LaMP UPDATE
LAKE ONTARIO • LAKEWIDE MANAGEMENT PLAN
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LAKE ONTARIO LAKEWIDE MANAGEMENT PLAN UPDATE 2001

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Lake Ontario Lakewide Management Plan – Moving Forward

The Lake Ontario Lakewide Management Plan (LaMP) has wrapped up the three year workplan published in the May 1998 Stage 1 report. The binational workplan identified activities to further reduce inputs of critical pollutants to Lake Ontario, reassess beneficial use impairments in open lake waters, manage biological and habitat issues and develop ecosystem objectives and indicators. Many of the actions identified in the workplan have been completed and reported in the LaMP 1999 and 2000 Updates. Other actions have been initiated or are in the planning stage, and will be carried over to the new workplan.

The LaMP Update 2001 highlights the LaMP's ongoing progress to better define sources and loadings of critical pollutants, define a strategy to lead to action on sources, and establish targets and measures to show environmental progress in the lake.

Reducing Inputs of Critical Pollutants and Other Pollutants

The Lake Ontario LaMP Stage 1 identified PCBs, DDT, mirex, dioxins/furans, mercury and dieldrin as critical pollutants responsible for lakewide problems requiring coordinated binational actions. Several articles in this Update discuss activities by the Four Parties: U.S. Environmental Protection Agency (U.S. EPA), Environment Canada (EC), New York State Department of Environmental Conservation (NYSDEC), and the

(continued on page 2)

Source: U.S. EPA

Lake Guardian, U.S. EPA research and monitoring vessel.

Source: EC

Limnos, EC research and monitoring vessel.

Lake Ontario Lakewide Management Plan – Moving Forward

(continued from page 1)

Ontario Ministry of the Environment (OMOE), and other partners to improve our understanding of these critical pollutants and develop reduction strategies.

A binational Critical Pollutant Sources and Loadings Reduction Strategy has been agreed upon by the Four Parties. The Four Parties have also developed plans to identify significant sources of contaminants to the lake. This important foundation, described on page 12, outlines how both countries plan to reduce the critical pollutants identified by the LaMP as causing beneficial use impairments in Lake Ontario.

Last year we featured an article on a strategic sampling project in the City of Rochester's municipal waste water system to locate potentially significant PCB sources. Similar studies are underway in Carthage and Lockport, New York to help identify and control sources of critical pollutants entering Lake Ontario.

An example of work currently underway in Ontario can be found in this year's Ontario's Approach to Priority Pollutant Track-Down in Lake Ontario Tributaries article, found on page 9. This work builds on a 1998 study summarized in the LaMP 2000 Update, which identified contaminants in six Lake Ontario tributaries that could require follow-up "source trackdown" monitoring.

Once significant sources are identified, actions can be developed in the U.S. and Canada to implement reductions. Progress on the identification of sources and follow-up actions will be reported in the LaMP 2002 report.

The Wet Weather Flow Management Master Plan for the City of Toronto is a plan to divert combined sewer overflows and reduce pollutants from entering the lake. (See article on page 6.) Similar projects in the Greater Rochester area in New York and Kingston, Ontario offer additional examples of work underway to deal with long-term solutions to municipal pollution sources.

Developing Ecosystem Indicators

The Four Parties proposed an initial set of 11 ecosystem indicators at the State of the Lakes Ecosystem Conference (SOLEC) 2000 in Hamilton, Ontario. These indicators are linked to the LaMP goals and ecosystem objectives, and will be used to help measure progress in restoring the beneficial uses of Lake Ontario. An article on page 9 describes the development and intent of the proposed indicators. A final suite of indicators will be adopted and reported in the LaMP 2002 report. The LaMP partners will continue to fine-tune the indicators, adding available data and targets as these are developed.

Managing Biological and Physical Factors

The status of fish and wildlife habitat in the Lake Ontario watershed is the subject of two articles on pages 15 and 16 of this Update. The articles contain information from both Canada and the U.S. to provide a general picture of the health of the Lake Ontario habitat. Physical, biological and chemical threats are discussed. Habitat protection and restoration activities through Remedial Action Plans (RAPs), volunteer-based projects, multi-partner binational, regional and local programs, as well as private land stewardship projects are highlighted.

A report on the Status and Trends in Fish and Wildlife Habitat on the Canadian Side of Lake Ontario has been completed and will soon be available from Environment Canada. Further information on protection and restoration projects in the U.S. can be found on the web at: www.epa.gov/glnpo.

Monitoring and Evaluating

The LaMP has developed an inventory of monitoring efforts, which describes the programs in place within various agencies in the U.S. and Canada. The inventory includes monitoring programs for tributaries, point sources, water, sediment, fish, plankton, benthos, birds and waterfowl, wetlands/habitat, contaminant effects and exotic species. This review of existing programs provided valuable information and identified data gaps, which will assist in planning a future binational cooperative monitoring project.

At the same time, studies have been underway on both sides of Lake Ontario to help us learn more about sediments in the lake. The Canadian study focuses on mapping of lake sediment types, while the U.S. study provides an estimate of pollutant concentrations in lake sediments (see articles on pages 3 and 4). Together, these studies contribute to a greater understanding of Lake Ontario sediment type and quality.

Moving Forward in Partnership

The articles contained within this LaMP Update describe some of the activities being undertaken in the Lake Ontario basin by the Four Parties and our partners, including an update on Lake Ontario RAP actions (see page 18). We encourage you to get involved in actions to improve the Lake Ontario basin ecosystem, and look forward to working with you in partnership to restore and protect the lake.

Putting Together Pieces of the Puzzle

Below you will find two articles written on sediment studies - one being conducted in the U. S., the other in Canada. While their subject matter is not the same, they help us to learn different things about lake sediments and add to our body of knowledge about the topic.

The Canadian study will give a detailed map of lake sediment types. This is important for understanding habitats for aquatic life. Also, because many of the toxic pollutants tend to attach to finer particulate matter, the study will help to show us where these pollutants might be more prevalent.

The U.S. study uses the random design to allow us to make a reasonably accurate estimate of pollutant concentrations in lake sediments as a whole. It will also allow us to estimate the percentage of lake sediments that exceed various guidelines. However, while we will have good estimates of "how much," further studies will be needed to give insight into "where" the pollutants are in the lake.

Each study gives us a piece of what we need to know, and they do complement each other.

Canadian Studies on Sediment Mapping

Norm Rukavina, EC

In 1998, EC's National Water Research Institute (NWRI) repeated a survey of Lake Ontario bottom sediments which had last been run in 1968. The primary objective was to determine any changes in the spatial, or geographic, distribution of contaminants over that time span. In addition to the collection of samples on the original grid, an acoustic sediment survey was run through the grid points with a system called RoxAnn. RoxAnn collects continuous data using bottom echoes produced by an echosounder and is able to interpret them as bottom-sediment types. This is data required for updating the substrate maps needed by LaMP habitat programs and for understanding the rate and scale of changing sediment patterns through time as the result of lake-bed erosion and sedimentation.

The 1998 survey results were disappointing in that no useful RoxAnn data were collected in depths greater than 30m because the ship sounder was under-powered. Fortunately, the echosounder records themselves were of excellent quality and it was possible to map major changes in sediment type from their properties.

A second sampling survey in 2000 provided the opportunity for a second RoxAnn trial, this time with a new deep-water echosounder. Good results were obtained in this case to depths of about 90 m and at the normal ship's speed of 10 knots or about 5 metres per second. As the results of sample analysis have just become available, the acoustic bottom types from RoxAnn and the echosounding records have yet to be confirmed with data from the sediment samples. EC has used RoxAnn successfully for the past several years in surveys of contaminated sediment sites and in nearshore surveys in Lake Ontario. Because other equipment for acoustic classification of sediments has now become available, a trial was arranged to compare RoxAnn performance with two other systems. This involved collaboration with the Fresh Water Institute which made available their QTC View system with an operator, and the local Canadian Hydrographic Service which conducted a survey using their multi-beam sonar system. QTC View is a RoxAnn-like system which operates on slightly different principles; the multi-beam sonar is a new hydrographic tool that can provide very high resolution, 3-dimensional maps of bottom depth and shape and which has the potential to map substrate types as well. Trials were conducted with all three systems at Stoney Creek in Lake Ontario in September 2000 and were followed-up with sampling and underwater television surveys to provide independent data on bottom types. Good results were obtained in all surveys and data are now being processed.

Experience of this type should be helpful in selecting the best system for future work at both contaminated sites and in Great Lakes habitat mapping. It will also contribute to a binational initiative underway by the Canadian and U.S. geological surveys and the Canadian Hydrographic Service on detailed mapping of Great Lakes basin sediments, using state-of-the-art sonar and positioning systems.

U.S. Survey and Evaluation of Sediment Quality

Richard Coleates, U.S. EPA

Lake sediments are an especially useful medium for measuring progress in reducing overall levels of critical pollutants in the lake. The six critical pollutants identified in the Lake Ontario LaMP belong to classes of chemicals which tend to bind with particles in the water rather than remain dissolved, and thus are carried to the lake floor. There, critical pollutants affect aquatic life in two major ways: 1) they are consumed along with organic matter by organisms, sometimes causing immediate toxic effects, and certainly enter the food chain, and 2) they may reenter the dissolved state, becoming available for direct absorption by fish and other organisms. Ultimately, as inputs of critical pollutants to the lake are reduced, contaminated sediments will be covered by cleaner sediments and will become isolated from the aquatic ecosystem.

In the fall of 1997, scientists from the U.S. EPA, National Oceanic and Atmospheric Administration (NOAA), and the NYSDEC, cooperated on a comprehensive study of sediment quality in Lake Ontario. The project was intended to evaluate surficial (the top 2-4 inches) sediment quality in the lake as a whole, establishing a baseline of environmental information by which future trends could be measured. This cooperative study had three basic objectives:

- To establish a baseline of data for chemicals of concern in Lake Ontario surface sediments and to characterize the degree of lake wide sediment contamination for each of these chemicals.

