# INTERNATIONAL JOINT COMMISSION

# Hamilton Harbour

## AREA OF CONCERN STATUS ASSESSMENT

**December 1999**

*Submitted to the Governments of the United States and Canada*

Report on the ongoing remedial and preventive efforts by responsible governments and organizations relative to restoring the Hamilton Harbour

International Joint Commission

Canada and United States

# Hamilton Harbour Area of Concern

The **International Joint Commission (IJC)** was established by the 1909 Boundary Waters Treaty of the United States and Canada. The treaty recognizes that each country is affected by the other's actions in the lake and river systems along their common border. Its primary purpose is to prevent and resolve disputes concerning these shared waters. In 1972, the governments of the United States and Canada signed the **Great Lakes Water Quality Agreement**. In 1978, the governments signed a new Agreement which included additional commitments to rid the Great Lakes of persistent toxic substances. Its purpose is to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes basin ecosystem. The IJC was given the responsibility to assess and evaluate the governments' programs and progress under the 1972 Agreement and assist in its implementation. In 1987, the governments signed a Protocol that included a commitment to report on progress and calling on the IJC to review Remedial Action Plans being developed and implemented for the 42 identified Areas of Concern in the Great Lakes basin. The IJC has initiated a process for examining progress in specific Areas of Concern and open lake waters, called the Status Assessment process. The Hamilton Harbour Area of Concern is the third such assessment.

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# Introduction

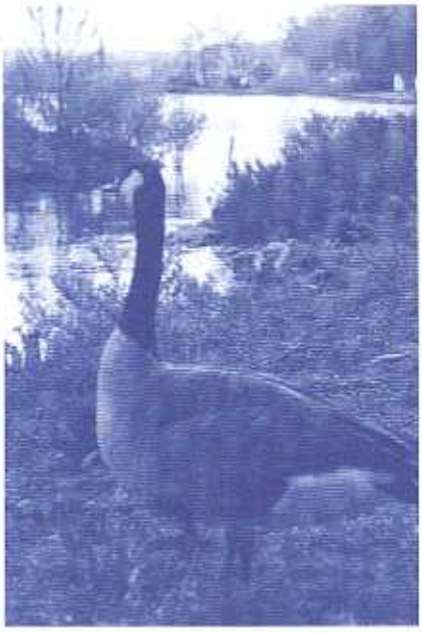
## Remedial Action Plans and Areas of Concern

The goal of **Remedial Action Plans** (RAPs) is to restore and protect beneficial uses in 42 identified **Areas of Concern** (AOCs) within the Great Lakes basin. AOCs are geographic areas where human activities have caused or are likely to cause impairment of beneficial uses or the area's ability to support aquatic life. The United States and Canada (the Parties), in cooperation with state and provincial governments, agreed to develop and implement RAPs in a 1987 protocol to the Agreement. Each RAP is to embody a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses and serve as an important step toward virtual elimination of persistent toxic substances. Further, the Parties, in cooperation with state and provincial governments are to ensure that the public is consulted in all actions undertaken pursuant to Annex 2 of the Agreement.

The IJC is to review and comment on RAPs during three stages of development: when the definition of the problem has been completed; when remedial and regulatory measures are selected; and when monitoring indicates that impaired beneficial uses have been restored. In 1996, after more than ten years of reviewing and assisting in development of RAPs, and expressing concern with overall progress in development and implementation of cleanup and prevention strategies in some AOCs, the IJC adopted a new initiative to examine progress toward restoration of beneficial uses by initiating status assessments in individual AOCs in an attempt to enhance the restoration process.

## The Status Assessment Process

Status assessments are intended to: examine progress toward restoration and protection of beneficial uses, assess program implementation relative to remedial and preventive actions; and identify and make recommendations on specific activities that could be taken to overcome obstacles and make measurable progress in restoring uses in the area. These status assessments are not comprehensive environmental audits, but assessments of ongoing efforts and activities of the responsible governments and organizations. Objectives of the status assessment process include collecting information on and transferring successful methods and experiences among different AOCs, and facilitating constructive interaction among various agencies and organizations that may have limited opportunity to exchange ideas.



