DETROIT RIVER CANADIAN REMEDIAL ACTION PLAN
STAGE 2 REPORT

2010

Edited by: Natalie Green, Luca Cargnelli, Ted Briggs, Richard Drouin, Matthew Child
Jennifer Esbjerg, Marcia Valiante, Tom Henderson, David McGregor, and David Munro

DETROIT RIVER CANADIAN CLEANUP
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Edited by:

Natalie D. Green, Detroit River Canadian Cleanup
Luca Cargnelli, Environment Canada
Ted Briggs, Ontario Ministry of the Environment
Richard Drouin, Ontario Ministry of Natural Resources
Matthew Child, Essex Region Conservation Authority
Jennifer Esbjerg, Ontario Ministry of Natural Resources
Marcia Valiante, DRCC Outreach Committee
Tom Henderson, Public Advisory Council
David McGregor, Brighton Beach Power
David Munro, Public Advisory Council

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For more information, contact:

Detroit River Canadian Cleanup
311-360 Fairview Avenue West
Essex, Ontario N8M 1Y6
postmaster@detroitriver.ca
Tel: 519-982-3722
Fax: 519-776-8688

Report also available at:
www.detroitriver.ca

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Ted Briggs	Ontario Ministry of the Environment
Luca Cargnelli	Environment Canada
Matthew Child	Essex Region Conservation Authority
Paul Drca	City of Windsor
Richard Drouin	Ontario Ministry of Natural Resources
Jennifer Esjberg	Ontario Ministry of Natural Resources
Natalie Green	RAP Coordinator, Detroit River Canadian Cleanup
Doug Haffner	Great Lakes Institute for Environmental Research
Tom Henderson	Public Advisory Council
David McGregor	Brighton Beach Power
David Munro	Public Advisory Council
Al Stephens	Public Advisory Council
Marcia Valiante	Outreach Committee

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EXECUTIVE SUMMARY

The Canada-U.S. Great Lakes Water Quality Agreement (GLWQA) was signed in 1972 in response to public outcry concerning the over-enrichment and pollution of the Great Lakes. The agreement demonstrates the commitment of both countries to address pollution in their shared Great Lakes. The Canadian federal and provincial governments demonstrated their commitment to restore, protect and conserve the Great Lakes Basin ecosystem by signing the Canada-Ontario Agreement (COA): Respecting the Great Lakes Basin Ecosystem. First signed in 1971, the COA was most recently renewed in 2007. In 1978, the GLWQA was revised to address persistent toxic substances, and in 1987 a Protocol to the GLWQA was signed which called for the development and implementation of cleanup plans, known as remedial action plans (RAPs), to restore ecosystem health at 43 Areas of Concern (AOCs) within the Great Lakes Basin.

The focus of the 1987 Protocol was on human and aquatic ecosystem health using beneficial uses to guide restoration activities. The GLWQA defines 14 beneficial uses that must be restored before an AOC can be delisted (i.e., removed from the list of Great Lakes AOCs). When a beneficial use is degraded, it is referred to as a beneficial use impairment (BUI). Because each AOC is impacted by different environmental issues, remedial action plans are locally driven and defined. Since the GLWQA and COA were signed, three AOCs in Canada and one in the U.S. have been delisted, and two AOCs (one in Canada and one in the U.S.) have been designated 'Areas in Recovery'. The Detroit River was listed as an AOC (in part) due to contaminated sediments, fish consumption advisories, combined sewer overflows, and loss of fish and wildlife habitat.

Work on the Detroit River AOC began as early as 1985, with a Stage 1 RAP Report being completed in 1991. This report was a binational collaboration between the Ontario Ministry of the Environment and the Michigan Department of Natural Resources. Soon after, work on a binational Stage 2 RAP Report began; however, state, provincial and federal agencies were unable to agree on the implementation actions, responsibilities, and timelines and several members of the Binational Public Advisory Council refused to endorse the report. As a result, the report was never accepted by all RAP participants and was released instead as a Detroit River RAP Update Report in 1996. Since then, the implementation of the Detroit River RAP has functioned separately on the Canadian and American sides of the Detroit River. In 1998, the federal (U.S. and Canada), provincial and state agencies signed the Four Agency Letter of Commitment to guide their roles and responsibilities in the Detroit, St. Clair, and St. Mary's River AOCs. Also that year, the Detroit River Canadian Cleanup (DRCC) was formed (then called

the Detroit River Canadian Cleanup Committee) to serve as the Canadian RAP Implementation Group in order to coordinate efforts to address the beneficial use impairments and to ensure progress toward delisting the AOC.

This Detroit River Canadian Stage 2 RAP Report was developed to comply with the requirements of the GLWQA and to identify and prioritize the remaining actions required for restoring the Detroit River's beneficial uses in order to delist the AOC. The report provides an updated status of each of the BUIs, proposed revisions to the delisting criteria which are objectives that need to be achieved for each BUI to be considered 'not impaired', and a list of recommendations detailing actions required to meet the delisting criteria for each BUI. The report utilizes information from both Canadian and U.S. sides of the Detroit River; however, the focus of all analyses, summaries, and recommendations is on the Canadian side only.

The status of beneficial uses in the Detroit River was first assessed in the 1991 Stage 1 RAP Report. Eight beneficial uses were deemed impaired and 6 were listed as not impaired. Several subsequent reports (i.e., 1996 RAP Update Report, 1999 Detroit River Update, and 2006 BUI Status Report) have provided evidence to re-designate the status of beneficial uses; however, none of these proposed changes were ever officially adopted for the Canadian side of the Detroit River AOC. This Stage 2 RAP Report proposes changing the official status of five beneficial uses (all of the others will retain the same status as listed in the 1991 Stage 1 RAP Report). The assessment in this report concludes that, for the Canadian side of the Detroit River AOC, 9 beneficial uses are impaired, 3 are not impaired, and 2 require further assessment. These BUIs are summarized in the table below; a complete assessment of all fourteen possible beneficial use impairments is provided in Chapter 4.

This Stage 2 RAP Report makes recommendations for achieving delisting related to habitat, monitoring and research, education and public involvement as well as point and non-point source discharges. It is important to understand the current scientific data used for updating the status of beneficial uses in order to make appropriate recommendations; however, it is equally important to understand what has already been accomplished. Chapter 6 provides a review of projects completed since the DRCC partnership was first initiated in 1998. The majority of Detroit River RAP projects have been completed by DRCC stakeholders with financial assistance from the federal and provincial governments. Some projects were funded outside of the RAP program but have been integral in achieving the delisting goals. Together, the BUI status overview and the inventory of completed project have helped DRCC stakeholders identify current knowledge and data gaps.

The Detroit River continues to be impacted by several environmental problems; however, the

collaborative efforts between DRCC stakeholders ensure that progress toward restoring beneficial uses in the AOC continues. In order to continue to make progress toward delisting, commitments from the local community, local industry, government, and other partners are required. Together, we can achieve a healthier Detroit River ecosystem!

The following is a brief overview of the Detroit River Canadian beneficial use proposed status changes.

Beneficial Use	Status	Rationale for change
Fish taste and odour	1991: Not Impaired 2010: Requires further assessment	Two surveys on fish taste and odour contradict each other. The Canadian (Health Canada) survey suggested that this beneficial use is not impaired but the data are now over twelve years old and may not be representative of the AOC.
Healthy fish and wildlife populations	1991: Not Impaired 2010: Impaired	Human impacts (habitat destruction and water/sediment contamination) continue to affect diverse fish and wildlife populations. However, we have noted ecological recovery in some species.
Reproductive birds and animals without deformities	1991: Not Impaired 2010: Impaired	Changed to impaired but it is showing signs of improvement. There are no recorded bird deformities but some in snapping turtles and leopard frogs, however, more research is required to confirm. Bald eagles are reproducing in the AOC and a decline in egg contaminants has been noted but there are still signs of reproductive impairment (lower hatching success, feminization, lower egg viability).
Drinking water taste and odour	1991: Impaired 2010: Not Impaired	There are no taste and odour problems due to *Geosmin* or 2-Methylisoborneol (MIB). Any taste or odour complaints have been due to the treatment process (chlorine) and not because of Detroit River water quality.
Healthy phytoplankton and zooplankton populations	1991: Not Impaired 2010: Requires further assessment	There is not enough information on Detroit River phytoplankton and zooplankton communities to make an appropriate assessment. Further research is required.

RÉSUMÉ

L'Accord canado-américain relatif à la qualité de l'eau dans les Grands Lacs (AQEGL) a été signé en 1972 en réponse aux protestations du public concernant la surfertilisation et la pollution des Grands Lacs. L'Accord traduit la volonté des deux pays de gérer les problèmes de pollution touchant les Grands Lacs de part et d'autre de la frontière. Les gouvernements du Canada et de l'Ontario ont démontré leur engagement à l'égard de la restauration, de la protection et de la conservation de l'écosystème du bassin des Grands Lacs en signant l'Accord Canada-Ontario (ACO) concernant l'écosystème du bassin des Grands Lacs (renouvelé en 2007). En 1978, on a modifié l'AQEGL afin d'y inclure les substances toxiques persistantes. Par la suite, en 1987, un protocole élargissant la portée de l'AQEGL a été signé en vue de l'élaboration et de la mise en œuvre de plans de nettoyage, appelés plans d'assainissement (PA), visant à restaurer l'écosystème des 43 secteurs préoccupants (SP) désignés dans le bassin des Grands Lacs.

Dans le cadre du protocole de 1987, axé sur la protection de la santé humaine et de l'écosystème aquatique, les activités de restauration étaient fondées sur les utilisations bénéfiques. L'AQEGL définit 14 utilisations bénéfiques devant être rétablies avant que l'on puisse retirer un secteur préoccupant de la liste des SP des Grands Lacs. Lorsqu'une utilisation bénéfique est dégradée, on parle d'utilisation bénéfique altérée (UBA). Comme les problèmes environnementaux varient d'un SP à l'autre, les plans d'assainissement sont établis à l'échelle locale. Depuis la signature de l'AQEGL et de l'ACO, trois SP au Canada et un SP aux États-Unis ont été retirés de la liste, et deux SP (un au Canada et un aux États-Unis) ont été classés « secteurs en voie de rétablissement ». La rivière Detroit a été inscrite sur la liste des SP en raison, notamment, de la contamination de ses sédiments, des avis concernant la consommation de poisson, du trop-plein des égouts unitaires et de la perte d'habitat du poisson et d'autres espèces sauvages.

Des travaux ont été entrepris dès 1985 dans le SP de la rivière Detroit, et un rapport sur la première étape du PA a été publié en 1991. Ce rapport résultait d'une collaboration binationale entre le ministère de l'Environnement de l'Ontario et le Department of Natural Resources du Michigan. Les travaux portant sur le rapport binational de deuxième étape du PA ont débuté peu de temps après. Les organismes aux échelons étatique, provincial et fédéral ne sont cependant pas parvenus à s'entendre sur les mesures à prendre, les responsabilités et les échéanciers, et plusieurs membres du Comité binational de consultation publique ont refusé d'appuyer le rapport. Celui-ci n'a donc jamais été accepté par l'ensemble des participants au PA et a été publié sous forme de rapport d'étape sur le PA de la rivière Detroit en 1996. Depuis, la mise en œuvre du PA de la rivière Detroit se déroule de manière

distincte dans les portions canadienne et américaine du SP. En 1998, quatre organismes œuvrant aux échelons fédéral (États-Unis et Canada), provincial et étatique ont signé une lettre d'engagement exposant leurs rôles et responsabilités relativement à l'assainissement des SP des rivières Detroit, Sainte-Claire et St. Mary's. Cette même année, on créait le Comité canadien d'assainissement de la rivière Detroit (CCARD) chargé de mettre en œuvre la portion canadienne du PA et de coordonner les efforts visant à remédier à l'altération des utilisations bénéfiques en vue du retrait de la liste des SP.

Le présent rapport canadien de deuxième étape du PA de la rivière Detroit a été rédigé conformément aux exigences de l'AQEGL, dans le but de déterminer les mesures prioritaires devant être appliquées pour rétablir les utilisations bénéfiques de la rivière Detroit en vue de son retrait de la liste des SP. Ce rapport fait le point sur la situation de chaque UBA, propose des modifications aux critères de retrait de la liste, qui sont des objectifs à atteindre pour qu'une utilisation bénéfique soit considérée comme « non altérée », et recommande une série de mesures visant à assurer le respect des critères de retrait de la liste pour chaque UBA. Le rapport repose sur des données concernant les portions canadienne et américaine de la rivière Detroit, mais les analyses, les sommaires et les recommandations qu'il contient se limitent à la portion canadienne du PA.

La situation des utilisations bénéfiques de la rivière Detroit a d'abord été évaluée dans le rapport de première étape du PA publié en 1991. Dans ce rapport, huit utilisations bénéfiques étaient jugées altérées et six utilisations étaient considérées comme non altérées. Plusieurs rapports subséquents (rapport d'étape sur le PA de 1996, rapport d'étape sur la rivière Detroit de 1999 et rapport d'étape sur les UBA de 2006) ont montré la nécessité de revoir la situation des utilisations bénéfiques. Aucun des changements proposés n'a cependant été officiellement adopté pour la portion canadienne du SP de la rivière Detroit. Le présent rapport de deuxième étape du PA propose de modifier la situation officielle de cinq utilisations bénéfiques (la situation de toutes les autres demeure identique à ce qui était indiqué dans le rapport de première étape publié en 1991). Selon l'évaluation de la portion canadienne du PA de la rivière Detroit faite dans le cadre du présent rapport, neuf utilisations bénéfiques sont altérées, trois ne sont pas altérées et deux nécessitent une évaluation approfondie. Les UBA dont la situation est modifiée sont résumées dans le tableau qui suit. Le chapitre 4 présente une évaluation complète des 14 UBA possibles.

Le présent rapport de deuxième étape du PA présente des recommandations visant le retrait de la liste. Ces recommandations portent sur l'habitat, les activités de surveillance et de recherche, l'éducation et la participation du public ainsi que les sources de rejet ponctuelles et diffuses. S'il est important de bien comprendre les données scientifiques actuelles utilisées pour mettre à jour la

situation des utilisations bénéfiques afin de formuler des recommandations appropriées, il est tout aussi important d'avoir une bonne idée des travaux qui ont été effectués par le passé. Le chapitre 6 présente un survol des projets réalisés depuis l'établissement du CCARD, en 1998. La majorité des projets liés au PA de la rivière Detroit ont été réalisés par les intervenants du CCARD, avec l'appui financier des gouvernements aux échelons fédéral et provincial. Certains projets qui n'étaient pas financés dans le cadre du PA ont joué un rôle central dans l'atteinte des objectifs de retrait de la liste des SP. Le survol de la situation des UBA et l'inventaire des projets réalisés ont permis aux intervenants du CCARD de déterminer les lacunes à combler en matière de connaissances et de données.

Plusieurs problèmes environnementaux continuent d'affecter la rivière Detroit, mais les efforts concertés des intervenants du CCARD assurent la réalisation de progrès constants vers le rétablissement des utilisations bénéfiques dans ce SP. Pour poursuivre le travail en vue du retrait de la liste, il faut compter sur l'engagement des collectivités, des entreprises industrielles locales, du gouvernement et d'autres partenaires. Ensemble, nous pouvons restaurer l'écosystème de la rivière Detroit!

Voici un aperçu des modifications proposées à la situation des utilisations bénéfiques pour la portion canadienne du SP de la rivière Detroit.

Utilisation bénéfique	Situation	Justification du changement
Goût et odeur du poisson	1991 : Non altérée 2010 : Nécessite une évaluation approfondie	Deux études réalisées sur le goût et l'odeur du poisson présentent des résultats contradictoires. Selon l'étude canadienne (Santé Canada), cette utilisation bénéfique n'est pas altérée. Les données utilisées datent cependant de plus de 12 ans et ne sont peut-être pas représentatives du SP.
Populations saines de poissons et d'autres espèces sauvages	1991 : Non altérée 2010 : Altérée	Les répercussions des activités humaines (destruction d'habitat et contamination de l'eau et des sédiments) continuent d'affecter diverses populations de poissons et d'autres espèces sauvages. Le rétablissement de certaines espèces a cependant été constaté.
Oiseaux et animaux sans malformations ni problèmes de reproduction	1991 : Non altérée 2010 : Altérée	Utilisation bénéfique maintenant altérée, mais montrant des signes d'amélioration. On n'a rapporté aucune malformation chez les oiseaux, mais certaines malformations ont été observées chez la chélydre serpentine et la grenouille léopard; des recherches seront nécessaires pour confirmer ces données. Le pygargue à tête blanche se reproduit dans le SP : on a noté une diminution des concentrations de contaminants dans les œufs,

		mais des signes de troubles de la reproduction demeurent (baisse du taux de succès de l'éclosion, féminisation, baisse de la viabilité des œufs).
Goût et odeur de l'eau potable	1991 : Altérée 2010 : Non altérée	Il n'y a pas de problème de goût ou d'odeur dû à la *géosmine* ou au 2-méthylisobornéol (MIB). Les plaintes portant sur le goût ou l'odeur étaient liées au procédé de traitement (chlore) et non à la qualité de l'eau de la rivière Detroit.
Populations saines de phytoplancton et de zooplancton	1991 : Non altérée 2010 : Nécessite une évaluation approfondie	On ne dispose pas de données suffisantes sur les communautés de phytoplancton et de zooplancton de la rivière Detroit pour poser un diagnostic approprié. D'autres recherches sont nécessaires.

Chapter 1
INTRODUCTION

1.1 Background

Since European settlement in the 1700s, the Detroit River has been used intensively, serving as an important international shipping and industrial corridor, as a source of drinking water and recreation for millions of people, and as the busiest international border crossing point in North America (Transport Canada 2008; Canadian Heritage Rivers Board 2000). Due to the environmental impacts of these intensive uses, the International Joint Commission (IJC) designated the Detroit River a Great Lakes "problem area" in 1973 and a Great Lakes Area of Concern (AOC) in 1987 (Figure 1).

1.2 Overview of the AOC Program

The Great Lakes Water Quality Agreement (GLWQA), signed by the governments of the United States and Canada in 1972, renewed in 1978 and amended in 1987 (IJC 1987), commits both countries to controlling pollution in the Great Lakes and to cleaning up waste waters from industries and communities. The major issue at the time of the first agreement was phosphorous over-enrichment, while the renewal in 1978 focused on ridding the Great Lakes of persistent toxic substances. The 1987 amendment introduced provisions for Lakewide Management Plans (LaMPs) and the identification of Areas of Concern (AOCs) around the Great Lakes including the development and implementation of Remedial Action Plans (RAPs) for each of these AOCs.

According to Annex 2 of the GLWQA, an AOC is defined as "a geographic area that fails to meet the general or specific objectives of the GLWQA where such failure has caused or is likely to cause impairment of beneficial uses or of the area's ability to support aquatic life". The RAPs are cleanup plans, developed in consultation with the local public, to improve environmental quality and restore beneficial uses within AOCs. The GLWQA requires RAPs to proceed in three stages (IJC 1987): Stage 1 – problem definition; Stage 2 – identification of remedial actions; and Stage 3 – restoration of beneficial uses (delisting). Fourteen (14) potential impairments to beneficial uses were defined in the GLWQA (Table 1). The beneficial uses identify ways that humans and wildlife may be significantly impacted by changes in the chemical, physical, or biological integrity of the AOC.

1.3 History of the Detroit River RAP

The Detroit River RAP process was officially initiated in 1986, although preliminary efforts began as early as 1985. A binational RAP Steering Committee was established to develop the RAP in October 1986, and a Stage 1 RAP Report was completed in June 1991 (MDNR and OMOE 1991). The report identified eight impaired beneficial uses resulting from a number of environmental issues facing the Detroit River including habitat loss, pollution from contaminated sediments, point source discharges from municipal and industrial sources, and non-point sources (e.g., urban and rural stormwater runoff).

The status of each of the Detroit River's 14 potential beneficial use impairments (BUIs) as determined in the Stage 1 RAP Report is presented in Table 1.

Following the completion of the Stage 1 RAP Report, the development of a Stage 2 RAP Report was initiated. By 1996 a draft report had been completed; however, provincial, state and federal agencies

Figure 1. Location of the 43 AOCs in the Great Lakes-St. Lawrence River basin as identified in Annex 2 of the GLWQA (as amended by protocol 1987). Source: Environment Canada.

Table 1. The status of Detroit River AOC BUIs as determined by the 1991 RAP Stage 1 Report (MDNR and OMOE 1991) and this RAP Stage 2 report. Please refer to Chapter 4 for more details on the status changes.

GLWQA BUI #	Beneficial Use Impairment	Stage 1 Status (1991)	Stage 2 Status (2010)
1	Restrictions on fish and wildlife consumption	Impaired for fish	Impaired for fish
2	Tainting of fish and wildlife flavour	Not Impaired	Requires further assessment
3	Degraded fish and wildlife populations	Not Impaired	Impaired
4	Fish tumours or other deformities	Impaired	Impaired
5	Bird or animal deformities or reproductive problems	Not Impaired	Impaired
6	Degradation of benthos	Impaired	Impaired
7	Restrictions on dredging activities	Impaired	Impaired
8	Eutrophication or undesirable algae	Not impaired	Not impaired
9	Restrictions on drinking water consumption or taste and odour problems	Impaired	Not impaired
10	Beach closings	Impaired	Impaired
11	Degradation of aesthetics	Impaired	Impaired
12	Added costs to agriculture or industry	Not impaired	Not impaired
13	Degradation of phytoplankton and zooplankton populations	Not impaired	Requires further assessment
14	Loss of fish and wildlife habitat	Impaired	Impaired

were unable to agree on the required implementation actions, responsibilities and schedules (the central component of a Stage 2 RAP Report). At a July 20, 1996 meeting of the Binational Public Advisory Council to ratify the report, 12 members refused to endorse the report (DRCCC 1999). Thus, the draft report was never ratified by all RAP participants and, as a result, was released as a Detroit River RAP update report in 1996 (MDEQ 1996).

Since then, separate Canadian and American RAP implementation processes have been in operation. In 1998, the governments of Canada, the United States, Ontario and Michigan signed the Four Agency Letter of Commitment which provided a framework of the roles and responsibilities for the implementation of the Detroit River, St. Clair River and St. Mary's River binational RAPs. That same year, a Canadian RAP implementation group, the Detroit River Canadian Cleanup Committee (DRCCC) (now the Detroit River Canadian Cleanup), was formed as the focus for Canadian efforts toward restoration of beneficial uses in the Detroit River.

1.4 History and Structure of the Detroit River Canadian Cleanup

In January 1998, the DRCCC was formed to serve as the implementation group for the Canadian side of the Detroit River RAP. The structure of the DRCCC consisted of six subcommittees (Point Source, Non-Point Source, Contaminated Sediments, Combined Sewer Overflows, Habitat, and Public Involvement and Communications) that advised and reported to the DRCCC (the 'Steering Committee' for the DRCCC was all-inclusive). The DRCCC produced a Detroit River RAP update report in November 1999 that summarized the progress that had been made on the Detroit River since 1996 (DRCCC 1999).

By 2002, members recognized that a renewed commitment by the federal and provincial governments and restructuring of the DRCCC were needed to re-invigorate the organization. At a February 12, 2003 meeting the DRCCC passed Resolution CC 4/03 in support of efforts by Environment Canada and the Ontario Ministry of the Environment to hire an Implementation Specialist (now called a RAP Coordinator) and to develop details for restructuring the DRCCC.

In July 2003, the DRCCC hired a full-time RAP Coordinator, funded jointly by Environment Canada and the Ontario Ministry of the Environment. This was followed by a restructuring that led to the formation of the Detroit River Canadian Cleanup (DRCC). In 2009, a review of the DRCC's structure was conducted through a survey delivered to DRCC members. Overall, the results of the survey were positive but identified some improvements to implement the RAP. In April 2010, the DRCC hosted a General Meeting whereby the Steering Committee Co-chairs presented a proposed, revised structure. The 2010 revised DRCC structure is comprised of two main groups: the Steering and Implementation Committee with four expert work groups and a Public Advisory Council (Figure 2).

The role of the DRCC Steering and Implementation Committee is to provide overall coordination and direction for the implementation of the RAP (refer to Appendix 1 for details). The primary role of the Public Advisory Council is to provide a venue for the public to input into the Canadian Detroit River RAP process.

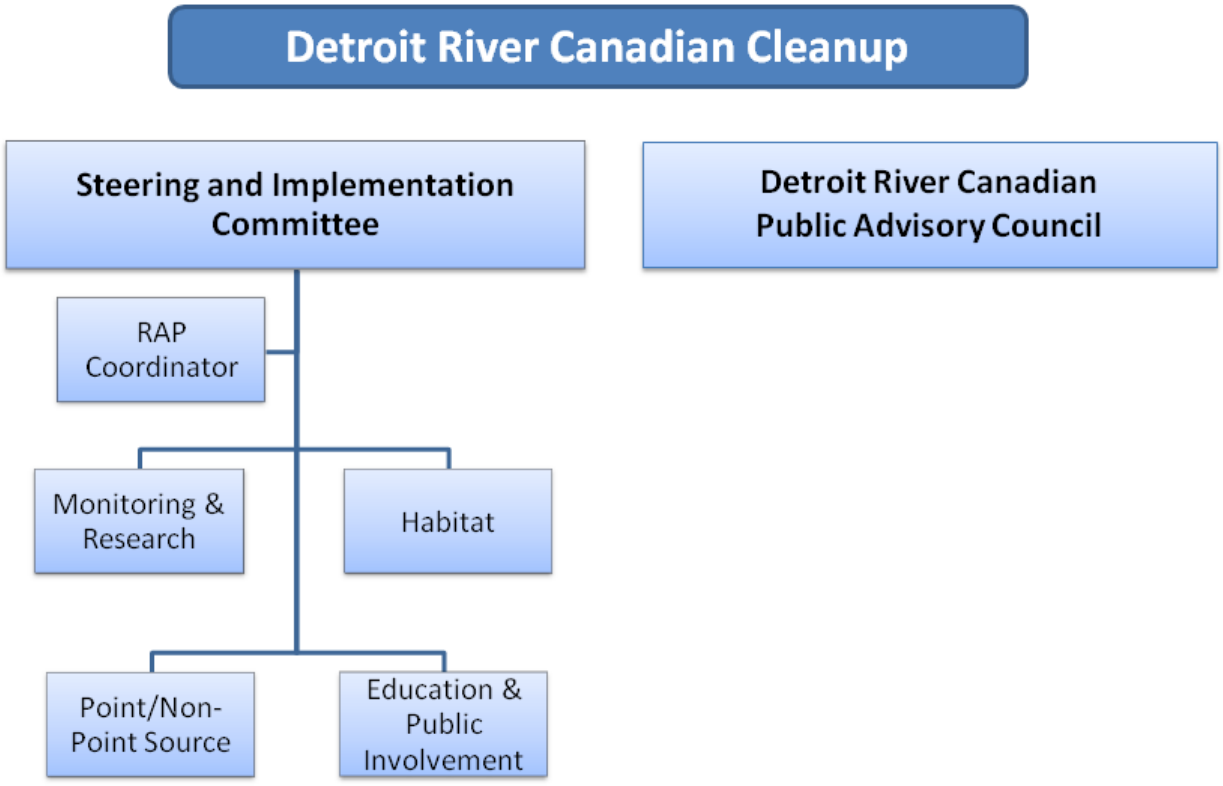


Figure 2. Organizational structure of the Detroit River Canadian Cleanup. Further details are provided in Appendix 1.

The role of the RAP Coordinator (originally referred to as the RAP Implementation Specialist) is to provide coordination and secretariat support for the DRCC committees, to support and report on the activities of the various implementation agencies, to support the development and assessment of delisting criteria for the Detroit River RAP, to facilitate DRCC communications via maintenance of the DRCC web site and distribution of the DRCC E-newsletter, to support DRCC member projects undertaken through the Detroit River RAP, to act as a RAP liaison in the community with the media, and with other organizations that are involved with the Detroit River, and to coordinate the development of RAP update reports and other DRCC publications.

For information about DRCC membership, please see Appendix 1.

1.5 Purpose

This Stage 2 Report for the Canadian side of the Detroit River RAP has been developed in order to comply with the requirements of the GLWQA and to identify and prioritize the remaining actions for restoring the beneficial uses of the Detroit River and achieving delisting of the AOC. This report also provides an updated status of each of the 14 Beneficial Use Impairments (BUIs), revised delisting criteria that set the targets to be achieved for each BUI to be considered *not impaired*, and details of the specific actions required to meet the delisting criteria for each BUI.