- To determine the biological quality of the sediments by means of analyses that include identifying the benthic species present at the various sampling locations, counting the number of individuals of each species, and performing laboratory tests to determine the toxicity of the sediments themselves.

- To identify any specific relationships between levels of chemical contamination and macroinvertebrate (bottom dwelling) populations. This information can then be used by environmental managers to assign priorities for future actions.

Sampling Design

The sampling design for the project took advantage of the power of statistical analysis to estimate environmental conditions over a wide area. This capability depends on a strategy of random selection of sampling locations. If a sufficient number of samples is collected, it is possible to characterize the entire study area with a reasonable level of confidence for whatever conditions are evaluated.

A total of 67 locations was sampled over a five day period during the 1997 survey. The samples were analyzed for metals, PCBs, pesticides, dioxins/furans, polyaromatic hydrocarbons, total organic carbon, grain size, and toxicity. In addition, samples at each location were sieved, and the benthic organisms in each sample were identified and counted.

Lake sediments were also tested for overall toxicity with a standardized laboratory procedure utilizing midge larvae (*Chironomus tentans*). The test exposes larvae to sediment samples for a 10 day period, and the number of surviving organisms is counted. The advantage of this type of test is that it can provide a measure of overall sediment toxicity, independent of chemical analyses. Sediments are considered to be non-toxic if more than 80% of the test organisms survive to the end of the test.

Sediment Guidelines

In order to evaluate the meaning of the analytical data obtained from the project, it is necessary to compare data with guidelines which give numerical levels by which ecotoxic effects may be estimated. The most commonly used chemical guidelines for Lake Ontario are the OMOE's "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario." (OMOE, 1993). These guidelines define three levels of ecotoxic effects, based on chronic, long term effects of contaminants on benthic organisms:

No Effect Level: No toxic effects have been observed on aquatic organisms. This is the level at which no biomagnification through the food chain is expected.

Lowest Effect Level (LEL): A level of sediment contamination that can be tolerated by the majority of benthic organisms. However, an adverse effect can be expected on some more sensitive species.

Source: U.S. EPA

U.S. EPA scientists retrieving a sediment sample on a Lake Ontario survey.

Severe Effect Level (SEL): The level at which significant impacts on the sediment-dwelling community can be expected. At this concentration, a majority of benthic species would be adversely affected.

Results

The volume of data generated by the survey was quite large, and the necessary statistical analyses of the results is still taking place. However, it is possible at this time to draw some early conclusions from the results.

Toxicity:

For this project, 100% of the sediments were found to be not acutely toxic. It should be noted that this test measures acute toxicity, and does not evaluate long term sublethal effects of contamination.

Mercury:

Mercury is widely used in modern society and enters the lake via runoff, surface water discharges, and air deposition. The mean mercury concentration for Lake Ontario sediments was 0.36 parts per million (ppm). This exceeds the LEL guideline of 0.2 ppm. Approximately 60% of the surface sediments in Lake Ontario exceeded the LEL guideline. However, on a more positive note, none of the sediments sampled exceeded the SEL guideline of 2.0 ppm.

Dieldrin:

Dieldrin is a pesticide which has been banned from use in the U.S. and Canada for a number of years. The mean concentration of dieldrin in the lake sediments was 2.03 parts per billion (ppb). This is very close to the LEL guideline of 2.0 ppb. More than 95% of the sediments in the lake had dieldrin concentrations below the LEL guidelines.

Mirex:

The mean concentration of mirex (widely used as a fire retardant) in the lake sediments was 4.47 ppb. This is well below the LEL guideline of 7.0 ppb. However, an estimated 30% of the lake's sediments did exceed the LEL guideline.

DDT:

Although the use of DDT has been banned in the U.S. and Canada for more than 25 years, the pesticide still persists in the environment. The mean concentration of DDT in Lake Ontario sediments was 5.26 ppb. This is below the LEL guidelines for DDT, of 8.0 ppb. An estimated 80% of the lake's sediments had DDT concentrations below the LEL guideline.

In order to get a more complete picture of contamination resulting from past use of DDT, it is useful to consider the sum of DDT and its metabolites, DDD and DDE. Planned statistical analyses will include consideration of the sum of DDT and its metabolites.

Work Remaining

Analytical data for PCBs and dioxins are still being evaluated.

Physical data are being evaluated to see if the assessment of lake sediments can be further refined to provide separate assessments of the near-shore and deeper central areas of the lake. NOAA scientists are evaluating the communities of benthic organisms observed, to determine the relative health of these communities, and to see if there are linkages with other factors such as chemical contamination.

• U.S. Survey and Evaluation of Sediment Quality

Check It Out!

The Lake Ontario LaMP has a website.

Read about the Lake and LaMP activities; find reports and fact sheets; and learn about upcoming meetings and opportunities to participate!

Find more information at either:

www.epa.gov/glnpo/lakeont

or

www.on.ec.ca/glimr/lakes/ontario

Wet Weather Flow Management Master Plan for the City of Toronto

Michael D'Andrea, City of Toronto

• Wet Weather Flow Management Master Plan for the City of Toronto

Stormwater runoff and combined sewer overflows from municipalities are important sources of critical pollutants during wet weather conditions. Wet weather flow impacts in the Toronto area have been noted as the major impediment to the restoration of beneficial uses along the Lake Ontario waterfront and within the watersheds draining to the waterfront. To combat this problem, the City of Toronto has implemented a range of wet weather flow management measures including: downspout disconnections and the use of rain barrels on individual properties, correction of "leaky" storm sewer pipes, construction of end-of-pipe treatment facilities such as stormwater management wetlands, as well as innovative flow balancing systems such as the $12 million Eastern Beaches storage tanks and the $56 million Western Beaches Storage Tunnel (to be completed by the spring of 2001). These measures are making a difference. For example, since constructing the Eastern Beaches tanks, nearshore water quality has improved and beach postings have been drastically reduced.

The City of Toronto has recently undertaken the development of a master plan which will further formulate strategies for the prevention, control and reduction of wet weather flow impacts across the city.

GOAL

"To reduce, and ultimately eliminate the adverse effects of wet weather flow on the built and natural environment in a timely and sustainable manner, and to achieve a measurable improvement in ecosystem health of the watersheds."

PROGRESS TO DATE

In consultation with a multi-stakeholder Steering Committee and the public, city staff and technical consultants gathered and analyzed huge amounts of information on water quality, flows, pollutant loading, and practices used in other jurisdictions. This review provided a more complete understanding of existing environmental conditions in Toronto and how wet weather flows affect our environment. A key outcome of the work was the adoption of a new philosophy developed in consultation with key stakeholders which is:

"Rainwater is to be treated as a resource to be utilized to enhance and nourish the city's environment. Wet weather flow quantity and quality issues are to be managed on a watershed basis to enhance and preserve ecosystem health through a hierarchy of source, conveyance and end-of-pipe control and/or treatment measures. Source control measures will be considered first in this hierarchy in a manner that is balanced with the other two measures in terms of environmental, social and economic impacts."

The hierarchical approach to managing wet weather flows reflects the "pollution prevention principle":

- At Source: first deal with stormwater where it lands on the urban landscape; through measures such as downspout disconnection and rain gardens, stormwater is removed from the system and contained at the "lot level".

- During Conveyance: next deal with stormwater as it is transported; through measures such as roadside swales/ditches or buried perforated pipes, stormwater quality is improved and can be used to help re-establish the natural hydrologic cycle through infiltration.

- End-of-Pipe: lastly, end-of-pipe treatment facilities can be used before the stormwater or combined sewer overflows are discharged to the receiving water body; these systems include measures such as stormwater management wetlands and underground storage tanks.

OBJECTIVES

The Master Plan will contribute to achieving the following objectives:

- Meet guidelines for water and sediment quality in water courses and along the lake waterfront
- Virtually eliminate toxics in groundwater and surface water through pollution prevention
- Improve water quality in rivers and the lake for body contact recreation
- Improve aesthetics in surface water through elimination of objectionable debris, nuisance algae growth, colour, turbidity and odour
- Preserve and re-establish a more natural hydrologic process
- Reduce erosion impacts on habitats and property
- Eliminate or minimize threats to life and property from flooding

Source: City of Toronto

Disconnected downspouts and rainbarrels keep rain out of sewers.

Kingston's Sewage Success Story

John Allen, OMOE

Kingston residents should once again enjoy their beaches this summer without the need for beach closures.

The City of Kingston has not had to close its beaches due to high bacteria levels for three years now thanks to an extensive program that involves significant upgrades to the sewer system. The program was initiated in 1992 as a result of a Pollution Control Planning Study which recommended several actions, including the separation of combined sewers.

Combined sewers take both storm water and sewage into one sewer. Normally this can be handled by the sewage system, but during periods of heavy rain the amount of storm water can be so great that the sewage treatment plant can't handle all of the water in the combined sewer. As a result, the combined storm water and raw sewage is bypassed - discharged directly to the lake - resulting in the pollution of Lake Ontario and higher bacteria levels at Kingston's waterfront and beaches.

The bypassing problem was a result of two main deficiencies in Kingston's sewer system. Because of the aging infrastructure, the system suffered from pipes that were too small and pumps at the sewage treatment plant didn't have a large enough capacity to handle the additional water during heavy storms.

Recognizing the problem, the city took a number of corrective actions, and has invested over $12 million to date.

Two combined sewer overflow tanks were installed to handle the excess water during wet weather. They are capable of storing up to 6,300 m^3 of untreated sewage and storm water until the sewage treatment plant can accept and process the excess wastewater.

