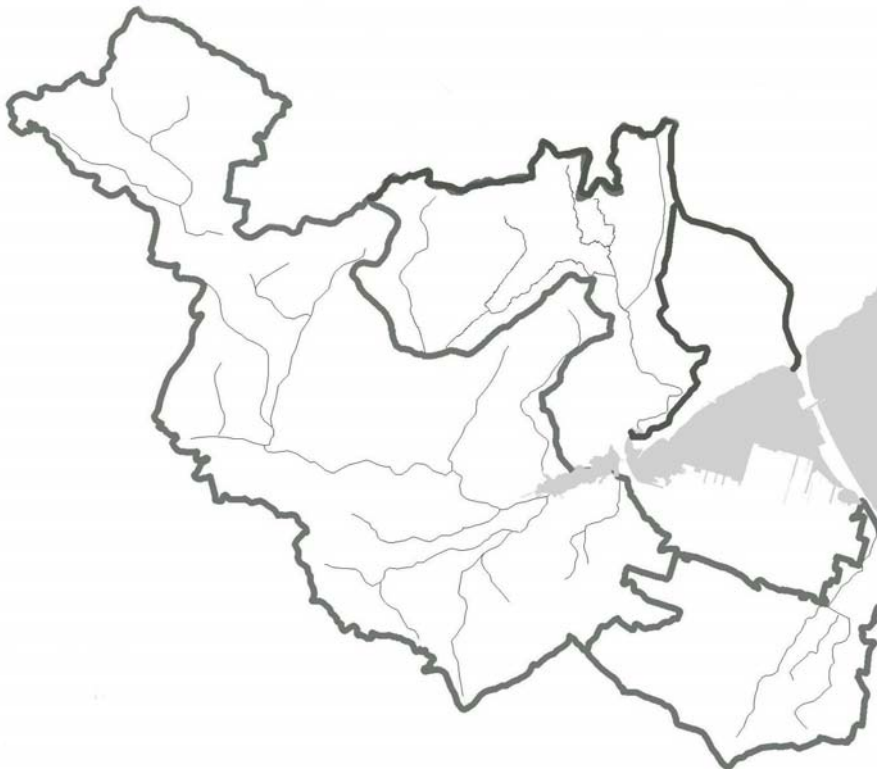


Stage 2 Update 2002



**Remedial Action Plan for
Hamilton Harbour**



Remedial Action Plan for Hamilton Harbour



Remedial Action Plan for Hamilton Harbour: Stage 2 Update 2002

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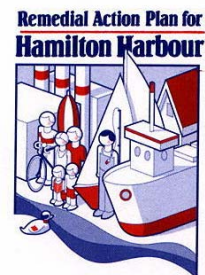
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Letter of Transmittal

June 2003

On behalf of the Hamilton Harbour Remedial Action Plan Stakeholders and the Remedial Action Plan Office we are pleased to present the 2002 Remedial Action Plan Stage 2 Update.

This Update is based on the 1992 Stage 2 Report and incorporates the considerable changes in and improvements to the Harbour that have occurred in the past ten years. It is intended to complement the 1992 Stage 2 Report and is still substantially grounded in the findings of the 1989 Stage 1 Report, Environmental Conditions and Problem Definitions. It retains the two all-important primary principles of an ecosystem approach and the elimination of persistent toxic chemicals; it has also added the additional principle of sustainable communities within the watershed.

This Update was begun in 1998 by assembling the original, and some new, Hamilton Harbour Stakeholders under the name of the Stakeholder Forum and with a mandate to endorse, modify or add to the recommendations of the 1992 Stage 2 Report. The review was carried out by a series of six Task Groups each consisting of scientists and stakeholders; each Task Group reported to the full Forum which then accepted or modified the report. When all were completed, the RAP Office combined them to create the new Update. The result is a document that presents an updated picture of the Harbour and contains recommendations that set out clearly who is responsible for implementing them and the long and short term timelines for their completion.

Throughout the Update process we have been pleased and impressed by the enthusiasm of all those involved. When the Draft Update was circulated for public consultation we found a wealth of support for both the ongoing work of improving the Harbour as well as the Update itself. We would like to acknowledge the enormous amount of work, which has been done in the past ten years by agencies and citizens that has led to the improvements we see today. We have great hopes that with the continuing support of all Stakeholders and citizens we shall achieve our goal of delisting by the International Joint Commission (IJC) in 2015.

Anne Redish
RAP Forum Chairperson

John D. Hall, MCIP, RPP
RAP Coordinator

Specific Acknowledgements

Hamilton Harbour RAP Forum Task Group Chairs: Brenda Axon, Victor Cairns,
Murray Charlton, John Gartner, Brian McCarry, Keith Rodgers, Jo-Anne Rzadki

RAP Researcher and Stage 2 Report Writer: Kristin O'Connor

PREFACE

In 1992, a Remedial Action Plan (RAP) was prepared for Hamilton Harbour, one of the Areas of Concern (AOC) identified pursuant to the Great Lakes Water Quality Agreement.

Remedial Action Plans consist of three parts: A Stage 1 Report - Environmental Conditions and Problem Definition; a Stage 2 Report – Goals, Options and Recommendations; and a Stage 3 Report – Evaluation of Remedial Measures and Confirmation of Restoration Uses.

In 1989 the Hamilton Harbour AOC submitted its Stage 1 Report, “Environmental Conditions and Problem Definition” to the IJC and this was accepted the following year. A second edition of this Report was submitted to the IJC in 1992 along with the Hamilton Harbour Remedial Action Plan Stage 2. It is anticipated that the Submission of a Stage 3 Report will not be forthcoming prior to 2015. With these time lines in mind, it was considered prudent to examine work completed on the RAP to-date and endorse, modify or add to recommendations contained in the 1992 RAP Stage 2 Report. This updating process was begun in 1998 by recalling the RAP Stakeholder group under the new name “RAP Forum”. The RAP Forum completed the review and update of the 1992 Stage 2 Report using Task Groups comprised of scientists and Forum stakeholders. During the following four years, the Task Groups completed their work and reported back to the Forum. The Forum then endorsed or modified the work of the Task Groups.

This RAP Stage 2 Update was then prepared by the Hamilton Harbour RAP Office staff and edited by a technical team of scientists and, in many cases, the Chairs of the RAP Forum Task Groups.

The Stage 2 Update 2002 Report is intended to complement the 1992 Stage 2 Report. It is a continuation of the RAP process and has purposely followed a similar format as the original report. The original report contains the original evaluation of remedial options; the update provides the current status and the next steps forward in the remediation process.

The RAP Forum found that the approach and remedial actions taken in the Hamilton Harbour RAP are principally sound and the update does not deviate from the original courses of action set out in the 1992 RAP Stage 2 Report. The RAP continues to take an ecosystem approach to restoring water quality, clean up sediments, and re-establishing fish and wildlife habitat in the Harbour. The ultimate objective of the Plan is to restore and preserve the benefits of the Harbour for present and future generations.

Release of this Stage 2 Update represents the work to-date of the RAP Forum and Task Groups. It has not been officially adopted by the federal or provincial governments, or approved by the International Joint Commission.

Figure 1. Hamilton Harbour Watershed Municipal Boundaries

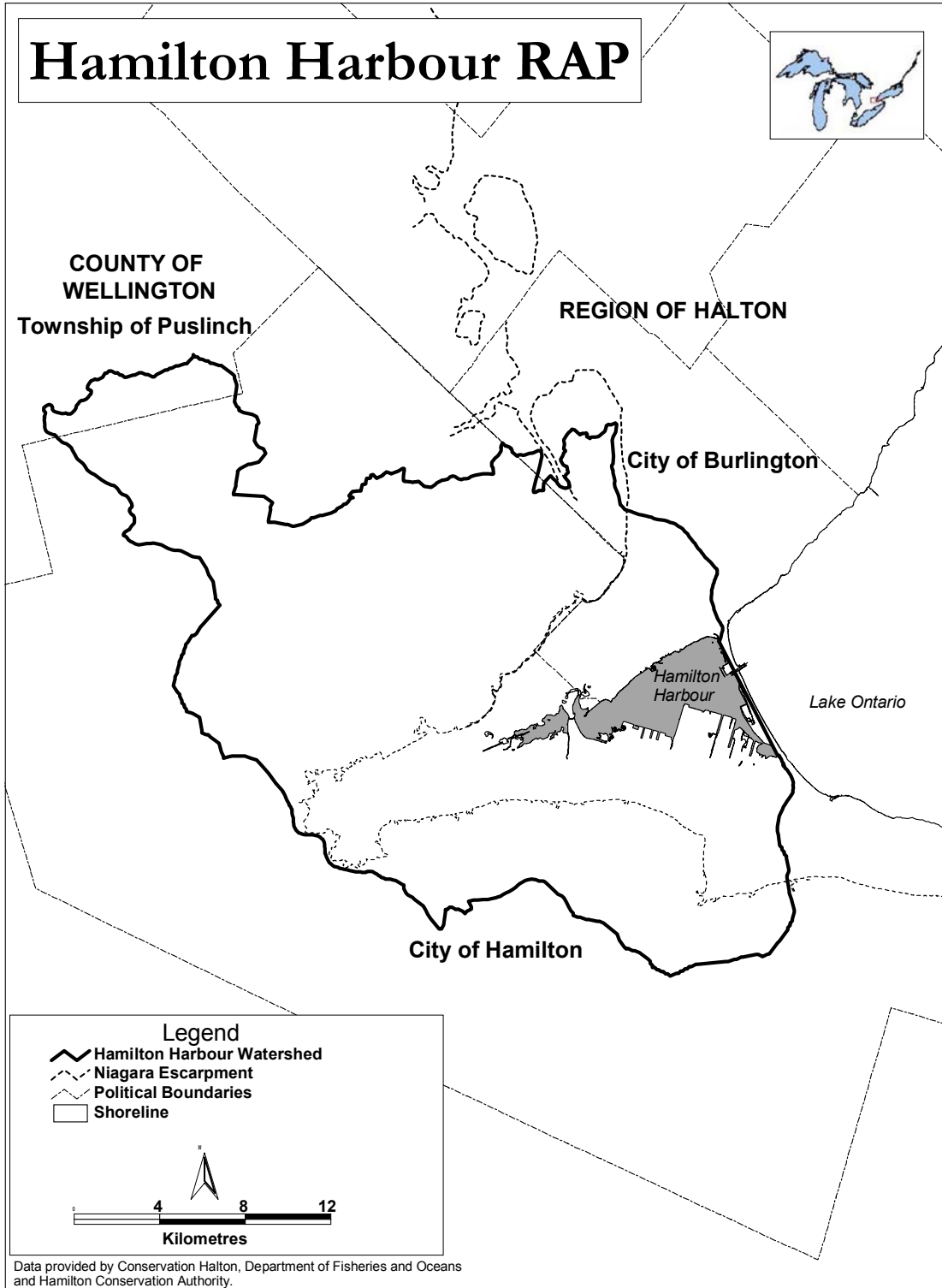
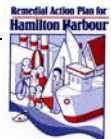