## For More Information

**For more information regarding IJC, you may contact IJC public information services at:**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Information can also be obtained from the IJC web page at **www.ijc.org** or through e-mail to commission@windsor.ijc.org

# Hamilton Harbour Area of Concern

## Setting and Sources of Contamination

Hamilton Harbour, an 2,150 hectare (5,313 acres) embayment, is connected to Lake Ontario by a single ship canal. Its watershed is comprised of 49,400 (122,495 acres) hectares. Approximately, 500,000 persons reside in the watershed. Hamilton and Burlington are the two largest communities in the watershed. Water systems obtain drinking water supplies from Lake Ontario and discharge treated sewage to the Harbour. Two steel producers, Stelco and Dofasco, occupy about 30% of the Harbour's waterfront. Other major dischargers include waste water treatment plants (WWTPs) and the City of Hamilton's combined sewer overflows (CSOs). Contaminants of concern include polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), cyanide, phenols, copper, nickel, zinc, cadmium, lead, iron, manganese, mercury, arsenic, ammonia, phosphorus, benzene, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans. Of these compounds, Environment Canada and the Ontario Ministry of Environment have detailed that the RAP lists PCBs, PAHs, copper, nickel, zinc, cadmium, lead, iron, manganese, mercury, arsenic, ammonia and phosphorus as being of concern to the community (Governments of Canada and Ontario 1999). Subsequently, Environment Canada and the Ontario Ministry of Environment notified the IJC that an earlier document which showed no local sources of dioxin[1] has been updated to confirm local sources as discussed below (Governments of Canada and Ontario 1999).

Air emissions of persistent toxic substances are a concern in the AOC. Dofasco and Stelco are sources of benzene air emissions. Stelco's iron sintering plant is a principal source of dioxin air emissions within the AOC. Stelco has provided to Environment Canada and the Ontario Ministry of Environment information showing annual stack emissions, based on stack testing conducted on behalf of Stelco, estimated at 5.7 grams dioxin. An earlier approximation of annual releases for this source was developed [using test results from an iron sintering plant formerly operated at Wawa, Ontario] by Environment Canada and the Federal/Provincial Task Force on Dioxin and Furans. That approximation was 23.5 grams dioxin (Environment Canada 1999a). It is noted by Environment Canada that no representatives of Environment Canada or the Ontario Ministry of Environment were present at the stack test conducted on behalf of Stelco. If the stack test results are found to be acceptable by Environment Canada and the Ontario Ministry of Environment, the Stelco provided estimate rather than the approximation of 23.5 grams dioxin will be incorporated into the existing inventory of releases (Environment Canada 1999b). Other suspected sources of dioxin in the Hamilton-Wentworth Region include two electric arc furnaces and the Region's Solid Waste Reduction Unit. The governments of Canada and Ontario (1998) have also noted "The steel manufacturing industry is a likely source for mercury emissions."

The Stage 2 RAP, submitted to governments for approval in 1992 and to the IJC for review for review and comment in1996, documented contamination of bottom sediment as a principal concern. The document states "The contamination present is largely the result of past industrial discharges." The Stage 2 further states "Major assessments are required before advice on remedial action for *in situ* sediments can be given." Information presented in the Stage 2 RAP documents concerns in regard to PCBs, metals and PAHs.

Due to local sources such as air emissions, other exposure routes besides fish consumption exist for persistent toxic substances such as dioxin and benzene. Children often have greater chance for exposure, greater

1 For the purposes of this document, the term "dioxin" will be used to refer to all polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans as measured in terms of 2,3,7,8-tetrachlorodibenzo-p-dioxin toxicity.

potential for health problems, and less ability to avoid the hazards presented by persistent toxic substances (Amler 1998). The IJC has been informed of plans to utilize Stelco's iron sintering plant for disposal of treated contaminated sediment from Randle Reef (Governments of Canada and Ontario 1999). The current level of dioxin air emissions from this plant and other sources is significant and a concern exists regarding any potential increases of dioxin air emissions. Due to the potential increase in the air emissions of dioxin, concerns exist regarding the scope of public consultation and consideration of environmental implications including possible dioxin deposition onto Lake Ontario.