The report addresses issues and utilizes information from both the Canadian and US sides of the Detroit River. However, the focus of the analyses, summaries, and recommended actions is for the Canadian side of the Detroit River AOC only.

The information used in this report is up-to-date as of June 2010.

Chapter 2
DESCRIPTION OF THE DETROIT RIVER AREA OF CONCERN

2.1 Physical Description: the River and its Watershed

The Detroit River is a 51 km-long connecting channel in the centre of the Great Lakes basin that links Lake St. Clair to the western basin of Lake Erie (Figure 3). Its width varies considerably from 600 m at the Ambassador Bridge to over 6 km where it empties into Lake Erie. Water depths range from an average of 9-15 m in the upper river to 3-9 m in the lower river (Hartig 2003; Derecki 1984). The Detroit River Canadian AOC refers to the Canadian portion of the Detroit River proper. The Detroit River's Canadian watershed (AOC watershed) is not part of the AOC itself but has been identified as a potential source of impairment to the AOC and is the focus of certain implementation actions (Figure 4).

The river has a shallow and relatively uniform slope for its entire length with a total fall of only 0.9 m from Lake St. Clair to Lake Erie. One navigational shipping channel in the upper portion of the river (the Fleming Channel) and five navigational shipping channels in the lower portion of the river (the Fighting Island, Trenton, Ballards Reef, Livingstone, and Amherstburg Channels) are maintained by dredging to depths of 8.2 m below low water datum (Manny et al. 1988). The long-term average flow rate is 5240 m^3/sec, varying seasonally from 4400 m^3/sec in winter to 5700 m^3/sec in summer. The high water velocity results in an average retention time of water in the Detroit River of just 21 hours. Approximately 453 billion litres of water flow under the Ambassador Bridge every day (DRCCC 1999). Holcombe et al. (2003) reported that the Detroit River could supply Lake Erie with its entire lake capacity in only 2 years. The distribution of flow within the river is complex as a result of the 6 major Canadian and 13 major U.S. islands which divide up the flow (Derecki 1984).

The Canadian islands, Pêche, Fighting, Grassy, Turkey, Crystal Bay, and Bois Blanc (Boblo), are important habitat features within Canadian waters of the Detroit River. The islands provide important terrestrial nesting habitat for birds, while the shallow shelves and beds of submerged aquatic vegetation that surround the islands provide critical spawning and nursery habitat for fish. In fact, the river and its watershed support over 65 fish species and approximately 40 additional species have inhabited or migrated through the river (DRCCC 1999). The wetlands associated with the islands, along with those found along the stretch of Detroit River shoreline from Turkey Creek to the Canard River, constitute almost all of the remaining coastal wetlands on the Canadian side of the Detroit River.

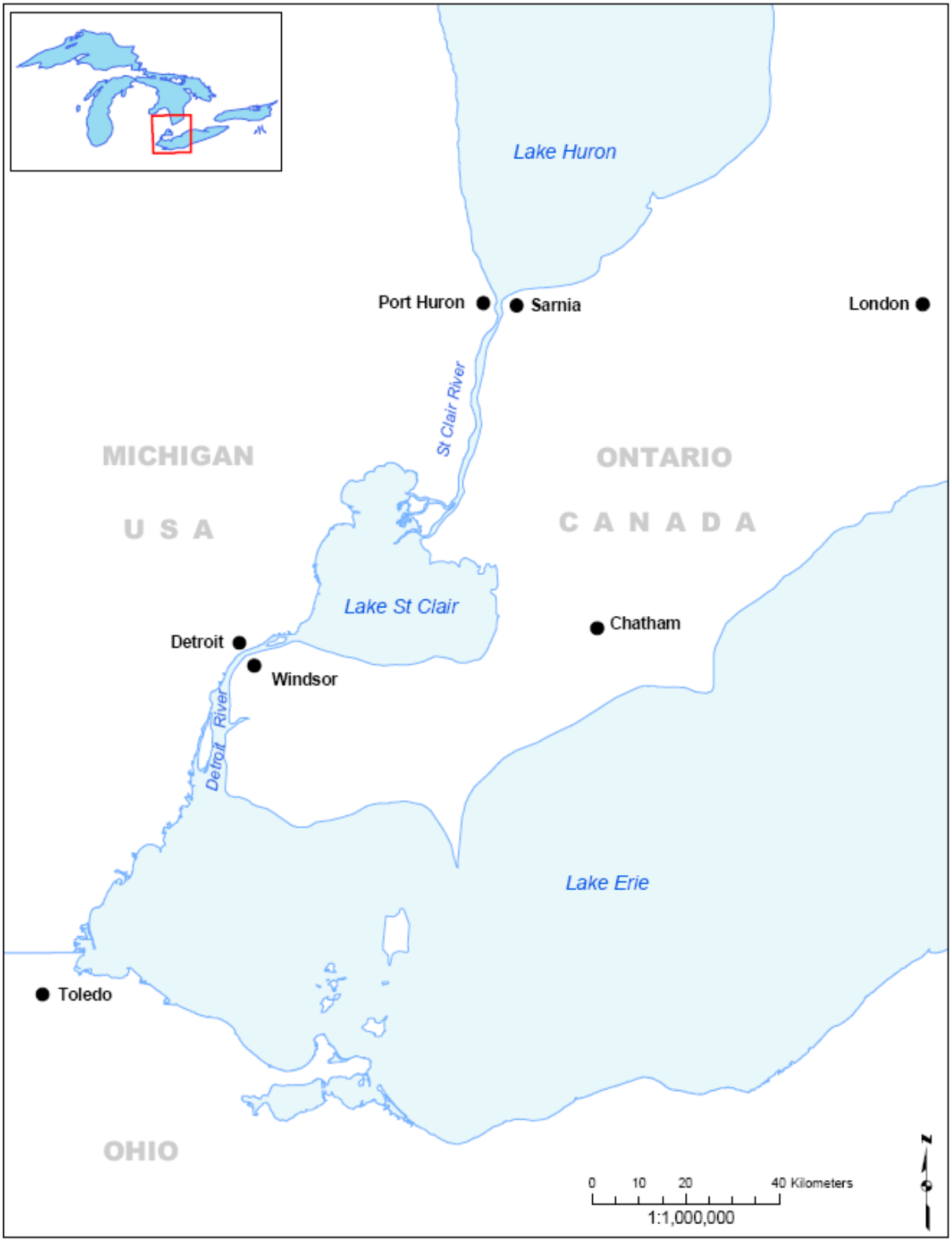


Figure 3. General location of the Detroit River within the Great Lakes basin's Huron-Erie corridor.

Figure 4. Map of the Detroit River Canadian Area of Concern and its watersheds.

The Detroit River watershed drains an area of approximately 2100 km^2, 75% of which is on the U.S. side (MDEQ 1996). There are five tributaries in the U.S. watershed, including the Rouge River which drains an area of about 1210 km^2, is itself a separate AOC and is considered a point-source to the Detroit River. The Canadian watershed has an area of about 517 km^2 and includes the Little River, Turkey Creek and Canard River sub-watersheds (Figure 4). The Little River drains an area of about 62 km^2 and discharges into the upper Detroit River near Pêche Island; Turkey Creek drains an area of 29 km^2 and discharges into the middle Detroit River at the north end of Fighting Island; the Canard River has the largest watershed draining 340 km^2 and discharges into the middle Detroit River south of Fighting Island. Little River and Turkey Creek drain mostly urban areas while the Canard River drains mostly agricultural lands.

2.2 Environmental Issues

The Stage 1 Detroit River RAP Report (MDNR and OMOE 1991) defined and provided a detailed description of the environmental problems affecting the Detroit River AOC including combined sewer overflows, urbanization and land use (degradation of habitat), and toxic contaminants (e.g., mercury, PCBs, PAHs, and metals) in water and sediment. These environmental issues have been identified as being related to, or the cause of, the impairment of several beneficial uses. Although 19 years have passed since the Stage 1 RAP Report was written, the Detroit River is still impacted by many of the same environmental issues (GLIER 2003); however, collaborative efforts between DRCC partners have helped make progress on the river, improving water quality and restoring aquatic habitat. Continued commitment from the community, industry, government, and other partners is required to remediate these major environmental concerns and achieve delisting of the Detroit River as an AOC.

2.3 Current Land Uses

The condition of the Detroit River is affected by human activities, urban and industrial land use, and inputs from the watershed. The Detroit River AOC is home to two large urban centres: Detroit, Michigan and its suburbs (with a population of over 4 million) and the metropolitan area of Windsor, Ontario (with a population of 323,342 [based on 2006 Census data]). Land use within the Detroit River Canadian watershed is comprised of approximately 64% agriculture/unclassified, 29% developed areas, and 7% woodlands (that are >0.5 ha) and wetlands (includes Canadian sub-watersheds and islands; estimates are based on 2000 SOLRIS and 2005-2009 ERCA data) (Figure 5). This contrasts with the U.S. portion of the watershed where land use is approximately 30% agricultural and 70% developed (including residential, urban, and industrial) (Hartig 2003).

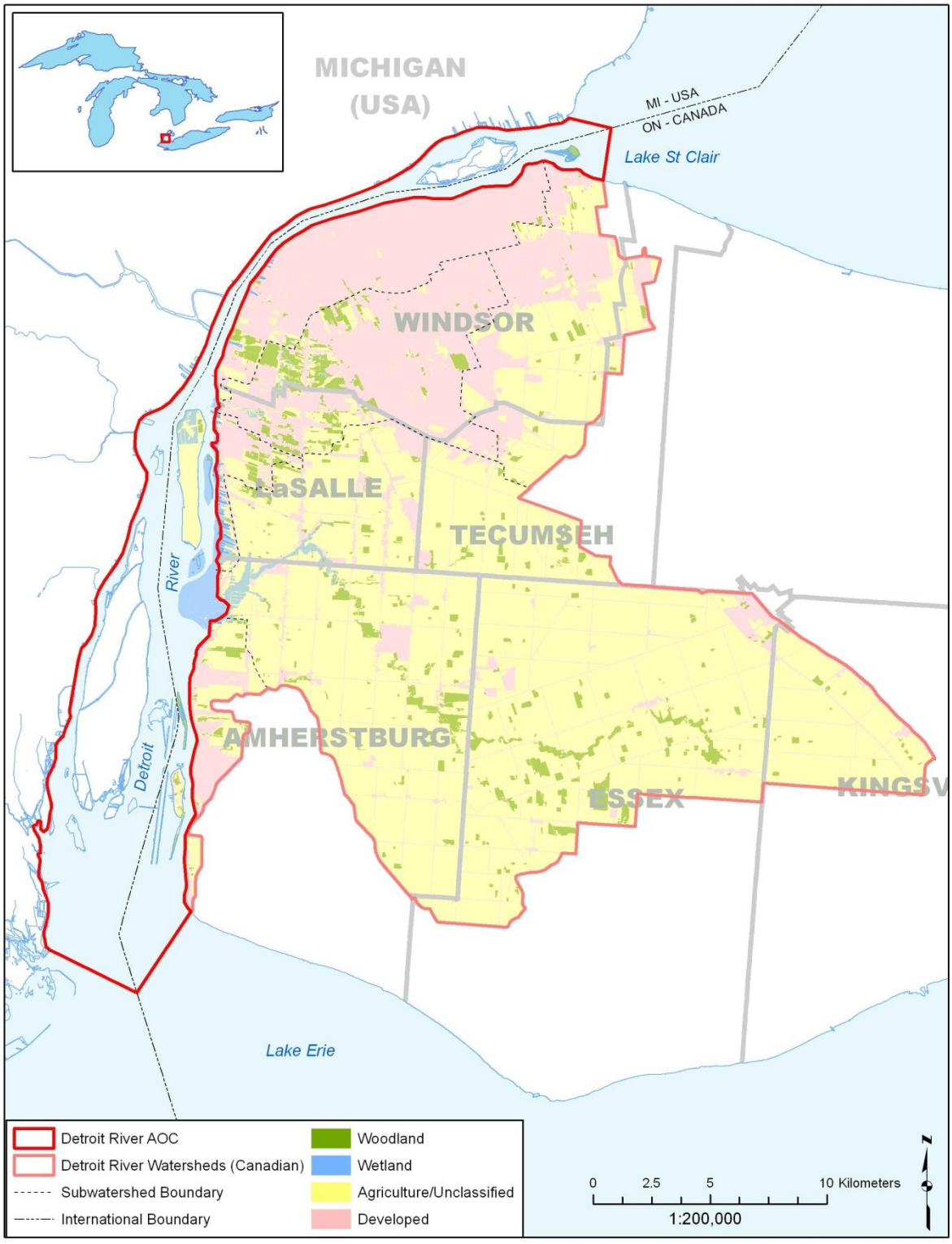


Figure 5. Map of land use in the Detroit River AOC and its watersheds estimated from 2000 SOLRIS data and 2005-2009 ERCA data.

2.4 *Contaminants (in water and sediment)*

Several inorganic substances (metals), pesticides (DDT), and industrial chemicals (PCBs, PAHs) are present in the Great Lakes, including the Detroit River. These contaminants can enter the aquatic environment from the atmosphere, industrial direct discharges, and runoff from the land. The Province of Ontario manages persistent toxic substances through the Municipal/Industrial Strategy for Abatement (MISA) program. The MISA program focuses on major toxic polluters in nine industrial sectors (petroleum, pulp and paper, metal mining, industrial minerals, metal casting, organic chemical manufacturing, inorganic chemical, iron and steel, and electric power generation). The MISA regulations have resulted in an improvement and decrease of pollutants in direct industrial discharges to Ontario waters. There is only one MISA Operating Plant discharging to the Detroit River AOC (Canadian Salt Company Ltd. (mine and evaporator)); however, there are other direct dischargers that operate and are monitored through a Certificate of Approval (e.g., Ford Motor Company of Canada Ltd. (Windsor Engine Plant) and Honeywell ASCa Inc. (Amherstburg)). For more information about the Certificate of Approval process, please contact the Ontario Ministry of the Environment (OMOE).

Contaminants can bind to organic matter in the water and settle in the sediments on the bottom of the river. They can also bind and accumulate in biological tissue (i.e., human, fish, birds, invertebrates) then biomagnify through the food web. Inorganic substances include mercury and other metals such as copper, zinc, cadmium, manganese, chromium, and arsenic. The use of mercury for industrial purposes was limited in the 1960s and 1970s; however, mercury continues to be found in fish tissue because it can still enter the environment from atmospheric and local, man-made sources. The use of the pesticide DDT was banned in Canada and the United States in the early 1970s (Environment Canada 2001) but the chemical is still found at low levels at various locations around the Great Lakes including the Detroit River. Polychlorinated biphenyls (PCBs) are a group of chlorinated organic chemicals that were banned in Canada and the United States in the 1970s but are also still present throughout the Great Lakes. PCBs are not found naturally so their presence in the environment is always due to human sources.

Freshwater mussels (*Elliptio complanata*) are commonly used to monitor the concentration of the bioavailable phase of contaminants (e.g., PCBs, DDT, and PAHs) in the water. A recent study found that the concentration of DDT ranged from 0.01 ng/L to 1.36 ng/L, below the IJC's objective to protect aquatic life (3 ng/L) (GLIER 2003). The same study measured concentrations of PCBs between 0.01 ng/L to 1.0 ng/L in Detroit River water from 1996 to 2000 (GLIER 2003). The average concentration of PCBs in water in the Trenton Channel (lower U.S. side of the Detroit River) water was 4.5 times higher than the river-wide average (0.16 ng/L) (GLIER 2003). Similarly, a 2002 study using caged mussels found that the average PCB concentration was five-fold greater in mussels on the U.S. side of the Detroit River (at the Ambassador Bridge and downstream of the Trenton Channel) compared to mussels on the Canadian side (Leney and Haffner 2006).

Sediment sampling conducted in 1999/2000 and 2008/2009 revealed that contamination occurred at several sites in the Detroit River and was generally higher and more frequent in the lower U.S. reach of the river. The 1999/2000 sampling indicated that mercury concentrations in the surficial sediment exceeded the OMOE's lowest effect level (LEL) at 39 U.S. sites and 30 Canadian sites (GLIER 2003). The data also indicated that there were ongoing, local sources of mercury in the Detroit River watershed.

The 2008/2009 follow-up study showed that there were no significant changes in the concentrations of mercury in sediments over the last 10 years and that mercury is distributed throughout the river (Drouillard et al. unpublished). Similarly, the levels of PCBs in Detroit River sediments have also remained unchanged since the 1999/2000 survey. The 2008/2009 study shows that PCB concentrations in the U.S. sediments were 6.5 times greater than concentrations in Canadian sediments (Drouillard et al. unpublished). Polynuclear aromatic hydrocarbons (PAHs), a class of genotoxic chemicals believed to be associated with fish tumours, are also found in Detroit River sediments. The concentration of PAHs in the sediment exceeded the LEL at 53 sampling sites (42 on the U.S. side and 11 on the Canadian side of the river). The data indicates that there are few PAH sources in the Canadian AOC (GLIER 2003).

2.5 Non-native Invasive Species

Non-native species are plants or animals that are introduced in areas outside of their normal range (OMNR, 2010). Some non-native species can severely, adversely affect the local ecosystem (invasive). The RAP acknowledges the presence of non-native, invasive species but it focuses efforts on impairments directly associated with the AOC. Non-native, invasive species are a problem throughout the Great Lakes basin (Hartig et al. 2007). Some examples of non-native, invasive species in this area are: zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena rostriformis bugensis*), round goby (*Neogobius melanostomus*), and the common reed (*Phragmites australis*).

2.6 The Binational Nature of the Detroit River RAP

The Detroit River is identified as a binational AOC with Canadian and U.S. Federal Government as well as Provincial (Ontario) and State (Michigan) jurisdiction. While the Detroit River Stage 1 RAP Report was a binational effort, the Detroit River RAP has essentially functioned as two separate domestic RAPs since 1996 (see Section 1.3) with the binational nature of the RAP being maintained at the level of the Four Agency Managers (see Section 1.3). Furthermore, ties are maintained by the involvement of Canadian and U.S. representatives with committees and groups on both sides of the border. For example, a RAP liaison from the U.S. EPA Great Lakes National Program Office (GLNPO) participates on the DRCC Monitoring and Research Work Group. Two Detroit River Public Advisory Councils (PACs) function separately on each side of the river; however, the Canadian RAP Coordinator attends U.S. PAC meetings as a liaison between both countries and the U.S. PAC Chair occasionally attends Canadian PAC meetings. Moreover, the DRCC Monitoring and Research Work Group frequently attempts to coordinate research and monitoring projects in the Detroit River AOC and its watershed to benefit both U.S. and Canadian RAP goals.

It is also important to note that federal, provincial and state governments have agreed, in the Four Agency Letter of Commitment and corresponding Compendium of Position Papers (2009 Update) that the delisting of a binational AOC can be done domestically or bi-nationally in the following circumstances:

- All beneficial use impairments have been re-designated (i.e., delisting criteria have been met),
- The local community concurs that the actions taken have restored beneficial uses and supports the delisting of an AOC, and
- Environmental conditions based on sound science confirm restoration of beneficial uses with no trans-boundary concerns.

Chapter 3
PUBLIC INVOLVEMENT IN THE RAP

3.1 Overview of Public Involvement

The DRCC Education and Public Involvement Work Group (formerly the Outreach Committee) and the Public Advisory Council (PAC) are both involved in implementing activities and projects that promote public awareness of the RAP. Due to the similarity in goals between the two groups, they often meet together. The Education and Public Involvement Work Group consists of members from public interest groups, advocacy groups, 'Friends of Watersheds' organizations, municipalities, industry, and government. Their goal is to undertake projects that promote and contribute to the restoration of the beneficial uses in the Detroit River AOC (DRCC 2004). For example, in 2008 a rain barrel installation and downspout disconnection program was implemented and administered by the City of Windsor through funding from the DRCC Outreach Committee (now called the Education and Public Involvement Work Group) and the Ontario Ministry of the Environment (OMOE). This pilot program focused on an area in the City of Windsor that is prone to basement flooding and combined sewer overflows (CSOs) into the Detroit River. By implementing downspout disconnection and the installation of rain barrels, there will be fewer CSO events and residents in the Detroit River AOC will conserve water. Other Education and Public Involvement Work Group projects have included pollution prevention, tree plantings, a native plant demonstration garden, and public tour events (refer to Section 3.2 for details).

Membership with the DRCC PAC is inclusive and open to anyone interested in the health of the Detroit River ecosystem and ultimately, the restoration of the AOC. The PAC's main purpose is to provide a venue through which the public can offer input and promote action on Detroit River AOC restoration and implementation efforts (DRCC 2004). Moreover, the role of the PAC is to review and report on RAP projects aimed at restoring beneficial uses and ultimately delisting the AOC. These reports are produced for and distributed to the public but are also submitted to politicians and governmental representatives. The DRCC PAC is ultimately a Canadian effort; however, U.S. Detroit River PAC members (Friends of the Detroit River) are encouraged to attend meetings and become involved in DRCC PAC activities.

As members of the Stage 2 Writing Team, the DRCC PAC and the Outreach Committee were instrumental in providing input and feedback on several drafts of the Stage 2 RAP document. Further, they helped to organize open houses and events to engage the public in learning about the Detroit River AOC and encourage them to participate in the RAP process. A summary of public input into the development of the Stage 2 RAP report is provided in Section 3.4 of this document.

3.2 *Public Outreach and RAP Education Activities Since 2003*

Communication and Education

Website Re-design and E-newsletters

The DRCC website was re-designed in 2007 to have a more current and appealing look. It continues to be updated to include more information for the public about the RAP's goals and activities. The DRCC website is an excellent information resource for the public and a good location for announcing DRCC-

related events and goals. The E-newsletters are distributed to subscribers monthly. The goal of the E-newsletter is to inform and engage the public in the RAP.

Report Cards on RAP Progress

The DRCC PAC is active in publishing report cards (technical and public-friendly summaries) on BUI re-designation progress for the Detroit River RAP. To date the PAC has developed 2 report cards, focused on Fish Consumption Advisories and Beach Closings. Each report card examines progress on the RAP and provides suggestions for achieving re-designation of Beneficial Use Impairments (BUIs) to *not impaired*.

Detroit River Research Seminar for the Non-Scientist

A public information session was jointly hosted by the DRCC PAC and the U.S. Detroit River PAC in March of 2007 to inform the public about current research in the Detroit River. Three scientists were invited to speak about their research results about water and sediment quality and historic/current maps of the Detroit River.

Earth Day

The DRCC has participated in Earth Day events in April annually since 2006. The RAP Coordinator sets-up a display at the event including RAP information, projects, brochures and promotional materials. DRCC members, the PAC and the public participate in a tree planting at Malden Park (Windsor, Ontario). Members also assist the Coordinator in promoting the RAP and answering questions at the display booth.

Pêche Island Day

Pêche Island is a small island located at the head of the Detroit River that is owned by the City of Windsor. The purpose of Pêche Island Day is to celebrate and highlight the island's ecology, biodiversity, and history as part of the Detroit River. The Day also provides an opportunity for people without boats to visit and explore the island. The use of boats has been generously donated by the OMNR, BASF, GLIER, the City of Windsor, the Windsor-Essex County Canoe Club and the Friends of the Detroit River (U.S.). This event has been successful since its inception in 2006. In the past, the DRCC has recorded over 400 people in attendance.

Watershed Tours

The Citizens Environment Alliance (CEA) has conducted watershed tours since 2003. A second round of tours of the Detroit River watershed (Little River and Canard River sub-watersheds) offered in October 2006 was organized by the CEA and funded by the DRCC. The tours were well attended by the public, environmental organizations, City Councilors and Members of Parliament (MPs). Transit Windsor provided a bus to collect individuals at various locations and to bring them to key areas in the watersheds.

Detroit River Watershed Self-Guided Tour and Pêche Island Informative Brochures

Informational, self-guided tour brochures were developed with the help of a DRCC Outreach Committee member organization, the CEA, with funding from Environment Canada. Since 2003, the CEA has conducted several tours of portions of the watershed that were very well-received, but they were one-time events. These publications are based on those past tours and will enable interested

individuals to visit key environmental areas with information in-hand to describe them. Three brochures were developed: one for each of the Little River, Turkey Creek and Canard River watersheds. Due to the popularity of Pêche Island Day, an informational brochure about the history and ecology of Pêche Island and its place within the Detroit River ecosystem was created for the public.

Downspout Disconnection and Rain Barrel Program

On February 11, 2008 the City of Windsor implemented By-law 26-2008 that made downspout disconnection mandatory in certain areas of Windsor. The pilot rain barrel program was launched to complement downspout disconnection in the South Walkerville area of Windsor, an area that has been prone to basement flooding and storm water infiltration due to aging sewer systems. Letters and brochures to support the initiative were developed and sent to residents in the area and over 100 households requested downspout disconnection and rain barrel installation. This program helped promote water conservation and positively impacted water quality by redirecting storm water that would have otherwise contributed to CSOs to the Detroit River.

Go Natural: Pull, Don't Spray Campaign

To promote a City of Windsor by-law phasing in a ban on the cosmetic use of pesticides, the DRCC developed a *Go Natural: Pull, Don't Spray* brochure and distributed them at various locations around the city during the month of May 2007. As an example of pesticide alternatives, weed pullers were distributed to those who visited the promotional location. Approximately 6,000 weed pullers were given away and brochures continue to be circulated. The pesticide ban came into full effect in 2009 in the City of Windsor. A province-wide ban on the use of cosmetic pesticides came into full effect on Earth Day (April 22) 2009. For more information about Ontario's pesticide ban, please visit: http://www.ene.gov.on.ca/en/land/pesticides/.

Destination Eagle

In 2004, the 'Destination Eagle' project was launched as a partnership between the DRCC, the Essex County Field Naturalists' Club, and Bird Studies Canada (BSC). Through this program, juvenile bald eagles were examined, banded, tested for toxins, and fitted with satellite transmitters. The DRCC sponsored two eaglets in 2006 (named Gwayah and Phoenix) that could be tracked online by visiting the DRCC or BSC website. This project confirmed that the Detroit River is a very important stopover for birds migrating from southern Ontario to Michigan and beyond. Educational signage was also developed and installed in select locations within municipalities along the Detroit River to promote stewardship and highlight the importance of bald eagles in the Detroit River region.

Household Mercury Collection

The DRCC partnered with the Essex-Windsor Solid Waste Authority, the City of Windsor, the Town of LaSalle, the OMOE, and Environment Canada on a project to reduce mercury pollution in the Detroit River AOC. Residents were encouraged to bring mercury-containing items (e.g., thermometers, thermostats, fluorescent bulbs, batteries) to the Household Hazardous Waste Depot during April 2004 and February 2006 in return for special bonuses. The project was a success and **over 90 kg of mercury** was collected (750 thermometers, 100 thermostats, over 1000 fluorescent light bulbs, 20 jars of mercury, and many other items).

Detroit River Week

The DRCC in collaboration with the U.S. 'Friends of the Detroit River' hosted a Detroit River week from May 15 to May 22, 2004 to increase public attention about the Detroit River. The week included organized cleanups of the Canard River, Turkey Creek, and the Detroit River and also a DRCC PAC meeting.

Community-based Naturalization Projects

Tree Plantings

Numerous community tree plantings occur annually within the Detroit River watershed and its 3 sub-watersheds. Plantings are completed at various parks and schools in the area and engage many students, community members, and groups (e.g., Little River Enhancement Group (Lil'Reg), Friends of Watersheds (ERCA), Essex County Stewardship Network (ECSN), and Essex County Field Naturalists' Club). Through community and school tree plantings, more than 970 large stock trees and 700 seedlings were planted in the AOC watershed in 2008 alone. Tree plantings (including community plantings) help increase forest cover and wildlife habitat in the Detroit River AOC while fostering environmental stewardship in children and adults in the community.

Watershed Cleanups

Cleanup events held in the Detroit River watershed engage various community groups (e.g., Friends of Watersheds (ERCA), Lil' Reg, Citizens Environment Alliance (CEA), Canadian Auto Workers, and Essex County Field Naturalists' Club), the University of Windsor, numerous elementary and secondary school students, industry representatives, and individuals from surrounding municipalities. Approximately five community cleanups in the AOC watershed (Little River, Turkey Creek, and Canard River) were completed in 2008. Some of the items removed during the cleanups included shopping carts, tires, electronics, bicycles, and large amounts of litter. Metal parts were recycled and electronics were donated to *Computers for Kids* (Windsor, Ontario). The cleanups are always a success and continually attract more volunteers.

