the creation of an interdisciplinary team of Lake Ontario researchers, which has been announced via the GLRC newsletter and will again be broadcast during the GLRC spring research meeting and a separate Canadian research meeting this spring of 2001. This team of researchers will wait to learn whether the UN endorses Lake Ontario as a HELP Pilot basin before coordinating responses to new research initiatives and requests for proposals that advance HELP research objectives.

4. USEPA Letter from David Ullrich and William J. Muszynski to Dr. Bonell indicating USEPA support for the Lake Ontario nomination.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES NATIONAL PROGRAM OFFICE
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

Dr. Michael Bonell
UNESCO/HELP
7, place de Fontenoy
75352 PARIS 07 SP
France

Dear Dr. Bonell:

We are writing to express the support of the U.S. Environmental Protection Agency for the nomination of Lake Ontario to the UNESCO Hydrology for the Environment, Life and Policy (HELP) Initiative.

As you may be aware, Lake Ontario, along with the other four Great Lakes, has been the focus of considerable effort by the U.S. and Canada to address issues recognized since the signing of the first Great Lakes Water Quality Agreement in 1972. Outgrowths of that agreement have included the Lake Ontario Toxics Management Plan and its successor, the Lake Ontario Lakewide Management Plan; designation of several Areas of Concern and development of Remedial Action Plans to address those concerns; the Niagara River Toxics Management Plan; a Binational Virtual Elimination Strategy, and the biennial State of the Lakes Ecosystem Conferences held to bring forth and share progress in knowledge about the Great Lakes. It is important to us and our Canadian counterparts that the HELP initiative be implemented in a manner that embraces these ongoing initiatives.

The nomination of Lake Ontario and its watershed to the HELP initiative opens the door to an opportunity to consider the lake in a holistic manner that can augment, complement, and bring into a single perspective the various efforts noted above, as well as additional efforts by the International Joint Commission, the Great Lakes Fisheries Commission, the Great Lakes Commission, and numerous federal, state, provincial and tribal agencies of both nations. Please keep EPA well informed as the initiative moves forward. You can reach the Great Lakes National Program Office at the above address, and Region 2 at 290 Broadway, New York, NY 10007-1866.

Please note that this endorsement is written with the understanding that being on the HELP Registry is a research tool and in no way constitutes ceding of U.S. sovereignty or property rights.

Sincerely yours,

ORIGINAL SIGNED BY DAVID ULLRICH AND WILIAM J. MUSZYNSKI, P.E.

David Ullrich
Acting Great Lakes National Program Manager

William J. Muszynski, P.E.
Acting Regional Administrator, Region 2

cc: Theodore A. Endreny, Ph.D.
College of Environmental Science & Forestry
207 Marshall Hall, 1 Forestry Drive
Syracuse, New York 13210

George P. Christich, Office of International Activities
2650 R Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Simon Llewellyn
Environmental Conservation Branch, Environment Canada
867 Lakeshore Road
Burlington, Ontario L7R 4A6

Donald Zelazny
New York State Department of Environmental Conservation
270 Michigan Av.
Buffalo, New York 14203

5. Environment Canada Letter from Harvey Shear indicating EC support for the Lake Ontario nomination.



Environment
Canada

Environnement
Canada

Ontario Region
4905 Dufferin Street
Downsview, Ontario
M3H 5T4

Région de l'Ontario
4905, rue Dufferin
Downsview, Ontario
M3H 5T4

Ted Endreny,
College of Environmental Science and Forestry,
Faculty of Forestry,
SUNY,
211 Marshall Hall,
One Forestry Drive,
Syracuse, NY,
13210-2778

Dear Ted,

I have no problem supporting the UNESCO HELP initiative as long as it is consistent with and provides value added to the Lake Ontario Lakewide Management Plan activities, the State of the Lakes Ecosystem Conference indicator reporting work, the Binational Virtual Elimination Strategy, and the Council of Great Lakes Research Managers activities.

Sincerely,

Harvey Shear, Ph.D.,
Regional Science Advisor

6. UNESCO Letter (May 21, 2001) and attachments indicating that the Lake Ontario basin was accepted by the HELP Wallingford Group as an 'Operational Basin'. The Operational Basin status indicates the basin has implemented the HELP philosophy and involved most stakeholders but remains short of the need to be classified as a 'World Reference Basin'.