### Hamilton Harbour Area of Concern History

Water quality problems related to raw sewage were noted in Hamilton Harbour as long ago as the 1850s (Ontario Ministry of Environment and Environment Canada 1992). More recently, other problems, such as the presence of persistent toxic substances, have been identified in Hamilton Harbour and in other areas of the Great Lakes basin.

Stage 1 (problem identification) and Stage 2 (selection of remedial measures) RAPs are available for the Hamilton Harbour Area of Concern. Table 1, pursuant to Annex 2 of the Great Lakes Water Quality Agreement (Agreement), presents the 14 possible beneficial use impairments, their significance, sources of problems, and information deficiencies. Identified sources of pollution are: contaminated sediment; point source discharges from municipal and industrial sources including combined sewer overflows; and non point sources of pollution from such sources as urban and agricultural runoff. Environmental issues of concern include: oxygen depletion; fish consumption advisories; changes in fish community structure; loss of fish and wildlife habitat; and adverse impacts of exotic species on fish and wildlife habitat.

### Human Health Considerations

Human health is addressed in the Stage 2 RAP under secondary principles. The document states "Contaminated areas of water are associated with potential human health risks." Since the Stage 2 document was completed in November 1992, a considerable amount of information has become available in regard to human health concerns related to exposure to persistent toxic substances.

Potential human health concerns include: exposure to persistent toxic substances from local emissions; consumption of environmentally contaminated fish; and exposure to bacteria and other contaminants through swimming. Concern exists in regard to the consumption of environmentally contaminated fish from the AOC. In particular, concern exists for populations which have a higher risk of short-term and long-term adverse health effects from exposure to contaminants in fish, i.e., sport anglers, urban poor and fetuses and nursing infants of mothers who consume contaminated fish.

In the Hamilton Harbour AOC, fish consumption advisories are in place because levels of PCBs, mercury and mirex are too high in fish tissue (Remedial Action Planning Office 1998). Cole and others (Cole *et al.* 1997) surveyed persons fishing at Hamilton Harbour AOC and found nineteen percent of fishers consumed their catch. At the Hamilton Harbour AOC, forty-five percent of these fish eaters consumed 26 or meals of Great Lakes fish during a one-year period. Persons eating fish at or above this level were considered high consumers. Of five AOCs sampled by these same researchers, the highest percentage of fish eaters, judged as high consumers, was found at Hamilton Harbour. The researchers concluded that alternative communication strategies are likely needed to reach these fishers. Relevant health research concerning the consumption of environmentally contaminated fish has been conducted elsewhere in the Great Lakes Basin. Neurobehavioral effects from consuming environmentally contaminated fish have been documented (Johnson *et al.* 1997, Lonky *et al.* 1996, Jacobson *et al.* 1984). Transgenerational effects in rats due to the maternal consumption of environmentally contaminated Lake Ontario coho salmon have been documented (Daly *et al.* 1998).

# Table 1. Considerations regarding the significance of beneficial use impairments, sources of problems and information deficiencies.