The city has made upgrades to its sewers by installing larger pipes, and by replacing aging pumps where necessary with new, higher capacity pumps at its pumping station. The city has also been pursuing the separation of combined sewers. By separating these sewers, only the sewage is directed to the treatment plant while the non-polluting storm water is discharged into the lake.

Thanks to these proactive steps taken by the City of Kingston, bacteria levels have been lowered, beaches have not been closed in over three years, and most importantly, the amount of pollution entering Lake Ontario has been lessened.

- Protect, enhance and restore natural features (eg. wetlands) and functions
- Achieve healthy aquatic communities
- Reduce fish contamination and consumption advisories
- Eliminate discharges of sanitary sewage including combined sewer overflows, treatment plant bypasses and illegal cross-connections and spills
- Reduce infiltration and inflow to sanitary sewers
- Reduce basement flooding

DEVELOPMENT OF THE MASTER PLAN

The aim is to develop a Wet Weather Flow Management Strategy for the City of Toronto. The city has been divided into five study areas (see map on page 8). Four of these generally conform to the boundaries of those portions of the major watersheds that lie within the City (Mimico and Etobicoke Creeks, the Humber River, the Don River, and the Rouge River and Highland Creek). The fifth study area includes all the sections of Toronto in which there are still combined sewers.

Geographic information systems (GIS) are being used extensively to present data on existing environmental conditions, to support the development of computer simulation models and to identify opportunities and potential sites for various wet weather flow control measures.

Hydrologic, hydraulic and water quality simulation models are being developed to assess the effectiveness of the various control options against receiving water targets.

Source: City of Toronto

Porous pavement allows rainfall to infiltrate the ground.

The U.S. EPA Hydrologic Simulation Program (HSPF) is being applied to simulate the flow and water quality response within each of the watersheds. The Dorsch QQS model is being developed for the land based combined sewer service area within the city. The output from this model will be used as input to the HSPF watershed models for the Humber and Don Rivers. Furthermore, continuous time series of flow and water quality

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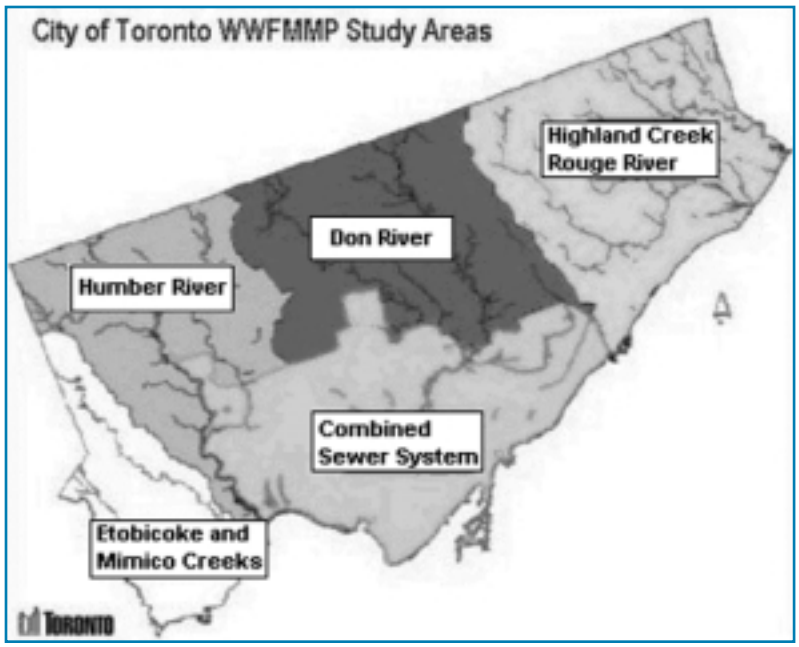

Source: City of Toronto

City of Toronto WWFMMP Study Areas.

Wet Weather Flow Management Master Plan for the City of Toronto

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will be generated for each of the six watersheds and for each combined sewer overflow discharge along the waterfront. These will then serve as input to a waterfront water quality simulation model which will assess the cumulative impact of all flows across the entire waterfront.

Watershed groups, government agencies, municipalities within each of the watershed study areas, and the public at large, will be consulted throughout the process to provide public input at key decision points throughout the plan development process. The plan is expected to be completed by December 2001.

For more information on the City of Toronto's Wet Weather Flow Management Master Plan, please see the City of Toronto website at: http://www.city.toronto.on.ca/wetweatherflow/

Greater Rochester Storm Water Management

Monroe County's Frank E. VanLare Publicly Owned Treatment Works serves the largest metropolitan area in New York's portion of the Lake Ontario Basin. Wastewaters are collected from the City of Rochester as well as a number of surrounding communities to be properly treated before they are discharged to Lake Ontario. The development of wet weather flow controls for this sewage treatment plant was identified as a high priority, given the large volume of wastewater handled by the plant.

Portions of the City of Rochester's collection system date back to the 1800s, when untreated waste and storm water ran into the same sewer lines and were discharged to Irondequoit Bay and the Genesee River. These combined sewer overflow systems (CSOs) worked well except during rainy periods, when high volumes of storm water entering the CSOs exceeded the capacity of the sewage treatment plants. Large volumes of untreated storm water would then be discharged directly to waterways, resulting in widespread contamination. To address this problem, Monroe County developed the Combined Sewer Overflow Abatement Program. A $550 million deep rock tunnel system was constructed to capture and hold major storm runoff and wastewater until it could be properly treated. Construction on the tunnel system began in 1982 and was completed in 1991.

Before installation of the tunnel systems, there was an average of 30-40 overflow events per year. Now during wet weather the storm water is directed into this huge network of tunnels, which is capable of storing up to 175 million gallons. After the storm is over, the storm water is sent to the plant for treatment. Since the system has been fully operational (1993), it has captured more than 26 billion gallons of combined sewer overflow that otherwise would have spilled into local waterways, and water quality in the Genesee River has improved significantly.

Ontario's Approach to Priority Pollutant Track-Down in Lake Ontario Tributaries

Fred Fleischer, OMOE

The reduction of critical pollutants entering Lake Ontario has been identified as a key objective in the LaMP. As reported in the "LaMP Update 2000", results of the joint 1997-98 OMOE and EC tributary sampling program for priority pollutants revealed a relatively uniform background concentration of total PCB at the mouths of six Lake Ontario tributaries across a range of different land uses.

Since concentrations of total PCB in some Lake Ontario tributaries have been found to exceed the Provincial Water Quality Objective of 1.0 ng/L (nanogram per litre) in the 1997-98 study as well as other investigations, a commitment was made by OMOE to confirm these findings using an integrated high-frequency sampling approach to characterize typical concentrations of PCB along with other priority pollutants including polynuclear aromatic hydrocarbons (PAHs), and organochlorine compounds (including DDT and mirex). This approach involves the collection of four-week composite samples made up of subsamples collected every six hours throughout the entire year, rather than relying on 10 to 15 grab samples to characterize annual conditions. In this way, a more complete range of seasonal hydrological conditions within the watershed is taken into account. This approach was applied to several Lake Ontario tributaries from July 2000 through June 2001.

In addition to this refinement in the sampling approach, OMOE is also developing and applying a tributary "trackdown" strategy to answer the questions:

1. Are concentrations of PCB and other priority pollutants significantly elevated at Lake Ontario tributary mouths relative to headwaters? and

2. Is there evidence of significant, local sources of PCB and other priority pollutants within Lake Ontario tributaries?

In essence, the goal is to determine whether observed concentrations of PCB and other priority pollutants are attributable to locally controllable sources, or whether they reflect recycled contaminants from diffuse historical sources.

These questions will be answered for selected tributaries by: (a) quantifying upstream-downstream differences in total concentrations (and congener patterns where possible) of PCB in water, sediment, and juvenile fish tissue; and (b) quantifying differences in biomonitored (caged mussel) tissue PCB concentrations and congener patterns at selected points throughout the watershed.

Three pilot watershed projects are being selected from Lake Ontario tributaries where elevated PCB levels were found and good screening level data are available from both provincial and federal studies. These include water quality and juvenile fish data from the 2000-01 and 1997-98 studies described above, along with previous data from the 1991-92 Toronto area six tributary study.

Based on these criteria, Twelve Mile Creek was selected as the first of these pilot projects in the western part of the Lake Ontario basin; field work for the PCB trackdown started here during the summer of 2000 and is scheduled to be completed during summer of 2001. Work on the other two pilot projects, Etobicoke Creek and Cataraqui River, located in the central and the eastern part of the basin, commenced during the summer of 2001.

Once the sample results are available, a summary report will be prepared with recommendations for targeted action within the watershed if a significant, controllable source of PCB or other priority pollutants is identified.

Developing Ecosystem Indicators for Lake Ontario

Fred Luckey, U.S. EPA/NYSDEC

The restoration of a healthy Lake Ontario ecosystem is the goal of the Lakewide Management Plan. But what is a "healthy ecosystem" and how do we measure progress towards this goal?

In May 1998, after consultation with other natural resource agencies and the public, the Four Parties finalized the Stage 1 LaMP report for Lake Ontario. The LaMP addresses issues that are lakewide in nature and require binational actions to resolve. The Stage 1 report identified the problems (known as beneficial use impairments) that exist lakewide in Lake Ontario, and the chemical, physical, and biological causes of these impairments.