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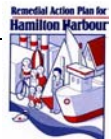
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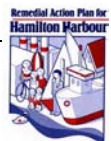


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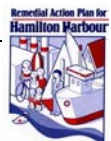
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EXECUTIVE SUMMARY

This Stage 2 Update Report for the Hamilton Harbour Remedial Action Plan (RAP) is the product of a four-year process carried out by the RAP Forum Stakeholders and its Task Groups.

Stakeholders RAP Forum	Anne Redish, Chair
Water Quality and Bacterial Contamination Task Group	Keith Rodgers, Chair
Urbanization and Land Management; Public Access and Aesthetics Task Group	John Gartner, Chair
Toxic Substances Task Group	Brian McCarry, Chair
Fish and Wildlife Task Group	Brenda Axon and Victor Cairns, Co-Chairs
Research and Monitoring Task Group	Murray Charlton, Chair
Education and Public Information Task Group	Jo-Anne Rzadki, Chair

The RAP Forum found that the approach and remedial actions taken in the Hamilton Harbour RAP are principally sound and the update does not deviate from the original courses of action set out in the RAP Stage 2 Report, 1992.

The description of environmental conditions, as they existed at the outset of remedial action planning are contained in the second edition of the RAP Stage 1 Report, 1992.

The 1992 RAP Goals, Objectives and Principles were reviewed by the RAP Forum and endorsed with only minor changes to reflect special issues that have arisen. These are found in Chapter III, Goals and Objectives, and include the primary principles of an Ecosystem Approach, a Zero Discharge/Virtual Elimination Approach to persistent toxic substances, and maintaining a Sustainable Communities Approach.

Chapter IV, Updated RAP Recommendations and Progress on Implementation Actions, does not repeat the analysis of the various alternative options set out in the 1992 Stage 2 Report. It updates the various recommended remedial actions with the addition of detailing tasks, timelines and those agencies responsible or anticipated to be involved in implementing the particular recommendation. In many cases recommendations remain unchanged; in most cases they are refined by the more definitive tasks; and in several cases new or expanded recommendations have been added. The recommendations have been organized into seven components:

- Water Quality and Bacterial Contamination
- Urbanization and Land Management
- Toxic Substances and Sediment Remediation
- Fish and Wildlife
- Public Access and Aesthetics
- Education and Public Information
- Research and Monitoring



Stage 2 Update

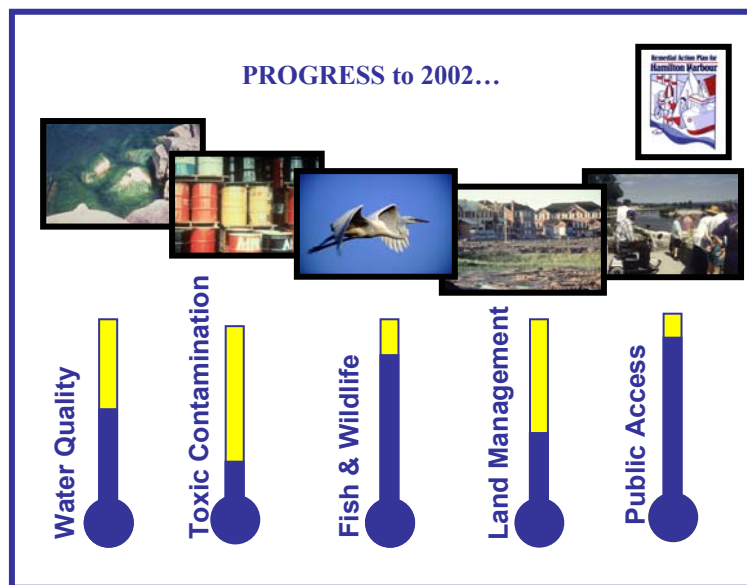
The delisting objectives to be met and a discussion of the attainability of meeting the delisting objectives are set out in Chapter V, Attainability of Reaching Delisting Objectives. It is anticipated that approximately \$650 million will be required (between years 2000 – 2015) if the RAP is to achieve delisting of Hamilton Harbour as an Area of Concern (AOC) under the Great Lakes Water Quality Agreement. These costs are set out in Chapter VI, Costs for Implementation Actions.

Chapter VII, Public Consultation was written once the public consultation process on the remainder of the document was finished.

Monitoring required to chart and direct progress is set out in Chapter VIII, Research and Monitoring Plan.

In order to assist the public in understanding this update to the RAP, a series of fact sheets have been prepared for each of the issue areas. Once public consultation completed, the plan was revised and moved back to the RAP Forum for endorsement. Following endorsement by the RAP Forum, the federal and provincial ministries of environment finalized their review and the document will proceed to the International Joint Commission. In the interim, it will be used as the master plan to guide implementation of the Hamilton Harbour RAP.

Finally, it should be stated that this update of the RAP Stage 2 Report is a continuum in the remedial action plan process. It should not be viewed as replacing the original Stage 2 Report, 1992, but as complementing that report. The original Stage 2 Report should continue to be used in order to provide a full understanding of the recommendations and courses of actions defined in this Hamilton Harbour Remedial Action Plan Stage 2 Update 2002.



I. INTRODUCTION

I.1 Background on Pollution Concerns

Concern for pollution problems in Hamilton Harbour is not new. The problems were identified in a formal way in the early 1970s, leading to the designation of the Harbour by the International Joint Commission (IJC) as one of the 43 Areas of Concern (AOC) identified in the Great Lakes Water Quality Agreement (1987). But even in the 1850s, when a new water supply was being considered for the small but growing city of Hamilton there were concerns. The engineer-in-charge, Mr. Thomas Keefer, recognized that the bay was already contaminated, that growth of the city could make it worse (there was no treatment of sewage at that time and all sewage just drained down to the waterfront), and that he had to find a better source of drinking water out at the beach on Lake Ontario.

Recognition of further problems following the Second World War led to the establishment of water quality standards and a cleanup of discharges of pollution to the Harbour to restore better water quality conditions. In the past 30 years, an estimated \$800 Million has been spent by industry, local municipalities, provincial and federal governments to reduce the discharge of nutrients and contaminants to the Harbour. The first 20 years of these measures (\$600 Million) resulted in major improvements that are documented in the RAP report entitled, “Remedial Action Plan for Hamilton Harbour – Environmental Conditions and Problem Definition” (March 1989). The second edition of this report was published in 1992. The last ten years, 1990 – 2000 (\$200 Million), are documented in Appendix H within this report.

I.2 The Remedial Action Plan Program

The Remedial Action Plan program under the Great Lakes Water Quality Agreement (GLWQA) is an initiative (formalized in the Revised Great Lakes Water Quality Agreement of 1978 – as amended by Protocol signed November 18, 1987) that requires the Canadian and U.S. governments to develop plans explaining how the remaining problems in each of the Areas of Concern, such as Hamilton Harbour, will be addressed.

There are three stages to be addressed in Remedial Action Plans:

Stage 1 – Environmental Conditions and Problem Definition

Stage 2 – Goals, Options and Recommendations

Stage 3 – Evaluation of Remedial Measures and Confirmation of Restoration of Uses

Stage 1 was completed in 1989 with a second edition produced in 1992. Stage 2 was completed in 1992, with this 2002 report being an update to the original. Stage 3 will not be written until Hamilton Harbour is ready to apply to be delisted as an Area of Concern.



I.3 History of Hamilton Harbour RAP Process

- 1985 Release of Ontario Ministry of the Environment (OMOE) report, “Technical Summary”, that summarized the water and sediment quality problems and their potential solutions. Based on investigation of the Harbour in the 1970s and early 1980s.
- 1986 First Stakeholder Group formed by OMOE and Environment Canada to discuss and advise on a remediation plan.
- 1987 Release of “Revised Great Lakes Water Quality Agreement of 1978 - as amended by Protocol signed November 18, 1987”. Remedial Action Plans discussed under Annex 2.
- 1989 Release of “Hamilton Harbour RAP Stage 1 – Environmental Conditions and Problem Definition”, March 1989
- 1992 Release of “Second Edition of Hamilton Harbour RAP Stage 1 – Environmental Conditions and Problem Definition”, October 1992
Release of “Hamilton Harbour RAP Stage 2 – Goals, Options and Recommendations”, November 1992
- 1997 Five Year Review Committee recommends establishment of a RAP Forum to update 1992 Stage 2 report
- 1998 Release of “Hamilton Harbour RAP 1998 Status Report”, September 1998
RAP Forum established
RAP Forum review of Goals and Objectives
- 1999 RAP Forum update of Environmental Conditions and Problem Definition
Formation of the Water Quality Task Group
Formation of the Urbanization and Land Management Task Group
Release of “Headwaters to the Bay – Planning for Sustainability in the Hamilton Harbour Watershed”, October 1999
- 2000 Completion of the Water Quality Task Group Report
Completion of the Urbanization and Land Management Task Group Report
Formation of the Toxic Substances Task Group
- 2001 Completion of the Toxic Substances Task Group Report
Formation of the Fish and Wildlife Task Group and Completion of Report
Formation of the Education and Public Information Task Group and Completion of Report
Formation of the Research and Monitoring Task Group and Completion of Report
- 2002 RAP Coordinator Report to RAP Forum – Final Approval of Updated RAP Recommendations
Release of “Hamilton Harbour Remedial Action Plan Stage 2 Update: Draft for Public Comment”, September 2002
RAP Forum approval of “Hamilton Harbour Remedial Action Plan Stage 2 Update”, December 2002



I.4 Comparison to 1992 RAP Stage 2 Report

This update to the 1992 “RAP Stage 2: Goals, Options and Recommendations” report is intended to be a stand-alone document that complements the original. It will follow the general format of the 1992 Stage 2 Report in order to allow for comparisons between the reports (Figure 2.).