Native Plan Demonstration Garden

A partnership between the DRCC (with funding from Environment Canada), Friends of Turkey Creek, ERCA, and the Town of LaSalle resulted in a Native Plant Demonstration Garden site along Turkey Creek (near Matchette Road). The Native Plant garden was a follow-up to the 2007 *Go Natural: Pull, Don't Spray* campaign to promote awareness about pesticide-free gardening. The garden is maintained by the Friends of Turkey Creek.

Green Corridor – EcoHouse Front Garden Naturalization

The EcoHouse Front Garden Naturalization was sponsored by the DRCC in 2007. This project was implemented by the University of Windsor's Green Corridor Project in collaboration with horticultural students at a local high school and community volunteers. The Green Corridor group planted native plants and seeds to create a native garden demonstration in front of their EcoHouse (an existing Windsor home that was converted to demonstrate environmentally-sustainable living). The EcoHouse was recently relocated. Contact the Green Corridor Group for more information.

Tree planting at the Ford NEMAK (Essex Aluminum) Plant

In 2003, volunteers planted approximately 300 native trees on 2.8 ha of land near the Ford NEMAK Plant in Windsor, Ontario. A sign was erected to acknowledge the naturalization of the site and the partners involved.

Protection of Airport Woodlots

Land around the Windsor Airport (within the Little River watershed) contains three large forested parcels that, although isolated from one another, are relatively undisturbed. Beginning in 2003, the DRCC PAC, in collaboration with the Little River Enhancement Group and the Essex County Field Naturalists' Club, worked to have the Windsor Airport Woodlot properties joined and preserved. The City of Windsor was receptive to the PAC's concern and as a result, the City of Windsor developed a policy for the preservation of all three woodlots and has eliminated a planned road extension through two of those woodlots (DRCC 2007).

Activism

Environmental Review Tribunal

The DRCC PAC was granted "Presenter Status" at the Environmental Review Tribunal hearing between General Chemical (Amherstburg, Ontario), the Town of Amherstburg, and the Ontario Ministry of the Environment with respect to the OMOE's Order requiring cleanup of the waste on the General Chemical site. The PAC was the only non-government organization to seek status in the hearing. The PAC supported the OMOE's claim that General Chemical should pay for the cleanup, to ensure that the Detroit River would be protected. In November 2008, General Chemical agreed to provide funds to clean up the site, and the hearing was concluded.

Naturalization of the Windsor Family Credit Union Arena Site

In 2006, the DRCC PAC voiced their concern to the City of Windsor about the environmental impacts of runoff on the Little River (and ultimately, the Detroit River) from the proposed parking lot at the new arena site. The City of Windsor and the DRCC PAC (along with other organizations) worked to address the environmental concerns which led to natural cover at the site being increased to 30%. The City also created natural habitat areas along the riparian zone of the Little River and committed to a road salt reduction program on the site.

Hydro One Natural Habitat Corridor Proposal

By 2012, Hydro One Inc. plans to construct a service road to install transmission towers and power lines. In 2008, the members of the DRCC PAC provided its support to the Little River Enhancement Group's initiative requesting that Hydro One create a natural habitat corridor to connect the Little River riparian corridor with the McAuliffe Woods Conservation Area after construction is completed. The PAC and its partners suggested restoring the area to a tallgrass prairie habitat and trail route for residents. The PAC has committed to supporting this project and will follow-up as necessary.

Windsor Official Plan Review

In 2008, the DRCC PAC (along with other organizations) submitted comments to the City of Windsor as part of the review of its Official Plan. The comments made suggestions for policies that would strengthen the protection of riparian habitat and significant natural areas within the Detroit River watershed.

Diverting a Truck Bypass through Natural Areas

A truck bypass through the Ojibway Prairie Complex and the Spring Garden Area of Natural and Scientific Interest (ANSI) was proposed by the City of Windsor in January 2005. The DRCC PAC opposed the proposal as it would have destroyed much of these natural areas. PAC members worked diligently writing letters, attending rallies, and lobbying politicians to ensure that the $300 million proposal did not gain approval. The proposal was dropped. The Ojibway Prairie Complex and the Spring Garden ANSI remain protected.

3.3 Detroit River RAP-related Publications

2010 Pêche Island (brochure)

2010 Watershed Tours of Little River, Turkey Creek and Canard River (brochures)

2009 PAC Report Card #2: Beach Closings (technical and summary)

2007 Detroit River Area of Concern Canadian Priority Habitat Sites

2007 PAC Report Card #1: Fish Consumption Advisories (technical and summary)

2007 The Current Newsletter

2006 Go Natural: Pull, Don't Spray (brochure)

2006 Don't let *your* household chemicals harm *our* Detroit River (brochure)

2006 Assessment of Beneficial Use Impairments in the Detroit River AOC (technical)

2005 Delisting Criteria for the Canadian Portion of the Detroit River RAP (technical and summary)

2005 Delisting Criteria for the Canadian Portion of the Detroit River RAP (summary)

2005 The Current Newsletter

2004 Household Mercury Collection (Bilingual Brochure)

2004 Natural Choices (brochure)

2003 Water Conservation Fact Sheet

1999 Detroit River Update Report

1996 Detroit River 1996 Report (Binational)

1991 Stage 1 Remedial Action Plan (Binational)

3.4 Public Consultation

The draft Stage 2 RAP Report was released for public review on September 23, 2009. A PDF document of the draft report was posted on the DRCC's website (www.detroitriver.ca). In addition, a link to an interactive reviewing and commenting module was available, which allowed the Stage 2 RAP Report (or sections thereof) to be viewed without having to download the entire document and provided the opportunity to submit comments online. The interactive module received a total of 347 visits during the public consultation period from September 23, 2009 to November 9, 2009.

In order to promote the draft Stage 2 RAP Report and encourage public participation in the RAP process, the DRCC's Outreach Committee held a special film screening event at a local theater in Windsor on the same night as the report's release. Over 240 people attended the screening of *Waterlife*, a recent documentary about the Great Lakes' environmental issues. Before the film began, the RAP Coordinator gave a brief overview of the DRCC, the draft Stage 2 RAP Report, and encouraged the public to review the report and attend the upcoming Open Houses. The RAP Coordinator and some DRCC representatives were available to answer questions after the film.

In addition to the promotion of the public review of the draft Stage 2 RAP Report at DRCC events and in the DRCC's E-newsletter, the draft Stage 2 RAP Report also received significant media coverage. The *Windsor Star* and four local radio stations covered the release of the Report including the dates and locations of the Open Houses. On October 2, 2009, the *Windsor Star* published a detailed article about the Stage 2 RAP Report (see Appendix 2). A number of presentations on the draft Stage 2 RAP Report were also given to municipal councils and local environmental organizations prior to the Open Houses.

The DRCC hosted three Open Houses; one in each of the municipalities adjacent to the Detroit River (Windsor, LaSalle, and Amherstburg) between October 27 and 29, 2009. The Open Houses each ran from 3:30 pm to 7:30 pm and included a presentation on the draft Stage 2 RAP Report by the RAP Coordinator at 6 pm followed by a question and answer period. The Open Houses allowed participants to drop in at their convenience and ask questions in a friendly, open setting. The RAP Coordinator and DRCC representatives were on hand to answer questions relating to the Detroit River AOC. Several informative posters were developed to address specific questions that the public may have had regarding the draft Stage 2 RAP Report, for example, "Can we eat the fish?", "Are the fish and wildlife healthy?", "How will we know when we've achieved our goals?", "What has the DRCC partnership accomplished?", etc. A copy of the draft Stage 2 RAP Report, brochures, past reports, and fact sheets were also made available.

LOCATION	DATE
Fort Malden National Historic Park, Amherstburg	Tuesday, October 27, 2009
Vollmer Culture and Recreation Complex, LaSalle	Wednesday, October 28, 2009
Mackenzie Hall Cultural Centre, Windsor	Thursday, October 29, 2009

In total, twenty-five people attended the three Open Houses. During the question and answer periods, several topics of interest were covered: sewer overflows/bypasses in the Little River, soil erosion, Canard River and Little River water depth, upcoming projects and commitment by the municipalities, and suggestions about rehabilitation projects used in Toronto. No suggestions for changing or revising the draft Stage 2 RAP Report were received at the Open Houses.

Written comments were received by email, regular mail, and via the online submission module between September 24 and November 9, 2009. Written comments were generally positive and did not require revisions of the Stage 2 RAP Report. One resident explained that she and her husband agreed with whatever needed to be done to restore the Detroit River. Another comment related to the active involvement of Bird Studies Canada in assisting the DRCC with specific monitoring needs. Lastly, one individual expressed his concern over algal blooms in Lake Erie. Detailed comments and responses are provided in Appendix 3.

Chapter 4
ASSESSMENT OF THE CURRENT STATUS OF BENEFICIAL USE IMPAIRMENTS

4.1 Status of BUIs Over Time

Annex 2 of the GLWQA (as amended in 1987) identifies 14 potential impaired beneficial uses by which the status of AOCs in the Great Lakes-St. Lawrence River Basin are to be assessed. The status of the possible beneficial use impairments (BUIs) in the Detroit River AOC was first examined and reported in the RAP Stage 1 Report; only 8 of the 14 were considered to be impaired (MDNR and OMOE 1991). Their status was subsequently re-assessed and revised in 1996 (MDEQ 1996), 1998 (DRCCC 1999), and 2006 (Leney and Haffner 2006). An additional BUI - Exceedance of Water Quality Standards/Objectives - was added by the BPAC sometime before 1996. Since it is not recognized by the provincial and federal governments in the GLWQA and it is not utilized in any other AOC, the DRCC has decided to remove this BUI from its list. The 2006 BUI Status update report indicated that 10 of 14 BUIs were known to be impaired, while two were identified as unknown (requires further assessment), and two were deemed unimpaired. Table 2 summarizes the proposed status of the BUIs in various reports and evaluations. *Note that the status listed in the 1991 RAP Stage 1 Report denoted the only official beneficial use status. However, the status of each BUI will now be officially changed to those listed in this RAP Stage 2 Report*.

4.2 Assessment of Detroit River Canadian BUIs and Delisting Criteria

Delisting criteria were developed for the Canadian side of the Detroit River AOC in 2005. These were based on several reports and workshops that were completed during the period from 2000-2002 (Dolan and Murray 2003). The reports were compiled into one document, and approved as the Canadian delisting criteria by the DRCC in June 2005. In 2006, the DRCC Monitoring and Research Work Group produced a BUI Assessment report (Leney and Haffner 2006) which was the first major update since the 1999 Report produced by the DRCCC. In the process of conducting the assessment, a number of deficiencies were identified in the 2005 delisting criteria. Specifically, it was found that some of the criteria were difficult to measure, some set targets that would be virtually impossible to achieve, and others included issues and factors not directly related to the impairment of the beneficial use. As a result of these concerns, the DRCC undertook a review of the Canadian delisting criteria, including an experts' workshop held in December of 2007. The intent of the modifications to the delisting criteria was to make them measurable, achievable and scientifically-defensible. To guide their approach to revising/rewriting the delisting criteria on the Canadian side of the Detroit River AOC, the DRCC Monitoring and Research Work Group developed the following principles:

- The RAP should recognize that the Detroit River (as a whole) is surrounded by significant urban development with some rural influences on the Canadian side. Even though the entire river is classified as an AOC, it is not clear that the entire river is impaired. There may be hotspots (e.g., the Trenton Channel or at marinas) but certain BUIs in the river as a whole may be unimpaired. Delisting should be based on the river as a complete ecosystem and should not be dependent on the complete elimination of all hotspots.

- There are some region-wide issues that are beyond the scope of the AOC program. Therefore, causes of beneficial use impairments must originate within the Detroit River AOC.
  - Need to distinguish between in-river sources and upstream/regional sources.
  - Sources should be active and anthropogenic in nature.
  - A significant portion of the river must be affected. For example, loading from a tributary may have a minimal, localized impact at the mouth of the tributary, but the river as a whole may not be impacted. However, if severe impairment in a smaller area exists, it would have to be addressed before delisting can occur.
  - The RAP should deal with only those watershed issues that impact the river (i.e., those that are linked to BUIs). Recommendations have been made in this Stage 2 RAP Report for investigating the impacts of the watershed on the river. If the cause of the impairment is the watershed, then a program should be developed to address it.

- Delisting criteria should be linked to the original reasons (identified in the Detroit River Stage 1 RAP Report) that the beneficial use was deemed impaired.

- Delisting criteria must recognize that much of the AOC is located in an urbanized area and that the Detroit River is a major international shipping corridor. The attainment of the criteria would not mean that the Detroit River has returned to a pristine, natural state. However, the achievement of these goals would mean that the Detroit River is no longer the seriously polluted body of water it once was, and is well on its way to becoming even healthier.

- After the delisting criteria have been achieved and a BUI is re-designated as *not impaired*, the BUI should be assumed to remain unimpaired unless monitoring demonstrates that a significant impairment has again arisen. Once all beneficial uses are unimpaired, monitoring and implementation will continue under the Lake Erie Lakewide Management Plan (LaMP) or within other core programs (e.g., OMOE Sport Fish Monitoring).

The following sections include a literature review of current information in order to assess and update the status of each BUI using the 2005 Detroit River Canadian delisting criteria. A status gauge indicates the proposed status of each BUI based on the assessment. An arrow pointing to the left (red) indicates an impaired status and an arrow pointing to the right (green) indicates that the status is not impaired. Each section also includes the revised Canadian delisting criteria as well as a description of the rationale for the revisions and proposed design considerations for future studies in order to achieve scientifically sound delisting targets.

Table 2. The status of BUIs recommended for the Detroit River RAP as indicated in the current report (2010) and various reports between 1991-2006 (modified from Leney and Haffner 2006).

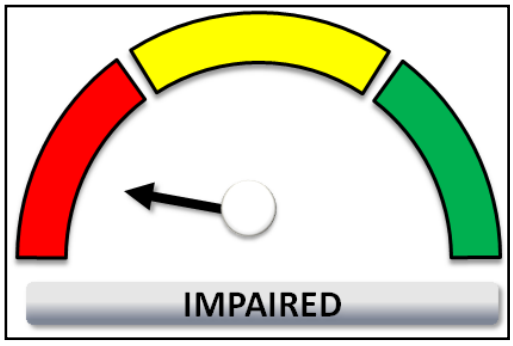
GLWQA Beneficial Use Impairment	RAP Stage 2 2010	2006 Evaluation*	DRCCC 1999 Evaluation*	1996 RAP Report‡	RAP Stage 1 1991
Restrictions on fish and wildlife consumption	Impaired for fish	Impaired for fish	Impaired for fish	Impaired for fish	Impaired for fish
Tainting of fish and wildlife flavour	Requires further assessment	Unknown	Impaired for fish	Impaired for fish	Not impaired
Degradation of fish and wildlife populations	Impaired	Impaired	Impaired	Not impaired/fish; unknown/wildlife	Not impaired
Fish tumours or other deformities	Impaired	Impaired	Impaired	Impaired	Impaired
Birds or animal deformities or reproductive problems	Impaired	Impaired	Impaired	Unknown	Not impaired
Degradation of benthos	Impaired	Impaired	Impaired	Impaired	Impaired
Restrictions on dredging activities	Impaired	Impaired	Impaired	Impaired	Impaired
Eutrophication or undesirable algae	Not impaired	Not impaired	Not impaired	Not impaired	Not impaired
Restrictions on drinking water consumption or taste and odour problems	Not impaired	Not impaired	Impaired taste and odour	Impaired taste and odour	Impaired
Beach closings	Impaired	Impaired	Impaired	Impaired	Impaired
Degradation of Aesthetics	Impaired	Impaired	Impaired	Impaired	Impaired

GLWQA Beneficial Use Impairment	RAP Stage 2 2010	2006 Evaluation*	DRCCC 1999 Evaluation*	1996 RAP Report‡	RAP Stage 1 1991
Added costs to agriculture or industry	Not impaired	Impaired	Not impaired	Not impaired	Not impaired
Degradation of phytoplankton and zooplankton populations	Requires further assessment	Unknown	Not impaired	Not impaired	Not impaired
Loss of fish and wildlife habitat	Impaired	Impaired	Impaired	Impaired	Impaired

* Produced by the DRCC work groups but not officially adopted.
‡ Produced by the MDEQ but not officially adopted.

Restrictions on Fish and Wildlife Consumption

Overview



Restrictions on Fish and Wildlife Consumption was first designated as *impaired for fish* in the 1991 Stage 1 RAP Report (MDNR and OMOE 1991) due to elevated PCB and mercury levels in certain fish species. The status remained *impaired for fish* in the 1996 RAP Update Report (MDEQ 1996) and in the 2006 BUI Assessment Report (Leney and Haffner 2006) because there was evidence that contaminated sediments in the Detroit River, particularly those in the lower U.S. reach of the river, were contributing to fish consumption restrictions (Drouillard 2005). The status should remain *impaired for fish* based on the information provided below.

Since 1976, the Ontario MOE and MNR have worked collaboratively to monitor the level of contaminants in various fishes in Ontario. Monitoring of sport fish contaminants is used in the production of the *Guide to Eating Ontario Sport Fish* (hereafter referred to as the *Guide*). The *Guide* was first distributed to the public in 1977 and has been published every other year since then. The 2009-2010 *Guide* provides advice for the consumption of sport and game fish at approximately 1,800 locations in Ontario, including the upper and lower sections of the Detroit River. Advice for eating Ontario fish is based on health protection guidelines (i.e., Tolerable Daily Intakes; TDI) developed by Heath Canada (Table 3) (OMOE 2009). The TDI is the amount of a particular chemical that can be consumed on a daily basis without adverse human health effects (Leney and Davidson 2007). Due to their increased sensitivity to contaminants, children under the age of 15 and women of child-bearing age (sensitive population; pregnant women, women attempting to become pregnant, and nursing women) are given different, usually more restrictive, consumption advice compared to the general population (OMOE 2009).

The Ontario Sport Fish Monitoring Program analyzes fish tissue samples for a number of chemicals including inorganic substances (mercury and other metals), industrial chemicals (PCBs, dioxins, furans, dioxin-like PCBs, mirex, and photomirex), pesticides (DDT, toxaphene), and other contaminants (chlorinated phenols, chlorinated benzenes, and polycyclic aromatic hydrocarbons). Although the Sport Fish Monitoring Program analyzes fish tissue samples for all of these chemicals, some are only occasionally found in fish or are not at levels that would cause a consumption restriction. Fish consumption restrictions in the Huron-Erie corridor (including the Detroit River AOC) are due to elevated levels of mercury, dioxins, furans, and dioxin-like PCBs (dlPCBs) (Figure 6). For the purpose of developing fish consumption advisories,

Table 3. Contaminant concentrations in sport fish resulting in fish consumption restrictions (minimum and maximum thresholds) (OMOE 2009). Therefore, sport fish receive consumption advisories/restrictions if concentrations are above the lowest limit (column A). No fish consumption is recommended if sample concentrations exceed the total limit (column B).

Contaminant	Population affected	Concentration (TDI)	
		(A) No restriction if below this value	*(B) Total restriction (no consumption) if above*
Mercury	Sensitive	0.26 ppm	0.52 ppm
	General	0.61 ppm	1.84 ppm
PCBs	Sensitive	0.105 ppm	0.211 ppm
	General	0.105 ppm	0.844 ppm
Dioxins, furans, dioxin-like PCBs	Sensitive	2.7 ppt	5.4 ppt
	General	2.7 ppt	21.6 ppt
Mirex	Sensitive	0.082 ppm	0.164 ppm
	General	0.082 ppm	0.657 ppm
Photomirex	Sensitive	0.015 ppm	0.031 ppm
	General	0.015 ppm	0.122 ppm
Toxaphene	Sensitive	0.235 ppm	0.469 ppm
	General	0.235 ppm	1.877 ppm

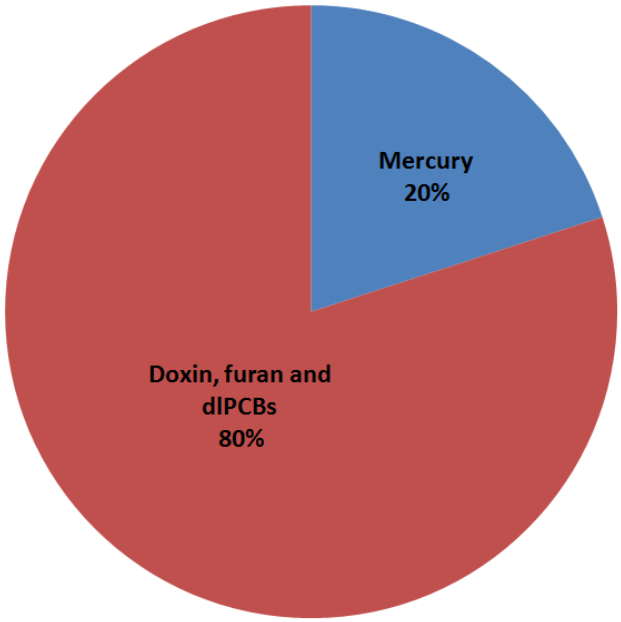


Figure 6. Percentage of consumption restrictions for the general population caused by mercury and dioxin, furans, and dioxin-like PCBs (dlPCBs) for the Huron-Erie Corridor (Detroit River, Lake St. Clair, and St. Clair River). The dlPCBs have toxicological properties similar to dioxins; thus, they are included in the same group (modified from OMOE 2009).

total PCBs are sometimes used to estimate the amount of toxic equivalents caused by dlPCBs (OMOE 2009).

It is virtually impossible to sample every fish species in every lake; therefore, the OMOE and OMNR sample different, appropriate fish species in each sampling location. The selection of fish species analyzed depends on the contaminant and the fish's feeding habits. For example, fish that are the top predator (e.g., walleye or pike) in a particular location are more likely to contain higher concentrations of mercury than fish that feed lower on the food chain. For organic chemicals that accumulate in fatty tissues (e.g., PCBs and mirex) species with higher fat content such as salmon, trout, and carp are chosen for analysis (OMOE 2009). The Detroit River fish sampling regime is divided into two portions: the upper Detroit River (Lake St. Clair to Fighting Island) and the lower Detroit River (south of Fighting Island to Lake Erie). Ten species in the Upper Detroit River and 9 fish species in the Lower Detroit River have been tested for mercury, PCBs, mirex/photomirex, pesticides, dioxins, furans, dlPCBs, PAHs, chlorinated phenols, and chlorinated benzenes (Table 4). It is important to note that because fish listed in the *Guide* were tested for a particular contaminant it does not mean that those fish will contain it. Anglers and fish consumers should read and follow the advice in the *Guide* carefully.

Table 4. A list of fish species that were tested for contaminants in the Detroit River for the 2009-2010 *Guide* (OMOE 2009).

Upper Detroit River (Lake St. Clair to Fighting Island)	Lower Detroit River (south of Fighting Island to Lake Erie)
Northern pike	Walleye (pickerel)
Walleye (pickerel)	Largemouth bass
Largemouth bass	Yellow perch
Yellow perch	White bass
White perch	White perch
White bass	Rock bass
Rock bass	Carp
Carp	Channel catfish
Channel catfish	Freshwater drum
Freshwater drum	

A Detroit River Fish Consumption Hazard Assessment Model was recently developed to predict contaminant (PCB and mercury) bioaccumulation that would lead to consumption advisories for Detroit River fishes. The model revealed that the primary driver of the most restrictive fish consumption advisories is sediment contamination on the U.S. side. The model was also used to predict consumption advisories under various situations. For example, a virtual elimination of the PCBs in the U.S. sediment with no change to water quality would result in a change to 2-8 advisories and reduce the intensity of the advice for 8-12 sport fish species

(Drouillard et al. unpublished). However, the model simulation showed that the complete removal of PCBs in Canadian sediments would reduce the Ontario advisory for only one fish species (freshwater drum). The authors noted that the results of the Detroit River Fish Consumption Hazard Assessment Model provide a strong rationale for a focus on remediation of contaminated sediments on the U.S. side of the Detroit River rather than the Canadian side.

A survey of individuals fishing along the Detroit River (from Pêche Island to Amherstburg) conducted in 1996-1997 revealed that 52% of respondents had eaten Detroit River fish in the last 12 months. Similarly, a recent survey conducted along the Detroit River in 2007 found that 44% (n=37) of Canadian anglers interviewed ate their catch (Kalkirtz et al. 2008). A greater percentage of Detroit River anglers reported eating their catch compared to those interviewed in Hamilton Harbour (20%), Metro Toronto (23%), and Niagara River (32%) (Dawson 2000). Of the survey participants that did not eat their catch from the Detroit River in 1996-1997, over half offered reasons related to polluted/contaminated water and/or fish while 22% simply didn't like eating fish (Dawson 2000). A 2009 angler creel survey by the OMNR on Canadian waters of the Detroit River confirms that walleye has consistently been the target species for on-water anglers over the last 30 years while shoreline anglers prefer white bass and yellow perch. Kalkirtz et al. (2008) reported that walleye, catfish and yellow perch were among the species most frequently kept for consumption on both sides of the Detroit River. The 2009 Detroit River angler creel survey shows that on-water anglers keep 92% of their walleye catch and 31% of the white bass caught. Shoreline anglers tended to keep 83% of the white bass caught and 44% of their yellow perch catch.

Results from the survey indicated that the 10 most consumed fish in the Detroit River were (in order): yellow perch, walleye, white bass, rock bass, smallmouth bass, white perch, channel catfish, bluegill sunfish, largemouth bass, and crappie (Dawson 2000). The *Guide* offers consumption advice for 7 of the 10 most consumed Detroit River fish. For example, the sensitive population should not eat yellow perch from the lower Detroit River that are greater than 30 cm in length (OMOE 2009). In the 2007 study, only 46% of Canadian interviewees were aware of the fish consumption advisories but 75% of those knew the correct information (Kalkirtz et al. 2008).

There are currently no established consumption guidelines for wildlife as there are for fish (Leney and Davidson 2007; Braune et al. 1999). However, a national survey was initiated in 1988-1995 to determine if waterfowl and game birds were safe to eat. The study showed that, overall, organochlorides and PCBs found in the pectoral (breast) tissue of waterfowl and game birds were relatively low compared to earlier studies (Braune et al. 1999). Therefore, Health Canada reported that the consumption of pectoral muscle of game birds did not pose a health threat to humans (Braune et al. 1999). In 1996-1997, Health Canada conducted a survey of

anglers along the Canadian side of the Detroit River and reported on the level of wildlife consumption within the AOC. The study showed that 8% of the survey participants had consumed aquatic wildlife (e.g., ducks, geese, turtles, frogs, and snails) in the 12 months prior to the interview (Dawson 2000). Of those wildlife consumers, more than half reported acquiring their wildlife meals from the Detroit River AOC (Dawson 2000).

Several studies have examined the contaminant concentrations in snapping turtle (*Chelydra serpentina*) eggs in Canadian AOCs, including the Detroit River. Snapping turtles are often studied because they are non-migratory, have a short dispersal, and small home ranges, making them good indicators of local conditions (de Solla et al. 2007). Research has shown that the mean PCB concentration was highest in snapping turtle eggs from Turkey Creek (928.6 ng/g wet weight) and moderate in eggs from Canard River (200.5 ng/g wet weight) (de Solla and Fernie 2004). The authors reported that the PCB contamination in the Turkey Creek turtle eggs were likely from historical sources. It is anticipated that these concentrations will decrease due to the removal of PCB-contaminated sediments from the Grand Marais Drain (Turkey Creek) in 2008 (see Chapter 6). The concentration of mirex and other organochloride pesticides in snapping turtle eggs were found to be significantly higher at the Turkey Creek site compared to the non-AOC reference sites (de Solla et al. 2007; de Solla and Fernie 2004).

Note: The *Guide* is free of charge and a 2-page summary is available in 19 different languages. For your copy, contact the OMOE or visit their website (www.ontario.ca/fishguide).

Delisting Criterion
When consumption advisories for indicator fish species (e.g., walleye, brown bullhead, and smallmouth bass) given for the sensitive population in the AOC are similar to upstream and downstream non-AOC Great Lakes reference areas.