| Use Impairment | Incidence | Sources of Problems | Information Deficiencies as Identified in the Stage 2 RAP |
|---|---|---|---|
| **Restrictions on fish and wildlife consumption** | Consumption advisories (mercury, PCBs, and mirex) exist for 5 species mostly due to lakewide conditions, elevated PCB levels in wildlife | Contaminated sediment, sewage treatment plants, non-point sources including atmospheric deposition | Lack of evidence linking specific sources to levels of contaminants in fish<br><br>PCB and mercury distribution and linkages to local regional sources should be examined more precisely |
| **Tainting of fish and wildlife flavour** | Tainting has not been observed | Not applicable | No formal study of tainting of fish and wildlife has been undertaken |
| **Degraded fish and wildlife populations** | Current fish community indicates a highly degraded eutrophic system | Algal blooms, contaminated sediment, shoreline filling, exotic species | Information is needed in regard to storm event loading of suspended solids<br><br>Information is needed regarding fish and wildlife habitat requirements |
| **Fish tumours or other deformities** | Liver and skin neoplasms and epidermal papillomas have been reported | Contaminated sediment from steel mills operations and other industry combustion, urban runoff, and sewer systems | Additional evidence is required on cause of tumours |
| **Bird or animal deformities or reproductive problems** | To date, control sites for bird and animal populations have not been selected | Contaminated sediment in Hamilton Harbour and contaminants in Lake Ontario | Acceptable control populations need to be established<br><br>Concentrations of contaminants in snapping turtles are poorly understood |
| **Degradation of benthos** | Benthic community is characteristic of a highly eutrophic urban/industrial environment | Sewage treatment plant effluent deposits of organic material in sediment | information is needed regarding storm loadings of sediment, sediment phosphorus reflux, timing of natural capping of contaminants by cleaner sediment, and redistribution of sediment by ship traffic. |

| Use Impairment | Incidence | Sources of Problems | Information Deficiencies as Identified in the Stage 2 RAP |
|---|---|---|---|
| **Restrictions on dredging activities** | Sediment exceeds acceptable limits for open water disposal | Sewage treatment plants, industry, urban and rural runoff, combined sewer overflows | Information regarding the quality of current deposition and suitable source control limits is required |
| **Eutrophication or undesirable algae** | Ammonia and phosphorus concentrations are excessive | Combined sewer overflows, sewerage treatment plants, steel industry, agricultural and urban runoff | Additional information in regard to the non-point source contribution is needed |
| **Restrictions on drinking water consumption or taste or odor problems** | The harbour is not utilized as a drinking water supply | None | Not applicable |
| **Beach closings** | Swimming has been prohibited due to bacteria levels<br><br>Implementation of remedial actions may provide an opportunity to reconsider the ban | Raw sewage from combined sewer overflows and sewage treatment plants | Detailed bacterial data are needed |
| **Degradation of aesthetics** | Oil sheens, objectionable turbidity, floating scum, and debris have been observed | Industrial, highway, and shipping spills, runoff events, sewage treatment plants and combined sewer overflows | None |
| **Added costs to agriculture or industry** | No added costs | Sewage treatment plants, combined sewer overflows, and storm runoff have potential to contribute objectionable material | None |
| **Degradation phytoplankton and zooplankton populations** | Abundance is high, reflecting eutrophication | Municipal and industrial sources including sewage treatment plants and combined sewer overflows | Toxicity of harbour water to phytoplankton and zooplankton should be assessed |
| **Loss of fish and wildlife habitat** | Low dissolved oxygen, loss of submerged aquatic vegetation, loss of marsh and development impacts are problems | Filling from development, algal blooms, high lake levels, and resuspension of sediment | Impact of shoreline development needs to be assessed. |

## Current Status Assessment

This current status assessment of the Hamilton Harbour RAP was conducted between May 1997 and April 1998 and included consultation between IJC Commissioners and citizens; representatives of government agencies, local industries, municipalities, and the Bay Area Restoration Council (BARC). In addition to this public consultation, the IJC's Science Advisory Board conducted a public meeting concerning issues of scientific relevance to the development and implementation of the RAP.

An examination was conducted in the following areas: funding, institutional structure, roles of the Parties, jurisdictions and other sectors, and public consultation. This evaluation examines activities within the AOC that foster restoration of beneficial uses and is not confined to activities conducted as part of the RAP.

# Findings:

## The IJC's Status Assessment confirmed successes and obstacles in the restoration process for the Hamilton Harbour AOC. Examples of both are detailed in the following text in order to document and promote successful activities and help overcome the obstacles.