Figure 2. Comparison of 1992 and 2003 Stage 2 Chapter Titles

1992 RAP Stage 2 Chapters		2003 RAP Stage 2 Update Chapters	
I	Introduction	I	Introduction
II	Description of the Area	II	Description of the Area
III	Goals and Objectives	III	Goals and Objectives
IV	Analysis of Options	IV	Updated RAP Recommendations and Progress on Implementation Actions
V	Selection of Remedial Actions and Recommendations		
VI	Attainability of Designated Uses	V	Attainability of Reaching Delisting Objectives
VI.5	Estimating the Cost and Benefits of Remedial Measures	VI	Costs for Implementation Actions
VII	Public Consultation	VII	Public Consultation
VIII	Surveillance, Monitoring, and Research and Development	VIII	Research and Monitoring Plan
IX	Delisting Criteria	(Merged into Chapter V above)	

The 2003 RAP Stage 2 Update report will be used by the Bay Area Implementation Team (BAIT) as the basis for implementing RAP recommendations.

I.5 The Purpose of This Report

This report is an update to Stage 2 in the Hamilton Harbour RAP process. As required by the GLWQA, it is to provide:

- a) clear and precise goals consistent with the general and specific objectives of the Great Lakes Water Quality Agreement,
- b) an evaluation of remedial measures already in place,
- c) a discussion of additional remedial measures still required to restore beneficial uses,
- d) the beneficial uses that will not be restored (if any) and why they will not be restored,
- e) the description of a monitoring program to track the effectiveness of the remedial works, and
- f) a listing of the agencies or persons responsible for implementation of the measures that make up the RAP.

I.6 The Approval Process for the RAP Stage 2 Update

Six Task Groups prepared all the recommendations and delisting objectives, and provided information for the status of each recommendation. After RAP Forum approval, the RAP Office took the work of the Task Groups and wrote a preliminary draft. A Technical Editing Team had an opportunity to check for accuracy before the preliminary draft was passed to the members of the RAP Forum for their comments and approval. With the assistance of the Bay Area Restoration Council (BARC), a draft report was presented to the public for comment.

Following receipt of comments from the public, the RAP Forum considered the comments, made appropriate revisions, and included the results of the public survey in this report. Stakeholders in the RAP Forum were asked to endorse the final draft of the RAP Stage 2 Update in December 2002.

A final draft report was passed from the RAP Forum to Environment Canada (EC) in February 2003. EC in concert with the Ontario Ministry of Environment (OMOE) completed their technical review of the document in May 2003.

This report will be sent to the International Joint Commission (IJC) for comment. The IJC serves as an auditor for all Canadian and U.S. RAPs to ensure consistency between the two countries in their programs to eliminate water quality problems in the Great Lakes, and to ensure that the Plan meets the terms of the Great Lakes Water Quality Agreement between the United States and Canada.

II. DESCRIPTION OF THE AREA

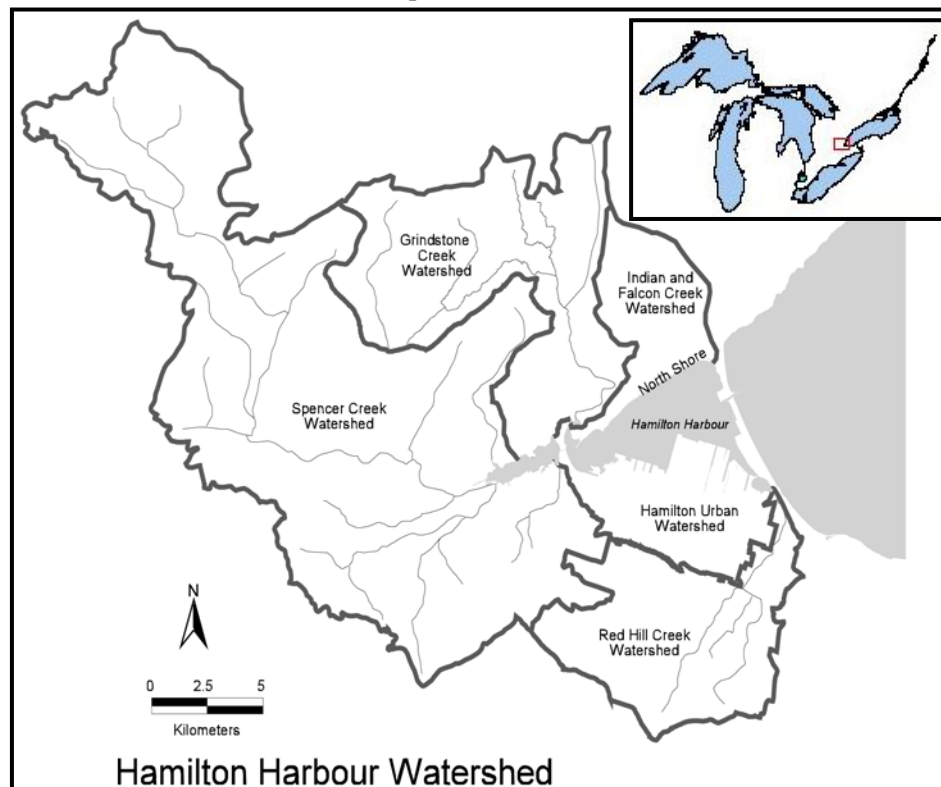
II.1 The Watershed and its Hydrology

Hamilton Harbour is a 2,150 hectare (ha) embayment of Lake Ontario connected to the lake by a single ship canal across the sandbar that forms the bay. The conditions in the Harbour reflect natural inputs, human activities, land uses, and drainage from the watershed of 49,400 ha.

This watershed (Figure 3) is drained by three main tributaries: Grindstone Creek draining the north central area of the watershed (9,000 ha); Red Hill Creek draining the southeast sector of the basin (6,640 ha); and Spencer Creek draining the northwest and western parts of the watershed (28,452 ha). There are also minor tributaries that drain parts of the shore of Cootes Paradise and the north shore of Hamilton Harbour. The urban runoff from a major portion of the City of Hamilton is collected in a combined sewer system (sanitary and storm) that has outfalls discharging directly into the Harbour. There is a program underway to capture and treat all the combined sewer overflows. The urban runoff from the City of Burlington is collected in a stormwater system (separate from the sanitary sewer system) of which a portion outfalls into the Harbour.

Spencer Creek reaches the main part of the Harbour through a 250 hectare, shallow area of both marsh and open water called Cootes Paradise Marsh, discharging at an artificial opening into the west end of the Harbour called the Desjardins Canal.

Figure 3. Hamilton Harbour Watershed Map



There are four wastewater treatment plants (WWTP) that discharge to the Harbour. The Regional Municipality of Halton operates the Skyway WWTP, which discharges into the northeast end of the Harbour. The City of Hamilton operates the other three plants. The largest plant, the Woodward WWTP, discharges into Red Hill Creek. The Main Street WWTP (also known as the Waterdown WWTP) discharges into Grindstone Creek. The King Street WWTP (also known as the Dundas WWTP) discharges into Cootes Paradise.

The Harbour also receives the treated wastewater from all of Stoney Creek (via the Woodward WWTP) and Burlington (via the Skyway WWTP) - large portions of which are not in the natural watershed of the Harbour. Hence, the recommendations of this report will have to be addressed by all the citizens of these communities in the “sewershed” - not just those in the natural watershed.

The flow contribution from tributaries and WWTPs into the Harbour ranges between 7.3 m³/second (2.3 x 10⁸ m³) in the summer and 10 m³/second (3.2 x 10⁸ m³) in the winter. In addition, there is a flow of water that enters the Harbour from Lake Ontario through the Burlington Ship Canal that is difficult to measure. In the winter there is a surging of the currents back-and-forth in the Canal. In the summer there is an exchange of water with the Lake by a distinct inflow of cold water along the bottom of the Canal into the Harbour and an outflow of warm water from the Harbour out into the Lake. These and other flow related phenomena are studied by researchers at the National Water Research Institute (NWRI) to create models in order to better understand flows in the Harbour, the Canal, and out into Lake Ontario.

II.2 Topography and Geology

The Niagara Escarpment is the most outstanding physiographic feature of the area, dividing the area of the watershed in half. The area above the escarpment is generally very flat (typical gradients of 1 in 2,000). The escarpment itself gives rise to stream gradients of up to 1 in 20 with several scenic waterfalls. Below the escarpment, with stream gradients in the order of 1 in 100, streams move across plains of clay and sand, or down the Dundas Valley.

At the present time, approximately 80 % of the Red Hill Creek, 12 % of the Grindstone Creek, and 20 % of the Spencer Creek watersheds are developed. Erosion in the river valleys below the escarpment is a matter of general concern, although concern for erosion from construction sites is greater.