Design and Rationale

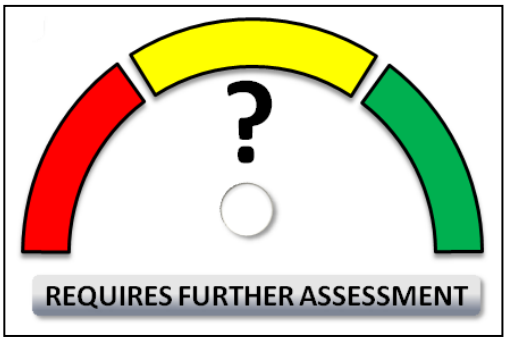
The delisting criterion was revised to focus on contaminants within the AOC, and the strictest consumption advisories (sensitive population) given for the AOC, compared to other Great Lakes locations. The criterion also utilizes indicator species representing different components of the Detroit River fish community. For example, brown bullhead is a local benthivorous fish (bottom feeder) and is a good indicator of local sediment conditions. Smallmouth bass is a local, pelagic fish (lives in open water) that is highly regarded by recreational anglers. It is intolerant of pollution, and therefore, is a good indicator of a healthy environment. Walleye is a migratory species but is highly sought after by anglers and is a frequently consumed species caught in the Detroit River. The DRCC will request that brown bullhead and smallmouth bass are collected and analyzed at the same time as the collection for the Sport Fish Monitoring Program in order to re-assess the status of this BUI.

The proposed revised criterion does not include wildlife as part of the delisting target because there are no established safe consumption levels for wildlife (Leney and Davidson 2007; Braune et al. 1999). Based on a Health Canada study in the area it was determined that the consumption of game birds does not pose a human consumption concern. It is recognized that there is a considerable amount of waterfowl hunting in the AOC; however, the level of waterfowl consumption in the AOC is poorly understood. Furthermore, because waterfowl are mainly migratory, spending only a portion of their time in the Detroit River, they are not likely a good indicator of local conditions. Therefore, it is proposed that fish be used as the only indicator for safe consumption.

Note: Health Canada's review of this report concurred with the RAP's approach to using only fish as indicators of consumption advisories in the AOC.

Tainting of Fish and Wildlife Flavour

Overview



The status of this BUI was listed as *not impaired* in the 1991 Stage 1 RAP Report because there had been no reports of fish, wildlife or waterfowl tainting in the Detroit River (MDNR and OMOE 1991). Upon reviewing the Stage 1 Report, the IJC questioned this conclusion on the basis of insufficient information. The status was changed to *impaired for fish* in the 1996 Update Report (MDEQ 1996) based on the results of two studies of walleye conducted in 1992 and 1993 by the Michigan Department of Natural Resources (Wood 1994; Waggoner 1993). Leney and Haffner (2006) recommended that the status be changed to *unknown* because the existing information was dated and conflicting.

The 1992 study utilized a panel of volunteers to taste fish and compared walleye from the Detroit River (Trenton Channel) to walleye purchased from a seafood market. Four of the 6 Trenton Channel walleye were found to taste impaired (Waggoner 1993). A follow-up study was conducted in 1993 to evaluate the spatial extent of any fish flavour impairment problems (Wood 1994). The study also utilized a taste panel and included 5 walleye from Lake Huron, 2 from Lake Erie, 5 from the Detroit River (Trenton Channel), and 5 from the Detroit River (east of Grosse Ile). Although several factors limited the conclusions that could be drawn from the study, the authors concluded that the results were consistent with the findings of the 1992 study and that a small percentage of walleye in the Trenton Channel may exhibit flavour impairment.

In 1996-1997, Health Canada conducted a survey of anglers on the Canadian side of the Detroit River (Dawson 2000). The study interviewed 999 individuals fishing along the Detroit River shoreline from Pêche Island to Amherstburg. Fifty-two percent of survey participants ate fish from the Detroit River. Although not focused on fish flavour, the survey found that more than two thirds of the anglers that consumed fish did so because it “tastes good” (Dawson 2000). Only 4 out of 453 survey participants explained that they did not eat their catch because it tasted or smelled bad.

The results of the Health Canada survey suggested that tainting of fish flavour was not an issue, which contradicts the earlier studies which concluded that some level of fish tainting may have been occurring. However, the results of the 1992 and 1993 taste test studies, which led to impaired designation in 1996, were spatially limited to the Trenton Channel and, therefore, cannot be used to make conclusions about the Canadian side of the AOC or, for that matter, the

Detroit River as a whole. Furthermore, there is uncertainty regarding the source of the flavour impairment identified by the latter studies. In fact, the majority of the walleye harvested in the Detroit River come from the Lake Erie population (Haas et al. 1988). Tagging studies have shown that walleye move from spawning locations in Lake Erie, up the Detroit River into Lake St. Clair, the St. Clair River and southern Lake Huron.

Thus, the only existing information that is relevant for the Canadian side of the AOC suggests that fish flavour is not impaired. However, these data are now 13 years old and should be updated to provide more accurate information on the status of fish flavour in the Detroit River AOC. Therefore, it is proposed that the status be changed to *requires further assessment*.

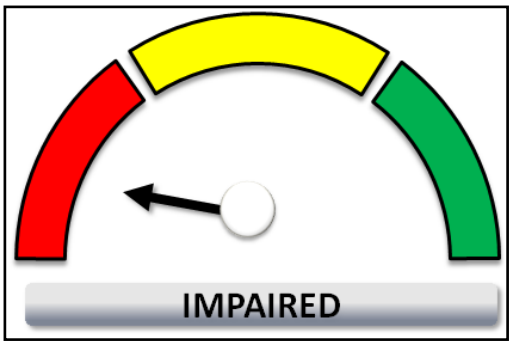
Delisting Criterion
When survey results confirm that there is no statistically significant tainting of fish flavour when compared to fish from upstream of the Detroit River.

Design and Rationale

The proposed revised delisting criterion sets a target in the context of the Huron-Erie corridor. Fish tainting in the Detroit River should be compared to the St. Clair River (which requires monitoring to be coordinated with the St. Clair River AOC). The BUI should be considered not impaired when a statistically significant proportion of survey participants indicate no problem with the flavour of fish in the Detroit River. Fish are recommended as the indicator for this BUI since wildlife consumption in the Detroit River area is poorly understood.

Degradation of Fish and Wildlife Populations

Overview



The Stage 1 RAP Report first identified this BUI as *not impaired* based on a fish community described as diverse with more than 60 species present and occupying all niches (Hamilton 1987 cited in MDNR and OMOE 1991). However, the report recognized that human impacts had altered the balance of the fish community in favour of benthivorous species, suggesting some degradation had occurred. The 1999 Update reported that the river continued to thrive by providing anglers with a high quality fishery (DRCCC 1999) with more than 30 species of fish using the river to spawn. Due to more than 90% of the habitat having been converted to more intense usage, the wildlife productive capacity has been greatly reduced over time. Based on recent information summarized below, it is proposed that the status be changed to *impaired*.

In 1999 researchers reported that the human impact on sediment, water quality and habitat was degrading the health of fish and wildlife populations, stating that the reduction in the number of waterfowl, raptors and other bird species was linked to human-induced activities (DRCCC 1999). Specifically, researchers were concerned about how contaminants (likely via contaminated sediments) were accumulating throughout the food chain. For example, although a five-fold decrease in mercury concentration has been observed since pollution abatement programs were initiated, those concentrations have now levelled off with little change (DRCCC 1999).

Today, after 35 years of pollution prevention, there appear to be signs of ecological recovery occurring in the Detroit River AOC, with the return of the bald eagle and the spawning of lake sturgeon and lake whitefish (Hartig et al. 2007; Roseman et al. 2007). In 2005, USGS researchers documented the first spawning event by lake whitefish in the Detroit River in nearly 100 years and in 2001 the successful spawning of lake sturgeon was documented for the first time in over 20 years (Hartig et al. 2007; Caswell et al. 2004). Lake sturgeon populations remain low (approximately 1% of the historical population size), but international efforts to increase the amount of spawning habitat in the Detroit River proved successful with the documentation, in the spring of 2009, of the spawning of lake sturgeon on a newly constructed spawning reef on the northeast corner of Fighting Island in Canadian waters (USFWS, pers. comm., 2009).

A strong 2003 year class has made a significant contribution to the walleye fishery in the Detroit River. An estimated 4 million walleye annually utilize the river to spawn or to migrate

through the corridor (Haas and Towns 2009; Manny et al. 2007). Along with walleye, an additional 54 fish species were identified throughout the Detroit River (Edwards et al. unpublished). Of those, 34 different larval fish species were observed (Haas and Towns 2009; Francis 2008). Recent population trends indicate that walleye populations remain strong. Contaminant concentrations in fish have declined; however, consumption advisories are still in effect for certain sizes and species (Hartig et al. 2007; OMOE 2009).

The Detroit River is located between two major waterfowl migration flyways (Mississippi Flyway and Atlantic Flyway). As a result, a vast number of waterfowl, raptors, non-raptors (loons, warblers, cranes), and butterflies stage in the Detroit River corridor (Manny 2003). Above average counts of 22,000 canvasbacks have been documented in 12 of the past 20 years (Hartig et al. 2007). The majority of birds stage primarily in the St. Clair River; however, a large portion occupies the lower Detroit River making the corridor one of the most important staging areas for waterfowl. Annual observations through the Christmas Bird Count also indicate that waterfowl populations, in general, appear to be on the rise (Christmas Bird Count 1978-2005; cited in Hartig et al. 2007). The common tern (*Sterna hirundo*) is an excellent indicator of ecosystem health in the Detroit River because its diet consists mainly of fish, making it susceptible to bioaccumulation of toxic substances via the food chain. In the last 25 years there has been a dramatic decline in common tern production as a combined result of possible shifts in nesting population (D.V. Weseloh, Canadian Wildlife Service, pers. comm., 2008) and poor fledgling success (Hartig et al. 2007). Like walleye contaminant trends, PCB levels in common tern eggs have steadied from their downward trends (Hartig et al. 2007). However, as a result of the change in nesting populations away from areas like Fighting Island, researchers have suggested focusing on black-crowned night heron (*Nycticorax nycticorax)* as a possible surrogate indicator species (DRCC 2008). Finally, bald eagle (*Halaeetus leucocephalus*) population trends appear to be increasing across Lake Erie and the Detroit River. The bald eagle breeding population appears to be within stable, self-sustaining production capacity; the occupied breeding areas increased to 44 in 2006 from none in 1974 (Hartig et al. 2007). However, a number of factors could be masking the reality of the situation as sources of 'uncontaminated' bald eagles from inland areas continue to expand their range into the Great Lakes region. The observed shorter life span of Great Lakes bald eagles may suggest that the area (Detroit River and western Lake Erie) continues to act as a sink (Hartig et al. 2007).

In 2008, the Canadian Wildlife Service undertook a study of leopard frogs (*Rana pipiens*) as a model for determining impacts on amphibian reproduction and deformities in the Detroit River AOC and to gauge the health of AOC wetland systems. Preliminary results indicate that Detroit River water does not impair hatching success (i.e., no samples fell below the 95% hatching success limit). Leopard frog deformities (which could affect population growth) were also considered low to moderate and did not significantly differ from the reference site (except

frogs from Turkey Creek which has known historical sediment contamination) suggesting that Detroit River water quality does not significantly impair the growth and development of amphibians. Gonad histology results indicate that leopard frogs from the Turkey Creek area exhibit signs of feminization with higher testicular ovarian follicles present; however, due to a small sample size, further research is necessary to make any conclusions about those results (Environment Canada 2008).

Delisting Criterion
When environmental conditions support self-sustaining and healthy communities of indicator fish (e.g., walleye, bass, lake sturgeon, brown bullhead) and wildlife (e.g., black-crowned night heron, Northern leopard frog) species.

Design and Rationale

In order to assess the status of Fish and Wildlife Populations in the Detroit River, an indicator approach is recommended. There are obvious linkages between the issues and study parameters related to this BUI and the *Bird or Animal Deformities or Reproductive Problems* BUI. As a result, common indicator species should be utilized for both BUIs, and studies relating to reproductive problems should be used in the assessment of this BUI. Indicator species include, but are not limited to, walleye, smallmouth bass, lake sturgeon, lake whitefish, brown bullhead, black-crowned night-heron, and Northern leopard frogs. It is important to note that some species in the region are listed as species at risk and should not be used in the assessment of this BUI; however, they are important to monitor and track (e.g., lake sturgeon, Blandings turtle). At the 2007 DRCC Delisting Workshop (DRCC 2008), participants suggested using mink as an indicator species due to their sensitivity to food and because of increased sightings in the lower Detroit River compared to the past. However, it is important to note that these might be 'escapees' from mink farms and not an increase in the natural population.

Data collected from studies related to this BUI should be evaluated by the DRCC every 5 years to assess the current status. Studies of fish and wildlife populations should rely on measures of diversity (e.g., biotic Index or multivariate analyses) and indicator species using similar parameters for comparison such as growth rates, age/size distribution, reproductivity, etc. Reference sites in other non-AOC Great Lakes locations should be incorporated into the study design. If fish and wildlife populations at AOC sites are not significantly different from non-AOC sites, then the BUI could be considered unimpaired.

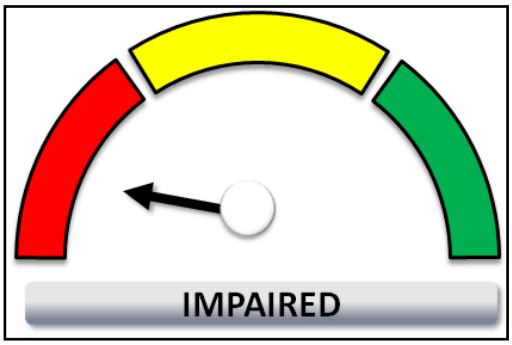
In 2007, the DRCC identified priority habitat sites in the Detroit River AOC to guide habitat-related restoration projects (DRCC 2007). Furthermore, the United States Geological Survey (USGS) recently began creating interactive maps of the Huron-Erie corridor using recent and historic fish spawning sites to identify and predict physical characteristics remaining in the river

that are conducive for fish/wildlife. Together with the DRCC Habitat Priority Sites, the interactive map could be used to quickly and easily identify available areas for spawning and nursing habitat and help direct remediation of habitat (and therefore assist in the recovery of degraded populations). This approach could be used for both this BUI (*Degradation of Fish and Wildlife Populations*) and BUI #14 (*Loss of Fish and Wildlife Habitat*).

The RAP acknowledges that climate change and invasive species (e.g., round goby and zebra mussel) may impact fish and wildlife populations; however, those issues should not impede delisting since they are Great Lakes basin-wide problems and are not specific to the AOC. It is recommended that researchers work to understand these changes in the ecosystem and report on work being done to address them (as they relate to the AOC).

Fish Tumours or Other Deformities

Overview



Contaminated sediments are commonly found in heavily industrialized areas around the Great Lakes basin. Sediments in those locations (including the Detroit River) are often contaminated with PCBs, polycyclic aromatic hydrocarbons (PAHs), and metals which may adversely affect the health of various aquatic organisms (Arcand-Hoy and Metcalfe 1999), especially those in direct contact with sediments such as brown bullhead (*Ameiurus nebulosus)*.

External (e.g., dermal lesions and truncated barbels) and internal (e.g., liver tissue) abnormalities have been noted in various fish species (especially benthic feeders) around the Great Lakes basin including the Detroit River. Recent evidence shows that external lesions (including lip papillomas) are not related to contaminant exposure, but rather are likely caused by a retrovirus while liver lesions are caused by chemical contaminants (Baumann 2010). The DRCC is, therefore, interested in the prevalence of liver tumours in Detroit River brown bullhead as an indicator of contamination-related abnormalities. However, information on the physiological effects of contaminants and external abnormalities is also provided in this section.

This BUI was first designated *impaired* in the 1991 Stage 1 RAP Report due to the elevated incidence of oral lesions and tumors in Detroit River fishes. A study conducted between 1985 and 1987 examined 5 fish species from the U.S. side of the lower Detroit River. In total, 8.2% of all fish tested exhibited oral/dermal lesions and 10.1% had liver lesions (Maccubbin and Ersing 1991). Oral/dermal lesions were found in 10.2% of brown bullhead and 4.5% of walleye tested; there were none in the 3 other species examined. Liver tumors were identified in all 5 fish species collected and the incidence varied from 8.8% to 18.2% (Maccubbin and Ersing 1991). In 2000, the prevalence of liver lesions in Detroit River brown bullhead from the Trenton Channel was 5.9%, although the sample size was low (n=34) (Blazer et al. 2009). Further sampling of brown bullhead from the Canadian side of the Detroit River is required to obtain an appropriate sample size to assess this BUI. Until then, it will remain listed as *impaired*.

External Abnormalities

In 1993, researchers observed external abnormalities (e.g., lip lesions, truncated barbels, body lesions) in 88% of brown bullhead collected from the Trenton Channel compared to 61% and 59% from the Amherstburg Channel and Pêche Island, respectively (Leadly et al. 1998). The following year, researchers examined the incidence of abnormalities in brown bullhead aged 3

to 5 years from five sites including three that were known to be contaminated with PAHs (Hamilton Harbour, Detroit River [Trenton Channel], and Black River). Researchers collected approximately twenty brown bullhead from each of the five sites. They found epidermal lesions in 50% of Hamilton Harbour and Black River bullhead; in comparison, only 5% of Detroit River bullhead had similar lesions (Arcand-Hoy and Metcalfe 1999). The lower incidence rate reported in the latter study may have been due to a small sample size (not representative of the brown bullhead population) or age (a positive correlation between age and tumor incidence was demonstrated in past studies (Maccubbin and Ersing 1991)). In 2000, sixteen brown bullhead aged an average of 5 years old were collected from the lower U.S. reaches of the Detroit River and examined for raised dermal lesions and barbel deformities. These researchers found that 23.5% of the brown bullhead collected at this location exhibited external lesions while 64.7% had barbel deformities (Yang 2004).

Physiological Abnormalities

The activity of the hepatic (liver) enzyme, ethoxyresorufin-*O*-deethylase (EROD), is induced upon exposure to environmental contaminants such as PAHs (Arcand-Hoy and Metcalfe 1999). Arcand-Hoy and Metcalfe (1999) found that brown bullhead from the Detroit River (Trenton Channel) and Hamilton Harbour AOCs had significantly higher EROD activity than fish from reference sites, indicating some exposure to chemical contaminants. Furthermore, the researchers examined the level of fluorescent metabolites (fluorescent aromatic compounds (FACs)) in the bile of bullheads as an indicator of recent exposure to aromatic hydrocarbons. Results indicate that bile FACs from Detroit River fish were not significantly different than reference locations, suggesting that those fish had not recently been exposed to high levels of PAHs but were more likely chronically exposed to contaminants (Arcand-Hoy and Metcalfe 1999).

Some contaminants are genotoxic or known to cause damage to cellular DNA. Pandrangi et al. (1995) used the alkaline single cell gel electrophoresis or “comet” assay to detect DNA damage caused by environmental contaminants in brown bullhead and carp (*Cyprinus carpio*). Researchers found a high correlation between the concentration of pollutants and DNA damage (Tigano et al. 2009). A high ratio is related to high DNA damage and is indicative of increased exposure to environmental pollutants. The DNA damage ratio for fish collected in Hamilton Harbour (Lake Ontario), Big Creek (Lake Erie), and the Detroit River (near LaSalle) produced ratios between 3.81 and 4.65 compared to fish from reference sites which had damage ratios between 1.30 and 1.40 (Pandrangi et al. 1995). This technique was shown to be successful for detecting the level of genotoxicity caused by several contaminants, probably PAHs and PCBs, in the sediments.

Several studies indicate that brown bullhead in the Detroit River, particularly those from the Trenton Channel (U.S. side of the Detroit River), are still negatively impacted by contamination. Sediment sampling in 1999/2000 and 2008/2009 determined the spatial distribution of contamination in the Detroit River. Sediment contamination occurs at various locations in the Detroit River but contamination is significantly higher in the lower U.S. reaches of the river (i.e., Trenton Channel) (Drouillard et al. unpublished; Leney and Haffner 2006; GLIER 2003). Researchers have noted that the results of the Detroit River Fish Consumption Hazard Assessment Model used to predict drivers of fish contamination provide a strong rationale for a focus on remediation of contaminated sediments on the U.S. side of the Detroit River. In 2003, approximately 23,000 m^3 of contaminated sediments were removed from the Black Lagoon (renamed Elias Cove after the shoreline habitat was restored) in the Trenton Channel (Friends of the Detroit River and U.S. PAC 2008). Hopefully, with continued efforts toward the removal of contaminated sediments, specifically from the Trenton Channel, and consistent monitoring the incidence of tumors in Detroit River brown bullhead will decrease.

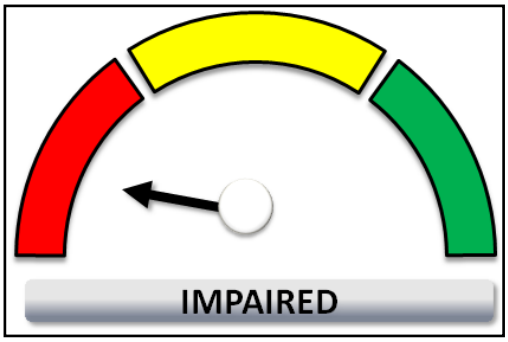
Delisting Criterion
When incidence rates of liver tumours in (3-5 yr old) brown bullhead are not statistically different than the Great Lakes background rate.

Design and Rationale

Brown bullhead was chosen as the indicator species for sediment contamination because it is common throughout the lower Great Lakes (Leadly et al. 1998), is often in direct contact with sediments while searching for food (Scott and Crossman 1998), and is sensitive to contaminants, particularly those found in sediments (Leney and Haffner 2006). The delisting criterion was revised to include the prevalence of liver tumours because it is an appropriate indicator of contaminant-induced abnormalities. Recent evidence shows that external lesions (including lip papillomas) are not related to contaminant exposure, but instead, are likely caused by a retrovirus. At a DRCC Delisting Criteria Workshop in 2007, scientists agreed that electrofishing is the most effective technique for catching brown bullhead compared to gill netting (DRCC 2008). Participants also proposed that a minimum of two sampling events take place 3 years apart to show the changes in sediment contamination and because tumours are positively correlated to age (Baumann 2010). At a 2010 Canadian AOC Workshop, participants noted that the incidence of tumours in brown bullhead should be compared to lower Great Lakes reference sites or urban “far field” sites (urban locations with no known point sources of PAHs). The background liver tumour prevalence for Great Lakes’ brown bullhead that will be used to assess the status of this BUI is 2% (Baumann 2010).

Bird and Animal Deformities or Other Reproductive Problems

Overview



This BUI was first designated as *not impaired* in the 1991 Stage 1 RAP Report (MDNR and OMOE 1991) because there were no documented bird or animal deformities associated with the Detroit River AOC. The BUI's status was changed to *unknown* in the 1996 RAP Update Report (MDEQ 1996) and then suggested to be changed to *impaired* in the 1999 DRCC Update Report (DRCC 1999). In 2006, it was reported that this beneficial use was *impaired* because, despite a reduction in the severity of reproductive problems in birds and wildlife since the 1960s and 1970s, there was evidence that Detroit River bird populations were still showing some signs of reproductive problems (Leney and Haffner 2006). The status of this BUI continues to be considered *impaired* based on evidence of reproductive problems.

Deformities

Snapping turtles (*Chelydra serpentina*) have been used as an indicator species to evaluate animal deformities due to contaminants (e.g., PCBs, dioxins, pesticides) in several AOCs (de Solla et al. 2008). The snapping turtle is a good indicator of local conditions because they have small home ranges and short dispersal distances (de Solla et al. 2007). Researchers use several external body parts to identify and assess potential deformities, including morphological deformities of the carapace scutes, eyes, head, limbs, and tail (de Solla et al. 2008). A study conducted between 2001 and 2004 found that there were significantly lower deformity rates (1.2%) in turtle hatchlings from the Turkey Creek study site than reference sites (5.3% and 11.3%) (de Solla et al. 2008). The authors acknowledged that the differences in deformity rates may have been due to handling stress. Contaminants such as PCBs, dioxins, and PAHs have been shown to accumulate in snapping turtle eggs and may contribute to deformities in turtles (de Solla et al. 2008; de Solla et al. 2007; de Solla and Fernie 2004). However, a direct causal link between these anthropogenic stressors and hatchling deformities remains unclear (de Solla et al. 2008; de Solla et al. 2007).

Preliminary results from a study conducted by the Canadian Wildlife Service in 2008 show that leopard frog (*Rana pipiens*) deformities from the Detroit River AOC were low to moderate and did not significantly differ from the reference site. Moreover, a histological analysis revealed that leopard frogs from the Turkey Creek area exhibited signs of feminization with higher testicular ovarian follicles present; however, further research is necessary due to a small

sample size (Environment Canada 2008). There have been no recorded bird deformities in the Detroit River AOC (Dr. D.V. Weseloh, Environment Canada, pers. comm. 2008).

Reproductive Problems

The pesticide DDT (dichlorodiphenyltrichloroethane) was frequently used to control insect pests along shorelines, wetlands, and agricultural areas until the early 1970s when its use was banned in Canada and the United States (Environment Canada 2001). Poisoning by DDT, its breakdown product DDE (dichlorodiphenyldichloroethylene), and other contaminants were found to be the cause of death in adult and developing (eggs and hatchlings) birds around the Great Lakes, leading to overall reproductive failure. In the mid-1970s, reproductive problems were at their worst; only 38% of Michigan's bald eagle (*Halaeetus leucocephalus*) population successfully fledged young (Hartig et al. 2007). The peregrine falcon (*Falco peregrinus*) also experienced reproductive problems and a severe population decline in the 1950s-1970s due to pesticides and DDT (Hartig et al. 2007). Even 10 years after the ban on DDT, Great Lakes bald eagles continued to suffer from reproductive failure and very few active nests remained (Environment Canada 2001). However, by the late 1980s the levels of DDE and PCBs had declined by 50% and 80%, respectively (Environment Canada 2001), allowing for the improvement in bald eagle and herring gull (*Larus argentatus*) reproductive rates (Leney and Haffner 2006; Environment Canada 2001).

Recent evidence shows that there has been a return of reproducing birds and animals in the Detroit River AOC (Hartig et al. 2007). The bald eagle breeding areas in the Detroit River and Western Lake Erie region have increased over the last 20 years. In 1974 there were no occupied bald eagle breeding areas, but by 2006 there were 44 in the Detroit River/Western Lake Erie region (Hartig et al. 2007). In 2005, researchers recorded 4 bald eagles nesting territories on the Canadian side of the Detroit River and two along the Ontario side of Lake Erie. Only two of the four Detroit River Canadian nests successfully produced (fledged) two chicks each (Laing 2005). Generally, it appears as though the bald eagle breeding population in the overall Detroit River region is within stable, self-sustaining production capacity.

However, there are still signs of bird and animal reproductive impairment. Snapping turtle hatching success was significantly lower in the Detroit River AOC (Turkey Creek site) compared to combined reference locations (Algonquin Park and Tiny Marsh) (de Solla et al. 2008). Furthermore, Leney and Haffner (2006) indicated that researchers found herring gull egg viability in 2001 to be significantly lower in the Detroit River (Fighting Island) compared to a reference site; however, no significant differences were observed between those sites in 2002. Researchers have noted a decline in common tern production that may be associated with shifts in the nesting population and poor fledgling success (Hartig et al. 2007; D.V. Weseloh, pers. comm. 2008). Contaminants accumulated in eggs may also adversely affect reproduction

by altering the sex ratio of developing embryos. In 2001, there were more male herring gull chicks than females in the Detroit River AOC compared to reference sites (Environment Canada 2003). Moreover, the study found a higher number of dead herring gull embryos in the Detroit River AOC and western Lake Erie than at reference sites (Environment Canada 2003).

Today, levels of contaminants in herring gull eggs continue to decrease and bird reproduction is improving; however, there are still signs of reproductive effects in certain bird and animals species.

Delisting Criteria

When incidence rates of bird and animal reproductive problems in sentinel wildlife species do not exceed background levels at suitable reference sites elsewhere in the Great Lakes basin or suitable inland control populations for a minimum of three years; and

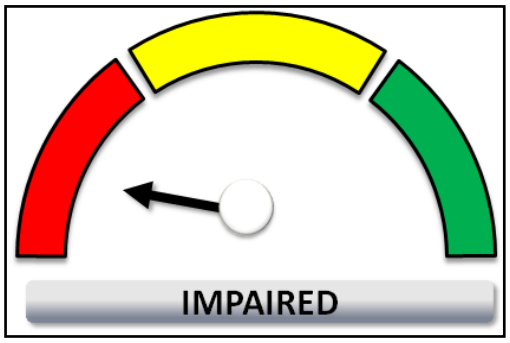
When scientifically defensible wildlife bioassays of indicator species confirm that there are no reproductive problems and no significant toxicity from the water column or sediment contaminants or bioaccumulation.