*Sorting of fish and removal of carp at Cootes Paradise Carp Barrier*

# Notable Successes

**Advances toward restoration of the Hamilton Harbour AOC were recognized during the Status Assessment. Notable successes are detailed below:**

- The Regional Municipality of Hamilton-Wentworth has completed, at a cost of $48 million, five combined sewer overflow (CSO) tanks designed to control the release of untreated waste. These projects, the first of 14 or so proposed tanks/tunnels, have resulted in noticeable reductions of the release of untreated sewage, on the order of 45% reduction from CSO's Region-wide. In some locations, CSO volumes have been reduced by 90%. These improvements have reduced bacterial and phosphorus loadings to Hamilton Harbour.

- Implementation of the Municipal-Industrial Strategy for Abatement has contributed to improvements of effluent quality.

- The Bay Area Restoration Council (BARC) has provided an extraordinary level of input in support of remedial action plan implementation. The BARC has made a concerted effort to raise funds locally, but with limited results.

- Local elected officials have provided a considerable level of attention and effort to remedial action plan activities.

- Previous Federal staffing and expenditure levels appear to have benefitted the restoration efforts.

- To date, restoration of habitat conditions within Cootes Paradise appears to have been very successful with re-establishment of submergent vegetation in 1997.

- Environment Canada and the Ontario Ministry of Environment in cooperation with Stelco are taking steps toward addressing the more polluted sediment in the Randle Reef area of Hamilton Harbour.

- BARC's annual publication of "Toward Safe Harbours" and the 1998 Status Report by the Remedial Action Planning Office have provided a realistic estimation of progress toward remediation and recommendations for further activities.

*Credit: Hamilton Harbour RAP*

*Tony Wagner, Canadian Co-chair of the IJC's Great Lakes Science Advisory Board, viewing Hamilton Harbour*

# Notable Obstacles to Success and the IJC Recommendations

**Obstacles to a timely restoration of beneficial uses in the Hamilton Harbour AOC were noted during the Status Assessment process. Presented below are key obstacles and the IJC recommendations.**

## Expected Reductions in the Availability of Funding for Remediation and Yet-to-be Quantified Needs

The IJC is concerned regarding the current and expected levels of federal and provincial funding for remedial activities especially in regard to treatment of contaminated sediment and control of combined sewer overflows. Future funding needs may represent a formidable obstacle to the timely and comprehensive restoration of the AOC. Estimates of treatment costs for harbour sediment range from $60 million [1998 Status Report] to $1 billion [Stage 2 RAP]. Environment Canada, in Annex A of the Stage 2 RAP (Governments of Canada and Ontario 1995), notes that it is "undertaking discussions with other stakeholders in order to gain their support and participation in the actual clean up of the most severely contaminated sediment in Hamilton Harbour, in keeping with the polluter pay principle."

Development of a plan to deal with a portion of the Randle Reef contaminated sediment is understood to be near completion and the highest, medium and lowest priority zones for sediment remediation were outlined in the Stage 2 Update. Regarding Randle Reef, Environment Canada and the Ontario Ministry of Environment (Governments of Canada and Ontario 1999) confirmed "The current preferred option is controlled precision dredging, conditioning of the sediment, and use of the Stelco sintering plant for disposal." Regarding possible sediment remediation beyond Randle Reef, a need exists to develop a comprehensive plan which includes volume of material to be treated or removed and benefits [including benefits foregone regarding the no remediation alternative] and costs of the various alternatives. Beyond remediation of Randle Reef, the failure to forecast necessary funding and the lack of clear funding commitments by government, or an alternative funding strategy make the source(s) of any future funding for contaminated sediment remediation unclear. Environment Canada and the Ontario Ministry of Environment (Governments of Canada and Ontario 1999) have informed the IJC that "Until the highly contaminated areas have been addressed, and the results of this action have been monitored, and the whole-harbour situation reassessed in light of this, it would be premature to make further decisions."