II.3 Current Land Uses

Urban centres located in the watershed are the City of Hamilton (population 490,268 in 2001 - Statistics Canada, 2001 Census) and the City of Burlington (population 150,836 in 2001 - Statistics Canada, 2001 Census). The City of Hamilton amalgamated with all of the members of the old Region of Hamilton-Wentworth in 2001. Recent urban growth within the watershed has focused on Hamilton Mountain and Flamborough (Waterdown). Development has resulted in a nearly continuous urban area surrounding the Harbour, below the Niagara Escarpment.

II.3.1 Land Use Breakdown

The breakdown of the 1996 Land Use Categories based on property codes for the City of Hamilton is:

- 65 % agricultural land use
- 14 % residential land use
- 8 % combined industrial, commercial and institutional/government land use
- 8 % public open space/conservation land use
- 5 % combination of vacant, private open space, or railways

The agricultural lands in the watershed are primarily mixed farms (livestock, hay, grains, corn) and fruit and vegetable farms.

II.3.2 Recreational and Environmentally Sensitive Areas

Recreational areas include 14 conservation areas (3246 ha) managed by the Hamilton Conservation Authority, 7 conservation areas (360 ha) managed by Conservation Halton, the Royal Botanical Gardens (1102 ha comprised of 687 ha land areas and 415 ha aquatic areas) and the natural areas and trails associated with the Niagara Escarpment.

Recreational boating is available on the Harbour itself through facilities at LaSalle Park Marina, Royal Hamilton Yacht Club, Leander Boat Club, MacDonald Marine, Harbour West Marina, and the Macassa Bay Yacht Club.

Over fourteen thousand hectares (14,514 ha or 29 % of the watershed) are designated as Environmentally Significant/Sensitive Areas (ESA), including the 373.2 ha Cootes Paradise Marsh that is a Provincial Class 1 wetland. Development in ESAs is subject to a range of provincial, conservation authority, and municipal controls in an attempt to prevent or minimize damage to plants, animals, landforms, forests, and to retain the educational, research or aesthetic values embodied in these locations.

II.3.3 Port of Hamilton

The Harbour's deep water port supports the largest concentration of heavy industry in Canada. The port and its associated industries are located along the south and east shores of the Harbour. Direct and indirect employment related to the port facilities is estimated at 30 % of the total Hamilton area employment.

The City of Hamilton has had an economic structure based primarily on the iron and steel industry and other heavy industry. The Harbour is a key element in its development, and in its continuance here. The Harbour is the largest Canadian port (in terms of tonnage handled) in the Great Lakes, and 80 % of the tonnage is iron ore and coal for the two major steel industries, Dofasco and Stelco. In addition, the Hamilton Port Authority (formerly the Hamilton Harbour

Commissioners) exercises control over the Harbour waters, almost all of the remaining water lots, and the major industrial land holdings around the Harbour.

In addition to being a major shipping centre, the Harbour is ringed by major highways, which have an impact on water quality and habitat in the Harbour. A commercial/passenger railway system and an airport also service the watershed.

II.3.4 Harbour Alterations

From the time when Governor Simcoe built a military road in 1793 through the Dundas Valley from Burlington Bay to the Thames River, the present physical basin of the Harbour has been irreversibly altered.

Canals and infilling of the Harbour have had major environmental impacts. In 1823 a ship canal was built through the sandbar separating the Harbour from Lake Ontario. It was placed south of the natural outlet and was wider and deeper. This channel is now 88 m wide and 10 m deep - a situation that makes possible the exchange of Lake Ontario and Harbour waters, as well as accommodating the largest seaway vessels.

The long since abandoned Desjardins Canal, constructed through Cootes Paradise to move shipping up to Dundas in 1853, resulted in a change to the location of the outlet in that major marsh area, from a location near the Valley Inn Road on Grindstone Creek to the artificial cut under the Thomas B. McQueston bridge on York Boulevard.

II.3.5 Shoreline Use

The south and east shores of the Harbour have been filled over time and developed for industrial and commercial activities (primarily the iron and steel industries), marine terminals, railway and highway construction, institutional uses, and recreational uses. Twenty-five percent of the area of the original bay has been filled, eliminating 65 % of the wetlands, protected inlets and shallow areas that served as the nursery habitat for the largest fishery that existed on Lake Ontario until the first decade of this century.

The eastern shore is comprised of the highway, the canal, institutional lands, as well as commercial activities that prevent significant general public access. However, increasing public access in the south eastern end has been set as one of the new tasks of the Hamilton Harbour RAP.

The north shore of the Harbour in the Aldershot district of the City of Burlington consists largely of private homes and a private golf course. There are two cemeteries (Woodland Cemetery and Holy Sepulchre Cemetery) with limited public access due to the nature of the land use. There is one large park, LaSalle Park, which is fully public with recent trail enhancements and lookout. Finally, there is a "Window on the Bay" lookout available to the public along the north shore.

The western shore is now shared between railway land and a public trail due to the construction of the Hamilton Waterfront Trail in 2000.

The western end of the south shore includes Bayfront Park and Pier 4 Park, both with public beaches. The National Parks Service is planning to construct the Canada Marine Discovery Centre on Pier 8. Other lands on Pier 8 are available for development and discussions are underway to decide what should go there. A trail to extend the Waterfront Trail from Pier 4 to Pier 8 is in the planning stages.

In terms of the 42 kilometres of shoreline available, the space is utilized approximately as follows:

- 46% - Industrial, including proposed developments on existing piers (19.4 km)
 - 3% - Transportation (1.4 km)
 - 10% - Residential (4.3 km)
 - 10% - Institutional (cemeteries, public buildings) (4 km)
 - 4% - Private open space (private marinas, golf courses) (1.5 km)
 - 27% - Public open space (public marinas, parkland, wildlife habitat) (11.1 km)
- (Source: Hamilton Port Authority, personal communication 2001)

II.3.6 Public Access

Public accessible shoreline has increased from 7 % of the shoreline in 1992 to 27 % in 2001. This dramatic shift in access has inspired the RAP Forum Stakeholders to raise the bar and set a new goal for 35 % of the Hamilton Harbour shoreline to be physically accessible to the public. The land transfers in 2001 between the Hamilton Port Authority and the City of Hamilton have created new opportunities (e.g. Pier 8 and Windermere Basin) for continuing to increase public access.

II.3.7 Landfills

The Region of Halton does not have any active landfill sites in Burlington. There are two sites within the Harbour watershed under Halton's jurisdiction that have been closed in the last thirty years. Gas (methane), leachate collection system, groundwater and surface water are monitored at both sites.

The City of Hamilton has one active landfill site, but it does not fall within the watershed (Glanbrook); however, leachate from the landfill is discharged to the Woodward WWTP. The Solid Waste Reduction Unit (SWARU) incinerator is also owned by the City of Hamilton, but was permanently closed in December 2002. There are 12 closed landfill sites under Hamilton's jurisdiction, but only six of them are within the watershed (Brampton, Dundas, Edgewood, Rennie, Upper Ottawa, West End). The leachate collection systems used at each site and the monitoring of sites varies. More information on City of Hamilton landfills is available on the City's website (www.city.hamilton.on.ca/CityDepartments/toe/wm/landfills).

Philip Services Inc. owns and operates the Taro Landfill Site. The Taro West Section is closed and Taro East currently accepts solid, non-hazardous, commercial, institutional, and industrial wastes. These landfills discharge leachate to the Woodward WTP.

II.3.8 Jurisdiction

Jurisdiction over matters affecting water quality, the potential for future costs of monitoring the environment, and land use in the watershed or around the Harbour are complex, to say the least. The federal and provincial governments are responsible for numerous statutes and regulations related to navigation, fish and wildlife, as well as water and air quality. Municipal planning for new housing, industrial development, and open spaces can have an important effect on the Harbour. Equally important is the diligent enforcement of by-laws that are designed to minimize the impact of construction activities, and to monitor business or other services to see that regulated activities are carried out effectively.

Jurisdiction for controlling waterfront land uses for shipping and navigation activities rests with the Hamilton Port Authority by virtue of the fact that these regulatory/operation functions are vested in a federal agency. Other waterfront planning authorities include the Regional Municipality of Halton, the Cities of Hamilton and Burlington, and the two local Conservation Authorities (Conservation Halton and Hamilton Conservation Authority).

II.4 Socio-Economic Conditions

This section is based on a report by Schaefer and Robinson (1991), but has been updated with information from the 1996 Census and projections by the Regional Municipality of Halton and the Cities of Hamilton and Burlington.

II.4.1 Population and Demographics

II.4.1.1 Hamilton

In 2002, the City of Hamilton's planning and development department looked at three growth scenarios: slow rate, current rate, aggressive rate. At the current rate of growth the population of Hamilton is expected to increase to about 549,000 by 2011.

Overall, migration into Hamilton is expected to remain positive, stimulated by the higher real estate prices in Toronto, and sustained by the future availability of development infrastructure locally.

The number of households was projected to increase from 161,100 in 1986 to about 211,885 by 2011 according to year 2000 forecasts. The new forecasts look out to 2031 and see numbers ranging from 235,600 – 306,200 for private households in Hamilton. The majority of this household growth is expected to occur in the periphery of the City of Hamilton, such as in the former Town of Stoney Creek and Township of Flamborough.



II.4.1.2 Regional Municipality of Halton

The Regional Municipality of Halton has experienced steady growth both in absolute terms, and in terms of its size as a percent of total Greater Toronto Area (GTA) population. It increased from 5.6 % of the GTA total in 1961, to 7.3 % in 1986 and remained at 7.3 % in 1996. Future population totals in Halton Region are expected to increase from 387,200 in 2001 to 543,000 in 2016. This outlook reflects the Region's strategic location near to Toronto, strong transport links, and other environmental amenities.

II.4.1.3 City of Burlington

For the City of Burlington, the only Region of Halton area municipality located in the Hamilton Harbour watershed, population growth averaged 1.7 % annually over the period from 1986 to 1996. Future growth in the Halton Region is expected to focus primarily on urban Milton however, and Burlington's growth is expected to average only 1.1 % annually from 2000 to 2011. From 2001, population is expected to increase by 24,100 to reach 178,900 by 2016. As a percent of Halton's total population, Burlington will therefore account for roughly 33 % in 2016, compared to 43 % in 1986.