Design and Rationale

The delisting criteria were revised because there is no evidence of bird or animal deformities in the Detroit River (Dr. D.V. Weseloh, Environment Canada, pers. comm. 2008); however, there may still be reproductive problems. The proposed indicator species for the assessment of this BUI include, but are not limited to, black – crowned night heron, leopard frog, and snapping turtle. Study parameters to be measured for a bird reproductive viability assessment in the AOC should include, but are not limited to: overall breeding phenology, clutch size, egg size, egg shell thickness, egg/clutch volume, lipid content of eggs, contaminant profile of fresh and dead eggs, hatching success/infertility rate of eggs, colony size, growth rate of chicks, condition index of chicks, and chick survival/fledging success. Contaminant analysis should indicate no significant toxicity from the water column, sediments or bioaccumulation. Monitoring of these parameters should be conducted for a minimum of 3 years prior to re-assessment. Results will indicate further actions and identify potential data gaps.

Degradation of Benthos

Overview



The Degradation of Benthos was designated as *impaired* in the Stage 1 RAP Report due to evidence that benthic community composition was degraded in several areas including the Michigan shoreline and areas near the Rouge River (Trenton Channel) (MDNR and OMOE 1991). However, comments by the IJC stated that the report did not seem to acknowledge the link between sediment toxicity and the degradation of benthos. There is now growing evidence that the degradation of benthos is a result of contamination of the surficial layer of sediments, the biologically active portion of the sediment where organisms live (Friends of the Detroit River and U.S. PAC 2008). Although the Stage 1 RAP Report indicated that the benthic communities along Canadian shoreline were *not impaired* (MDNR and OMOE 1991), the status of this beneficial use has remained *impaired* in several subsequent reports (Leney and Haffner 2006; DRCCC 1999; MDEQ 1996). The status should remain *impaired* until future assessment shows otherwise.

Benthic invertebrates are bottom-dwelling organisms of lakes, streams and rivers that depend on water for a portion of their life cycle and tend to spend much of their lives at the bottom of lakes, streams, rivers, etc. (e.g., larval form of *Hexagenia*). They feed primarily on microorganisms attached to the sediment and organic debris and are an integral part of the aquatic food chain (Hartig et al. 2007; MDNR and OMOE 1991). Therefore, their health can impact the health of other organisms and may affect, or be linked to, several other BUIs. Because benthos live in direct contact with the sediments, are relatively immobile, and are easy to capture, they are excellent indicators of local sediment conditions (Zhang 2008). The most common benthic invertebrate species in contaminated zones are worms (oligochaetes), midge larvae (chironomid), and *Hexagenia* mayfly nymphs (Ephemeropterans) (Hartig et al. 2007). The presence or absence of a particular species can be used as an indicator of water and sediment quality in a location (MDNR and OMOE 1991). The presence of environmentally-sensitive or pollution intolerant benthic organism (e.g., mayfly nymphs) is indicative of good local habitat conditions. Conversely, if pollution tolerant species (e.g., oligochaetes) are dominant, then the sediments in that location are likely polluted and the benthic community is degraded (DRCCC 1999). For example, a density of *Hexagenia* larvae above 100 larvae/m^2 is indicative of good water quality.

There are several attributes that are indicative of a degraded benthic invertebrate community:

- An indicator species characteristic of degraded environmental conditions is dominant;
- A keystone species expected in a specific habitat is absent or has been replaced by an pollution-tolerant species;
- Taxa designated as ecosystem objectives for a specific zone have not attained the recommended density, biomass, or productivity;
- The composite (multimetric) biotic score determined for the area does not fall within a range previously designated as indicative of unimpaired quality;
- A suite of species (multivariate assemblage) collected from the area is very different (statistically significant different, $p<0.01$) from the assemblage of species expected to be found in reference areas with the same physical environmental characteristics; or
- The taxa richness per unit of benthic density is below that expected of a particular environment.

Surveys of benthic invertebrates in the Detroit River have been conducted to assess the condition of the river since as early as the 1930s. A survey conducted in 1929-1930 reported the presence of snails, fingernail clams and tubificid worms but an absence of mayflies, suggesting reduced water quality (MDNR and OMOE 1991). Benthic surveys completed between 1949 and 1956 revealed a further reduction in water quality in the lower Detroit River and western Trenton Channel (MDNR and OMOE 1991). As a result of pollution control programs in the 1970s, Detroit River water quality improved and surveys in 1984 found diverse populations of benthos upstream of Belle Isle and on the Canadian shoreline (MDNR and OMOE 1991). In fact, the Belle Isle site was the only U.S. location where mayflies were present (Hartig et al. 2007).

Organic pollution such as sewage contains bacteria that consume oxygen in sediments. Since mayfly larvae cannot survive in low oxygen conditions, their presence and abundance are good indicators of water and sediment quality. An abundance above 100 mayfly larvae/m^2 is indicative of good sediment and water quality while values below 20 mayfly larvae/m^2 implies anoxic conditions (no oxygen) due to organic pollution. Figure 7 shows that the density of mayfly larvae in the Detroit River has decreased since a high recorded in 1980. However, densities exceeded the threshold of 20 mayfly larvae/m^2 in both 1999 and 2004. It is important to note that due to the timing of sampling in 2004, many samples were likely collected before the nymphs hatched from their eggs resulting in a lower density estimate than was actually present (Hartig et al. 2007).

Several studies have examined the status of benthic communities in the Detroit River in 1991 (Farara and Burt 1993, cited in Zhang 2008), 1999 (Wood 2004, cited in Zhang 2008), and 2004-2005. However, many of these studies were conducted using locations known or suspected to have high contamination and degradation which has resulted in a biased dataset

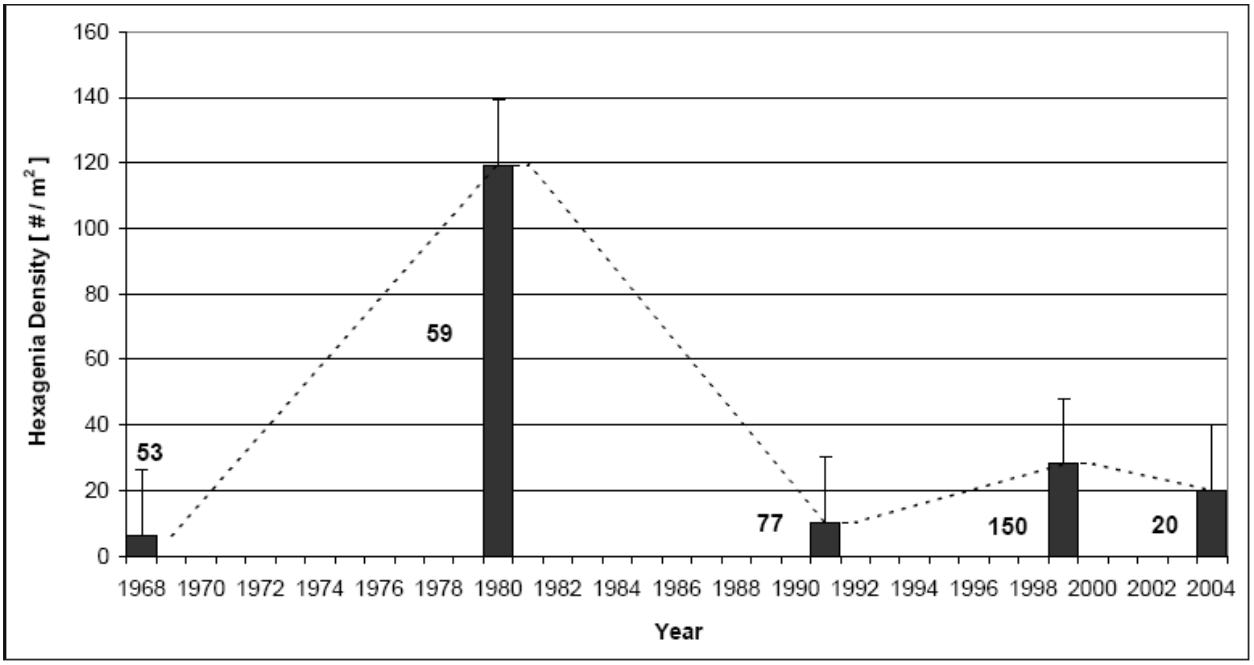


Figure 7. Mean ± standard error density of *Hexagenia* mayfly in the Detroit River between 1968 and 2004 compiled from various studies. Density values above 100 *Hexagenia* larvae/m^2 indicated good water quality conditions. The number next to the bar indicates the number of sites sampled (from Hartig et al. 2007).

(Friends of the Detroit River and U.S. PAC 2008). A more recent study utilized a more inclusive approach to provide a "big picture" perspective of the river. Zhang (2008) combined all three datasets (1991-2004) and used a novel 'Reference-Degraded Continuum' (RDC) multivariate approach to develop zoobenthic community indicators and assess the condition of benthos along the entire Huron-Erie corridor, as well as for Detroit River sites alone. The author noted that this technique (i.e., combining community and individual indicators) was more diagnostic of benthic habitat quality than using either approach alone (Zhang 2008).

Generally, reference sites are locations with a complete absence of disturbance. Because of the widespread, long-term human disturbances in the Huron-Erie corridor, those types of reference sites do not exist (Zhang 2008). Thus, 'reference' sites in the context of an urban river system such as the Huron-Erie corridor represent locations that are 'least-disturbed' and may not be the best when compared to natural conditions. Most 'reference' sites in a Detroit River case study were identified at the head of the Detroit River near Pêche Island while most 'degraded' sites were located along the U.S. side of the river (near Zug Island, Trenton Channel) and downstream of Fighting Island (main channel and Canadian side) (Figure 8) (Zhang 2008). Various statistical analyses resulted in a zoobenthic condition index (ZCI) and a contamination score for depositional and erosional sites that represented distinct zoobenthic assemblages along the Huron-Erie corridor. A higher ZCI and low contamination score is indicative of 'reference' conditions. Accordingly, a low ZCI and high contaminant score indicated 'degraded' conditions. In depositional zones of the corridor, most Detroit River sites fell in the middle of the Reference-Degraded Continuum (Figure 9) while more erosional sites fell within the 'reference' conditions (Figure 10). Overall, the Detroit River case study found that the sediment quality of the Detroit River has changed between 1991 and 2004, improving at depositional and mixed sites and showing a (non-statistically significant) trend toward improved quality at erosional areas. The depositional sites within the Huron-Erie corridor were most often identified as 'degraded' because slow-moving waters at these locations allow pollutants to settle. Consequently, most 'reference' sites were noted at erosional areas due to faster-moving waters that likely wash contaminants away.

A 2008/2009 survey of Detroit River sediment quality indicated that the levels of PCBs in sediments on the U.S. side were 6.5 times greater than those on the Canadian side (Drouillard et al. unpublished). In addition, researchers developed a model to predict consumption advisories under various situations. It was found that the elimination of PCBs in U.S. sediments would have a significant positive impact on Detroit River fish contamination, providing a strong rationale for a focus on remediation of contaminated sediments on the U.S. side of the Detroit River.

Figure 8. The distribution of 'reference' (5-point stars) and 'degraded' (triangles) sites along the Detroit River based on sampling conducted in 1991, 1999, and 2004. The sites were derived from mean contaminant scores in a Detroit River case study (from Zhang 2008).

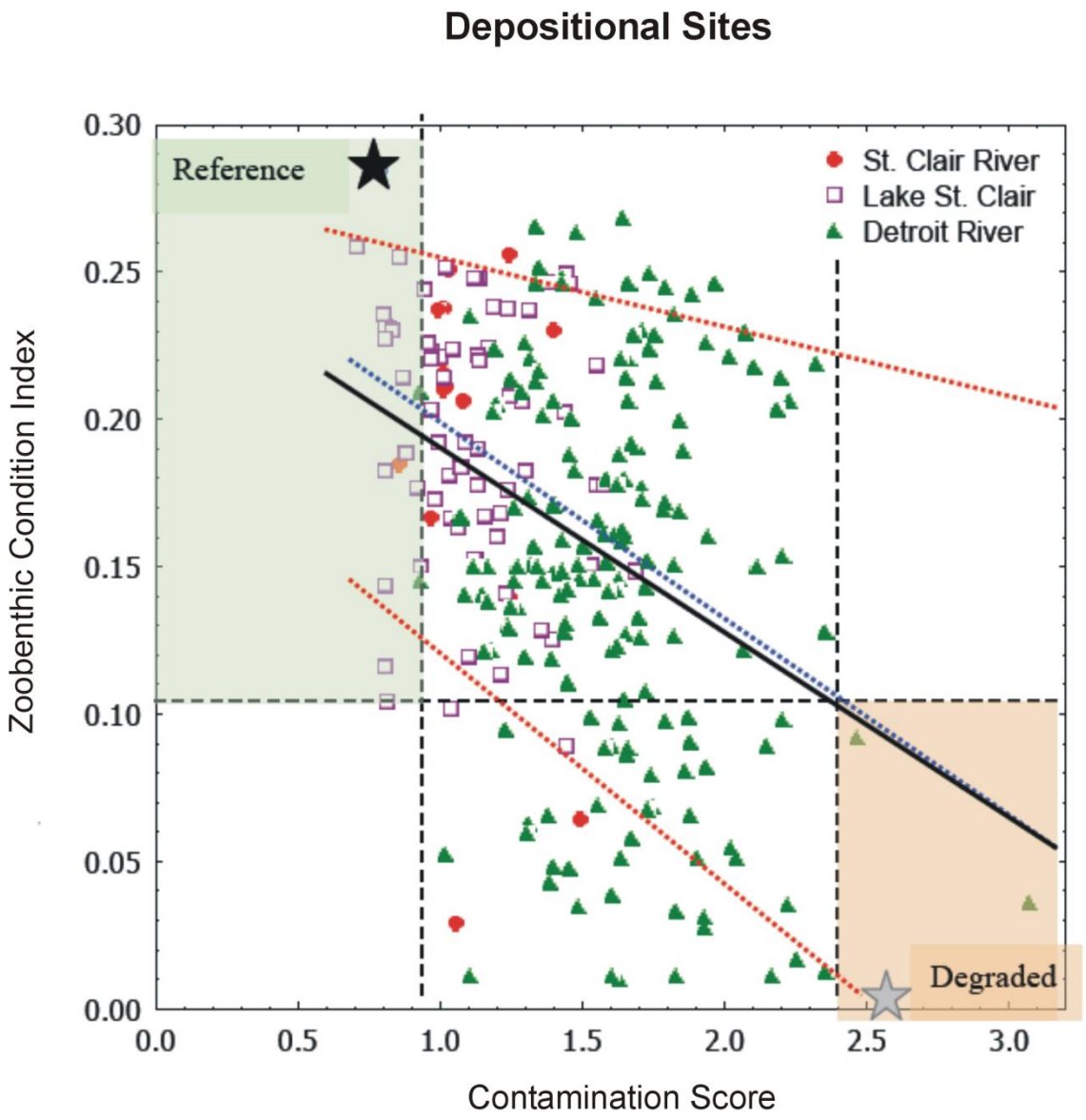


Figure 9. The relationship between the zoobenthic condition index (ZCI) and the sediment contamination score at depositional sites along the Huron-Erie corridor between 1991 and 2004 (n=255 sites). All sites with contaminant score ≤1.0 and a ZCI score ≥0.10 are said to be in 'reference' condition. Sites with a contaminant score ≥2.4 and a ZCI score ≤0.10 are said to be in 'degraded' condition (modified from Zhang 2008).

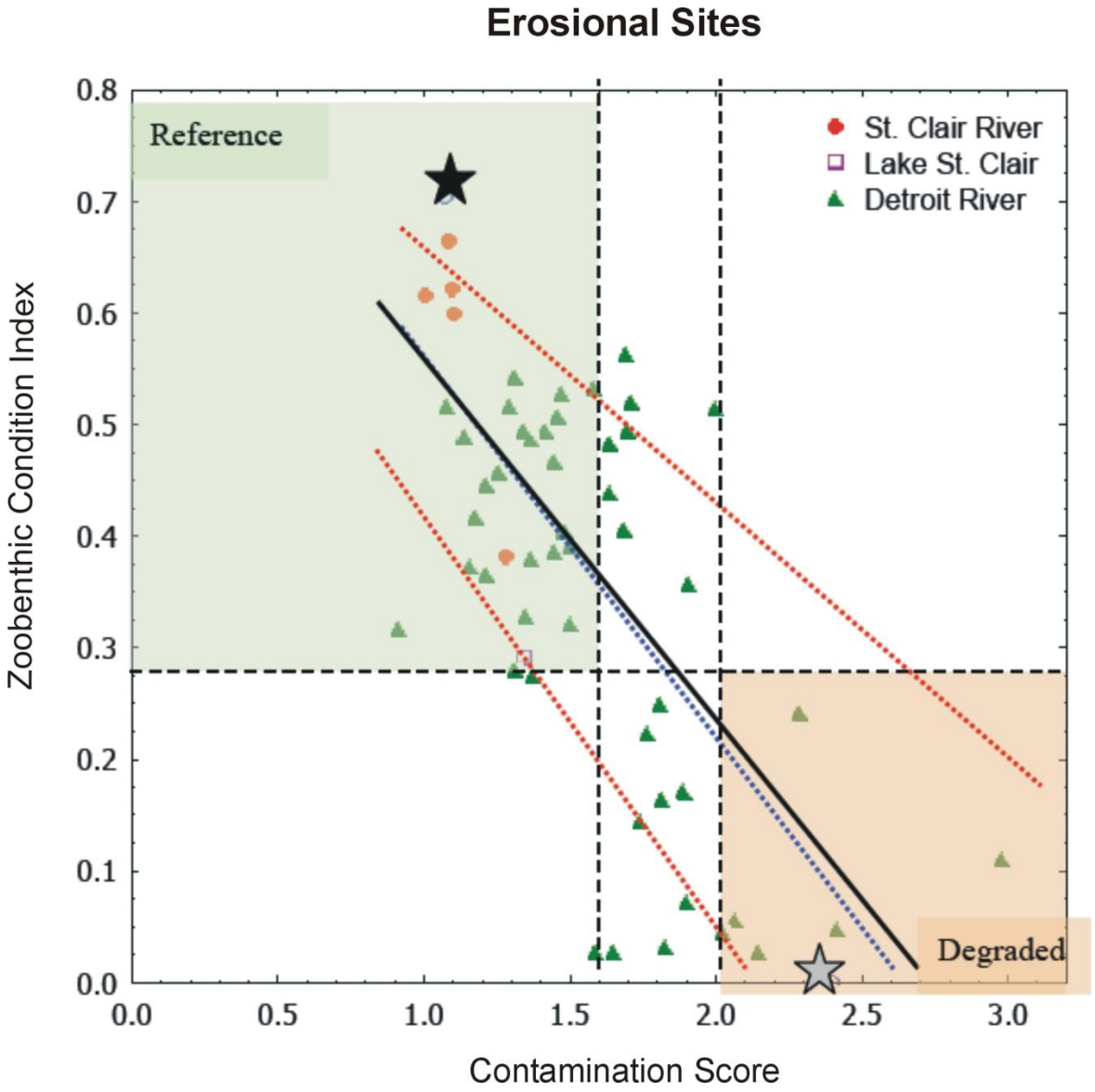


Figure 10. The relationship between the zoobenthic condition index (ZCI) and the sediment contamination score at erosional sites along the Huron-Erie corridor between 1991 and 2004 (n=56 sites). All sites with contaminant score ≤1.55 and a ZCI score ≥0.27 are said to be in 'reference' condition. Sites with a contaminant score ≥2.0 and a ZCI score ≤0.27 are said to be in 'degraded' condition (modified from Zhang 2008).

A number of sediment remediation projects have taken place within the Detroit River AOC (several on the U.S. side and one on the Canadian side) since the 1991 Stage 1 RAP Report. Major U.S. projects include: 3,100 m^3 of PCB-contaminated sediments were removed from Elizabeth Park marina in the Trenton Channel in 1993; over 19,000 m^3 of sediments were dredged at Monguagon Creek in 1997; a total of 87,200 m^3 of contaminated sediment, including an estimated 302 kg of PCBs, were removed from Conner Creek in 2002-2003; and 23,000 m^3 of contaminated soils were removed from the Black Lagoon in the Trenton Channel (since renamed Elias Cove) in 2004-2005, the first site to be remediated under the Great Lakes Legacy Act (Friends of the Detroit River and U.S. PAC 2008). On the Canadian side of the Detroit River AOC watershed, 975 m^3 of contaminated sediments were removed from the Grand Marais Drain of Turkey Creek in 2008.

It is important to note that even though these projects have been successfully implemented there is still much to be completed in order to achieve healthy benthic invertebrates, especially on the U.S. side of the AOC. Future contaminated sediment removal projects could positively affect the Detroit River benthos and consistent monitoring of the benthos is important for future re-assessment of this BUI.

Delisting Criteria

When the benthic community composition is temporally and spatially identified as non-impaired based on an objective and quantitative community analysis and/or a comparison to appropriate reference sites within the river, and

When benthic organisms analyzed for persistent, bioaccumulative substances (e.g., PCBs and mercury) are below thresholds required to protect fish and wildlife.

Design and Rationale

The 2005 delisting criteria were based on community balance. It is important that the revised criteria accommodate past databases so that trends through time can be analyzed. Assessments that will contribute to the current database need to be conducted at two scales: the Detroit River and the Huron-Erie corridor. There is a good historic dataset using a random-stratified design to appropriately represent the river. The assessment of this BUI needs to take into account that benthic invertebrate community structure can vary naturally due to substrate and flow conditions. Monitoring may show that benthos is impaired at some specific sites, but this does not necessarily mean the whole river is impaired. For example, if 10 out of 100 sampling locations are shown to be impaired but are not clustered in the same location, then it is likely that this is just natural variation due to physical features of the river. However, if impaired sites are clustered together in one sampling area, then this may indicate a localized problem that will require further monitoring and remediation.

Studies should be conducted annually and multivariate analyses (e.g., the RDC multivariate approach described earlier) should be used to assess the data. Due to the costs and time required to assess this BUI, data should be collected and reviewed every 5 years to make appropriate assessments. More frequent assessments may be conducted, if necessary.

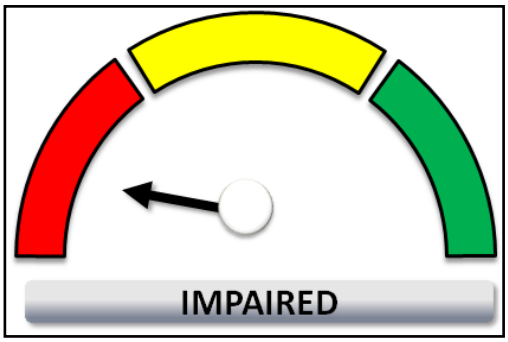
The benthic community should be considered impaired by toxicity if:

- The community is degraded;
- Bioassays using sediment from a particular area indicate toxicity to benthic organisms;
- Benthos collected from the sediments have significantly elevated incidences of deformities or other abnormalities; or
- The contaminant burden of benthic animals is great enough that predators are at risk of bioaccumulating contaminants at concentrations that would trigger human consumption advisories.

If the BUI is shown to be impaired, then laboratory bioassays using Detroit River benthic organisms should be conducted to determine the cause of the impairment and whether further investigation may be required. Moreover, sampling should be conducted randomly on the whole river and not just the known impaired sites or the just the Canadian side.

Restrictions on Dredging Activities

Overview



Navigational dredging in the Detroit River began as early as 1876 when the U.S. removed rock extending east of Stony Island (upper portion of the Livingstone Channel) to increase the depth and width of the channel (U.S. Army Corps of Engineers (USACE) 2006). Several subsequent projects to remove shoals, create a new channel, and deepen and widen existing channels were completed through to the 1960s. During that time, dredged material from one area was dumped into other portions of the river creating dikes and changing the capacity of certain portions of the river (USACE 2006).

Today, routine maintenance dredging (which does not include the expansion of navigation channels) is conducted at least once every five years (Fisheries and Oceans Canada (DFO) 2010). This type of dredging refers to "the removal of accumulated sediment from channel beds to maintain the design depths of existing public use facilities such as navigation channels" (DFO 2010). Because dredging poses a risk to fish and fish habitat, no one may conduct routine maintenance dredging without approval by the DFO (or a local Conservation Authority depending on the site). The applicant is responsible for determining if the sediments are contaminated. If the dredged sediments are contaminated, they must be disposed of according to Ontario Ministry of the Environment (OMOE) guidelines. The disposal of sediments can be done at a local landfill or at a confined disposal facility (if they exceed sediment guidelines and pose an increased environmental risk).

Restrictions on Dredging Activities was initially listed as *impaired* in the 1991 Stage 1 RAP Report because dredge spoils on the Michigan side of the Detroit River (downstream of Conner's Creek) and in the lower river were not suitable for open water disposal (MDNR and OMOE 1991). The status remained *impaired* in the 1996 RAP Update Report, 1999 Detroit River Update Report and the 2006 BUI Assessment Report because some areas in the River (particularly the U.S. side) exceeded sediment quality guidelines (Leney and Haffner 2006; DRCCC 1999; MDEQ 1996); however, the concentration of contaminants in sediment is not conclusive evidence of ecological degradation. The *Restrictions on Dredging Activities* BUI has no clear ecological metric and impacts to ecosystem health due to sediment contamination are captured in the *Degradation of Benthos* and *Restrictions on Fish and Wildlife Consumption* BUIs.

An analysis of recent routine maintenance dredging data should be conducted to re-assess the status of *Restrictions on Dredging Activities* against the delisting criterion below. Until then, it will remain listed as *impaired*.

Visit http://www.charts.noaa.gov/OnLineViewer/14848.shtml to view a chart of the Detroit River's navigation channels.

Delisting Criterion
When there are no limitations on the disposal of sediments removed for routine navigational dredging.

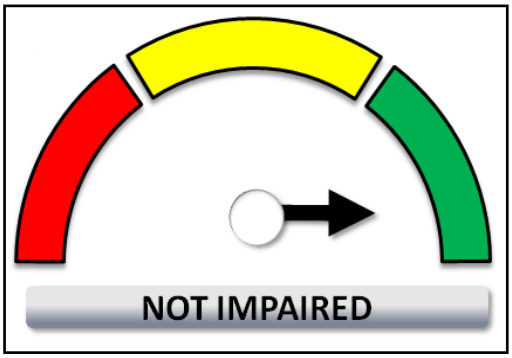
Design and Rationale

This criterion was revised to more clearly define its intent. It deals with routine navigational dredging to maintain the shipping channels in the Detroit River, which is comparable to delisting criteria used in other Canadian AOCs.

Public Works and Government Services Canada (PWGSC) uses the biologically based Provincial Sediment Quality Guideline (PSQG) to assess sediment quality within proposed dredging locations. If concentrations of contaminants in the sediments are below the PSQGs, sediment may be disposed of in a local landfill and is considered to have no limitations. Sediments that surpass the PSQGs are disposed of in a confined disposal facility because they pose environmental risk and are considered to have limitations.

Eutrophication or Undesirable Algae

Overview



The status of this BUI was listed as *not impaired* in the 1991 Stage 1 RAP Report because eutrophication had not been documented in the river and "is unlikely to occur due to the short retention time of the river" (MDNR and OMOE 1991). This status was maintained in the 1996 Update Report (MDEQ 1996). Water use goals adopted by the Binational Public Advisory Council in 1992 included, as a goal for this BUI, that nutrients from the river shall not impair uses downstream. This goal was incorporated into the delisting criterion developed for the Canadian side of the RAP in 2005. In 2006, the DRCC Monitoring and Research Work Group recommended that the status of *not impaired* be maintained, but noted that more data were required to determine whether the Detroit River is causing algal blooms in the western basin of Lake Erie (Leney and Haffner 2006).

Data for the assessment of this BUI are very limited; however, it is clear that algal blooms and other signs of cultural eutrophication (e.g., low dissolved oxygen) are not a problem in the Detroit River itself. This is in large part due to the water current; the average time for water to pass through the Detroit River is only 19 to 21 hours (Derecki 1984). A 1988 study reported that total phosphorus loadings increased by 50-80% along the length of the Detroit River (from the head to the mouth) (Upper Great Lakes Connecting Channel Study (UGLCCS) 1988).