**Recommendation:** **The IJC recommends that the Ontario Ministry of Environment and Environment Canada explicitly recognize that anticipation of future funding needs is an important planning element to be developed for contaminated sediment in Hamilton Harbour AOC, and develop, in coordination with Bay Area Implemention Team and BARC, a list of possible future actions and cost estimates for these various actions. Preliminary cost estimates, that for actions other than contaminated sediment in the main harbour, were published in Table 9 of the Stage 2 RAP are an excellent example of the type of product that is necessary.**

*Credit: Hamilton Harbour RAP*

## Ensuring Optimal Public Consultation and Public Outreach

BARC activities toward public involvement in the RAP have been exemplary. The involvement of local governments serves as a model for other AOCs in the Great Lakes Basin. However, negotiations between Environment Canada, the Ontario Ministry of Environment and Stelco regarding remediation of contaminated sediment have taken place with very limited information provided to the public due to the "sensitive" nature of the negotiations. Nevertheless, the planning process should ensure that adequate early public consultation is achieved on this aspect of remedial action. In particular, the public should be consulted regarding consideration of use of Stelco's iron sintering plant for disposal of contaminated sediment from Randle Reef. The recent release of dioxin and benzene emissions estimates for facilities in the AOC, possible increases in dioxin emissions, and ongoing citizen concerns regarding wastewater treatment plant operation in the AOC have served to make some citizens and the media in the Hamilton Harbour AOC more alert to these environmental issues. These type of concerns, in the future, may place agreements between government and industry under closer scrutiny.

**Recommendation:** **Action should be taken to ensure that as information regarding environmental conditions including pollutant releases and recommended remedial actions becomes available, it is shared with BARC and the general public in a manner such that early feedback is encouraged and adequate consultation is achieved.**

## Uncertain Future Funding for the Bay Area Restoration Council

BARC's major functions were supported mostly by funding from the Ontario Ministry of Environment and Environment Canada from 1991 to 1996. In 1996, the Ministry of Environment terminated its financial support for BARC. The schedule for this termination was never laid out and its withdrawal was abrupt (BARC 1997). Although Environment Canada made up the shortfall for one year, these crash transitions are an obstacle to AOC restoration as previously noted (IJC 1998). The Provincial funding cutback has resulted in an increased need for local fund-raising by the BARC. While BARC may be better situated to deal with this type of funding cutoff than similar organizations in other areas, local fund-raising efforts have been met with limited success. The timing of the funding cutoff is problematic since it occurs at a time when BARC's need to communicate with the general public is considerable. Increased communication and more ambitious fund-raising efforts may be necessary in the future. BARC's need for greater focus on fund-raising detracts from its ability to undertake outreach efforts during important implementation activities.

**Recommendation:** **The IJC recommends that funding cutoffs to organizations such as BARC be avoided due to the high ratio of volunteer effort to agency funding and the advantage in supporting this type of activity. In any event, adequate notice and consultation should occur prior to adverse actions of this nature in order to minimize discontinuity of effort.**

# Concluding Remarks

The Hamilton Harbour AOC has benefitted from a substantial level of financial support from federal, provincial and local governments. Because of the magnitude of the environmental problem, substantial work remains to be accomplished. Attention is required to ensure citizens are adequately consulted. Information necessary to make informed decisions should be developed and made widely available in the AOC. Care should be taken to ensure remedial actions are properly phased so that unnecessary environmental risks including those to human health do not occur. Major concerns include the control of pollution from combined sewer overflows and the Woodward Avenue Wastewater Treatment Plant, despite the considerable leadership, to date, of the Regional Municipality of Hamilton-Wentworth in setting and working toward the long-term goals of controlling these sources of pollution and achieving remediation of contaminated sediment in the Harbour.

The funding available for remediation has become more limited and decisions in regard to contaminated sediment in the main harbour remain to be made. Remediation alternatives should be clearly quantified and public consultation including explanation of human health benefits (or benefits foregone in the case of no remedial activity) that can be derived from sediment clean-up should be undertaken to ensure public understanding and support for the necessary actions. To date, it appears that the human health impacts from this reservoir and source of persistent toxic substances may be underestimated.