The number of households in the City of Burlington is projected to increase from 50,250 in 1996 to 68,760 in 2016. The greatest pressure for development will be in the Alton community (north of Hwy 5 and south of Hwy 407).

II.4.2 Age Structure

A widely recognized demographic feature, the aging population phenomenon, applies particularly to Hamilton and Burlington. The Hamilton Census Metropolitan Area (CMA), which includes both areas, was identified in the 1986 Census as having the third oldest average population of the 33 Canadian cities listed (33.4 years). As of the 1996 Census the average age of the Hamilton CMA populations had risen to 36.7 years in comparison to the national average of 35.8 years. This "aging" phenomenon obviously comes as the result of fewer babies and more seniors living longer.

II.4.3 Regional Growth Patterns

One widespread transition experienced in the Hamilton Harbour area, as in many communities throughout North America, is a substantial increase in peripheral development and suburban sprawl. While there are substantive advantages in terms of individual land and property ownership, there are, from a more holistic or sustainable perspective, a number of limitations. As with many North American communities, the spilling of development outside of the urban framework has resulted in: lost open space; reductions in agricultural land; an increased reliance on the automobile, yielding increased traffic congestion, air pollution and ultimately, water

pollution; increased flooding activity during heavy rainfall; costly infrastructure expansion; and a deterioration of downtown core area.

Both Halton and Burlington have strong Official Plan policies to limit development outside of defined urban areas and to control sprawl. Based on forecasted population projections, the existing urban areas in Halton should be sufficient to accommodate the Region's projected growth to 2016. A comprehensive urban structure review is required under the Official Plan as part of the five-year review of the Official Plan before considering the designation or expansion of urban area boundaries.

Due to the 2001 amalgamation, the City of Hamilton is undergoing a consolidation and review of all of the former Official Plans. Policies on defining urban areas and controlling sprawl are expected to be examined during this review.

II.4.3.1 Implications for Harbour Remediation

An increase in population in the Hamilton Harbour area has at least two implications for remediation. First, there will be increased stress on existing wastewater treatment plants, most of which are near capacity. From a socio-economic perspective, this highlights the enormous potential for water demand management (water conservation, pricing mechanisms, leak detection, pressure reductions, etc.) in the Halton and Hamilton area to reduce the quantity of water being used, thereby extending the life of treatment plants and potentially reducing the concentrations of certain contaminants in plant effluent.

Secondly, as the population around the Harbour continues to grow, there will undoubtedly be an increase in the demand for water-based recreational activity. This warrants a closer look at the anticipated growth of the existing and potential uses in the Harbour to facilitate the allocation of waterfront land. This point will become increasingly important as waterfront land becomes available in an already intensely used waterfront on the main Harbour.

The aging phenomenon may be most significant in the context of RAP plans for waterfront recreational use. For planning future remedial options, it suggests relatively more demand for passive uses like trail walking and bird watching, and less demand for strenuous water sports and other active uses. This implies that passive multi-use greenspace might be given higher priority among competing foreshore uses. The construction of the Waterfront Trail in the west end of the Harbour in 2000 is an example of a passive, multi-use space.

Given the comprehensive nature of remedial action planning, as outlined in the Great Lakes Water Quality Agreement, there is some merit in investigating the implications of changing development patterns for improving water quality in Hamilton Harbour. In fact, as outlined above, the linkages are inherent. A decentralized development pattern, from an environmental perspective, is usually quite unsustainable. To alleviate many of the problems of decentralization and to make more efficient use of existing land, more attention should be directed at strengthening metropolitan districts, largely through more diverse housing (for all ages and income groups), improved public transportation (increased number of links with employment hubs, etc.), and strengthened commerce. In short, there is a greater need to integrate the various 'people activities' (i.e. living, working, shopping, entertainment, etc.). These suggestions provide

little help for immediate water-related problems in the Harbour, but can go a long way to facilitating the maintenance of restored beneficial uses, in the long term.

II.4.4 Employment and Industry Outlook

On a combined basis, employment growth within the Greater Hamilton Census Metropolitan Area (CMA) has been strong between 1986 and 1996, with the total labour force increasing by 44.3 % from 214,895 to 310,105. Meanwhile, unemployment rates have fluctuated from a peak of over 11.0 % in 1982, 6.1 % in 1988, 8.1 % in 1996, and to down to 5.0 % in 2000. The expanding labour force and a generally declining unemployment rate suggests that job creation in the CMA has been sufficient to absorb the annual increase in those employed or looking for work.

The Labour Force Employment numbers for 1981, 1986 and 1996 are shown in Figure 4, with a focus on the percent change between 1986 and 1996. 2001 Census information was not yet available at the time of publication.

Underlying this recent employment growth is a fundamental shift in the nature of local employment, away from manufacturing and towards the service sector. Also, the aging population is expected to create substantial new job opportunities in the service sector, ranging from tourism services to nursing-home care.

This shift from manufacturing jobs has apparently had a positive impact on real wages in the community. From 1981 to 1986, average employment income for males increased from \$18,337 to \$32,737 (1986 dollars), and by 1996 was \$34,691 (in 1996 dollars). For females from 1981 to 1986, average employment income increased from \$8,316 to \$19,697 (1986 dollars), and by 1996 was \$20,506 (in 1996 dollars).

The “new economy” not only brings higher pay, but it attracts the best and the brightest individuals. These people will be looking for a place to relocate their families that offers a clean environment and academic opportunities. Hamilton certainly has the academic opportunities with McMaster University and Mohawk College located here. However, the stigma of Hamilton’s old reputation of being a dirty, smelly place remains. It may be difficult to convince these top-notch candidates to bring their families to Hamilton with this environmental reputation. It follows then that a cleanup of the Harbour may be an important consideration to future economic prosperity of Hamilton.

Figure 4. Labour Force Employment by Industrial Sector

Industry Sector	1981	1986	1996	% Change 1986 - 1996
Primary	3,905	4,595	5,690	23.8
Manufacturing	69,945	61,575	62,770	1.9
Construction	12,715	13,200	16,280	23.3
Transportation ⁽¹⁾	10,955	11,325	18,240	61.0
Trade	32,900	37,610	57,150	52.0
FIRE ⁽²⁾	8,875	10,375	18,695	80.2
Government	7,725	7,635	12,295	61.0
Education	not available	not available	23,935	not available
Health and social service	not available	not available	33,070	not available
Accommodation, food and beverage service	not available	not available	18,845	not available
Other Services	59,000	68,580	22,960	73.5 ⁽³⁾
TOTAL	206,020	214,895	310,105	44.3 %
<p>(1) Transportation includes Communications and utilities</p> <p>(2) FIRE refers to Finance, Insurance and Real Estate</p> <p>(3) Calculation based on comparison of 1986 Other Services number to sum of 1996 Education, Health, Accommodation, and Other Services numbers.</p> <p>Source: 1992 Stage 2 Report and 1996 Census</p>				

Trends within the steel industry continue to involve changing technologies including continuous casters, direct reduction, and an eventual shift to non-coke based steel making. Already there is restructuring taking place, with continuous casting having made the intermediate operations like the ingot floor virtually obsolete. Dofasco has two continuous casters, one of them using 100% scrap metal from their Electric Arc Furnace. Dofasco's long-term strategy as of 2001 includes the gradual reduction on the dependence on coke, but there is no definite date on this eventual operational change. Stelco has reduced its use of coke in its Blast Furnace operation by installing a Pulverized Coal Injection facility, which injects coal directly into the Blast Furnace, thus eliminating the coke production phase. This has permitted the shutting down one of its two Coke Oven Batteries. Stelco has also shut down the older one of two Blast Furnaces due to the increased efficiency of operating the remaining furnace. Stelco believes that the future of iron and steel making lies in direct reduction technology that will eliminate the need for coke and the coke oven and by-product facilities.

II.4.4.1 Implications for Harbour Remediation

The steady growth in business services since 1971 is a trend that will likely continue into the future. To some extent it depends on whether the local mix of labour skills continues to meet the demands of new highly paid business service occupations. But more importantly perhaps, it

depends on the ability of local policy-makers to ensure a healthy working environment for attracting more skilled labour into the area. This means not only providing affordable office space with suitable access, but also implies a willingness to control pollution and to create additional recreation amenities. In this way, the Hamilton Harbour area can promote a well diversified labour force, which will minimize the risk of depending too much on one economic sector.

With respect to the large 'footprint' of the industrial uses of the waterfront land, it seems difficult to foresee how public access could be realized in the face of proven safety and security concerns. However, access is such an important public issue that consideration should be given to establishing a community committee to explore the practical potential for providing access through existing industrial or Hamilton Port Authority properties.

II.4.5 Summary

This section is not exhaustive in its description of socio-economic conditions in the Hamilton Harbour watershed. It has, however, shown the importance of including social and economic information in the remedial action planning process, and has provided some illustrations of its relevance in facilitating the selection of remedial options to ensure the maintenance of restored beneficial uses. Some of these observations are summarized below.

Increases in population levels will continue to put stress on existing water supply and wastewater infrastructure, and exacerbate the pressure for improved access to the Harbour. Specifically, demographic trends point towards an aging population base for the future, with more leisure time on their hands. This suggests a relatively strong future demand for passive recreational uses like trail walking and bird watching and improved employment opportunities in the tourism, recreational, and other service sector industries.

The Area of Concern's economic structure is becoming increasingly diverse. With the adoption of new technologies, more automation, and increased international competitiveness, the area's main manufacturers may become less labour and land intensive. Steel making may no longer be the engine of growth for Hamilton. Skilled service sector occupations have grown substantially in the recent past and this trend is expected to continue into the foreseeable future, with the growth of small business.