It is known that, overall, phosphorus concentrations have declined considerably since the 1960s. The serious oversupply of phosphorus in the past has decreased substantially and the Detroit River is classified as a mesotrophic ecosystem (Manny et al. 1988). Prior to 1970, the Detroit Wastewater Treatment Plant was the single largest contributor of phosphorus to Lake Erie (Hartig et al. 2007). However, since 1970, when the waste water plant began removing phosphorus from its effluent, total phosphorus loading to the Detroit River (and ultimately Lake Erie) has decreased by more than 90% (Hartig et al. 2007). Between 1985 and 1994, the total phosphorus loading to Lake Erie only exceeded the Great Lakes Water Quality Agreement (1987) target load of 11,000 metric tonnes per year in 1990 and 1993 (DRCCC 1999). A more recent study estimated the total phosphorus (TP) loading to Lake Erie from the Detroit River between 3,500 to 4,000 metric tonnes per year (Burniston et al. 2010). Recent studies (GLIER unpublished data) reveal that total phosphorus concentrations of the waters entering Lake Erie from the Detroit River and upstream sources are approximately 20 µg/L, sufficient to support

mesotrophic conditions in the western basin of Lake Erie. Therefore, is it recommended that the status of *Eutrophication or Undesirable Algae* remain listed as *not impaired*.

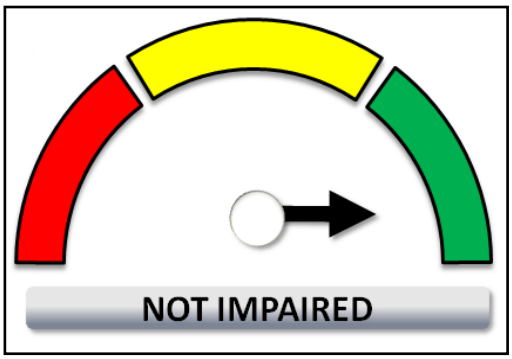
Delisting Criterion
When the nutrient status of the waters of the Detroit River will support the establishment of mesotrophic conditions in the Western Basin of Lake Erie, and the shoreline of the river will support minimal grown of attached algae (e.g., *Cladophora*).

Design and Rationale

This BUI has been designated *not impaired* since the 1991 RAP Report, and as a result, delisting criteria are not required. However, they are provided as rationale for maintaining the *not impaired* status and to help guide monitoring efforts. The focus of future monitoring for this beneficial use (no undesirable algae) will be on the potential for impacts to Lake Erie. This BUI is closely linked to *Degradation of Phytoplankton and Zooplankton Populations* in that over 98% of the water flowing through the Detroit River comes from the oligo-mesotrophic Lake Huron and moves through the Huron-Erie corridor very quickly. Furthermore, the target load of 11 tonnes of phosphorus per year (IJC 1987) has been met through industrial/municipal controls.

Restrictions on Drinking Water Consumption or Taste and Odour Problems

Overview



Based on a recent evaluation (Leney and Haffner 2006) and updated information for this Stage 2 RAP Report, this BUI should be considered *not impaired*. The BUI was first listed as *impaired* in the 1991 Stage 1 RAP Report and remained *impaired* in the 1996 RAP Update Report due to possible taste and odour problems in July/August 1990, which have been theorized to be caused by *Geosmin*, a chemical naturally secreted by blue-green algae (MDNR and OMOE 1991; MDEQ 1996). The recommendation to change the status to *not impaired* is based on the fact that, between 2001-2009, there were no problems with disease-causing organisms and the majority of the complaints from the public regarding taste and odour were related to the chlorination process (M. Reid, Compliance Coordinator, Windsor Utility Commission, pers. comm. 2008; Leney and Haffner 2006). It is important to note that, according to the Ontario Water Works Research Consortium (OWWRC) (2009), taste and odour is related to aesthetics and not to health problems since there are no health related guidelines for *Geosmin* and MIB (2-methylisoborneol).

The two drinking water treatment facilities that draw water from the Canadian side of the Detroit River are the Albert H. Weeks Water Treatment Plant in Windsor and the Amherstburg Water Treatment Plant. Each of these municipal water treatment plants must comply with the Ontario Drinking Water Systems Regulation (O. Reg. 170/03) under the *Safe Drinking Water Act* (2002). Although it is not required, the Windsor Utilities Commission (WUC) monitors the level of *Geosmin* and MIB at the A.H. Weeks Water Treatment Plant as an indicator of taste and odour problems. Indication of taste and odour problems occurs if *Geosmin* is ≥4 ng/L and MIB ≥9 ng/L (R. Bejankiwar, Source Water Protection, ERCA, pers. comm. 2008). In the third quarter of 2008, the WUC measured *Geosmin* at 2.9 and MIB at 2.8, both well below limits that would indicate taste and odour problems.

In 2001, the A.H. Weeks Water Treatment Plant added ozone treatment to its conventional drinking water treatment process (coagulation/flocculation, sand filtration) for disinfection and to inactivate pathogen (*Cryptosporidium*) oocytes (Hua et al 2006; Jasim et al. 2006; Leney and Haffner 2006). Ozone treatment also improves taste and odour and has been shown to be very effective in removing pharmaceuticals and other chemicals from untreated water (Hua et al. 2006). Although the addition of ozone treatment to the conventional treatment is not yet

common in Canada, this process has been shown to be very effective in purifying drinking water and has been proposed for the Great Lakes region (Hua et al. 2006; Jasim et al. 2006). Other filtration methods used to control taste and odour are multimedia filtration, powdered activated carbon, and granular activated carbon (OWWRC 2005). Powdered activated carbon was reported as the most commonly used in the Great Lakes region but also the least effective (OWWRC 2005). Granular activated carbon and ozone were less common but reported as successful. The Amherstburg drinking water facility adds powdered activated carbon to its water during the summer months (Leney and Haffner 2006).

There have been no taste and odour problems related to *Geosmin* or MIB in Detroit River water at the A.H. Weeks Water Treatment Plant since 2001 (M. Reid, pers. comm. 2008). The only complaints received were due to the water treatment process (e.g., chlorine odour or solids in water) and not related to the quality of Detroit River water (M. Reid, pers. comm. 2008). Therefore, it is recommended that this BUI remain listed as *not impaired***.**

If you have a complaint about your drinking water taste and odour contact the Windsor Utilities Commission (Windsor & LaSalle – 519-255-2727) or Amherstburg Public Works (Amherstburg – 519-736-3664).

Delisting Criteria

When treatment (i.e., settling, coagulation, disinfection) required to bring raw river water to a quality that will meet provincial drinking water standards does not exceed the standard treatment used in comparable areas of the Great Lakes; and

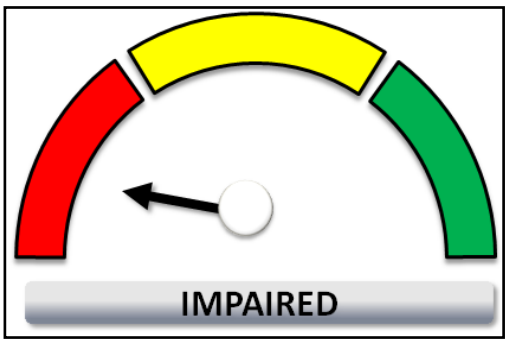
When surveys of drinking water providers confirm that there are no statistically significant taste and odour problems.

Design and Rationale

The delisting criteria were revised to include more scientifically-defensible wording and to compare drinking water treatment to other Great Lakes locations.

Beach Closings

Overview



According to the most recent DRCC PAC report card on Beach Closings, this BUI is *impaired* (Carreau-Green 2009); however, recent data suggests that it is improving. The Beach Closings BUI was first listed as *impaired* in the 1991 Stage 1 RAP Report because "total body contact activities in areas of the river are periodically impaired due to elevated bacteria levels and beach closings have occurred in the Ontario AOC" (MDNR and MOE 1991). The *impaired* status was maintained in 1996 and 2006 (Leney and Haffner 2006; MDEQ 1996).

Currently, there is only one monitored beach within the boundaries of the Detroit River Canadian AOC at Sandpoint Beach in Windsor, Ontario. This beach is located just upstream of the river, as a result, and is influenced by Lake St. Clair and Thames River water. There are no other routinely monitored locations within the Canadian portion of Detroit River AOC; however, there are locations such as marinas and parks on the Detroit River where people are known to swim. Beaches in Essex County are monitored weekly, from June to September, by the Windsor-Essex County Health Unit (WECHU). The indicator used to monitor beach health is the level of *E. coli* bacteria in water. In Ontario, the guidelines for safe swimming state that *E. coli* counts cannot exceed a daily geometric mean of 100 colony forming units (cfu) per 100 mL (Ontario Ministry of Health (OMOH) 1998). When *E. coli* levels exceed 100 cfu/100 mL, the beach receives an advisory, which means the public may swim at their own risk but there may be health risks associated with swimming. When *E. coli* levels exceed 1000 cfu/100 mL, the beach must be closed to the public because the health risks are much higher.

In the last 3 years, beaches upstream and downstream of the Detroit River Canadian AOC have received advisories against swimming due to elevated bacterial counts, but have rarely been closed. In a usual swimming season, the WECHU monitors beaches for 12 consecutive weeks; one beach closing (*E. coli* > 1000 cfu/100 mL) in a season corresponds to a frequency of beach closures of less than 10%. Results from a recent PAC Report Card on beach closings show that Sandpoint Beach received no closings in 2008 and only one in each of 2006 and 2007. Holiday Beach (downstream of the Detroit River; Lake Erie) received one closing in 2007 and none in 2006 and 2008. Hillman Beach, located the furthest from the AOC, has had no closings since 2002 (Figure 11).

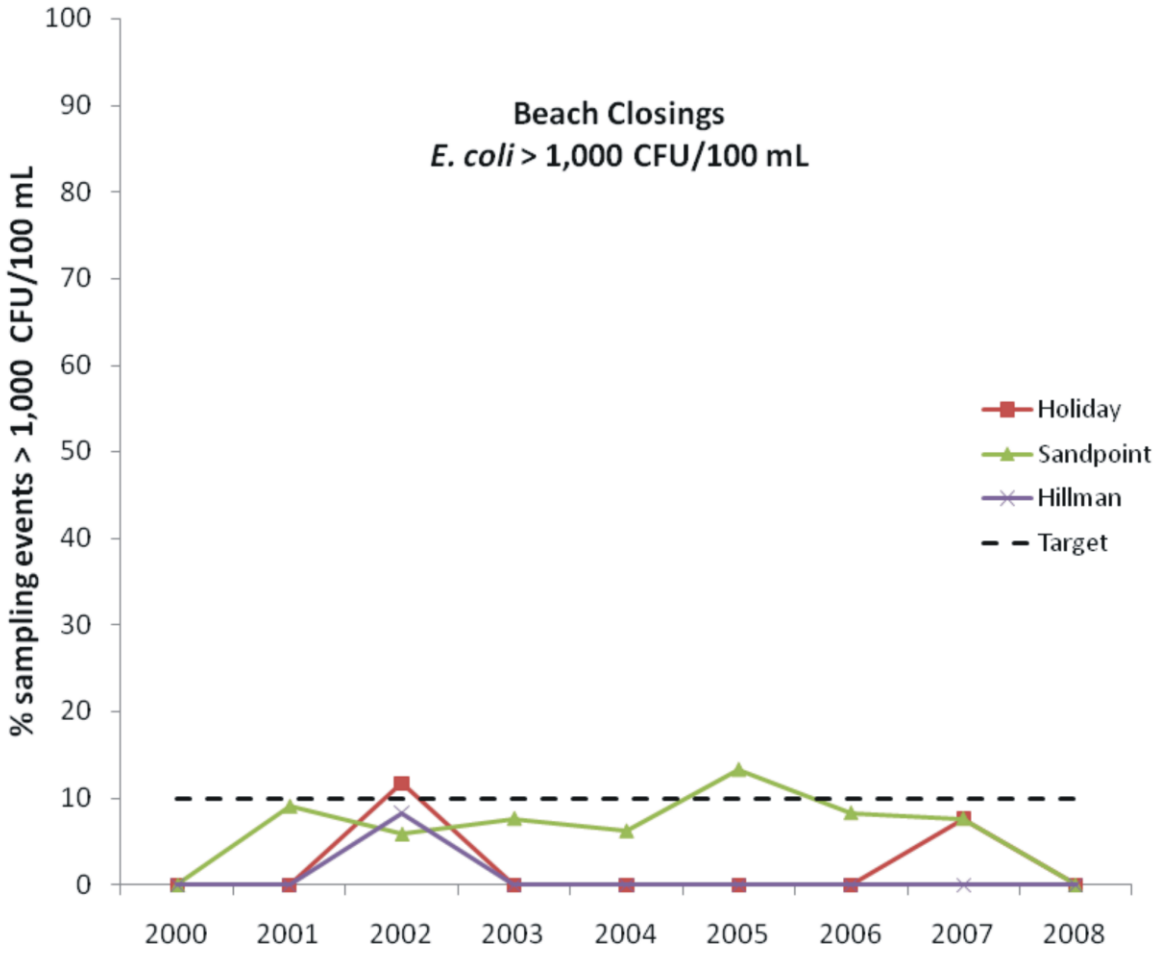


Figure 11. The percentage of sampling events in each swimming season that exceeded 1,000 *E. coli* cfu/100 mL resulting in a beach closing. Values are from Sandpoint Beach (upstream of the Detroit River), Holiday Beach (downstream, located on Lake Erie), and Hillman Beach (furthest from AOC on Lake Erie). Approximately one beach closing in a season corresponds to a frequency of beach closures of less than 10%. Data was obtained from the WECHU.

The beaches that are currently monitored by the WECHU do not accurately represent the condition of the Detroit River Canadian AOC. The single beach (Sandpoint) that is within the AOC boundaries is influenced by upstream conditions (e.g., the Thames River and Lake St. Clair) rather than conditions within the Detroit River. It has been recommended that sampling occur at another location within the AOC, in addition to those beaches monitored by the WECHU. For example, Carreau-Green (2009) suggested monitoring White Sands Beach or McKee Park and Leney and Haffner (2006) recommended that beach sampling be conducted at Pêche Island, Crystal Bay, or White Sands. By adding another beach to the sampling regime and using those tested by the WECHU as reference sites, the DRCC will be better able to assess the status of this BUI in the AOC.

Delisting Criterion
When the frequency of beach closures due to elevated counts of *E. coli* in the Detroit River (White Sands and McKee Park) does not exceed the frequency at upstream (Sandpoint) and downstream (Holiday) reference beaches.

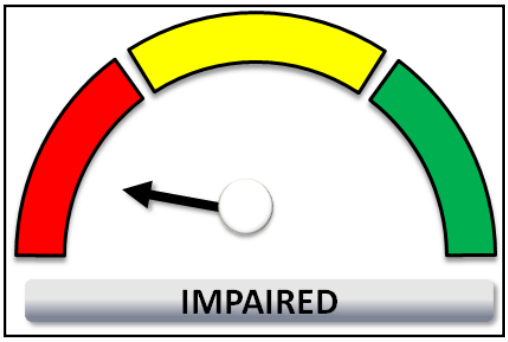
Design and Rationale

The revised delisting criterion is set up to compare beaches within the Detroit River (White Sands Beach, located on the southern tip of Bois Blanc Island and McKee Park near the Ambassador Bridge) to upstream (Sandpoint Beach) and downstream (Holiday Beach) reference beaches. The reference beaches are currently monitored by the WECHU as part of their beach monitoring program.

Monitoring of White Sands Beach and McKee Park will be conducted starting in 2009 by ERCA, who currently manage the White Sands Beach, following the WECHU protocol (OMOH 1998) and sampling schedule (i.e., 1 day per week from June to September). The frequency of beach closures due to elevated *E. coli* counts should not exceed 10% of sampling periods (i.e., one beach closing) annually for at least 3 years. The beaches identified for monitoring follow the WECHU definition of public bathing beach as defined in their beach management protocol (OMOH 1998).

Degradation of Aesthetics

Overview



This BUI was listed as *impaired* in the 1991 Stage 1 RAP Report because debris and persistent objectionable deposits from Combined Sewer Overflows (CSOs) existed along both shorelines of the Detroit River (MDNR and OMOE 1991). A CSO is a discharge of a mixture of sewage and surface runoff directly into the river. In dry weather conditions, combined sewers only carry sewage to the waste water treatment plant; however, during intensive wet weather events these sewers discharge the combination of storm and sewer water into the river. While a great deal of work had been undertaken on both the Michigan and the Ontario sides of the Detroit River AOC to control both CSOs and point source outflows to the river, it was noted that much work was left to do and, therefore, the status of the BUI was listed as *impaired* (MDEQ 1996).

Aesthetic surveys conducted in 1999 and 2000 found that the Detroit River was clear, colourless and odourless regardless of whether surveys were carried out in dry or wet weather. Debris in the river was reported but was generally from a natural source (i.e., woody debris) (Leney and Haffner 2006). Furthermore, foam and oil films were noted in some locations along the Detroit River but their sources could not be identified (Salim et al. 2005). Thus, Leney and Haffner (2006) recommended that the status of this BUI remain listed as *impaired* due to the occasional objectionable deposits, foam and oil sheens.

Presently, there is a lack of information for properly re-assessing the status of this BUI for the Canadian side of the Detroit River AOC; however, based on the information that is currently available the BUI remains *impaired*. An updated survey or more frequent monitoring is required on the Canadian side of the river. Due to recent upgrades to the City of Windsor's Lou Romano Water Reclamation Plant and expected upgrades to the Amherstburg Waste Water Treatment Plant, there is potential for a reduction in direct discharges to the river and a decrease in total pollutant loadings resulting in improved water quality and aesthetics. The construction of a retention treatment basin (RTB) along the City of Windsor's riverfront will also greatly improve water quality and aesthetics by greatly reducing CSO discharges along the Windsor waterfront. Once constructed, the RTB along with the interceptor sewer will collect and treat 7.85 cubic metres per second of combined sewer overflows along the Windsor riverfront. The CSOs that will be intercepted drain an area of approximately 1,288 ha. For more information about the RTB, contact the City of Windsor.

Delisting Criterion
When the waters are devoid of substances at levels that produce persistent objectionable deposits, colours, turbidity, and/or odour.

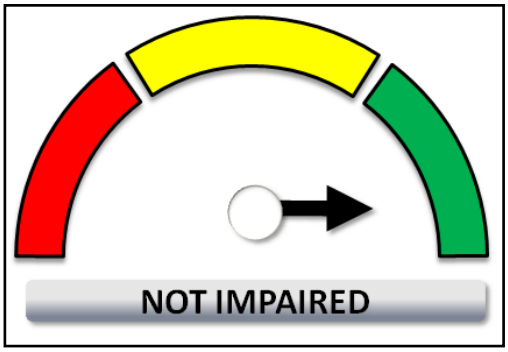
Design and Rationale

The proposed delisting criterion recognizes that the Detroit River is an urban river, and as such, certain substances (oils, litter, etc.) will always be present in the environment at some level. Therefore, impairment should be based on levels of such substances that cause persistent visual and odour problems. It is recognized that the term "objectionable" is subjective and that perception of what is objectionable varies among individuals. The cause of degraded aesthetics must originate from within the AOC to be considered an impairment. For example, turbidity does not always originate within the AOC (Lake St. Clair and the Thames River are sources). Further, turbidity may not always be an indication of polluted water (i.e., some pristine waters experience turbidity problems at various times of the year). Future assessments of the status of this BUI should be based on a large sample size.

As explained in the above overview, the current status of *Degradation of Aesthetics* is based on data from the U.S. side of the Detroit River. These data include U.S. spill data for the Detroit and Rouge Rivers (Hartig et al. 2007) and an aesthetics survey conducted in 1999 and 2000 along the Detroit, Michigan shoreline (Salim et al. 2005). These results are not representative of the aesthetics on the Canadian side of the river. Thus, Canadian data need to be collected to properly assess this BUI for the Canadian waters of the Detroit River AOC.

Added Costs to Agriculture or Industry

Overview



Added Costs to Agriculture or Industry relates to the quality of raw (untreated) water drawn directly from the Detroit River for agriculture or industrial purposes (i.e., intended for commercial or industrial applications and non-contact food processing) (IJC 1991). This BUI was designated as *not impaired* in the 1991 Stage 1 RAP Report (MDNR and OMOE 1991) but the IJC review stated that the conclusion was based on limited information and suggested a user survey be conducted.

In May 2010, the DRCC developed a survey which was delivered to six local organizations that were known users of raw (untreated) Detroit River water. Agricultural organizations were not surveyed because they do not draw raw Detroit River water. Based on the 2010 survey, *Added Costs to Agriculture and Industry* should be designated *not impaired***.**

The organizations contacted were:

- Hiram Walker & Sons Ltd.
- Brighton Beach Power L.P.
- Ford/NEMAK
- West Windsor Power
- University of Windsor
- Canada Salt Company

In total, five of the six organizations that were contacted participated in the survey; one organization did not participate in the survey because that person "was instructed not to participate at this moment". Of the five participating organizations, four confirmed their use of raw Detroit River water for their operations. One of the five organizations surveyed does not use raw Detroit River water. The following details on usage, rationale, and costs were provided by the survey participants.

Usage

Four organizations confirmed they use raw Detroit River water for the following purposes:

- As heating / cooling within the building and for aquatic facilities
- Just for open basin cooling. Raw Detroit River water is blended with City water (the percentage varies). Water is circulated through heat exchangers

- Cooling
- Cooling water (non-contact) used to condense steam

Rationale for its Usage rather than Municipal Source

The four organizations that use raw Detroit River water responded that they use raw Detroit River water instead of municipal water because:

- Convenience—intake is located nearby.
- Cost savings—less expensive and "does the job"
- Conservation—waste of treated City water just for cooling; volume of water (1,762,560,000 L per day) used for cooling is too high for the City's system

Cost

Participants explained that their organizations experience some costs (not above normal operating procedure) due to ice, silt (turbidity), or intake screen debris. Specifically, organizations incurred some costs to maintain heat exchangers due to turbidity and to dispose of the intake screen debris.

In summary, survey participants noted that raw Detroit River water was used for cooling purposes, drinking water source, and for aquatic facilities. The reasons for utilizing raw Detroit River water included convenience, cost savings, and conservation. Some costs were incurred due to ice, silt or intake screen debris. However, these are standard costs that are associated with the operation of a private water intake line, and are not considered "added costs" resulting from conditions specific to the Detroit River AOC. Furthermore, the savings accrued by using raw Detroit River water outweigh any costs incurred.

It is recommended that the same survey be conducted again in 2015 to monitor any possible changes.

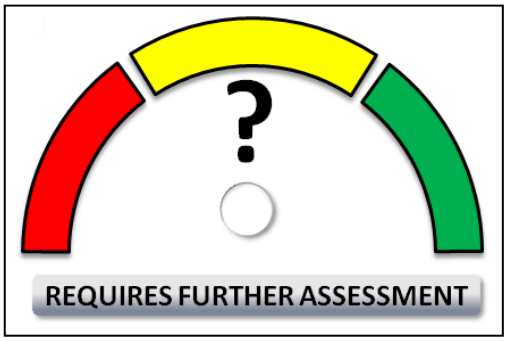
Delisting Criterion
When there are no significant additional costs required to use raw Detroit River water for agricultural and industrial purposes.

Design and Rationale

The delisting criterion deals specifically with water being drawn, for agricultural and industrial uses, directly from the Detroit River. Agriculture or industry drawing from one of the tributaries should not be considered as part of this BUI assessment. Furthermore, routine operations and maintenance activities, such as intake screen cleaning, should not be considered "additional" costs.

Degradation of Phytoplankton and Zooplankton Populations

Overview



The 1991 Stage 1 RAP Report listed the status of this BUI as *not impaired* based on the density, diversity, and species composition of phytoplankton and zooplankton. However, the composition of permanent, nearshore zooplankton populations was not examined at the time, thus it was noted that a further assessment of the nearshore zooplankton communities was needed (MDNR and OMOE 1991). The status remained *not impaired* in the 1996 RAP Update Report, but one reviewer commented that phytoplankton bioassays using Trenton Channel sediment suggested impairment (MDEQ 1996). Most recently, Leney and Haffner (2006) proposed that the status be changed to *unknown* due to limited information about the composition of Detroit River phytoplankton and zooplankton. It is proposed that the status be listed as *requires further assessment*.

Plankton are small (usually microscopic), floating organisms that live in freshwater and marine ecosystems. Phytoplankton are tiny plants including diatoms, desmids, and algae that require photosynthesis to live, while zooplankton are small animals (e.g., copepods, daphnids) that feed on those tiny plants (Smith and Smith 2001). Together, phytoplankton and zooplankton make up an important part of the aquatic food web.

Changes in phytoplankton and zooplankton populations can be an indication of changes in nutrient pollution. For example, an aquatic system that is nutrient-rich (i.e., high amounts of phosphorus or nitrogen) is said to be eutrophic and will stimulate an excessive growth of algae (phytoplankton). An oligotrophic system is characterized by clear water and low nutrient concentrations, and little phytoplankton growth. Mesotrophic systems have moderate amounts of nutrients. Because most of the Detroit River water is replaced in less than 24 hours (Derecki 1984), its waters and the composition of its zooplankton and phytoplankton communities reflect the condition of the Upper Great Lakes and Lake St. Clair (oligotrophic/mesotrophic).

Research is required to determine the status of the phytoplankton and zooplankton populations in the Detroit River.

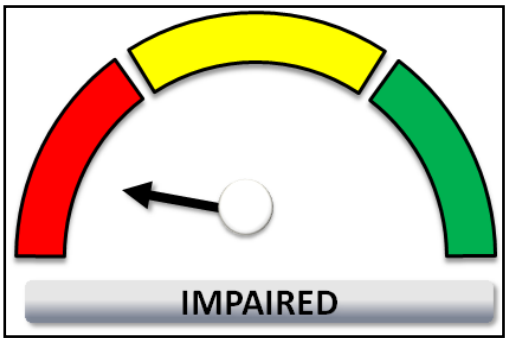
Delisting Criterion
When the composition and relative abundance of phytoplankton and zooplankton of the Detroit River reflect that of Lake Huron, and therefore represent primarily oligotrophic/mesotrophic conditions.

Design and Rationale

Since over 98% of the water in the Detroit River originates from Lake Huron, the phytoplankton and zooplankton communities should reflect the oligo-mesotrophic status of Lake Huron. The flow of water through the Huron-Erie corridor is too fast (Fahnenstiel 2008) to result in significant changes in the composition and relative abundance of plankton species (DRCC In preparation). Monitoring should be developed to assess seasonal patterns of phytoplankton and zooplankton composition at the mouth of the Detroit River. Sampling could be done using a corridor-approach by measuring algae assemblages in the St. Clair River (using the same methods as those for the Detroit River). Since both connecting channels receive water from Lake Huron, the composition will likely be similar. If monitoring shows that this BUI is impaired, then research should be conducted to determine the cause of the impairment.

Loss of Fish and Wildlife Habitat

Overview



The *Loss of Fish and Wildlife Habitat* has been listed as *impaired* in all AOC reports since the 1991 Stage 1 RAP Report due to the significant loss of wetlands and other habitats caused by industrial, urban, and agricultural development (MDNR and OMOE 1991; MDEQ 1996; DRCCC 1999; Leney and Haffner 2006).

Activities such as the construction of the shipping channel, the dumping of dredge spoils, the hardening of the shoreline and the destruction of shallow wetlands have all contributed to the loss of important fish and wildlife habitat (Manny et al. 1988). As an example, a large expanse of limestone bedrock and gravel bars existed in the lower Detroit River prior to the construction of the shipping channel. Large runs of spawning lake whitefish (*Coregonus clupeaformis*) are known to have inhabited the area. In order to expand the capacity of the shipping channel, large amounts of this whitefish spawning habitat was removed as shipping channels were widened and deepened. Coupled with over-harvest and predation by the invasive and parasitic sea lamprey (*Petromyzon marinus*), the reduction of coastal wetlands and modification of tributary habitat, lake whitefish populations virtually disappeared from the Detroit River (Roseman et al. 2007).

Today, the Detroit River AOC is better characterized by the two large urban centres (Windsor Census Metropolitan Area and Greater Detroit) and large continuous tracts of fertile agriculture land that occur on either side of the river. The 7.4% natural areas cover that remains in the Detroit River AOC (including the islands and the watershed) consists of 5.4 % fragmented forest and 2% wetland features (based on SOLRIS (2000) and ERCA (2005-2009) data). Within the river proper, the removal of naturally occurring substrates and silt deposition have reduced the amount of suitable spawning habitat for lake sturgeon from 9 historic spawning sites to just two (McClain and Manny 2000). Manny et al. (1988) suggest that significant spawning runs of important fish species like walleye, yellow perch and white bass were greatly reduced as a result of pollution.