# References


Amler, R.W. 1998. Closing Presentation at Children at Risk: Environmental Health Issues in the Great Lakes Region. Abstract in Children at Risk. July 8-9, 1998. Chicago, IL.

Bay Area Restoration Council. 1997. Bringing Back the Bay. No. 19. Hamilton, Ontario.

Cole, D.C., J. Dawson, J. Sheeshka, J.L. Keating, S. Owens and D. Kraft. 1997. Quantitative Results of An Assessment of Fish and Wildlife Consumption in Ontario Areas of Concern 1995-1996 Data. Abstract in Health Conference '97-Great Lakes/St. Lawrence. May 12-15, 1997. Montreal.

Daly, H.B., P.W. Steward, L. Lunkenheimer, and D. Sargent. 1998. Maternal Consumption of Lake Ontario Salmon in Rats Produces Behavioral Changes in the Offspring. Toxicology and Industrial Health. 14(½): 25-39.

Environment Canada and the Federal/Provincial Task Force on Dioxins and Furans. 1999a. Dioxins and Furans and Hexachlorobenzene Inventory of Releases.

Environment Canada. 1999b. May 14, 1999 letter to Thomas P. Behlen, Director, Great Lakes Regional Office.

Governments of Canada and Ontario. 1995. Hamilton Harbour RAP Stage 2: Annex A, Formal Implementation Commitments. Toronto, Ontario. 40pp.

Governments of Canada and Ontario. 1998. Incremental Progress in Restoring Beneficial Uses at the Canadian Areas of Concern: Program Overview and Site Specific Analyses. Toronto, Ontario. 65pp.

Governments of Canada and Ontario. 1999. February 10, 1999 letter to Thomas P. Behlen, Director, Great Lakes Regional Office. 4pp.

International Joint Commission. 1998. Beacons of Light: Successful Strategies Toward Restoration in Areas of Concern. Windsor, Ontario. 25pp.

Jacobson, J.L., S.W. Jacobson, G.G. Fein, P.M. Schwartz, and J.K. Dowler. 1984. Prenatal exposure to an environmental toxin: A test of the multiple effects model. Developmental Psychology. 20:523-532.

Johnson, B.L., H.E. Hicks, D.E. Jones, W. Cibulas, and C.T. DeRosa. 1997. U.S. Department of Health and Human Services, Public Health Implications of Persistent Toxic Substances in the Great Lakes and St. Lawrence Basins. Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia.

Lonky, E., J. Reihman, T. Darvill, J. Mather, Sr. and H.B. Daly. 1996. Neonatal behavioral assessment scale performance in humans influenced by maternal consumption of environmentally contaminated Lake Ontario fish. Journal of Great Lakes Research. 22:198-212.

Ontario Ministry of Environment and Environment Canada. 1992. Remedial Action Plan for Hamilton Harbour: RAP Stage 2. Hamilton, Ontario.

Remedial Action Planning Office for Hamilton Harbour Area of Concern. 1998. Remedial Action Plan for Hamilton Harbour-1998 Status Report. Burlington, Ontario.

# Schedule of Consultations

*May 22, 1997*

Bay Area Restoration Council, IJC Commissioner and IJC staff members

*May 27-28, 1997*

Environment Canada, Ontario Ministry of Environment, Bay Area Restoration Council, interested citizens, International Joint Commission's Science Advisory Board, and IJC staff members

*August 26, 1997*

Stelco representatives, Chairman of the Canadian Section of the IJC, IJC Commissioner, and IJC staff members

*August 26, 1997*

Dofasco Steel Corporation representatives, Chairman of the Canadian Section of the IJC, IJC Commissioner, IJC staff members