Successfully adapting the local economy to this structural change will depend on policy makers' ability to create a healthy working and living environment and the creation of new and improved recreation amenities to attract more skilled labour into the area.

The image of Hamilton as a polluted environment both in air and water, may be a significant deterrent to attracting the best and the brightest individuals and their families to Hamilton and therefore may impact on the economic conditions of Hamilton.

Finally, there is a real need to examine water demand management and effluent charges as a cost effective approach for improving water quality and for extending the sewage carrying capacity of the Harbour.

II.5 Environmental Conditions and Problem Definition

This section has been significantly altered in content and layout from the 1992 Stage 2 Report to better reflect the situation in the late 1990s. (The following is as approved by the RAP Forum in 1999.)

II.5.1 Water Clarity, Oxygen Levels and Nutrient Levels

Water clarity is poor. The desirable clarity is described as 3-metre secchi disc visibility. Water clarity is affected by:

- sediment from soil erosion
- solid particles from industrial waste water, waste water treatment plants and combined sewer overflows
- excessive growth of microscopic plants stimulated by excessive loadings of phosphorus from waste
- water treatment plants and other sources

Oxygen levels are too low. Desirable oxygen concentrations (to support fish) would be greater than 4 ppm. Oxygen levels are affected by:

- ammonia from waste water treatment plants
- decomposing plant material

Special issues to be investigated include the following. These may be integrated into the problem definition if investigations show that they are indeed a problem, in the sense that they impede progress toward goals.

- impact of zebra mussels
- impacts of climate change
- impacts of road salt
- impact of spills
- significance of groundwater
- impacts of landfill leachate
- impacts of Harbour discharge on water intakes in Lake Ontario
- impacts of blue-green algae and related toxicity.

II.5.2 Bacterial Contamination

Bacteria levels are too high. Desirable concentrations would be less than 100 E. coli per 100 ml of water, to permit swimming. Bacteria make the surface water in and around the Harbour less safe for recreational uses. They tend to be elevated in the creeks and streams, primarily because of urban runoff and combined sewer overflows, which occur during precipitation events, but also during dry weather due to sewer cross-connections. They can be elevated in the Harbour when prolonged or heavy rains or snowmelt carries them down to its shores. Special issues in this

category include: the negative impact of Harbour discharges on the beaches in Lake Ontario and restricted use of the Harbour for waste discharges to avoid use conflicts.

II.5.3 Urbanization and Land Management

Changes in urban, rural and industrial activities have resulted in destruction of sustainable natural ecosystems. This has taken the form of increased erosion, increasing demands on wastewater treatment plants, increased number and volume of toxic substances entering the watershed, and loss of access to the Harbour for the general public.

Desirable land management would include:

- an assessment of environmental impacts within an ecosystem approach to land-use planning;
- farmers and developers implementing erosion prevention techniques;
- integration of RAP goals and standards for the Harbour with other planning documents such as official plans, etc.; and
- watershed planning and stewardship of privately and publicly owned resources.

Special issues in this category include analysis of the uses of foreshore areas, impacts of growth in human populations, increases in water use and corresponding increases in rapidity of rates of runoff, analysis of Windermere Basin's function and the land uses surrounding it, infilling to meet RAP objectives should meet provincial guidelines and be subject to impact assessment, land use adjacent or close to the Harbour, and nonpoint source pollution. These may be integrated into the problem definition if investigations show that they are indeed problems, in the sense that they impede progress toward RAP goals.

II.5.4 Toxic Contaminants

Zinc, lead, nickel, PCBs, and PAHs contaminate water and sediments. Fish flesh is contaminated with some of these and with mercury.

Contributors to the problem include: large industry, small industry, business and householders who use municipal sewers to dispose of chemical waste, landfill leachate, farmers, homeowners and municipalities which use chemicals to control weeds and insects, atmospheric fallout, chlorine used in treatment of municipal waste (reaction).

Contaminated sediments pose a special problem because of the difficulty of remediation.

Special issues to be investigated include the need for information on the presence and sources of PAHs, PCBs, mercury, dioxins and furans and radioactive materials. With the exception of radioactive material, these persistent toxic substances are already defined as part of the problem, but little has been done since 1989 to determine whether diminished loadings continue to result in diminishing concentrations in the ecosystem. Other special issues are: sediment contamination with early action at Randle Reef, airshed depositions, and the emerging issue of endocrine disrupting compounds (EDCs) and pharmaceuticals.

II.5.5 Stresses on Fish and Wildlife

Fish and wildlife species are under stress, as indicated by:

- domination of fish and wildlife populations by pollution-tolerant non-indigenous species
- cancers, malformations and dysfunctions
- low species richness among fish and wildlife
- “impaired” status of abundance and diversity of marsh birds
- elevated rates of genetic mutation in herring gulls
- presence of fish consumption advisories because of high contaminant levels in fish flesh

Factors creating stress include historical loss of habitat (65% of littoral habitat has been lost) through infilling and restructuring, presence of carcinogens in bottom sediments, lack of oxygen, high levels of ammonia in the water from municipal and industrial sources (Stelco and Dofasco loadings of ammonia are within RAP targets), toxic substances in the water, sediments and the food chain.

Special issues falling into this category include the impact of weed proliferation and the impacts of growth in non-human populations. These results may be integrated into the problem definition if results of investigations show that they are indeed problems.

II.5.6 Public Access and Aesthetics

Adequate and useable public access to the Harbour shorelines is improving but still below the target. The target is for 35% of the Harbour shoreline to be accessible to the public and suitable for the enjoyment of residents and visitors. Shoreline aesthetics are much improved, but there remain occasions when floatables are visible, and there continue to be water- and air-related odour problems.

III. GOALS AND OBJECTIVES

Considerable work went into designing the goals and objectives for the 1992 Stage 2 Report. Some of the rationales behind the selections can be found in the 1992 report (pg. 31 – 48). After making some changes to the original lists, the RAP Forum endorsed the following updated Goals and Objectives in 1999.

III.1 Vision

People living in the Harbour's watershed have a vision of Hamilton Harbour as a vibrant centrepiece in their community's life. They look towards a time when the environment will be balanced, friendly, accessible, clean and humming with diversity. They see the pleasure of recreation mixed with prosperity from use of the Harbour as an essential marine transportation link. They hope that what is a vision for them will be reality for generations to come.

III.2 Statement of Purpose of the Plan

A plan to bring about sustainable natural ecosystems in Hamilton Harbour and its entire watershed, and to improve the potential for more extensive recreational uses while maintaining the Harbour's and the watershed's essential economic function.

III.3 Primary Principles

1. Ecosystem approach.
2. Zero discharge of inputs of persistent toxic substances.
3. Sustainable communities

III.3.1 Ecosystem Approach

The ecosystem approach is intended to integrate social, economic and environmental matters. The Stakeholder approach used in this RAP brings together representatives from across a wide range of community interests. Although there may be potential water use conflicts among the stakeholders at the "round table" discussions, this is still envisioned as the best method to push forward remediation in order to realize the vision.

Three propositions underpin the ecosystem approach as set out in the 1992 Stage 2 Report:

1. **knowledge** that our species and its associated technology originated in the Biosphere and hence is part of Nature,
2. **ecological behaviour** that takes account of feedback at diverse levels, from personal to planetary, and
3. **ethical behaviour** based on an ethic of respect for other systems of Nature, comparable to an ethic of respect for other persons. (Vallentyne, 1982)

III.3.2 Zero Discharge of Inputs of Persistent Toxic Substances

The intent of this principle is to recognize zero discharge as the ultimate direction toward which actions ought to move, while recognizing there may be interim targets to apply along the way, and that resources will be applied in ways which bring the biggest benefit to the ecosystem, rather than “chasing the last molecule” of a substance.

III.3.3 Sustainable Communities

This principle was discussed as part of the ecosystem approach in the 1992 Stage 2 report. During the examination of the original goals and principles, the 1999 RAP Forum Stakeholders felt that it was important to highlight the concept of sustainable communities by elevating it into its own primary principle.

The City of Hamilton, the City of Burlington and the Regional Municipality of Halton are incorporating the concept of sustainable communities into the review of their respective Official Plans.

III.4 Secondary Principles

1. Human health protection with multiple Harbour uses.
2. Public support requires access and attention to foreshore uses of shoreline – land use planning.
3. Improved aesthetics and amenities are required.
4. Public education facilitates implementation.

III.5 Water Uses To Be Enhanced

1. Recreational boating: for the whole Harbour
2. Water sports: for specific areas.
3. Shipping and navigation: to continue in certain areas of the Harbour.
4. Industrial Use: to continue in certain areas, consistent with sustainability objectives.
5. Wastewater Receiving Body: subject to acceptable standards, assigned to certain areas and subject (where appropriate) to loading targets so as not to impede other uses.
6. Fisheries: permit edible, naturally reproducing warm water fishery, with no impact on coldwater species reproduction or edibility. Long-term goal of restored coldwater fishery in the Harbour.
7. Wildlife: healthy, self-sustaining resident and non-resident wildlife populations to be enhanced. Improved understanding and reconciliation of conflicts between human beings and wildlife in the urban environment to be gained.
8. Swimming and water contact sports: water quality to permit swimming in west end (short term) and certain other areas of the Harbour (long term), all with no impact on swimming in nearshore Lake Ontario.

9. Educational Resources: for all ages to be informed of the current (improved) conditions in the Harbour and watershed, enhancing awareness of this problem.
10. Access: improve quality and quantity for visual and physical access.
11. Aesthetics: improve shoreline and water aesthetics.

III.6 Plan Development and Implementation

Continuation of the Stakeholder Groups (Bay Area Restoration Council, BARC and Bay Area Implementation Team, BAIT) through each stage of development and implementation of the Plan, in order to:

- Consider the relation between official plans and the RAP
- Review current plans of the RAP
- Review goals of the RAP
- Promote remedial actions
- Audit and integrate public comment into the RAP

III.7 Great Lakes Water Quality Agreement

The water uses to be enhanced listed above can be compared to the 14 beneficial uses that are listed in Annex 2 of the Great Lakes Water Quality Agreement (GLWQA) of 1978, as amended by protocol, signed November 18, 1987 (Figure 5). The delisting objectives, as discussed later in this report in Chapter V: Attainability of Reaching Delisting Objectives, are directly linked to the 14 beneficial uses in the GLWQA (Figure 6).