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Developing Ecosystem Indicators for Lake Ontario

(continued from page 9)

Lakewide Beneficial Use Impairments	Lakewide Critical Pollutants and Other Factors Causing Impairments
Restrictions on fish and wildlife consumption	PCBs, Dioxins, Mirex, Mercury, DDT
Degradation of wildlife populations	PCBs, Dioxin, DDT
Bird or animal deformities or reproductive problems.	PCBs, Dioxin, DDT
Loss of fish and wildlife habitat	Lake Level Management Exotic Species Physical loss, modification and destruction of habitat

**Dieldrin is also included on the Lake Ontario LaMP List of Critical Pollutants although it is not directly associated with a use impairment.*

The Four Parties, through the LaMP, are working to restore these beneficial uses by reducing the amount of critical pollutants in the Lake Ontario ecosystem and by addressing the biological and physical factors that have been identified.

The development of well defined goals and objectives provides a way for the LaMP to define what its goals are and to identify the tools needed to measure progress. A considerable amount of work has gone into the development of Lake Ontario ecosystem objectives and indicators over the last decade. The earlier Lake Ontario Toxics Management Plan began the development of ecosystem goals and objectives with the formation of the Lake Ontario Ecosystem Objectives Work Group (EOWG). This group, consisting of U.S. and Canadian monitoring experts, assisted in the development of broad ecosystem goals for Lake Ontario, which have been adopted by the LaMP.

> Ecosystem Goals for Lake Ontario
>
> The Lake Ontario Ecosystem should be maintained and as necessary restored or enhanced to support self-producing diverse biological communities. The presence of contaminants shall not limit uses of fish, wildlife, and waters of the Lake Ontario basin by humans and shall not cause adverse health effects in plants and animals.
>
> As a society we recognize our capacity to create great changes in the ecosystem and we shall conduct our activities with responsible stewardship for the Lake Ontario Basin.

The EOWG also developed proposed Lake Ontario ecosystem objectives that address various components of the ecosystem and beneficial use impairments. The LaMP presented these five draft ecosystem objectives for Lake Ontario in their 1998 report:

> Ecosystem Objectives for Lake Ontario
>
> Aquatic Communities: The lake waters shall support diverse and healthy reproducing and self-sustaining communities in dynamic equilibrium, with an emphasis on native species.
>
> Wildlife: The perpetuation of a healthy, diverse, and self-sustaining wildlife community that utilizes the lake habitat and/or food shall be ensured by attaining and sustaining the waters, coastal wetlands, and upland habitats of the basin in sufficient quantity and quality.
>
> Human Health: The waters, plants and animals shall be be free from contaminants and organisms resulting from human activities at levels that affect health or aesthetic factors such as tainting odor, and turbidity.
>
> Habitat: Offshore and nearshore zones surrounding tributary, wetland, and upland habitats shall be of sufficient quality and quantity to support ecosystem objectives for the health, productivity, and distribution of plants and animals in and adjacent to the lake.
>
> Stewardship: Human activities and decisions shall embrace environmental ethics and a commitment to responsible stewardship.

The LaMP is now ready to develop indicators with specific goals, measures and targets needed to track progress in restoration of the impaired beneficial uses.

Ideally, selected indicators will reflect broad ecosystem trends, reflect lakewide conditions and be sensitive to a number of stressors. For example,

healthy populations of bald eagles and lake trout, which are both top level native predators, would indicate the presence of suitable habitat, healthy populations of prey organisms, and low levels of environmental contaminants. Healthy populations of eagles and trout would also reflect our society's commitment to responsible stewardship through actions taken to protect their habitats, limit their harvest and reduce levels of contaminants in the environment.

Indicators proposed by the EOWG and the SOLEC served as a starting point for the development of Lake Ontario LaMP ecosystem indicators. The types of data currently collected by U.S. and Canadian government environmental monitoring programs was then reviewed to identify what types of data are collected on a regular basis which could be used to measure long term trends.

An initial set of 11 proposed indicators has been developed to help measure progress in restoring the beneficial uses of the lake. In selecting these, the LaMP used the following criteria:

- consistency with SOLEC and EOWG indicator recommendations;
- the availability of data from existing monitoring programs;
- the availability of historical data, which would allow for tracking and comparison over time;
- the ability to characterize general "ecosystem health" on a lakewide scale;
- the relevance/meaningfulness for the general public;
- the acceptance and recognition of their use by monitoring experts.

The proposed ecosystem indicators can be divided into three main groups:

Critical Pollutant Indicators - would measure concentrations of critical pollutants in water, young-of-the-year fish, herring gull eggs and lake trout for comparison against existing guidelines.

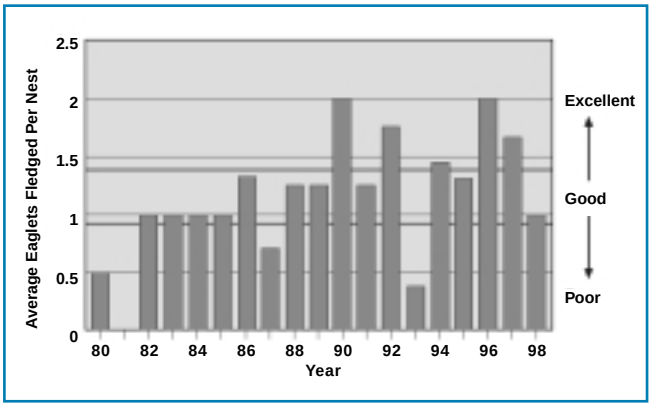
Lower Foodweb Indicators - would monitor nutrients, zooplankton and prey fish (e.g. alewife and smelt) to determine which reflect the ability of the ecosystem to support higher level organisms such as lake trout and waterbirds.

Upper Foodweb Indicators - would monitor the health of herring gull, lake trout, bald eagle, mink and otter populations – all top level predators that are dependent on quality habitat and sufficient populations of healthy prey free of problematic contaminant levels.

The LaMP welcomes all comments or suggestions as to how these indicators can be improved upon. Additional indicators will be considered as necessary to help guide LaMP restoration activities. The process of fine tuning and reporting about these indicators between U.S. and Canadian monitoring programs will enhance binational coordination on these issues.

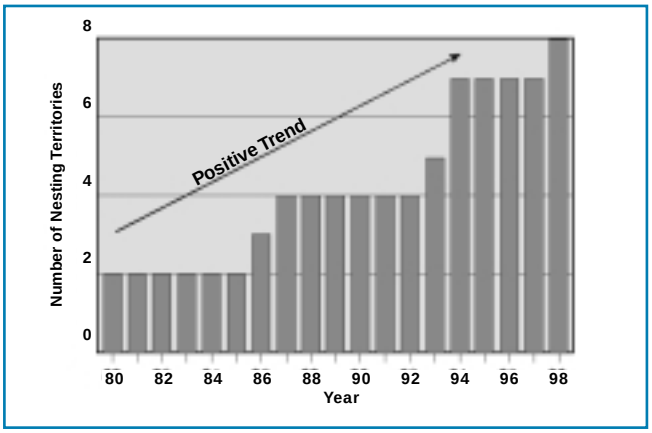
Source: U.S. Fish and Wildlife Service

Bald Eagle



Source: NYSDEC

Indicator: Bald Eagle Measure: Eaglets Produced Per Nest.



Source: NYSDEC

Indicator: Bald Eagle Measure: Number of Nesting Territories.

Critical Pollutant Sources and Loadings Reduction Strategy

Fred Luckey, U.S. EPA/NYSDEC

The Four Parties involved in the Lake Ontario Lakewide Management Plan have developed a cooperative binational approach to reducing critical pollutant loadings to the Lake.

Basic Understandings

The binational goal of the Lake Ontario LaMP is to reduce inputs of designated critical pollutants (PCBs, DDTs, mercury, mirex, dieldrin and dioxins/furans) in order to meet LaMP ecosystem objectives and restore associated beneficial use impairments. Pollutant reduction efforts will serve as an important step towards achieving the virtual elimination of persistent toxic substances from the Great Lakes Basin, a key element of the Binational Toxics Strategy.

Recognizing that the Lake Ontario LaMP aims to promote the reduction of inputs of critical pollutants and that the Four Parties have regulatory mandates, the LaMP uses a cooperative approach, working closely with regulatory programs, local governments, industry and individuals to develop and coordinate an effective critical pollutant reduction strategy to address known and potential sources of critical pollutants throughout the Lake Ontario Basin.

The Four Parties recognize that a load reduction schedule based on percent reduction targets over a given time period is not practical, due to the scale and complexity of pollutant sources within the basin. The LaMP is developing a focused and strategic approach to identify, assess and mitigate sources of critical pollutants. Percent reduction targets may be developed by individual jurisdictions for specific sources or for source categories if and when sufficient monitoring information is available.

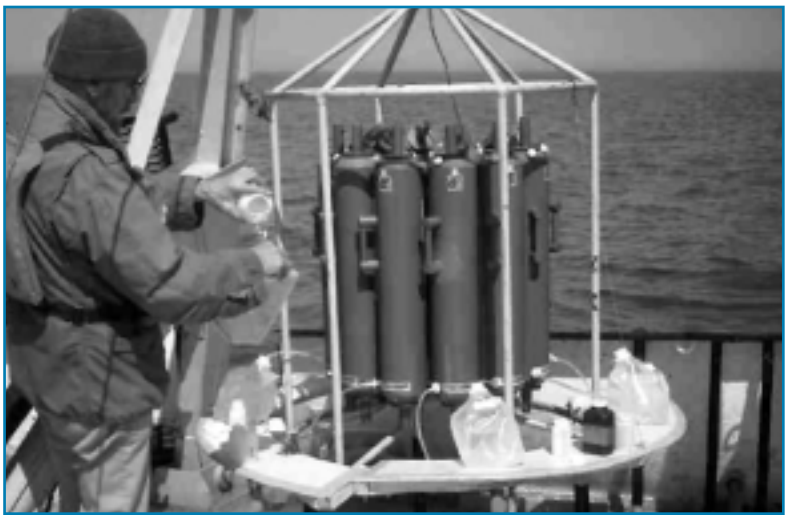
Qualitative information is acknowledged as an important component of the LaMP critical pollutant source identification process and decision making. Available regulatory monitoring information often does not include critical pollutants in routine monitoring, or may have used methods which could not detect low levels of contaminants of concern. Qualitative information, such as an understanding of past uses of critical pollutants and historical use records, may be helpful in identifying potential sources of these pollutants to the basin.