*January 20, 1998*

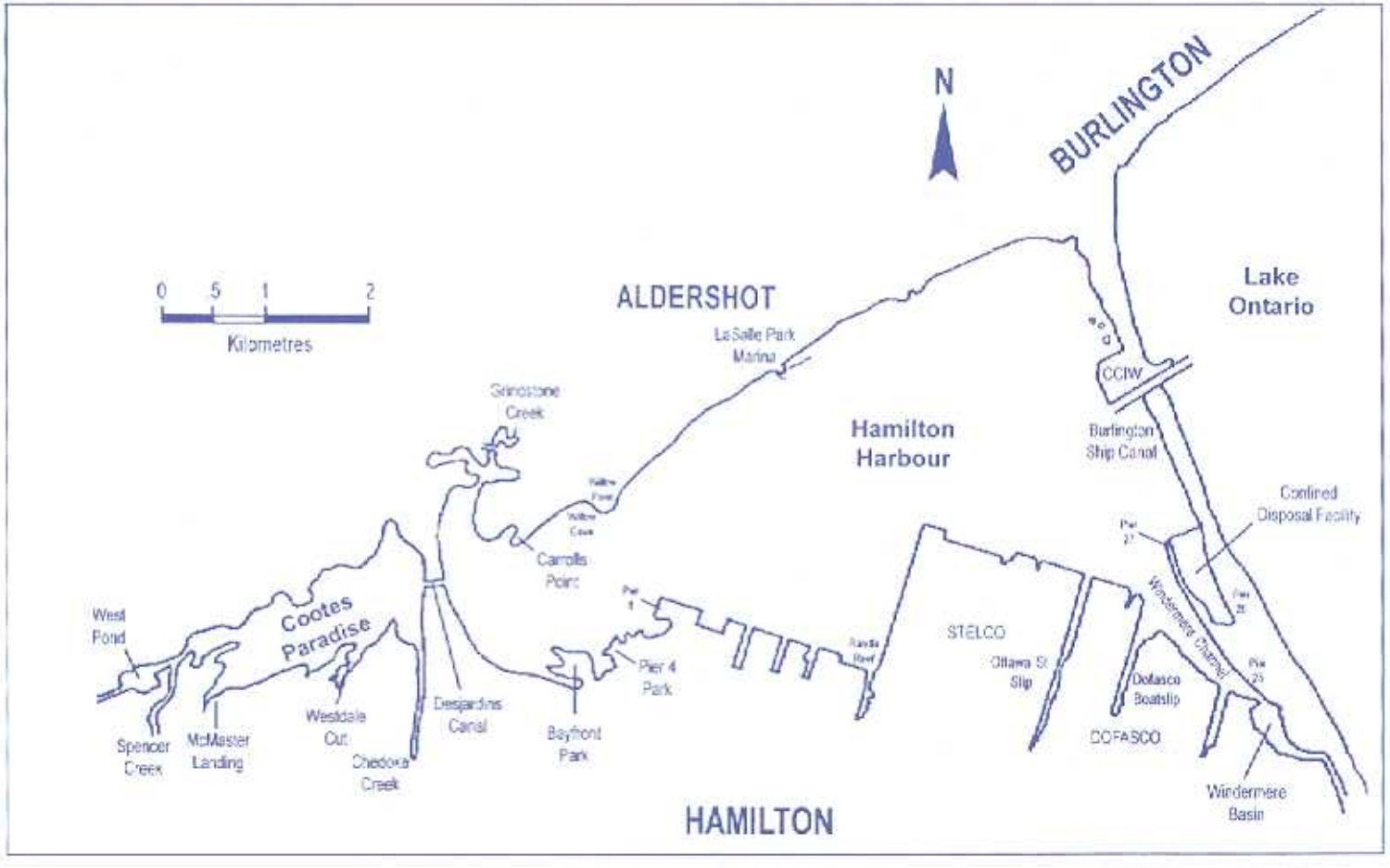
City of Burlington, City of Hamilton, and Town of Oakville representatives, IJC Commissioner, and IJC staff members

*April 30, 1998*

Representatives of: Environment Canada, Ontario Ministry of Environment, Ontario Ministry of Natural Resources, IJC Commissioner, and IJC staff members

*Habitat improvements near the Canadian Centre for Inland Waters. Credit: Hamilton Harbour RAP*

# Hamilton Harbour Area of Concern




*Credit: Hamilton Harbour RAP*