The emphasis in the GLWQA beneficial uses has been placed on the proper functioning of populations of fish, aquatic birds and wildlife dependent on the Harbour. The proper functioning of the aquatic system to allow natural reproduction of a healthy, well-balanced biota that does not accumulate metals and organics is the key measure of the achievement of a clean body of water.

Figure 5: Remedial Action Plans as Characterized in the Great Lakes Water Quality Agreement of 1978, and amended by protocol of 1987 (Annex 2)

General Principles:

1. Systematic and comprehensive ecosystem approach.
2. "Plan shall provide a continuing historical record of ... assessment ... remedial action ... methods ... changes in environmental conditions and milestones."
3. Build on existing strategies
4. Reduce "point source impact zones to the maximum extent possible ... pending the achievement of the virtual elimination of persistent toxic substances."
5. "Ensure that the public is consulted in all actions undertaken."

Plans to Include:

1. "A definition and detailed description of the environmental problem."
2. "A definition of the causes of use impairment."
3. "An evaluation of remedial measures in place."
4. "An evaluation of alternative additional measures."
5. "A selection of additional ... measures ... and a schedule."
6. "Identification of ... (those) ... responsible for implementation of remedial measures."
7. "A process for evaluating remedial measure implementation and effectiveness."
8. "A surveillance and monitoring process to track effectiveness of ... measures and confirmation ... of restoration of uses."

Impairment of a Beneficial Use:

This is intended to mean a change in the chemical, physical, or biological integrity of the Great Lakes System sufficient to cause any of the following:

1. Restrictions on fish and wildlife consumption
2. Tainting of fish and wildlife flavour
3. Degradation of fish and wildlife populations
4. Fish tumours or other deformities
5. Bird and animal deformities or reproduction problems
6. Degradation of benthos
7. Restrictions of dredging activities
8. Eutrophication or undesirable activities
9. Restrictions on drinking water consumption, or taste and odour problems
10. Beach closing.
11. Degradation of aesthetics
12. Added costs to agriculture or industry
13. Degradation of phytoplankton and zooplankton populations
14. Loss of fish and wildlife habitat

Source: Annex 2, Great Lakes Water Quality Agreement, as amended by protocol, signed November 18, 1987



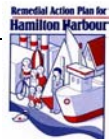
Figure 6: Hamilton Harbour Delisting Objectives

NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES
(i)	<p><i>Restriction on fish and wildlife consumption.</i></p> <p>That there be no restrictions on consumption of fish and wildlife from the Harbour attributable to local sources.</p>
(ii)	<p><i>Tainting of fish and wildlife flavour.</i></p> <p>When survey results confirm no tainting of fish or wildlife flavour.</p>
(iii)	<p><i>Degraded fish and wildlife populations.</i></p> <p>1. That the <u>fish community</u> has the following structure:</p> <ul style="list-style-type: none"> a. Shift from a fish community indicative of eutrophic environments, such as white perch, alewife, bullheads, and carp to a self sustaining community more representative of a mesotrophic environment, containing pike, bass, yellow perch, and sunfish. b. Attain a littoral fish biomass of 200 - 250 kg/ha. c. Increase the species richness from 4 species to 6-7 species per transect. d. Increase the native species biomass from 37% to 80-90% of the total biomass. e. Reduce the spatial variability in fish biomass within the Harbour.

NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES																						
<p>(iii) cont'd.</p>	<p>f. Proposed nearshore fish community of Hamilton Harbour:</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Category</u></th> <th style="text-align: right;"><u>Littoral Biomass (kg/ha)</u></th> </tr> </thead> <tbody> <tr> <td>Piscivores (<i>pike, bass</i>)</td> <td style="text-align: right;">40 - 60</td> </tr> <tr> <td>Specialists (<i>Insectivores like pumpkinseeds and yellow perch</i>)</td> <td style="text-align: right;">70 - 100</td> </tr> <tr> <td>Generalists (<i>Omnivores like carp and brown bullheads</i>)</td> <td style="text-align: right;">30 - 90</td> </tr> </tbody> </table> <p>The percent of fisheries biomass allocated to the three trophic groups was based on the effects of improved water quality in the Bay of Quinte and Severn Sound. The littoral fish biomass of 200-250 kg/ha was based on electrofishing data collected from Hamilton Harbour, Bay of Quinte and Severn Sound in 1990.</p> <p>g. Attain an Index of Biotic Integrity (IBI) of 55-60 for Hamilton Harbour</p> <p>2. <u>Colonial waterbirds:</u></p> <p>The overall objective is to have a self sustaining mixed community of colonial waterbirds generally with an increase of the rarer species and a reduction in the number of ring-billed gulls which currently nest in the Harbour. These figures are subject to revision once these general levels have been reached. Management of colonial waterbirds is experimental and achieving specific populations of particular species is highly speculative.</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;"><u>Suggested Interim Targets</u></th> <th style="text-align: right;"><u>Number of Pairs</u></th> </tr> </thead> <tbody> <tr> <td>Ring-billed gulls (<u>Larus delawarensis</u>)</td> <td style="text-align: right;">5,000</td> </tr> <tr> <td>Common terns (<u>Sterna hirundo</u>)</td> <td style="text-align: right;">> 600</td> </tr> <tr> <td>Herring gulls (<u>Larus argentatus</u>)</td> <td style="text-align: right;">350</td> </tr> <tr> <td>Caspian terns (<u>Sterna caspi</u>)</td> <td style="text-align: right;">> 200</td> </tr> <tr> <td>Double-crested cormorants (<u>Phalacrocorax auritus</u>)</td> <td style="text-align: right;">200</td> </tr> <tr> <td>Black-crowned night herons (<u>Nycticorax nycticorax</u>)</td> <td style="text-align: right;">200</td> </tr> </tbody> </table> <p>3. <u>Other wildlife</u> including waterfowl:</p> <p>No target will be suggested for other species of birds or animals, but a target for habitat has been suggested which will enhance wildlife populations generally. In addition, management of some species may be necessary as a result of habitat enhancement.</p> <p>That fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.</p>	<u>Category</u>	<u>Littoral Biomass (kg/ha)</u>	Piscivores (<i>pike, bass</i>)	40 - 60	Specialists (<i>Insectivores like pumpkinseeds and yellow perch</i>)	70 - 100	Generalists (<i>Omnivores like carp and brown bullheads</i>)	30 - 90	<u>Suggested Interim Targets</u>	<u>Number of Pairs</u>	Ring-billed gulls (<u>Larus delawarensis</u>)	5,000	Common terns (<u>Sterna hirundo</u>)	> 600	Herring gulls (<u>Larus argentatus</u>)	350	Caspian terns (<u>Sterna caspi</u>)	> 200	Double-crested cormorants (<u>Phalacrocorax auritus</u>)	200	Black-crowned night herons (<u>Nycticorax nycticorax</u>)	200
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NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES
(iv)	<p><i>Fish tumours or other deformities.</i></p> <p>When incidence rates of fish tumours or other deformities do not exceed rates at unimpacted control sites that are locally relevant and when survey data confirm the absence of neoplastic or preneoplastic liver tumours in bullheads or suckers.</p>
(v)	<p><i>Bird or animal deformities or reproductive problems.</i></p> <p>When the incidence rates of deformities or reproductive problems in sentinel wildlife species do not exceed background levels in control populations.</p>
(vi)	<p><i>Degradation of benthos.</i></p> <p>Using the BEAST (Benthic Assessment of SedimentT) Methodology:</p> <ol style="list-style-type: none"> 1. Littoral Zone (depth < upper limit of maximum extent of anoxic conditions) <ul style="list-style-type: none"> • Benthic community structure (BCS) not different from that of appropriate reference sites in the Great Lakes (i.e., Hamilton Harbour sites determined as “equivalent to reference conditions” by BEAST methodology) and BCS not correlated to sediment contaminant levels among sites. • Absence of acute or chronic sediment toxicity attributable to contaminants in sediments. 2. Profundal Zone (depth > upper limit of maximum extent of anoxic conditions) <ul style="list-style-type: none"> • BCS not correlated to sediment contaminant levels among sites. • Absence of acute or chronic sediment toxicity attributable to contaminants in sediments.



NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES																																																																												
(vii)	<p><i>Restrictions on dredging activities.</i></p> <p>When contaminants in sediments do not exceed biological and chemical standards, criteria, or guidelines such that there are no restrictions on disposal activities associated with navigational dredging.</p>																																																																												
(viii)	<p><i>Eutrophication or undesirable algae.</i></p> <p>That there are no persistent adverse water quality conditions for each of the components attributable to cultural eutrophication. The following net loading targets provide the specific objectives.</p> <p>Eutrophication goals and anticipated conditions in Hamilton Harbour, Cootes Paradise, and the Grindstone Creek area:</p> <p>TABLE 1: Net Loading Targets (Kg/d)</p> <table border="1" data-bbox="321 1031 1321 1486"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Phosphorous</th> <th colspan="2">Ammonia</th> <th colspan="2">Suspended Solids</th> </tr> <tr> <th>Initial</th> <th>Final</th> <th>Initial</th> <th>Final</th> <th>Initial</th> <th>Final</th> </tr> </thead> <tbody> <tr> <td>Woodward WWTP</td> <td>140</td> <td>60</td> <td>2270</td> <td>530</td> <td>3750</td> <td>900</td> </tr> <tr> <td>Skyway WWTP</td> <td>30</td> <td>12</td> <td>470</td> <td>115</td> <td>500</td> <td>200</td> </tr> <tr> <td>King WWTP (Dundas)</td> <td>5</td> <td></td> <td>22</td> <td></td> <td>28</td> <td></td> </tr> <tr> <td>Main WWTP (Waterdown)</td> <td>1</td> <td></td> <td>5</td> <td></td> <td>5</td> <td></td> </tr> <tr> <td>CSOs</td> <td>70</td> <td>5</td> <td>160</td> <td>20</td> <td>1400</td> <td>200</td> </tr> <tr> <td>Streams *</td> <td>90</td> <td>65</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Industry (combined)</td> <td></td> <td></td> <td>400</td> <td>270</td> <td></td> <td></td> </tr> <tr> <td>Stelco</td> <td></td> <td></td> <td></td> <td></td> <td>4000</td> <td>1500</td> </tr> <tr> <td>Dofasco</td> <td></td> <td></td> <td></td> <td></td> <td>3500</td> <td>1500</td> </tr> </tbody> </table> <p>* Stream loadings are extremely variable from year-to-year. The percentage of reduction is based on the estimated effect of best management practice.</p>		Phosphorous		Ammonia		Suspended Solids		Initial	Final	Initial	Final	Initial	Final	Woodward WWTP	140	60	2270	530	3750	900	Skyway WWTP	30	12	470	115	500	200	King WWTP (Dundas)	5		22		28		Main WWTP (Waterdown)	1		5		5		CSOs	70	5	160	20	1400	200	Streams *	90	65					Industry (combined)			400	270			Stelco					4000	1500	Dofasco					3500	1500
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NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES						
(viii) cont'd.	TABLE 2: Environmental Conditions						
		Hamilton Harbour		Cootes Paradise	Grindstone Creek Area	Beaches	
		Initial Goals	Final Goals	Initial Goals	Initial Goals	Initial Goals	
	Phosphorus concentration (ug/L)	34	17	60 - 70	60 - 70		
	Un-ionized Ammonia conc. (mg/L)	< 0.02	< 0.02	< 0.02	< 0.02		
	Chlorophyll a conc. (ug/L)	15-20	5-10	20	20		
	Secchi Disk Trans. (m)	2	3	1.5	1	1.2	
	Min. DO con. (ppm)	> 1	> 4	> 5	> 5		
	Submergent/emergent aquatic plant area (ha)	105	170	240	50		
	Suspended solids (ppm)			25	25		
Bacteria (E. coli organisms/100 ml water)					< 100		
(viii) cont'd.	TABLE 3: Criteria for Determining Compliance with RAP Goals						
	GOAL			COMPLIANCE FORMULA			
	Compliance with environmental conditions with respect to Phosphorus, Secchi depth and chlorophyll a			13 out of 13 samples analysed weekly* at the centre station from June to August are at or better than the targeted level.			
	Compliance with environmental conditions with respect to unionized ammonia			Weekly samples from March to June at the centre station are not to exceed 0.02.			
	Compliance with environmental conditions with respect to dissolved oxygen			Weekly samples at 1 metre from bottom at centre station, from July to September are at or better than the targeted level.			
Compliance with environmental conditions with respect to E. coli			Daily samples meet target on every day that is 48 hours after a rain event.				
* Although weekly sampling is recommended at only one location, there will be periodic sampling of a large number of locations harbour-wide to confirm representativeness of the centre station.							



NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES
(ix)	<p><i>Restrictions on drinking water consumption or taste and odour problems.</i></p> <p>That Hamilton Harbour water outflow to Lake Ontario not give rise to water quality restrictions on the water intakes for Hamilton and Halton.</p>
(x)	<p><i>Beach closings. (Water contact sports.)</i></p> <ol style="list-style-type: none"> 1. That Hamilton Harbour effluent to Lake Ontario not give rise to conditions which would cause restrictions on open Lake water contact sports. 2. That water quality conditions in the west-end and in the north-half of the Harbour, be such as to permit opening of beaches and which would cause no significant restriction on water contact sports.
(xi)	<p><i>Degradation of aesthetics.</i></p> <p>When the waters are free of any substance which produces a persistent objectionable deposit, unnatural colour or turbidity, or unnatural odour (e.g. oil slick, surface scum, algae).</p>
(xii)	<p><i>Added cost to agriculture or industry.</i></p> <p>When there are no significant additional costs required to treat water prior to use for industrial purposes (i.e. intended for commercial or industrial applications and non-contact food processing). Cost associated with zebra mussels or other invasive organisms are excepted. An added cost related to withdrawal of water from the Harbour to agriculture is not appropriate as this is not a use directly applicable to Hamilton Harbour.</p>

NO.	BENEFICIAL USE IMPAIRMENTS AND HAMILTON HARBOUR DELISTING OBJECTIVES
(xiii)	<p><i>Degradation of phytoplankton and zooplankton populations.</i></p> <p>When phytoplankton and zooplankton community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further in the absence of community structure data, this use will be considered restored when phytoplankton and zooplankton bioassays confirm no significant toxicity in ambient waters.</p>
(xiv)	<p><i>Loss of fish and wildlife habitat.</i></p> <ol style="list-style-type: none"> 1. Provide 500 ha of emergent and submergent aquatic plants in Hamilton Harbour, Cootes Paradise, Grindstone Creek delta, and Grindstone Creek marshes in accordance with the Fish and Wildlife Habitat Restoration Project (360 ha FWHRP sites + 140 ha littoral zone). 2. Provide 15 km of littoral shore. 3. Provide 300 ha of wildlife habitat. 4. Provide 3 ha of colonial nesting bird habitat.

IV. UPDATED RAP RECOMMENDATIONS AND PROGRESS ON IMPLEMENTATION ACTIONS

The 1992 Stage 2 Report set out 50 recommendations as the basis for the Hamilton Harbour Remedial Action Plan (RAP). In 1999, the RAP Forum assigned task groups to update the original 1992 RAP Recommendations and the 1992 Delisting Criteria. The six task groups formed between 1999-2001 were: Water Quality Task Group, Urbanization and Land Management Task Group (which also examined Public Access and Aesthetics), Toxic Substances Task Group, Fish and Wildlife Task Group, Education and Public Information Task Group, and Research and Monitoring Task Group. For each recommendation the task groups: determined the current status of the recommendation; either reconfirmed, deleted or revised the recommendation; and finally laid out specific targets and timelines for implementers to meet the updated recommendation. The task groups also added new recommendations to cover perceived gaps in the original list. The RAP Forum was presented with the updates and asked to approve the changes. This process was completed in 2002.

The 1992 Recommendations were numbered 1-50 and ranked in order of importance. New recommendations put forth by the task groups between 1999-2001 were numbered A-T. In order to align the two systems and to avoid re-ranking them all, a new method of numbering was chosen. The 57 recommendations approved for this update were divided among the seven components of the RAP as shown in Figure 7. Appendix F contains a detailed record of which task groups reviewed each recommendation, the fate of original recommendations that were either combined with others or deleted.

The introductory section of each RAP component answers three questions:

- “Where Have We Been?” – challenges facing stakeholders at the beginning,
- “Where Are We Now?” – accomplishments in implementation, and
- “Where Are We Going?” – plans for future projects and emerging issues.

Following the introductory sections are the recommendations for that component with corresponding responsible agencies, targets, timelines, and status of implementation.

The Bay Area Implementation Team (BAIT) has the principal responsibility for delivering the RAP program through implementation and monitoring. BAIT is comprised of representatives from the three levels of government, three industrial partners, two conservation authorities, the RBG, an academic institution, and a public interest group.

As the Hamilton Harbour RAP has progressed a “who does what best” approach to program delivery has evolved. The Bay Area Restoration Council (BARC), for example, has taken a lead role in education and public information. Often individual tasks are delivered by collaborations that include more than one RAP component in their program delivery. An example is the Fish & Wildlife Habitat Restoration Project’s (FWHRP) delivery of many components of the RAP through fish and wildlife, open space, and monitoring activities.

It is anticipated that this particular chapter may be updated from time to time to reflect the continual implementation efforts of Bay Area Implementation Team (BAIT) members.

Figure 7. Recommendations Approved for Hamilton Harbour RAP Stage 2 Update

New Recommendation Number (Old Numbering System)							
Water Quality and Bacterial Contamination	Urbanization and Land Management	Toxic Substances and Sediment Remediation	Fish and Wildlife	Public Access and Aesthetics	Education and Public Information	Research and Monitoring	
WQ - 1 (1)	ULM - 1 (A)	TSSR - 1 (7)	FW - 1 (12)	PAA - 1 (3)	EPI - 1 (38)	RM - 1 (15)	
WQ - 2 (2)	ULM - 2 (4)	TSSR - 2 (20)	FW - 2 (22)	PAA - 2 (24)	EPI - 2 (33)	RM - 2 (17)	
WQ - 3 (26)	ULM - 3 (5)	TSSR - 3 (28)	FW - 3 (13)	PAA - 3 (G)	EPI - 3 (34)	RM - 3 (27)	
WQ - 4 (50)	ULM - 4 (C)	TSSR - 4 (29)	FW - 4 (10)		EPI - 4 (E)	RM - 4 (T)	
	ULM - 5 (6)	TSSR - 5 (30)	FW - 5 (M)		EPI - 5 (Q)	RM - 5 (41)	
	ULM - 6 (25)	TSSR - 6 (31)	FW - 6 (18)		EPI - 6 (R)	RM - 6 (45)	
	ULM - 7 (F)	TSSR - 7 (37+L)	FW - 7 (19)			RM - 7 (46)	
	ULM - 8 (36)		FW - 8 (N)			RM - 8 (47)	
	ULM - 9 (40)		FW - 9 (9)			RM - 9 (48)	
	ULM - 10 (H)		FW - 10 (11)			RM - 10 (49)	
	ULM - 11 (I)		FW - 11 (14)				
	ULM - 12 (J)		FW - 12 (16)				
	ULM - 13 (42)		FW - 13 (23)				
	ULM - 14 (K)						