Given the persistence of the critical pollutants, the Four Parties will continue to seek the reduction of these pollutants at sources that can be addressed through regulatory or voluntary measures. The LaMP's critical pollutant reduction strategy may go beyond existing programs to address significant sources identified by the LaMP as a binational priority.

Significant amounts of critical pollutants from the upstream Great Lakes and connecting channels enter Lake Ontario via the Niagara River and from out of basin atmospheric sources. Restoring beneficial uses in Lake Ontario depends in part on the successful implementation of LaMPs and RAPs in upstream and out of basin programs that also address persistent toxics reduction.

General Approach

The LaMP critical pollutant reduction strategy is developed around three main elements – data/information and synthesis; coordination with regulatory



Source: U.S. EPA

U.S. EPA scientist with water sampling equipment.

actions; and promoting voluntary actions. A number of approaches can be developed for each element.

Information Synthesis

The organization of data on critical pollutants from ambient monitoring, known or suspected exceedences of criteria or standards, and point and non-point sources can assist in developing a picture of critical pollutant sources in watersheds of concern. Pollutant reduction strategies can then be developed to deal with specific problems, with links to appropriate local governments and community organizations.

Information on concentrations, sources, loadings and pathways of critical pollutants are being evaluated, with the aim of identifying source reduction actions. The identification of priority actions will be a primary focus of the LaMP 2002 report. Actions could include, for example, watershed evaluations, further monitoring, and source reduction activities.

Regulatory Actions

Regulatory actions have resulted in tremendous reductions in environmental concentrations of most of Lake Ontario's critical pollutants over the last three decades and continue to make a difference.

The LaMP will identify and highlight specific remedial and other regulatory program efforts underway that are contributing to LaMP pollutant reduction goals and that LaMP strategies can build upon. The LaMP will also ensure that regulatory programs are kept apprised of any information relevant to enforcement or monitoring requirements, so that regulatory tools can be applied as appropriate to address specific LaMP priority sources.

Voluntary Actions

Many communities, organizations and local governments in the Lake Ontario Basin have developed voluntary pollution prevention programs such as pesticide "clean sweeps" and mercury equipment/thermometer collection programs.

The LaMP's role in promoting voluntary efforts includes ensuring that community and local government programs are aware of LaMP goals and objectives; communicating and highlighting the importance of voluntary efforts (success stories); and encouraging accelerated product phase-outs, pollutant minimization plans or other actions from industry or local governments.

Cooperative Binational Strategy

The U.S. and Canada will use compatible approaches in source reduction strategies, to best utilize current initiatives, historic actions and individual human and information resources. The U.S. intends to evaluate all watersheds within its portion of the basin. Canada will focus on actions within priority watersheds, based on available ambient monitoring information and emissions data for industrial, municipal and other non-point source discharges (e.g. combined sewage overflows/stormwater, waste sites). Strategies will be developed to address identified sources of critical pollutants in these watersheds.

Contaminant Trends in Lake Ontario Sport Fish – Ontario Side

Alan Hayton, OMOE

Various jurisdictions around the Great Lakes carry out sport fish monitoring programs that provide consumption advice. The LaMP recognizes there are differences in reporting and consumption advisories between jurisdictions in Canada and the U.S. This article highlights recently released information from Ontario's Sport Fish Contaminant Monitoring Program.

Sport fish from the Canadian waters of Lake Ontario are monitored on an annual basis. The results are published every other year - along with consumption advice for sport fish from Ontario's inland lakes, rivers and Great Lakes - in the Guide to Eating Ontario Sport Fish. The guide offers size-specific consumption advice based on health protection guidelines developed by Health Canada for approximately 1,700 species.

Between 4,000 and 6,000 fish per year are tested through the Sport Fish Contaminant Monitoring Program. Staff involved in the program, a partnership between the Ontario Ministries of Natural Resources and the Environment, have been testing Ontario sport fish for more than 25 years. Staff from both ministries

(continued on page 14

Source: Center for Great Lakes and Aquatic Sciences

Lake trout, rainbow trout, brown trout and coho salmon.

Contaminant Trends in Lake Ontario Sport Fish – Ontario Side

(continued from page 13)

collect fish and send them to the Ministry of the Environment laboratory in Toronto. The skinless, boneless dorsal fillets of the fish are analyzed for a variety of substances, including mercury, PCBs, mirex/photomirex, and dioxins/furans - contaminants identified by the LaMP as critical pollutants.

In Ontario, consumption restrictions on Lake Ontario sport fish are the result of PCBs (47 per cent of advisories), mercury (26 per cent), mirex/photomirex (24 per cent), toxaphene (2 per cent) and dioxins/furans (1 per cent). Other chlorinated organic contaminants such as DDT, hexachlorobenzene, octachlorostyrene, chlordane and lindane are regularly detected in Lake Ontario sport fish but do not result in consumption restrictions.

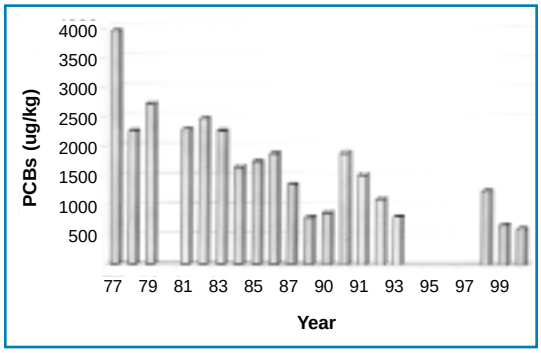
Coho salmon from the Credit River spawning run, southwest of Toronto, are illustrated to show long-term trends in Lake Ontario salmon and trout. In the mid 1990s, coho salmon stocks in the Credit River were low and no samples of fish were obtained. Contaminant levels have been steadily decreasing since monitoring began in the mid 1970s. PCBs and mirex, as well as other contaminants not illustrated, declined substantially during the past two decades. Levels of mercury, which was found at relatively low levels in the 1970s, does not appear to have changed markedly.

Levels of total DDT (DDT and its metabolites DDD and DDE) also decreased between 1976 and 2000. However, the greatest decrease in the individual compounds is in the concentration of the parent compound DDT. DDT decreased from approximately 200 micrograms per kilogram (ug/kg) in the mid 1970s to the detection limit of 10 ug/kg in 2000. In most years DDE concentrations have fluctuated between 200 and 400 ug/kg, showing no clear trend.

Ontario, through its Sport Fish Contaminant Monitoring Program, will continue to monitor Lake Ontario sport fish on an annual basis for trends in contaminant concentrations and to provide up-to-date consumption advice to anglers.

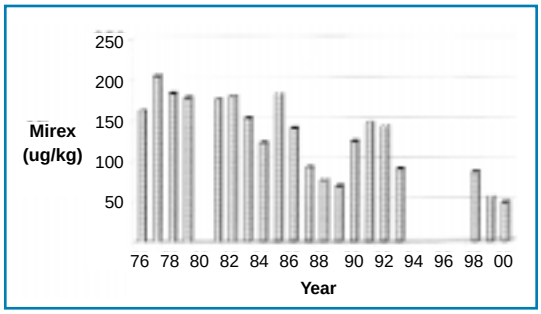
The Guide to Eating Ontario Sport Fish, published by the Ministry of Natural Resources, is available on the internet at www.ene.gov.on.ca. Ontario anglers should refer to this guide for specific consumption advisories.

U.S. anglers should refer to New York State Department of Health's *Chemicals in Sportfish and Game*, also available on the internet at www.health.state.ny.us/nysdoh/environ/fish.htm.



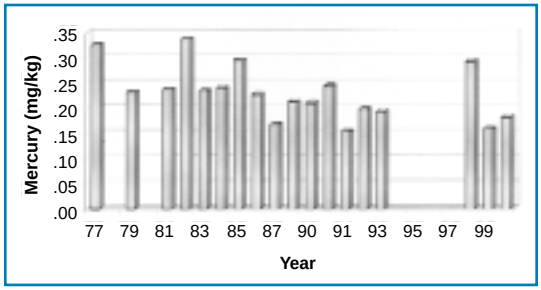
Source: OMOE

PCB Concentration in 65 cm Lake Ontario Coho Salmon.



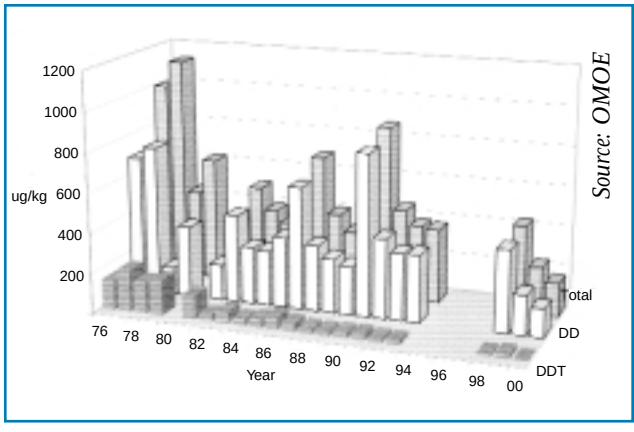
Source: OMOE

Mirex Concentration in 65 cm Lake Ontario Coho Salmon.



Source: OMOE

Mercury Concentration 9mg/kg in 65 cm Lake Ontario Coho Salmon.



Source: OMOE

Concentration of DDT and Metabolites in 65 cm Lake Ontario Coho Salmon (1976-2000).