After decades of pollution abatement programs and habitat restoration efforts, in addition to improved fish population management (fishing regulations), recent fish spawning surveys have documented successful spawning of a number of species including the return of lake whitefish, lake sturgeon, Northern madtom (*Noturus stigmosus*) and continued reproductive success of walleye (Manny et al. 2007; Roseman et al. 2007; Caswell et al. 2004). Continued

research and monitoring is required to better understand which of the environmental factors in the Detroit River are contributing to the successful spawning of these important fish species.

In addition to its role in fish migration and spawning, scientists have documented that the Detroit River serves as an important nursery habitat for larval fish. Tow-net surveys indicate that the river is a nursery for approximately 25 fish species (Manny et al. 1988; Francis 2008). Ontario Ministry of Natural Resources (OMNR) electrofishing surveys in coastal wetlands along the Ontario shoreline of the Detroit River documented 46 species (Maclennan 1992) and the Stage 1 RAP Report noted more than 60 fish species in the entire Detroit River (MDNR and OMOE 1991). Similar coastal/nearshore surveys were conducted by the Michigan Department of Natural Resources (MNDR) in the summer of 2008; 33 young-of-the-year fish species were observed from a total of 77 fishes identified (Francis 2008). These results indicate the significant importance of the wetland habitat and submerged vegetation beds in the Detroit River as nursery habitat for larval and young-of-the-year fish (Maclennan 1992; Manny et al. 1988). Researchers have also documented the linkage between walleye larval growth and survival to zooplankton densities, optimal water clarity and warm water temperatures associated with coastal wetlands, emphasizing the importance of connectivity between spawning and nursery habitat (Roseman et al. 2005). Beyond the linkage between spawning and nursery habitat, Lapointe (2005) observed an association with small fish, aquatic vegetation and predator avoidance suggesting that complex macrophyte communities were important factors in determining fish distribution.

Manny et al. (2007) suggested that the coastal wetlands in the river may be suitable for walleye larval production. Unfortunately, the extent of coastal wetlands in the Detroit River is only approximately 3% of its original distribution (Manny 2003). The coastal wetlands and submerged aquatic beds were once one contiguous system spanning the entire length of the river approximately 2 kilometers wide (Manny 2003; Manny et al. 1988). Trends in wetland loss are attributable to shoreline hardening, channelization, and infilling for agriculture or urban use. Landscape level analysis performed in 1982 indicated that coastal wetland loss exceeded 97% along both sides of the Detroit River shoreline. Compared to the original 1982 wetland inventory (also reported in the Stage 1 RAP Report) there has been little change in coastal wetland habitat along the Ontario shoreline of the Detroit River AOC (Table 5).

The protection of existing functionally-connected habitat features is critical to the fish and wildlife resources of the Detroit River (Manny et al. 1988). Although coastal wetland loss has essentially ceased over the past 20 years, efforts to restore the quality of those remaining wetland features are essential. Data collected through Bird Studies Canada's Marsh Monitoring Program indicates that Detroit River coastal wetlands have the ability to support a high diversity of amphibians but score below average for marsh bird indicators and marsh nesting

Table 5. Amount of wetland habitat in the Detroit River AOC over time (Erin Sanders, Wetland Evaluation Project Biologist, OMNR, pers. comm., 2009; DRCCC 1999; MDNR and OMOE 1991). Note: estimated area values in 2008-2009 are different than 2001, in part, due to more accurate digital mapping techniques. Differences between the 1991, 1999 and 2001 data are also likely due to more accurate techniques used in 2001.

Wetland Complex	Area (ha) 1991 Stage 1 RAP	Area (ha) 1999 Update Report	Area (ha) 2001	Area (ha) 2008-2009*
Detroit River Complex	575	575	424.02	679.00‡
Turkey Creek Marsh	32	32	36.67	46.90
Fighting Island Marsh	113	149	102.30	101.67
Canard River Complex	416	416	453.00	322.95‡
Total	**1136**	**1172**	**1015.99**	**1150.52**

* Based on aerial photo interpretation using 2006 South Western Ontario Orthoimagery Project (SWOOP) data followed by ground truthing in 2008.

‡ Parts of the Canard River Complex were found to be in Detroit River watershed boundaries and were thus transferred from the Canard River Complex to the Detroit River complex.

bird diversity compared to other non-AOC coastal wetland features (Timmermans et al. 2004). Further wetland quality studies were undertaken by Environment Canada (Canadian Wildlife Service) in 2006 and 2008. A number of Detroit River wetlands were assessed using a standardized method recommended by the Great Lakes Coastal Wetland Consortium (Environment Canada 2009). Metrics measured for each wetland that was assessed included water quality, aquatic vegetation, marsh-breeding birds and macroinvertebrates. The overall condition of the coastal wetland habitat ranges from “poor” to “very good”. However, it should be recognized that the majority of the wetlands (all but Pêche Island) are considered degraded based on water quality parameters (Environment Canada 2009). Similar results were also observed by the OMNR (1996) and the Fisheries and Oceans Canada (DFO) (2004-2005) when applying a fish community-based Index of Biotic Integrity (IBI) (Torenvliet et al. 2004). There was little change in overall scores from 1990 to 2003 and 2004, where site conditions ranged from “good” to “fair” to “poor” (Edwards et al. In preparation). As a point of interest, spring diversity index and species richness were observed to be the highest throughout the mid-section of the Detroit River, implying the importance of the continuous Detroit River coastal marshes as important fish habitat (Lapointe 2005; Hamilton 1987).

Recent studies by Environment Canada (EC) demonstrate that seasonal water quality parameters associated with high turbidity, nitrates and ammonia may negatively impact the quality of coastal wetlands (Environment Canada 2009). The sources of ammonia and nitrate loadings are indicative of run-off due to erosion either from upstream sources or direct input from local tributaries. There are two major tributaries directly influencing coastal wetlands along the Canadian shoreline of the Detroit River: Canard River and Turkey Creek. Concentrations of nutrients (i.e., total phosphorous (TP), nitrates and ammonia) routinely exceeded the respective Provincial Water Quality Objectives (PWQO), in both of these streams between 2000 and 2008. TP concentration exceeded the PWQO limit of 0.03 mg/L in 82% and 78% of the total samples collected in Canard River and Turkey creek respectively, during 2000-2008. Elevated levels of metals, such as aluminum, iron, lead and copper, were also observed in Turkey Creek and Canard River during the monitoring period. The overall quality of the Canard River is listed as "fair" to "poor", with the lower reaches of the Canard listed as "fair" with conditions degrading as one heads upstream (Hayman et al. 2005). In contrast, a tributary associated with the Canard (west branch of the Cahill Drain) is highly degraded, with little riparian cover and inputs associated with the adjacent agriculture land use (Hayman et al. 2005). The Turkey Creek watershed is more associated with the urban landscape of the City of Windsor. It is considered degraded with little habitat value and poor water quality parameters, particularly dissolved oxygen (Hayman et al. 2005).

Forest cover in the AOC and its watersheds has increased since the mid-1980s. Existing forest cover (i.e., a wooded feature >0.5 ha with an unmaintained understory; windbreaks not included) identified within Detroit River Canadian AOC watershed was recently estimated at 5.4% (T. Dufour, GIS Technician, Essex Region Conservation Authority, pers. comm. 2008).

Land cover and land use activities are known to be one of the single biggest drivers of Great Lakes water quality conditions (Environment Canada and US EPA 2008). Although there is general recognition that low natural areas coverage in watersheds contributes to degraded tributary conditions, the extent to which existing tributary conditions influence the Detroit River is the subject of ongoing investigations (R. Bejankiwar, Water Quality Specialist, ERCA, pers. comm. 2008). Both anecdotal observations and preliminary monitoring data from the Amherstburg Water Treatment Plant (located downstream of the Canard River outlet) show that Canard River flows can impact nearshore conditions in the Detroit River downstream of the mouth of the Canard (S. Taylor, Director of Source Water Protection, ERCA, pers. comm. 2008). The spatial extent and magnitude of such impacts are currently not understood. There is ample evidence that riparian restoration projects benefit tributary water quality (Yates et al. 2007) and that increasing natural areas cover in the AOC watersheds benefits both habitat and water quality conditions in the receiving environment (Environment Canada 2004). An ongoing focus

on AOC watershed restoration in areas that directly benefit Detroit River habitat and water quality conditions is needed in addition to restoration efforts in the river itself.

Recommendations by a number of management agencies and expert input suggest that continued efforts to protect, maintain and restore the existing coastal wetlands should be a primary goal of the Detroit River Canadian Cleanup (EC 2009; Hartig et al. 2007; Roseman 2005; OMNR 1994; MDNR and OMOE 1991; Manny et al. 1988). To achieve this goal, agencies, stakeholders, and land stewards should collaborate on providing adequate buffer strips around wetlands and increasing the riparian forest habitat associated with connecting tributaries. Where possible, efforts to create and restore wetland function should be pursued through capital projects which explore shoreline softening techniques, improve hydrological linkages and expand the connectivity to other natural heritage values as identified by the 2007 DRCC Priority Habitat Sites or the 2002 Essex Region Biodiversity Conservation Strategy, including projects in and adjacent to the Detroit River as well as its tributaries (EC 2009; Hayman et al. 2005; EC 2004; ERCA 2002; OMNR 1994).

Delisting Criteria

a) Coastal wetlands: Protect existing coastal wetland habitat and restore wetland function in priority areas of the AOC and its watershed (as identified in the 2007 Detroit River AOC Canadian Priority Habitat Sites and the 2002 Essex Region Biodiversity Conservation Strategy).

b) Aquatic & riparian habitat: Protect existing deep water, coastal spawning, and tributary fish and aquatic wildlife habitat and restore ecosystem function in priority areas in, and hydrologically connected to, the Detroit River.

c) Shoreline softening: Develop and begin to implement a shoreline management strategy to soften and naturalize Detroit River Canadian shoreline, whenever opportunities arise.

d) Terrestrial habitat: Protect existing natural terrestrial corridors and restore ecosystem function between the Detroit River and the Ojibway Prairie Complex, the LaSalle Candidate Natural Heritage sites, and other major identified habitat sites (as identified in the 2007 Detroit River AOC Canadian Priority Habitat Sites and the 2002 Essex Region Biodiversity Conservation Strategy).

Design and Rationale

In 2007, the DRCC Habitat Work Group produced a report to guide habitat-related actions in the Detroit River Canadian AOC (DRCC 2007). This document included a map showing the priority habitat sites within the Detroit River AOC and its watershed (Figure 12). It must be noted that appropriate reference documents should be used to guide important protection, restoration, and rehabilitation actions in priority sites where they will impact the Detroit River AOC.

In this section, *protection* is defined as protecting the remaining extent and distribution of habitat in the AOC, resulting in no net loss, primarily utilizing land use planning tools and through acquisition or related activities (e.g., conservation easements). *Function* needs to be established to improve habitat quality so that habitats are self-sustaining and diverse (i.e., not a monotypic stand of *Phragmites* sp. or cattail). *Restoration* refers to replacing lost habitats, while *enhancement* refers to improving the function of existing natural features.

(a) Coastal Wetlands

The RAP should address enhancing the function of existing wetlands through habitat and water quality improvements, in addition to restoring buffer areas around coastal wetlands. Restoration targets have been developed as part of the Biodiversity Conservation Strategy and should be implemented. In addition, ongoing wetland monitoring should be undertaken to determine whether improvements are being made in fish and wildlife populations related to habitat restoration and related enhancement projects. It is recommended that delisting targets (short-term) and ecological targets (long-term) be kept separate because the restoration of coastal wetlands will likely continue beyond the RAP. However, information gathered through the RAP will assist in determining if progress is being made toward the long-term targets. Monitoring needs to demonstrate that there are improvements in fish and wildlife populations (i.e., that there is enough functionality to confirm that the BUI is not degraded).

Further, a long-term habitat management plan should be developed for use after the AOC is delisted. Other AOCs have done this when delisting to demonstrate that there are programs in place beyond the RAP.

(b) Aquatic and Riparian Habitat

According to the Fisheries Act, fish habitat is defined as “spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes” (Fisheries Act 1985; DFO 2009). Information regarding fish habitat can be compiled using data from the U.S. Geological Survey, Essex Region Conservation Authority, U.S. Fish and Wildlife Service, and the Ontario Ministry of Natural Resources.

(c) *Shoreline Softening*

As summarized in Chapter 6, a number of shoreline softening projects have been completed in the AOC since the late 1990s. Historically, shoreline softening has been implemented based on erosion control priorities, where opportunity arose. There is a need for the RAP to strategically identify areas that can be softened for multiple benefits (including habitat improvements) on a proactive basis.

Therefore, a Detroit River Shoreline Management Strategy should be developed to:

- assess the current state of the entire Canadian shoreline;
- identify priority areas for potential shoreline softening projects;
- identify areas with failing or unstable shoreline protection so that soft engineering techniques can be encouraged;
- outline "softer" shoreline alternatives and techniques to reduce shoreline hardening (Hartig et al. 2007); and
- promote public awareness of shoreline hardening and friendly alternatives.

The Shoreline Management Strategy should follow an ecosystem approach to habitat conservation by integrating habitat enhancements on the land and in the water (i.e., in conjunction with possible wetland creation and riparian buffers). All shoreline should be included (i.e., mainland and islands). It is important to note that shoreline softening projects are not to be limited to the proposed Shoreline Management Strategy and can be implemented as other opportunities arise. The development of a Detroit River Shoreline Management Strategy will likely lead to further action plans and targets for shoreline softening under the RAP; however, complete implementation of the plan will likely be a long-term endeavour that will require continued implementation after the AOC has been delisted.

(d) Terrestrial Habitat

The Habitat Work Group proposed that the targets for this criterion could be based on those identified in the Biodiversity Conservation Strategy (BCS) (ERCA 2002) and the Priority Habitat Sites report (DRCC 2007). Long-term terrestrial habitat targets are set through the BCS and implemented by the Essex Region Conservation Authority. The 2002 BCS lists a goal of 18-20% for terrestrial habitat in the AOC watershed but this goal does not explicitly consider economic and social factors.

The RAP should emphasize the creation of linkages between terrestrial habitats and the river. For example, the Windsor Port Authority Ojibway Shores property could provide a linkage from the river to the Ojibway Nature Reserve lands. However, the focus needs to be on more than just the river but also the tributaries where aquatic wildlife is expected to utilize terrestrial habitat.

As outlined earlier, ongoing monitoring and research is needed to better understand how AOC watershed restoration benefits Detroit River habitat and water quality. As these understandings evolve, better decisions can be made regarding the location of priority areas for woodland and other habitat restoration. Major core terrestrial habitat areas likely have an influence on Detroit River wildlife. Regular monitoring of population trends will be required to

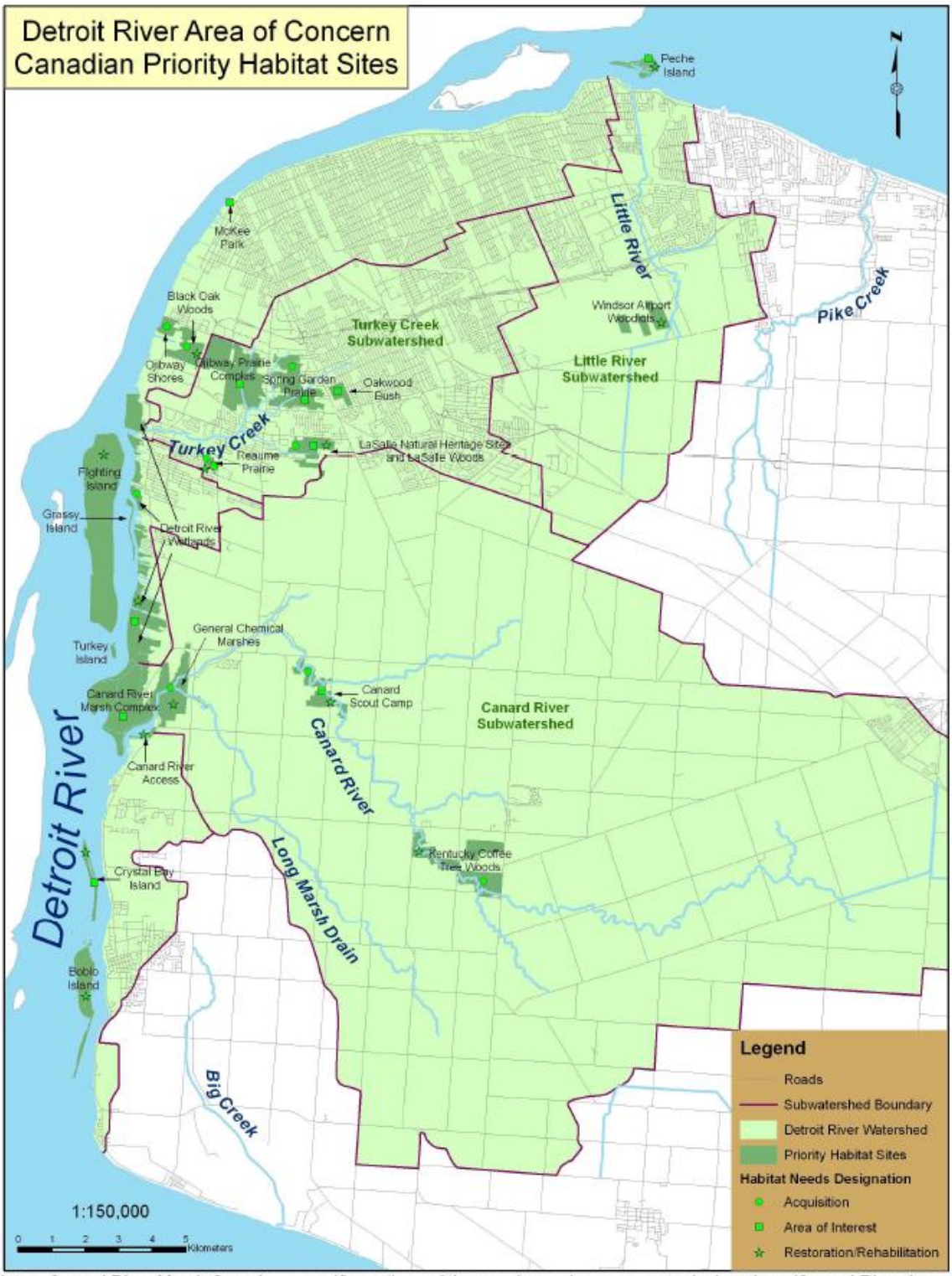
confirm the success of habitat initiatives. For example, certain populations may increase due to other changes in the species' requirements.

Research on the impacts of the AOC watershed on the Detroit River should be conducted to guide appropriate watershed rehabilitation where those actions will benefit the Detroit River AOC. More information is required to quantify the importance of non-point source actions and their impact on the AOC. The recently developed Annualized Agricultural Non-Point Source (AnnAgNPS) model for the Canard River watershed should be used to inform and further develop targets and guide restoration efforts in the AOC watershed. This may include modeling other parts of the watershed and/or improving the model and augmenting with field based analyses. For example, if it is shown that non-point source actions impact fish and wildlife habitat in priority area 'X', then restoration efforts can be focused there.

Finally, restoration projects should not be limited to the BCS or DRCC Priority Habitat Sites but should also be implemented as opportunities arise (e.g., if a landowner requests restoration to their land).

Conclusion

It is recommended that the DRCC develop and implement a long-term habitat management plan to protect fish and aquatic wildlife habitat and restore ecosystem function after the Detroit River Canadian AOC is delisted. This plan should include details about how to deal with invasive species (e.g., *Phragmites* sp.) as well as monitoring and assessment that need to be supported. The long-term habitat management plan should link to the Essex Region Biodiversity Conservation Strategy (ERCA 2002) and the habitat objectives of the Lake Erie Lakewide Management Plan (EC and USEPA 2006).



Notes: Canard River Marsh Complex - specific portions of the marsh may have separate designations (Canard RIver Access & General Chemical Marshes); Detroit River Wetlands include Grassy Island and Turkey Island.

Figure 12. Priority habitat sites with designated needs (acquisition, area of interest, or restoration/rehabilitation) in the Detroit River Canadian AOC watershed (from DRCC 2007).

Chapter 5
EXISTING MONITORING PROGRAMS

A number of monitoring programs are conducted outside of the RAP program but are very important in contributing information required by the RAP to update, assess, and monitor the status of BUIs. The purpose of this chapter is to identify and describe the existing Canadian monitoring programs that are conducted outside of the RAP. For more information regarding these programs, contact the lead agency listed in the summary below.

Title	Description	Timing	Lead	Partner(s)
Angler Creel Survey Program	Angler creel surveys are used to collect data on angler harvest, effort and catch characteristics. These surveys estimate angler effort, catch, harvest and yield, as well as target species effort, catch rate, harvest rate and size and age distribution of the harvest.	Periodic	Ontario Ministry of Natural Resources	-
Caged Mussel Biomonitoring	Although initially designed to measure the relative contribution of chemicals being discharged from municipal pollution control plants, it has since expanded to include the majority of the Windsor shoreline of the Detroit River, as well as the Little River and Turkey Creek tributaries.	Ongoing since 1996	Great Lakes Institute for Environmental Research	City of Windsor
Detroit River Head and Mouth Water Quality Monitoring	A long-term water monitoring program for contaminants using both large volume extraction techniques and special sampling procedures for metals. Combined with the above biomonitoring program, this program will also advance knowledge of loadings data in a similar manner.	Ongoing/annual	Environment Canada	-
Great Lakes Fish Contaminants Monitoring Program	One of the flagship monitoring programs in the Great Lakes and currently operates in Lake Huron and Lake Erie (Western Basin). Whole fish (walleye) samples provide key trend data sets. Sample archiving is also a critical component to deal with newly emerging issues such as flame retardants.	-	Environment Canada	-

Title	Description	Timing	Lead	Partner(s)
Great Lakes Fish Population Assessment	Fish population assessments directly address the health of fish communities in the corridor. A number of programs have operated through the years: MNR fish assessment (1980s), COA (DFO-MNR) fish assessment (2002, 2003, and 2004), MNR angler creel surveys, and MNR angler diary program (1980s-present).	Periodic	Ontario Ministry of Natural Resources	Fisheries and Oceans Canada University of Windsor
Great Lakes Herring Gull Egg Contaminant Monitoring Program	This monitoring program has been in place since 1970 to understand the temporal and spatial trends of environmental contaminant levels in Great Lakes wildlife. Sampling of gull eggs is done annually in a number of locations and results are compared with those from previous years. This is a very effective long-term program that provides valuable temporal trend data, and is an essential component of the corridor monitoring plan.	Sampling annually	Environment Canada	-
Great Lakes Marsh Monitoring Program	A binational program in Great Lakes AOCs to assess wetland status and identify long-term trends in wetland bird and amphibian populations.	Ongoing since 1995	Bird Studies Canada	Environment Canada ERCA U.S. EPA Volunteers
Great Lakes Surveillance Program	A cyclical monitoring program on the Great Lakes that includes general surveys of nutrients and contaminants in water and sediment. Data are typically provided within one year of the completion of sampling and samples are collected from the upper and lower Great Lakes in alternating years.	Alternating	Environment Canada	-

Title	Description	Timing	Lead	Partner(s)
MISA Discharger Assessment and Reporting	Ontario's Municipal/Industrial Strategy for Abatement (MISA) program requires direct dischargers in 9 sectors (e.g., inorganic chemicals, industrial, metal casting) to maintain detailed records of their regulated discharges, and report them to the OMOE on a regular basis. There is only one MISA Operating Plant on the Canadian side of the AOC: the Canadian Salt Company Ltd. (mine and evaporator). However, there are other direct dischargers that operate and monitored through a Certificate of Approval (e.g., Ford Motor Company of Canada Ltd. (Windsor Engine Plant) and Honeywell ASCa Inc. (Amherstburg)).	Ongoing	Ontario Ministry of the Environment Direct dischargers	-
Provincial Water Quality Monitoring Network (PWQMN)	Surface water quality information collected from rivers and streams at nearly 400 locations in Ontario Various water quality parameters are monitored at each PWQMN station, including chloride, nutrients, suspended solids, trace metals and other general chemistry parameters. Disease-causing substances, pesticides and other contaminants are monitored in detailed water quality surveys in priority watersheds.	Ongoing	Ontario Ministry of the Environment Essex Region Conservation Authority	-

Title	Description	Timing	Lead	Partner(s)
Region Wide Surface Water Monitoring Program	In addition to 8 PWQMN stations, ERCA monitors surface water quality at 66 sites across the region which includes 17 watersheds and 28 nearshore water quality monitoring sites. Several of these are located in the Detroit River AOC watershed. Monitoring includes both regular weather and wet weather sampling complemented by flow measurements at certain strategic locations.	Ongoing	Essex Region Conservation Authority	Ontario Ministry of the Environment
Sport Fish Contaminant Monitoring Program	Sport fish species targeted by the recreational fisheries are collected annually and dorsal muscle tissue is analyzed for a variety of substances including mercury, PCBs, mirex, DDT, and dioxins.	Ongoing	Ontario Ministry of the Environment Ontario Ministry of Natural Resources	-
Young-of-the-Year Fish Monitoring Program	Forage fish such as the spottail shiner provide excellent temporal and spatial monitoring of contaminants. Generally, this program focuses on tributary inputs, and it should be expanded similar to the mussel biomonitoring program (on a 3-year cycle) to provide a more detailed spatial assessment of contaminants in fish than is available from the sportfish contaminant monitoring program.	Periodic	Ontario Ministry of the Environment	Ontario Ministry of Natural Resources

Chapter 6
10 YEARS OF ACCOMPLISHMENTS: COMPLETED ACTIONS 1998-2008

Many projects (both Canadian and American) have been successfully implemented since the inception of the RAP program in 1987. This chapter highlights and focuses on Canadian actions completed between April 1998 and March 2008 (approximate dates). All of these projects, even those that were not funded by the RAP program, have contributed to the considerable progress that has been made toward delisting the Detroit River AOC.

Chapter 4, "Assessment and Status of Beneficial Use Impairments", provides information on the current status of BUIs and describes conditions in the Detroit River AOC which have caused *impaired* beneficial uses. The projects outlined in this chapter address causes of impairments in the AOC such as habitat loss and point source pollution from municipal sources. For example, through the Biodiversity Conservation Strategy Implementation Project and the Detroit River/Canard River Stewardship Initiative Program, the Essex Region Conservation Authority and the Essex County Stewardship Network have restored over 350 ha of forest, wetland and fish habitat in the Detroit River AOC. Point and non-point source pollution have been reduced as the City of Windsor has upgraded and expanded aging infrastructure. Alone, the expansion and upgrades to the Lou Romano Water Reclamation Plant have reduced loadings of total suspended solids to the Detroit River by 1,214 tonnes per year (P. Drca, Manager of Environmental Quality, City of Windsor, pers. comm. 2010). Additionally, monitoring and research projects implemented in the AOC have assessed BUIs and provided recommendations for future remedial actions. For example, the City of Windsor, Ontario Ministry of the Environment and Environment Canada monitored sediment and water contaminant concentrations in Turkey Creek which led to the cleanup of contaminated sediment in the Grand Marais Drain.

For ease of reading, this chapter has been broken into four categories based on the remedial action type: general, habitat, monitoring and research, and loadings. Education and public involvement activities including community tree plantings and cleanups are summarized in Chapter 3, Public Involvement in the RAP.

Table 6. Description of the headings for each remedial action or project completed between 1998 and 2008.

TITLE OF THE ACTION OR PROJECT	
Description	Brief overview of the project including location and action.
Status	Completed (YEAR), Started (YEAR), or Ongoing.
Lead	The lead organization that committed to take-on the remedial action or project.
Partners	Supporting organizations that committed to helping with the completion of the recommendation or action. The type of support may have been financial, in-kind, or other.
Total Cost	Total cost of the project including contributions from all organizations involved (lead and partners).
Related BUI(s)	Identifies the beneficial use impairment (and delisting criteria) related to recommendation or action.