The LaMP has begun the process of evaluating Lake Ontario habitat issues. It is important to recognize that much of the lake's natural habitat has been irrevocably altered since pre-colonial times and much of the genetic diversity and many native species have been lost forever. The challenge facing us now is how to preserve the quality and quantity of remaining fish and wildlife habitats while at the same time, meet the needs of human populations. In addition, options to restore lost or degraded habitats need to be explored. Fortunately, there has been significant progress, both in the protection and restoration areas. Today, more than 20% of Lake Ontario's wetlands are fully protected while additional areas are subject to a variety of government rules and regulatory programs. The following review outlines various issues to be considered in developing the LaMP's habitat assessment.

Reporting on the Status of Fish and Wildlife Habitats in the Canadian Watershed of Lake Ontario

Ronald A. Reid, Consultant to EC

A healthy Lake Ontario includes healthy habitats for fish and wildlife, both in the lake and its watershed. A status report prepared for EC documents current habitat conditions, recent trends and stresses on the Canadian side of the lake. It also looks at the wide range of programs involved in habitat restoration and protection.

How well are habitats doing? There is no single answer to that question, but by looking at various parts of the ecosystem, a general picture emerges.

In the lake's watershed, which stretches from the fruitlands of the Niagara Peninsula almost to the forested hills of Algonquin Provincial Park, much of the original forest and other natural cover was lost when Europeans settled the area. Forest cover has partly recovered in most areas, but fragmentation of the remaining forests into smaller and smaller pieces is creating problems for many species of wildlife. Wetlands and other original habitats such as prairies have been greatly reduced. Human populations are expanding very rapidly within the watershed, and urban growth in the Greater Toronto Area and the Hamilton-Niagara region is putting enormous stress on natural habitats.

The tributaries feeding into the lake are vital ecological connectors. Their quality is directly affected by activities on the lands around them, and most tributaries became significantly degraded from land clearing, poor farming practices, dams, and pollution. Most tributaries still have impaired fish communities, and do not come close to meeting local goals for streamside cover. However, in recent years the levels of suspended sediments and pollutants within streams have declined significantly. Unstable flow patterns resulting from urbanization and excessive water-taking are significant stresses.

Nearshore lands and waters have been a focal point for human activity, which has led to habitat loss and the altering of natural processes such as lake level fluctuations and the patterns of lakeshore erosion and sand transport by wave action. But nearshore pollution has been considerably reduced, with the phosphorus concentrations that produced algal blooms now reduced to target levels, and fewer toxins remaining at elevated levels. Fish and wildlife populations have responded to these improved conditions, from a healthier mix of bottom invertebrates to rebounding populations of most gulls and terns. However, the invasion of zebra and quagga mussels has overwhelmed some lakebed communities such as native clams, and is altering habitat conditions at a rapid rate.

In deeper offshore waters, major pollution problems that were affecting fish populations have been largely overcome, although some concerns about contaminated bottom sediments remain. However, the offshore aquatic communities are now dominated by introduced species as a result of accidental introductions and fish stocking. Fish, plankton, and invertebrate populations are very unstable, and their future composition is highly unpredictable.

Habitat protection and restoration activities have been widespread, through RAPs, volunteer-based projects, agency and municipal programs, and private land stewardship. Tree-planting and naturalization projects have been especially popular in urban areas, and farmers have been active in improving water quality through the development of Environmental Farm Plans and no-till cultivation techniques. Some examples of high quality habitats are protected in public parks and conservation areas, or through municipal planning policies.

(continued on page 16)

Reporting on the Status of Fish and Wildlife Habitats in the Canadian Watershed of Lake Ontario

(continued from page 15)

However, additional efforts are needed, especially to conserve the remaining areas of high quality habitat and to address emerging issues. The invasion of non-native species such as zebra mussels and the potential impact of climate change are major challenges for the future. Only through ongoing effort can the rich diversity of fish and wildlife in Lake Ontario and its watershed be assured for the future.

A report on Status and Trends in Fish and Wildlife Habitat on the Canadian Side of Lake Ontario is available. For a summary report, please contact: Marlene O'Brien, EC, at (905) 336-4552.

Fish and Wildlife Habitat in the United States Lake Ontario Watershed

Karen Rodriguez, U.S. EPA

The 24,720-square mile U.S. portion of the Lake Ontario basin, from the St. Lawrence River and including the Niagara River corridor, is diverse in fish and wildlife habitat. The St. Lawrence River supports habitat for the lake sturgeon. Along the shoreline are sand beaches, sand dunes, and wetlands including fens and coastal marshes, significant habitats for shorebirds, raptors, passerines, and waterfowl. Black terns and common terns nest and forage in the marshes. Sprinkled at the western end of the lake, alvars, which are areas of flat limestone bedrock where soils have been scraped away by ice, wind, and water, are habitats for grasses, wildflowers, mosses, lichens, stunted trees, and specialized birds and invertebrates. Upland are forests of oak, ash, white cedar, and hickory.

Threats to fish and wildlife habitats are physical, biological and chemical. Controlled lake levels are having a profound impact on shoreline habitats. For example, sand transport mechanisms needed to nourish sand beaches, dunes, and coastal wetlands have been disrupted. Shoreline development has impacted terrestrial and aquatic habitats. Non-indigenous invasive species are replacing native species in both terrestrial and aquatic habitats. Swallowort, for example, is threatening the native plants of limestone communities. Urban and agricultural runoff may impact tributary and harbor habitats.

Source: M. Knutson (The Nature Conservancy, Central and Western NY Chapter)

El Dorado Beach Preserve, Black Pond Wildlife Management Area.

The current status of fish and wildlife habitats that takes into account natural resource values and threats is incomplete. Efforts are now underway to assess particular habitats by a number of agencies and organizations. The U.S. Fish and Wildlife Service is continuing to update endangered species, wetland inventory, and aquatic habitat information and inventories. Regional bird conservation mapping being undertaken by Vermont University will help to characterize habitat used by songbird migrants. The Nature Conservancy is completing its second iteration of ecoregional planning that defines habitat protection and restoration needs for a number of Lake Ontario sites. The multi-partner International Alvar Initiative inventoried alvar sites and proposed direct actions to preserve habitats. The binational Marsh Monitoring Program utilizes citizen volunteers to monitor coastal wetlands and their amphibian and marsh bird populations. Local watersheds and partnerships, such as the Ontario Dunes Coalition, are conducting assessments of local natural resources and threats.

• Fish and Wildlife Habitat in the United States Lake Ontario Watershed

The following listing of completed and ongoing projects, funded in part by U.S. EPA, illustrates the scope of current protection and restoration activities and partnerships in the Lake Ontario basin and the potential for additional actions.

The Nearshore Habitat Priorities for Migratory Songbirds (Vermont University and State Agricultural College) project is identifying concentrations of songbirds in nearshore Lake Ontario and eastern Lake Erie habitats using a new remote sensing technique.

The Landscape-Level Conservation on Tug Hill project (The Nature Conservancy) is launching a community-based conservation program to protect the wetlands, rivers, streams, and working forests of the Tug Hill Plateau in New York.

The Collaborative Restoration and Education at Eastern Lake Ontario project (The Nature Conservancy, New York Sea Grant, Oswego County, Lake Ontario Dunes Coalition) is implementing a coordinated Dune Steward Program for the beaches and dunes of eastern Lake Ontario, restoring and re-vegetating damaged dunes using locally-grown native beachgrass, protecting dunes with sensitive public access, and engaging the local community through a dune/wetland education program.

The Contributing Factors in Habitat Selection by Lake Sturgeon project (Research Foundation of State University of New York) is determining the preferred prey types of St. Lawrence River juvenile and adult lake sturgeon, and examining the relationship between feeding characteristics of juvenile and adult lake sturgeon and the benthic invertebrate community.

The Identification of Lake Sturgeon Habitat in the St. Lawrence River (State University of New York College of Environmental Sciences and Forestry) project is obtaining new information about specific habitat preferences by the critical juvenile stage lake sturgeon in the St. Lawrence River near Massena, New York.

The Controlling the Spread of Swallowort project (The Nature Conservancy) is developing new techniques for controlling the non-indigenous invasive plant swallowort, which is threatening limestone communities from New York to Wisconsin.

The Restoration of Rush Oak Openings project (The Nature Conservancy) is working with state, local, and regional partners to develop and effect a joint restoration plan to unite ownerships, and to use volunteer and paid staff to implement restoration of the relict oak savannah community.

The Sand Transport in the Barrier Beach Ecosystem of Eastern Lake Ontario project (The Nature Conservancy and U.S. Army Corps of Engineers) is addressing the issue of changes in the coastal processes affecting distribution and transport of beach sands along the barrier beaches of eastern Lake Ontario.

The Conversion of Dry Basins to Created Wetlands for Mitigation of Runoff Water Quality project (Monroe County Environmental Health Laboratory) is demonstrating conversion of suburban dry retention basins into wetland detention ponds to provide treatment and thermal moderation of storm runoff, reducing hydraulic, thermal, and nutrient loading of receiving bodies while providing wetland habitat functions.

The Eastern Lake Ontario Conservation Initiative (The Nature Conservancy) identified key resources and ecosystem stresses, initiated land protection activities, developed partnerships with state, local, and citizen's groups active in the area, conducted outreach, and developed an initial conservation plan with specific protection, stewardship, and outreach programs for the Eastern Lake Ontario 29,000-acre dune/wetland/alvar system.

Detailed information about each project can be found at ***www.epa.gov/glnpo***.

• Remedial Action Plans Update

The Lakewide Management Plans for the Great Lakes focus on those environmental problems which are lakewide in nature and need a combined Canadian and U.S. effort to resolve. RAPs concentrate on identifying and addressing local environmental problems (beneficial use impairments) in 43 Areas of Concern (AOCs).

The RAP process strives to identify the pollutants causing the problems; locate the sources of the pollutants; recommend and implement remedial activities to restore the beneficial uses; and document progress towards restoration. The ultimate goal is to restore the area's beneficial uses and be able to delist the AOC.

Recognizing that there is an ecosystem linkage between the LaMPs and the RAPs, this Update provides a summary of progress on some of Lake Ontario's RAPs. You can also find information on the following websites:
www.on.ec.gc.ca/glimr/raps/intro.html or www.great-lakes.net/places/aoc/ontaoc.html.

Remedial Action Plans Update

Eighteenmile Creek (NY)

The RAP is focused on continuing the investigation and assessment of creek sediments; evaluating possible sources of PCBs and other contaminants; remediating inactive hazardous waste sites in the area; monitoring the creek; improving combined sewer overflows; and continuing surveillance activities. Implementation activities include sediment core sampling; an investigation of the hazardous waste site at Williams Street Island; and an evaluation of potential contaminant sources within the sewer system in the City of Lockport, NY. An investigative study of the plankton community is planned to establish the status of this use impairment indicator. A RAP status report is scheduled for later this year.

Rochester Embayment (NY)

Activities underway or completed that contribute to the Rochester Embayment RAP implementation include three watershed planning projects; point and non-point source pollution abatement projects; combined sewer overflow abatement; a mercury pollution prevention project; monitoring activities; and educational efforts. An Addendum to the RAP was published in 1999 to update and report on remedial measures, studies, and monitoring methods. Considerable progress has been made in establishing delisting criteria and monitoring needs to address impaired uses. A status update is planned for 2001.

Oswego River (NY)

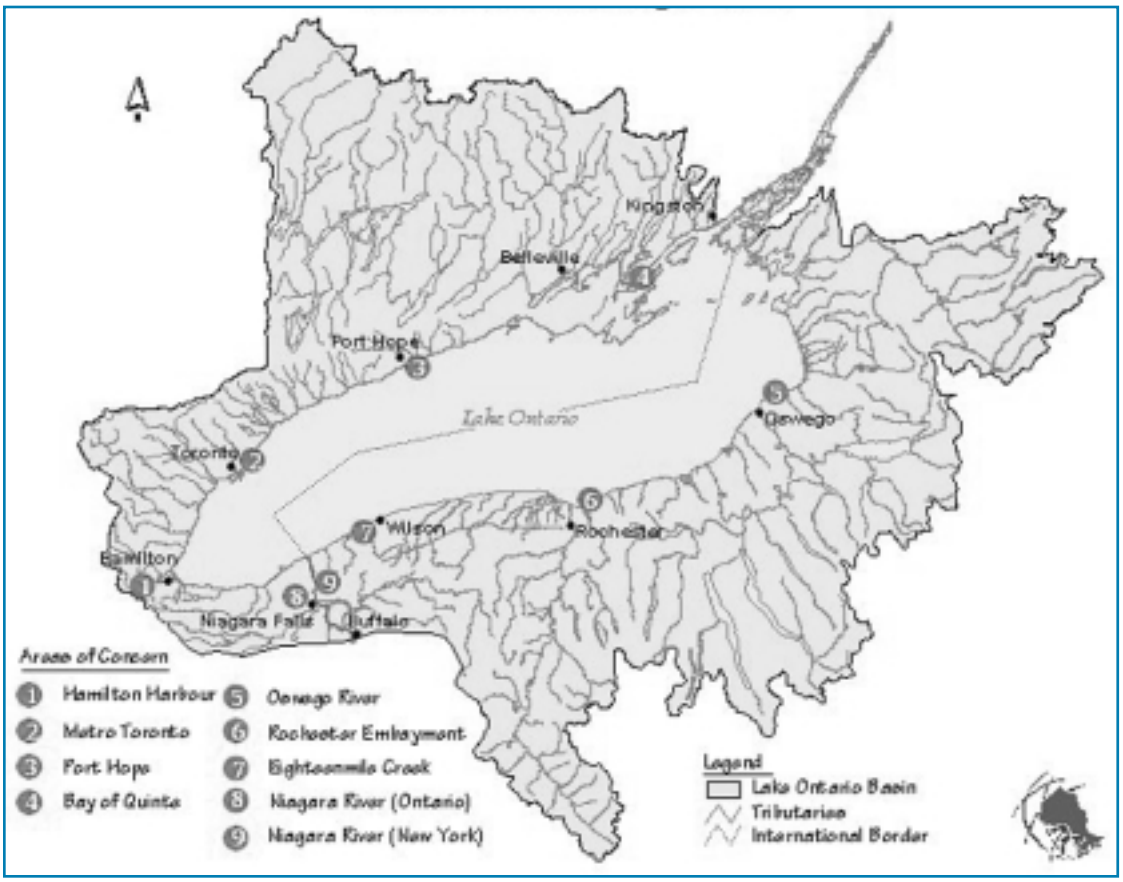
Remedial strategies continue to focus on upstream watershed activities such as federal relicensing of the Oswego River power dams and the restoration of habitat through hydrologic modification; inactive hazardous waste site remediation, including the Onondaga Lake cleanup; ongoing fish flesh studies in Lake Ontario and the Oswego River area; and conducting further investigations needed to assist in use impairment remediation. The Remedial Advisory Committee (RAC) has recently been revitalized with a new chairperson, facilitator, and sub-committee to address the use impairment indicators and enhance public involvement activities. A use impairment evaluation strategy and public involvement plan are under development by the RAC.

Hamilton Harbour (Ontario)

The City of Hamilton is developing a strategic water quality plan to upgrade the wastewater treatment plant and eliminate combined sewer overflows to the harbour. Public input is being sought on the proposal. Excellent progress is being made on improving fish and wildlife habitat. To date, approximately 340 hectares (of a target 372 hectares) of habitat has been re-established around the harbour. A major highlight this year was the official opening of the Hamilton Harbour Waterfront Trail. This 3.5 kilometre long trail, which connects the West Harbour to Cootes Paradise, incorporates shoreline naturalization and fish and wildlife habitat enhancements, while allowing greater public access to the harbour. Unfortunately, the Randle Reef contaminated sediment clean-up project has been delayed. The aim now is for a spring 2002 start-up date.

Toronto and Region (Ontario)

Over the last few years there has been heightened interest in reversing the degradation of the waterfront. Major initiatives underway include the Toronto Waterfront Revitalization Project, with a



Source: EC

Lake Ontario Drainage Basin.

major emphasis on restoring soil and water quality; the City of Toronto's Wet Weather Flow Management Master Plan, which when fully implemented should eliminate combined sewer overflows; and updating of Toronto's Official Plan and Waterfront Plan. The City has also put in place a new Sewer Use By-Law, which sets strict limits on dischargers to the sewer system and requires industries in key sectors to prepare mandatory pollution prevention plans to reduce the amount and type of pollutants discharged to sanitary and storm sewer systems. At the watershed level, strategies are being implemented in the Don, Humber and Rouge river watersheds, and are being prepared for the Etobicoke/Mimico and Highland. More than $10 million worth of restoration projects were funded last year across the RAP area through government/private partnerships, involving thousands of volunteers.

Port Hope (Ontario)

Sediment contaminated with low-level radioactive waste in the Port Hope Harbour is the primary environmental issue in the Port Hope Area of Concern. A conceptual plan to build a storage facility for this waste was approved locally in 1999. Currently, Natural Resources Canada is in negotiations with the Town of Port Hope and other government departments to determine the course of action to be taken. Clean up of the contaminated sediment would lead to the restoration of the harbour.

Bay of Quinte (Ontario)

New initiatives by the Bay of Quinte Restoration Council will build on the success of previous programs, which have resulted in the conversion of more than 30,000 hectares of farmland to conservation tillage; annual reductions of 16,500 kilograms of phosphorus from rural sources; and an over 50% reduction of phosphorus loads to the bay from sewage treatment plants. Habitat programs have secured the protection of 385 hectares of wetlands and rehabilitated an additional 256 hectares. Current and future actions include developing Natural Heritage Strategies, in partnership with the communities bordering the shores of the bay. A Fish Habitat Management Strategy is being developed as an aquatic complement for the protection of fish habitat critical to all life stages of the desired species. Ongoing research by scientists engaged in Project Quinte and other investigations provides information to determine the ecological status of the Bay of Quinte and document progress toward delisting.

Update on Public Involvement

Marlene O'Brien, EC

Since the last edition of Update, the Four Parties involved in the Lake Ontario LaMP have been busy finalizing a number of activities from the previous work plan and setting in motion plans for the next work plan.

The past year has shown progress in the development of Ecosystem Indicators – a significant component of the LaMP. A proposal for an initial group of indicators was unveiled at SOLEC 2000 in Hamilton, Ontario on October 19, 2000. Participants in a breakout session asked questions and commented on the proposed indicators.

You will find an article on the proposed Ecosystem Indicators on pages 9-11. These will also be posted shortly on the binational Lake Ontario web site, and we welcome your views. The final suite of indicators will be published in the Lake Ontario LaMP 2002 report, scheduled for release next Spring.

The formal Lakewide Advisory Network concept planned in the last workplan will be substituted with ongoing dialogue with RAPs and other partners, posting of information on the Lake Ontario LaMP web site, and mailings to interested parties.

The LaMP continues to seek out potential partnerships with groups that share the goal of restoration and protection of Lake Ontario. We have been compiling a list of groups that may be interested in opportunities for cooperation on projects of common interest, and would be interested in meeting to discuss ideas and gather input and suggestions.

To add your name to the mailing list, or for other information about the LaMP, contact:

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Burlington, Ontario L7R 4A6
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Mike Basile
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345 Third Street, Suite 530 Niagara Falls, NY 14303
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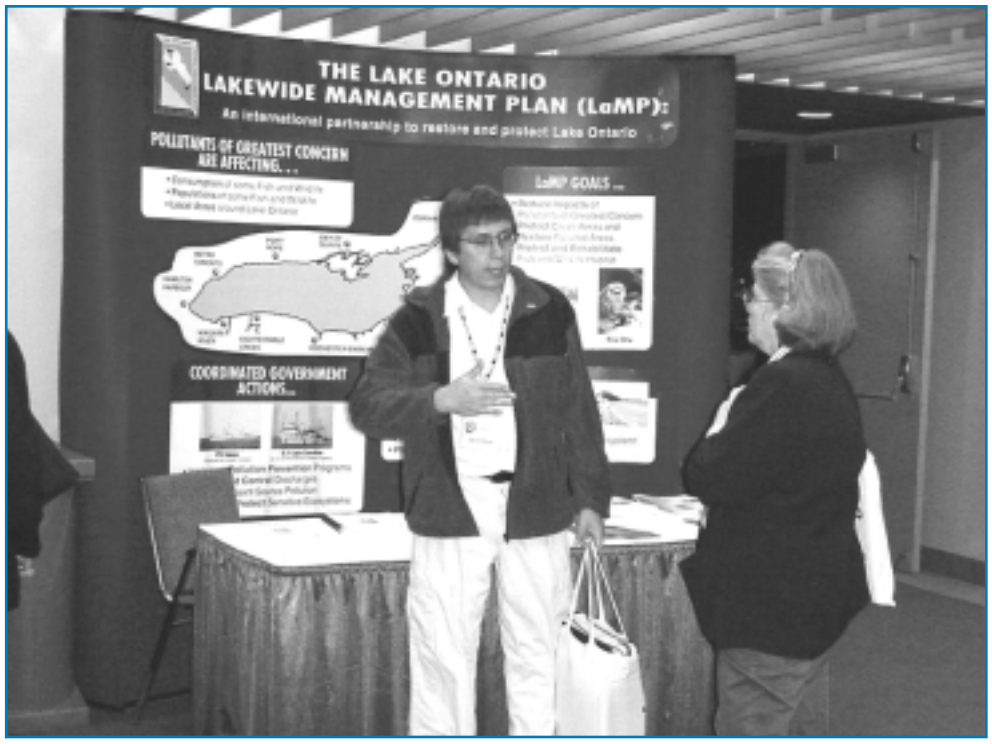
e-mail: basile.michael@epa.gov

The annual Lake Ontario LaMP/Niagara River Toxics Management Plan public meeting will be held on October 16, 2001. A notice will be mailed to those on the U.S. and Canadian mailing lists and will be posted on the Lake Ontario LaMP website at www.on.ec.ca/glimr/lakes/ontario/ or www.epa.gov/glnpo/lakeont/



Source: EC

State of the Lakes Ecosystem Conference (SOLEC) in Hamilton, Ontario, October 2000.

Lake Ontario Lakewide Management Plan Next Steps

Janette Anderson, EC

December 2000 took us to the end of the three year workplan which was published in the Lake Ontario LaMP Stage 1 document in 1998. In this Update, you will find a new LaMP Work Plan (pg.22) which has been developed to focus and structure activities for the two year period from January 2001 to December 2002. Work towards broadening LaMP activities to encompass issues that go beyond chemicals and address biological and physical stresses on the ecosystem have been added to LaMP priorities as we move forward into the next phase.

• Lake Ontario Lakewide Management Plan Next Steps

While many LaMP activities are ongoing and will be continued from the old workplan into the new, some activities are new to the workplan, such as a new monitoring project and habitat assessment actions.

Continual updating of the information base is critical to understanding the changes that are being experienced in the Lake Ontario basin. Source information is being refined, allowing more specific abatement or remedial actions to be targeted. New and better approaches to pinpoint sources and deal with them are being used in trackdown activities in the tributaries to Lake Ontario, and as this activity becomes more common, it will become more efficient.

With respect to our ecosystem objectives and proposed indicators, information gaps have been defined by conducting inventories of monitoring programs and modeling efforts and by the evaluation of data. A cooperative monitoring project is proposed for 2003, which aims to collect data needed by the LaMP for refining models, running scenarios, decision making and effectively reporting on progress.

In the area of habitat management, Canada will use its habitat assessment report and the U.S. will review its information base to identify priorities and follow up on recommendations. A binational habitat strategy for the LaMP will follow in future years.

The 2001-2002 workplan calls for the finalization and reporting of the ecosystem indicators (pages 9-11) in the LaMP 2002 report. Ongoing activities include using opportunities to meet with existing groups, forming partnerships locally to assist in LaMP projects, and providing information when requested and regularly through the LaMP web site and mailings. Annual reporting and the public meeting held each year in Niagara Falls continues, as does participation in other meetings such as SOLEC and International Joint Commission (IJC) biennial sessions.

In July 1999, the Great Lakes Binational Executive Committee (BEC), which is the group of senior government representatives to the Great Lakes Water Quality Agreement, adopted a resolution that called for the reporting on all elements of LaMPs every two years. In 2002, the Lake Ontario LaMP will present its first biennial LaMP report. It will include results of the work outlined in the load reduction strategy, details on trackdown efforts and implementation plans to reduce critical pollutant sources. A habitat strategy will be under development and routine reporting of environmental conditions through ecosystem indicators will commence. In addition, a cooperative monitoring strategy will be in the last phases of planning.

The Lake Ontario ecosystem has seen many changes since the early beginnings of the Lake Ontario Toxics Management Plan through to the transition to the LaMP. Critical pollutant levels have declined dramatically since the mid 1970s and with our continued collective efforts, we will stay on the road to recovery.

• Binational Workplan for the Lake Ontario Lakewide Management Plan

Binational Workplan for the Lake Ontario Lakewide Management Plan January 2001 - December 2002

LaMP Activities	Products **
A. Chemical. Reduce inputs of LaMP's six critical pollutants	
1. Goals, objectives and targets	
a. Establish set of ecosystem indicators and target levels for critical pollutants.	Report on proposed indicators (Update 2001). First set of indicators adopted and reported on (2002). Make progress on additional indicators as information becomes available; evaluate information to complete the assessment of beneficial use impairments.
2. Problem identification	
a. Update current total lake contaminant problem.	Updated Table 3-3 "Preliminary Estimates of Lake Ontario Critical Pollutant Loadings Information". Data for mercury to be added. U.S. Summary on sediment monitoring (Update 2001). Canadian summary of sediment mapping (Update 2001). Canadian summary of sediment quality (2002). Evaluation of sediment data for contribution to the contaminant problem; determine action plan.
b. Cooperative monitoring	Workplan for cooperative monitoring project to be developed by 2002. Project proposed for implementation in 2003.
3. Source identification	
a. Inventories	Binational Sources and Loadings Strategy, to include updating of tables, maps, identification of air and water sources and prioritized listings of sources. U.S.: Sources and Loadings Report by Watershed Canada: Report on priority watersheds to include status information; remedial measures; monitoring; recommendations for further action.
b. Source trackdown	Binational summary report on trackdown of contaminants from sources. U.S. Summary of preliminary reports of trackdown at Rochester Van Lare, Lockport, Carthage, Kelsey Creek and Wine Creek. Canadian Summary of PCB trackdown at 12 Mile Creek, Lower Trent River and Etobicoke Creek.
4. Reduction strategies	
a. Regulatory and voluntary actions	Draft Binational Sources and Loadings Strategy (Update 2001). Binational Sources and Loadings Strategy document
b. Mass balance model	Second cut of mass balance model (LOTOX2) to describe critical pollutants entering and leaving the lake. The 4 parties will: - develop scenarios to assess management options - develop a technical workplan for evaluating the model - plan for binational management oversight - plan for independent peer review Binational evaluation of applying the model for PCB load reduction activities.
B. Physical/biological	
1. Goals, objectives and targets	
a. Establish set of ecosystem indicators and targets for physical and biological objectives (e.g. mink, otter and other populations)	Binational proposed indicators in LaMP Update 2001. First set of indicators to be adopted and reported on (2002). Make progress on additional indicators as information becomes available.

2. Problem identification	
a. Habitat assessment	Summary report of Canadian habitat assessment. U.S. draft habitat strategy to be developed. Establish value added linkages to International Joint Commission's water level study
C. Public outreach, consultation, reporting and communicating	
1. Ecosystem indicators consultation	Posting on web site with request/submission form feedback. Meet with interested groups. Publish proposed indicators in Update 2001. Publish adopted indicators in LaMP 2002.
2. Promote partnerships	Establish contact with groups working on issues with goals similar to those of the LaMP, with a view to cooperating on projects and consulting on agency activities.
3. Maintain information connection	Review existing material, e.g. fact sheets; display unit. Update and develop new materials as appropriate. Update and maintain Lake Ontario LaMP web site. Mailings as appropriate to Lake Ontario mailing list to provide information or seek input. Review mailing list and add appropriate organizations as needed.
4. Binational Lake Ontario Meetings	Convene binational meetings as necessary to meet specific objectives.
5. Annual reports	LaMP Update 2001. LaMP Update to be produced, released and posted on the web site. LaMP 2002. LaMP report will be produced, released and posted on the web site.
6. Annual meeting	Annual Joint Lake Ontario/Niagara River Toxics Management Plan (NRTMP) public meeting.
7. SOLEC/IJC meetings	Participate in SOLEC and/or IJC meetings as required.

** Date of deliverable product is 2002, unless otherwise indicated.

• Binational Workplan for the Lake Ontario Lakewide Management Plan

Should you wish to receive further information on the Lake Ontario LaMP, (Binational Workplan, Next Steps, and Public Involvement) please contact one of the following:

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