GENERAL

Detroit River Remedial Action Plan Coordination and DRCC Governance	
Description	Environment Canada and the Ontario Ministry of the Environment share the costs to support Detroit River RAP coordination. This includes the Coordinator's staff time for writing and producing reports, organizing meetings, acting as a liaison in the community, supporting DRCC member projects, DRCC office administration (phone, supplies, photocopying), and funding for outreach projects (tree plantings, reports, fact sheets).
Status	Ongoing (2003-present)
Lead	Detroit River Canadian Cleanup
Partners	Environment Canada Ontario Ministry of the Environment
Total Cost	$120,000/annually
Related BUI(s)	All (indirectly)

City of Windsor Environmental Master Plan	
Description	The City of Windsor developed an Environmental Master Plan, with input from the Detroit River Canadian Cleanup, to provide direction and a framework with the purpose of protecting and improving the environment within the City of Windsor. The actions in the Environmental Master Plan are also related to the City's activities and operations.
Status	Completed (2006)
Lead	City of Windsor
Partners	Environment Canada Federation of Canadian Municipalities
Total Cost	$293,776
Related BUI(s)	All (indirectly)

HABITAT

Lake Sturgeon Habitat Restoration at Fighting Island

Description	Constructed sturgeon spawning reefs in a known historical spawning location off of the northeast corner of Fighting Island. The spawning habitat may also be used by other important Detroit River fish species such as walleye and whitefish. Post-construction monitoring has confirmed the use of the reef for spawning by lake sturgeon, lake whitefish, and walleye. The northern madtom, an aquatic species-at-risk, was also observed at this site. This project was a great example of international collaboration for habitat restoration.
Status	Completed (2008)
Lead	Essex Region Conservation Authority U.S. Fish and Wildlife Service
Partners	Environment Canada Ontario Ministry of Natural Resources U.S. Geological Survey - Great Lakes Science Center Michigan Wildlife Conservancy National Fish and Wildlife Foundation Detroit River Canadian Cleanup BASF Corporation DTE Energy Landmark Engineers Inc. International Wildlife Refuge Alliance Michigan Department of Natural Resources Michigan Sea Grant Wildlife Habitat Council
Total Cost	$320,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Loss of Fish and Wildlife Habitat

Windsor Riverfront Shoreline Stabilization and Habitat Enhancement (Elm Avenue to Caron Avenue)	
Description	In conjunction with a major erosion protection project, approximately 5,000m^2 of fish habitat was restored along the Detroit River shoreline at the City of Windsor's Waterfront Park.
Status	Completed (2006)
Lead	City of Windsor Essex Region Conservation Authority
Partners	Ontario Ministry of Natural Resources Environment Canada
Total Cost	$3,490,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Loss of Fish and Wildlife Habitat

Municipal Protection of Wetlands and Natural Areas	
Description	Municipalities included the protection of wetlands and other natural areas in their municipal plans.
Status	Ongoing
Lead	Town of LaSalle City of Windsor Town of Amherstburg
Partners	Essex Region Conservation Authority Ontario Ministry of Natural Resources Ministry of Municipal Affairs and Housing
Total Cost	No direct costs
Related BUI(s)	Degradation of Fish and Wildlife Populations Loss of Fish and Wildlife Habitat

Detroit River/Canard River Stewardship Initiative

Description	Improvement of water quality and natural heritage features along the riparian areas and main tributaries of the Canard River through landowner involvement in habitat enhancement programs. A total of 99.81 ha of tallgrass prairie, native shrubs and trees, and wetland habitats have been restored, enhanced and created. Projects include public education, wetland creation, marsh recovery plans, corridor connections, and public workshops. The program focuses on actions the landowners can undertake with assistance and guidance from the Essex County Stewardship Network and its community partners. Public open houses and tours have been held at project sites and have been attended by over 600 people and partners.
Status	Ongoing since 2001
Lead	Essex County Stewardship Network
Partners	Environment Canada Ontario Ministry of Natural Resources Essex County Field Naturalists' Club AMA Sportsmen's Association Windsor Sportsmen's Club Essex Federation of Agriculture Ducks Unlimited Canada Wetland Habitat Fund Landowners
Total Cost	$1,072,440
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Aesthetics Loss of Fish and Wildlife Habitat

Fort Malden Shoreline Stabilization and Habitat Enhancement

Description	Soft shoreline engineering project that replaced sheet wall and gabion baskets along a 280 m section of shoreline at Fort Malden in Amherstburg. The site now features rock revetment with three shore connected island/groyne structures. A variety of substrate sizes were incorporated and two submerged, offshore spawning shoals were constructed to provide habitat for lake sturgeon and other fish species.
Status	Completed (2004)
Lead	Parks Canada Essex Region Conservation Authority
Partners	Environment Canada
Total Cost	$345,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

McKee Park Improvements/Sturgeon Habitat Creation

Description	Constructed large rock islands to protect the shoreline and embayment from the high energy Detroit River water flow. A submerged reef was placed offshore for spawning by lake sturgeon and other fish species.
Status	Completed (2003)
Lead	City of Windsor Essex Region Conservation Authority
Partners	Environment Canada Ontario Great Lakes Renewal Foundation Brighton Beach Power ATCO Power Limited Windsor Port Authority
Total Cost	$484,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Loss of Fish and Wildlife Habitat

Upper Canard River Low Flow Augmentation	
Description	A large water retention facility was constructed on private land to capture and store flows during periods of high rainfall for slow release during the summer low-flow period to benefit downstream fish populations.
Status	Completed (2003)
Lead	Essex Region Conservation Authority
Partners	Environment Canada Ontario Great Lakes Renewal Foundation Landowners
Total Cost	$417,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Degradation of Aesthetics Beach Closings

Biodiversity Conservation Strategy Formulation	
Description	A comprehensive inventory and mapping of existing fish and wildlife habitat was done in order to develop a habitat strategy and to provide direction for fish and wildlife habitat restoration enhancement projects for the Essex Region, including the Detroit River watershed. The implementation of the strategy will be completed on an ongoing basis.
Status	Completed (2002)
Lead	Essex Region Conservation Authority
Partners	Carolinian Canada Citizens Environment Alliance County of Essex Ducks Unlimited Canada Environment Canada Essex County Field Naturalists' Club Essex County Stewardship Network Ontario Ministry of Natural Resources Parks Canada University of Windsor
Total Cost	$25,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

Biodiversity Conservation Strategy Implementation	
Description	Utilizing the Biodiversity Conservation Strategy (BCS), numerous high priority habitat restoration projects have been completed, primarily with private landowners throughout the AOC. Since 2000, over 260 hectares of new habitat have been established in the AOC through restoration projects. The majority of the restored habitat has included forest restoration (250 ha) (using machine planting and pit-and-mound forest restoration techniques) with smaller areas of wetland (6 ha) and fish habitat restoration (2.5 ha).
Status	Ongoing since 1999
Lead	Essex Region Conservation Authority
Partners	Environment Canada Ontario Great Lakes Renewal Foundation Ontario Ministry of Natural Resources Landowners
Total Cost	$3,395,150 (1999-2008)
Related BUI(s)	Loss of Fish and Wildlife Habitat

E.C. Row Expressway Cloverleaf Naturalization	
Description	Restored a portion of forest in the Little River watershed near the E.C. Row Expressway and Lauzon Parkway to help improve water and habitat quality. A 'Natural Benefits' brochure was prepared and distributed to educate landowners about the benefits of naturalization. The project continues to be a model for encouraging naturalization along roadsides.
Status	Completed (2003)
Lead	Little River Enhancement Group Ford C.A.W. Environment Committee
Partners	Environment Canada Ford NEMAK Concord Elementary School TD Friends of the Environment Foundation City of Windsor Detroit River Canadian Cleanup
Total Cost	$8,714
Related BUI(s)	Loss of Fish and Wildlife Habitat

St. Rose Beach Park Shoreline Naturalization and Habitat Enhancement	
Description	Improved the long-term stability of the shoreline and enhanced fish habitat over a 200 m section of Detroit River shoreline in the City of Windsor.
Status	Completed (2001)
Lead	City of Windsor Essex Region Conservation Authority
Partners	Environment Canada
Total Cost	$283,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

Detroit River Shoreline Stabilization and Habitat Enhancement (Langlois Avenue to Moy Avenue)

Description	Improved long-term stability of the shoreline and enhanced fish habitat over sections of shoreline from Lincoln Avenue to Langlois Avenue in the City of Windsor. The designs also facilitated the development of the riverfront park.
Status	Completed (2001)
Lead	City of Windsor Essex Region Conservation Authority
Partners	Environment Canada Ontario Ministry of Natural Resources
Total Cost	$1,248,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Loss of Fish and Wildlife Habitat

Goose Bay Shoreline Naturalization Habitat Enhancement

Description	Improved the long-term stability of shoreline and enhanced fish habitat over a 200 m section of the Detroit River shoreline in the City of Windsor.

Status	Completed (2000)
Lead	City of Windsor
Partners	Environment Canada Essex Region Conservation Authority
Total Cost	$168,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

Canard Marsh Improvements and Turkey Island Enhancement	
Description	Protection and enhancement of wetland habitat in the Canard Marsh complex by stabilizing and repairing dyke walls around the south wetland cell and south finger dyke, resulting in the protection and enhancement of fish and wildlife habitat in the provincially-significant wetland. Development of a Habitat Management Plan for Turkey Island.
Status	Completed (1999)
Lead	Essex Region Conservation Authority
Partners	Environment Canada Ontario Ministry of Natural Resources Landowners Ducks Unlimited Canada
Total Cost	$150,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

Little River Rehabilitation (Twin Oaks Business Park Improvements)	
Description	Restoration of riparian fish and wildlife habitat on both sides of a 1.15 km section of Little River.
Status	Completed (1999)
Lead	City of Windsor Essex Region Conservation Authority
Partners	Environment Canada Little River Enhancement Group Great Lakes Institute for Environmental Research Ontario Ministry of Natural Resources Essex County Field Naturalists
Total Cost	$124,000
Related BUI(s)	Degradation of Aesthetics Loss of Fish and Wildlife Habitat

Turkey Creek Channel Improvements	
Description	Removed contaminated sediments from Turkey Creek and reconnected wetland to improve 3.5 km of aquatic habitat.
Status	Completed (1998)
Lead	City of Windsor
Partners	Town of LaSalle Township of Sandwich South Essex Region Conservation Authority
Total Cost	$150,000
Related BUI(s)	Degradation of Benthos Loss of Fish and Wildlife Habitat

MONITORING & RESEARCH

Sturgeon Spawning Pre-construction Monitoring	
Description	Pre and post-construction monitoring of the site for the proposed sturgeon spawning habitat at Fighting Island. Included sampling of larval, fry, juvenile and adult sturgeon using a variety of techniques. In addition, site characteristics were assessed including bathymetry, flow velocities, and substrates. This project was a great example of international collaboration for habitat restoration.
Status	Completed (2008)
Lead	Essex Region Conservation Authority U.S. Fish and Wildlife Service
Partners	Environment Canada
Total Cost	$40,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Loss of Fish and Wildlife Habitat

South Cameron Stormwater Management Plan	
Description	An update to the 1992 Functional Design Report for the South Cameron Planning District was required for protection of woodlots and green space, proper disposal of storm and sanitary drainage, and ensuring proper management of development of undeveloped lands in the South Cameron area. The updated report aims to: re-establish drainage and sub-drainage area boundaries; review stormwater management alternatives to service future development; establish the most economic and practical routing for future storm and sanitary sewers; prioritize areas within the Planning District based on sufficiently signed local improvement petitions and the immediate availability of service; design and prepare contract drawings and specifications for the servicing of priority blocks.
Status	Report currently being finalized
Lead	City of Windsor
Partners	Environment Canada
Total Cost	$90,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings

Study of Trenchless Technologies in the City of Windsor	
Description	A study to investigate the effectiveness of two alternative trenchless technologies available to reduce the infiltration of stormwater into the sanitary sewer system.
Status	Started (2008)
Lead	City of Windsor
Partners	Environment Canada Ontario Ministry of the Environment
Total Cost	$125,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings

Assessment of Detroit River Beneficial Use Impairments	
Description	Assessment of two Detroit River BUIs whose status was identified as *unknown* or *requires further assessment*: *Eutrophication or Undesirable Algae* and *Degradation of Phytoplankton and Zooplankton Populations*.
Status	In progress
Lead	Great Lakes Institute for Environmental Research
Partners	Ontario Ministry of the Environment
Total Cost	$30,000
Related BUI(s)	Eutrophication or Undesirable Algae Degradation of Phytoplankton and Zooplankton Populations

Cause and Effect Linkages of Sediment Contamination and Fish Consumption Advisories

Description	A study to determine the cause-effect linkages between sediment contamination and fish consumption advisories in the Detroit River AOC. Researchers use a sediment triad assessment including combined toxicity studies, benthic community structure, and sediment chemistry at 60 Detroit River stations to evaluate the AOC's sediments and benthos. This project is integrated with several other Detroit River research projects to ensure effective information sharing and consistent study design.
Status	In progress (2007-2010)
Lead	Great Lakes Institute for Environmental Research
Partners	Environment Canada NSERC Strategic Grant Program Ontario Ministry of the Environment City of Windsor NSERC Discovery Program
Total Cost	$100,000 (2007-2010)
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Fish Tumours or Other Deformities Degradation of Benthos Restrictions on Dredging Activities

Assessment of Sediment and Water Quality in Turkey Creek	
Description	Investigations were conducted to determine the condition of Turkey Creek as well as potential contaminant sources. Remediation was done at this site in 2008. A more detailed project description is found in the 'Loadings' section.
Status	Completed (2006)
Lead	Environment Canada Ontario Ministry of the Environment
Partners	City of Windsor
Total Cost	$50,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Huron-Erie Corridor Sediment Sampling	
Description	Sediment sampling was conducted along the Huron-Erie corridor (includes the Detroit River) to provided information about changes in historic monitoring results. The project aided in identifying priority areas for sediment contamination remediation.
Status	Completed (2006)
Lead	Great Lakes Institute for Environmental Research
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Detroit River Beneficial Use Impairment Status Assessment Report	
Description	A report was written to report on the status of BUIs on the Canadian side of the Detroit River (Leney and Haffner 2006). This report was the first RAP update since 1999 and helped identify knowledge and research gaps in order to accomplish delisting. The report also identified problems with the Canadian delisting criteria which led to the current revisions.
Status	Completed (2006)
Lead	Great Lakes Institute for Environmental Research Detroit River Canadian Cleanup (Monitoring and Research Work Group)
Partners	Environment Canada Ontario Ministry of the Environment
Total Cost	$7,000
Related BUI(s)	All (indirectly)

Annualized Agricultural Non-Point Source Modeling (AnnAgNPS)	
Description	AnnAgNPS modeling was completed for the Canard River watershed, the largest agricultural watershed to the Detroit River AOC. The model identified areas with high potential for delivery of total phosphorus, nitrate, and total suspended solids to the Canard River and, therefore, the Detroit River.
Status	Completed (2008)
Lead	University of Windsor (Environmental Engineering)
Partners	Essex Region Conservation Authority Environment Canada
Total Cost	$7,000
Related BUI(s)	Degradation of Benthos Loss of Fish and Wildlife Habitat

City of Windsor Candidate Natural Heritage Site Assessment (CNHS)	
Description	In support of the City of Windsor Official Plan Review, a CNHS study was completed. The study measured and mapped vegetation communities and wildlife presence over several seasons, with a particular emphasis on species at risk.
Status	Completed (2008)
Lead	Essex Region Conservation Authority City of Windsor
Partners	Environment Canada
Total Cost	$65,000
Related BUI(s)	Loss of Fish and Wildlife Habitat

Water Quality Assessment at the Head and Mouth of the Detroit River	
Description	Provided updated water quality and contaminant data in the Detroit River which aided in the assessment of remedial action effectiveness. The study also identified additional contaminant issues.
Status	Completed (1999-2000, 2004)
Lead	Environment Canada
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Combined Sewer Overflow High-Rate Treatment Study	
Description	Study of chemical coagulation to determine the most cost-effective, high-rate treatment options for Combined Sewer Overflows in the City of Windsor.
Status	Completed (2000)
Lead	City of Windsor
Partners	Environment Canada National Water Research Institute University of Windsor Ministry of the Environment
Total Cost	$144,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Beach Closings

Application of KETOX-GIS Model to the Detroit River	
Description	Applied the KETOX-GIS Model (version 5.2) to the Detroit River to integrate monitoring data by the Ministry of the Environment. The tool helped assess the effectiveness of various management scenarios with respect to water, sediment, and fish tissue contaminant concentrations.
Status	Completed (2000)
Lead	Great Lakes Institute for Environmental Research
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Windsor Riverfront Pollution Control Planning Study	
Description	Determined the quality and quantity of wastewater that was discharged to the Detroit River as well as its impact on the river. The study resulted in recommendations to reduce Combined Sewer Overflows and total pollutant loadings to the river.
Status	Completed (1999)
Lead	City of Windsor
Partners	Environment Canada Ontario Ministry of the Environment
Total Cost	$415,732
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Eutrophication or Undesirable Algae Beach Closings Degradation of Aesthetics Degradation of Phytoplankton and Zooplankton Populations

Water and Sediment Quality Testing	
Description	Updated databases by testing water and sediment quality in selected tributaries of the St. Clair River, Lake St. Clair, and the Detroit River. Provided information about contaminant loading from tributaries and helped assess the effectiveness of remedial actions.
Status	Completed (1999)
Lead	Ontario Ministry of the Environment
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Measurement of Current Velocities	
Description	Researchers measured current velocities using a vessel-mounted acoustic Doppler current profiler to obtain information that supported the MOE's water and sediment monitoring.
Status	Completed (2000)
Lead	Ontario Ministry of the Environment
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Benthic Macroinvertebrate Survey of Selected Tributaries of the Detroit River AOC, St. Clair AOC, and Wheatley Harbour AOC	
Description	A comprehensive study of benthic macroinvertebrates that provided valuable information about water and sediment toxicity at three different AOCs.
Status	Started in 1998
Lead	N/A
Partners	Ontario Ministry of the Environment Environment Canada
Total Cost	Not available
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Benthic Monitoring Program	
Description	Researchers continue to collect valuable information about water and sediment toxicity through a benthic monitoring program.
Status	Ongoing; Started in 1990
Lead	Great Lakes Institute for Environmental Research
Partners	University of Windsor Environment Canada
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Distribution and Stability of Contaminated Sediments	
Description	Researchers mapped and continue to monitor the distribution and stability of contaminated sediments in the Detroit River AOC.
Status	Ongoing; Started in 1994
Partners	National Water Research Institute Environment Canada
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Restrictions on Dredging Activities

Freshwater Mussel Biomonitoring	
Description	Freshwater clams continue to be used downstream of two wastewater treatment plant outfalls to determine if there are any bioaccumulative substances in the effluent. Results (as of 2005) demonstrated that there are no problems with wastewater effluent.
Status	Ongoing; Started in 1996
Lead	Great Lakes Institute for Environmental Research
Partners	City of Windsor
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Bird or Animal Deformities or Reproductive Problems Degradation of Benthos Restrictions on Dredging Activities Degradation of Phytoplankton and Zooplankton Populations

Windsor Ultraviolet Treatment Study

Description	Investigated options for upgrading the water disinfection systems at Windsor waste water treatment plants. A manual about ultraviolet disinfection systems was produced for use by other municipalities.
Status	Completed (2002)
Lead	City of Windsor
Partners	Environment Canada Ontario Ministry of the Environment Federation of Canadian Municipalities
Total Cost	$30,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Eutrophication or Undesirable Algae Beach Closings Degradation of Aesthetics Degradation of Phytoplankton and Zooplankton Populations

LOADINGS (Point and Non-Point Source)

Sanitary Sewer Installation in the Turkey Creek and Little River Watersheds	
Description	Sewers were constructed in areas that were serviced by combined sewers or septic systems. The project has contributed to improving water quality.
Status	Completed (1999)
Lead	City of Windsor Town of LaSalle
Partners	N/A
Total Cost	$5,406,981
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Loss of Fish and Wildlife Habitat

Downspout Disconnection Program	
Description	The City of Windsor continues to offer a downspout disconnection program to decrease the flow to the sewer system during storm events, ultimately reducing CSOs to the Detroit River.
Status	Started (1999)
Lead	City of Windsor
Partners	N/A
Total Cost	$685,000 (to date)
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings Degradation of Aesthetics

Upgrade/Expansion of the C.M.H. Woods (formerly Caron Avenue) Pumping Station	
Description	Upgrades included increasing the capacity of combined sewage that could be pumped to the Lou Romano Water Reclamation Plant for treatment before discharging to the river. These upgrades have helped to reduce the number of Combined Sewer Overflows to the river and to improve water quality.
Status	Completed
Lead	City of Windsor
Partners	Environment Canada (for planning) Province of Ontario
Total Cost	$5,919,890
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings Degradation of Aesthetics

Environmental Farm Plan Stewardship	
Description	Funding for farmers in the Area of Concern watershed to implement best management practices (BMPs) to make their farm operations more environmentally sustainable is available through the Canada-Ontario Farm Stewardship Program (COFSP) associated with the Environmental Farm Plan (EFP).
Status	Ongoing
Lead	Ontario Farm Environmental Coalition Ontario Soil and Crop Improvement Association
Partners	Agriculture and Agri-Food Canada Ontario Ministry of Agriculture, Food and Rural Affairs
Total Cost	Not Available
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Loss of Fish and Wildlife Habitat

Rural Non-Point Source Pollution Remediation Program	
Description	This program provides technical and financial assistance to landowners to reduce soil erosion and improve water quality through tree planting, soil erosion control structures, septic system upgrades, and other best-management practices in the Area of Concern (AOC) watershed. Although separate from the NPS Program, surface water quality monitoring is conducted throughout the AOC to identify problem areas and track water quality improvements.
Status	Ongoing; Started (1999)
Lead	Essex Region Conservation Authority
Partners	Environment Canada Ontario Great Lakes Renewal Foundation Landowners
Total Cost	$3,618,300 (1999-2009)
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Loss of Fish and Wildlife Habitat

Replacement of 'over-under' Sewer Systems	
Description	The City of Windsor continues to replace the 'over-under' sewer systems in residential areas that contribute to Combined Sewer Overflows.
Status	Ongoing
Lead	City of Windsor
Partners	N/A
Total Cost	$17,160,541 (1998-2008)
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings Degradation of Aesthetics

Reduce Inflow/Infiltration to Sanitary Sewer Systems	
Description	Reduce the amount of groundwater and rainwater that can enter the sanitary sewer system. This project helps lower the risk of sanitary sewer overflows and reduces the amount of rainwater unnecessarily entering the waste water treatment plant.
Status	Ongoing
Lead	City of Windsor
Partners	N/A
Total Cost	$42,207,742 (1998-2008)
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings Degradation of Aesthetics

Household Mercury and Chemical Waste Collection	
Description	Collected over 90 kg of mercury from local households to eliminate the improper disposal of mercury into the environment. A fact sheet and brochure were also developed (see Chapter 3).
Status	Ongoing; Started (2004)
Lead	Detroit River Canadian Cleanup
Partners	Environment Canada Ontario Ministry of the Environment City of Windsor Essex-Windsor Solid Waste Authority Town of LaSalle
Total Cost	$15,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Degradation of Fish and Wildlife Populations Bird or Animal Deformities or Reproductive Problems Degradation of Benthos Restrictions on Dredging Activities

Upgrade/Expansion of the Lou Romano Water Reclamation Plant

Description	Expansion of the Lou Romano Water Reclamation primary plant included the addition of 3 primary clarifiers to provide treatment of 545 mega liters per day (MLD) peak flow rate, the replacement of coarse bar screens, the renovation of the sludge pumphouse, and the installation of 2 high speed centrifuges for sludge dewatering. The upgrade also included the addition of 16 biological aerated filters for secondary biological treatment and an ultraviolet (UV) disinfection system to handle up to 436 MLD peak flow rate which kills bacteria in the water and replaces the chlorine disinfection system. These upgrades have improved water quality and eliminated raw sewage bypass.
Status	Completed (2008)
Lead	City of Windsor
Partners	Province of Ontario Government of Canada
Total Cost	$110,000,000
Related BUI(s)	Degradation of Fish and Wildlife Populations Degradation of Benthos Beach Closings Degradation of Aesthetics

Turkey Creek/Grand Marais Drain PCB Removal and Drain Enhancement

Description	Results from the Turkey Creek sediment and water quality study (pg. 101) led to locating polychlorinated biphenyl (PCB) contamination in the Grand Marais Drain. The PCBs were tested and sediment above 1 ppm was removed east of Walker Road in Windsor and disposed at the regional landfill in Essex. A total of 975 m^3 of contaminated sediments were removed from the drain. An additional 10,425 m^3 were removed to improve the drain's hydrology resulting in protection from becoming re-contaminated and able to withstand a 100-yr storm event.
Status	Completed (2008)
Lead	City of Windsor
Partners	Environment Canada Ontario Ministry of the Environment Essex Region Conservation Authority in partnership with OMNR Detroit River Canadian Cleanup Local industries
Total Cost	$2,650,000
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Degradation of Fish and Wildlife Populations Fish Tumours or Other Deformities Bird or Animal Deformities or Reproductive Problems Degradation of Benthos Degradation of Aesthetics

Upgrades to the Ford Windsor Engine Plant Water Re-circulation System	
Description	Upgrades were completed to the water re-circulation system oil tanker unloading area, ultra filtration system (for oil waste treatment), and secondary containment of oil waste for all tanks. These improvements continue to reduce the frequency of oil spills and chemical releases.
Status	Completed (2004)
Lead	Ford Motor Company of Canada Ltd.
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Tainting of Fish and Wildlife Flavour Degradation of Fish and Wildlife Populations Degradation of Benthos Degradation of Aesthetics Loss of Fish and Wildlife Habitat

General Chemical Effluent Stream Diversion	
Description	Diverted high toxicity effluent streams (ammonia and other persistent chemicals) to settling basins and also diverted recyclable materials from the effluent to reduce toxic effluent discharges to the river.
Status	Started (2002); General Chemical ceased operations in 2005
Lead	General Chemical Canada Ltd.
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Degradation of Fish and Wildlife Populations Degradation of Benthos Degradation of Aesthetics

General Chemical Ammonia Discharge Upgrades	
Description	Installed a secondary containment and spill collection system to reduce the frequency and severity of ammonia discharges to the river. The company also installed ammonia detection equipment on plant drains to obtain early warning signs of ammonia discharges and react quickly.
Status	Completed (1998)
Lead	General Chemical Canada Ltd.
Partners	N/A
Total Cost	Not available
Related BUI(s)	Restrictions on Fish and Wildlife Consumption Degradation of Fish and Wildlife Populations Degradation of Benthos Degradation of Aesthetics

Chapter 7
RECOMMENDATIONS AND IMPLEMENTATION ACTIONS

This section describes recommendations and implementation actions to be completed with help from various agencies and organizations to achieve the delisting criteria described in Chapter 4. This section will be used to develop work plans to guide implementation actions and keep organizations and/or agencies on target for protecting, restoring and enhancing the Detroit River AOC ecosystem. Annual and five year work plans will be created and updated specifying actions, participants and costs to fulfill the recommendations outlined in this chapter. The costs noted in this section are estimates and not meant to be final. Some projects may in fact require more (or less) funding to implement. The total estimated costs for Detroit River Canadian remedial actions should be determined during the development of annual work plans.

This chapter is broken into 5 categories based on the type of remedial action (i.e., general, habitat, loadings (non-point source and point source), monitoring and research, and education and public involvement). Each category includes recommendations, key actions, a timeline, estimated cost, participants, and a list of related BUIs related to that topic or category (see Table 7 for details). For a description of accomplishments on the Canadian side of the Detroit River AOC and its watershed (i.e., completed remedial actions), please see Chapter 6.

Table 7. A legend describing the sections for each recommendation listed in this chapter.

NAME	DESCRIPTION
G, HAB, PS, NPS, MR, and EPI	An acronym used to identify the category for the type of remedial action (i.e., general, habitat, point or non-point source, monitoring and research, and education and public involvement). The numerical value next to the acronym is for tracking purposes and is not intended to demonstrate priority.
Recommendation	A general statement describing a goal for achieving the delisting targets in each category. Each recommendation is identified by a unique code for quick and easy reference. The unique code is also used to identify recommendations and/or actions related to a particular BUI in Chapter 4.
Key Actions	Key actions can be projects or steps required to achieve the related recommendation. Actions are identified by a unique code used for reference in brackets next to any cost or partner related to that particular action.
Estimated cost	The estimated cost (CDN $) associated with completing the recommendation or specific actions. (When cost is associated with an action, the action code is noted in brackets next to the cost).
Timeline	Indicates the time period for beginning or completing a recommendation and/or action.
Participants	The organizations or groups proposed to take on the recommendation and/or key action(s). The suggested lead(s) is designated in brackets, if applicable. The type of support can be financial, in-kind, or other as required. Other participants can be added and/or consulted as required.
Related BUI(s)	Identifies the beneficial use impairment related to recommendation or action.

GENERAL

Recommendation G-1
Support the coordination of the Detroit River Canadian RAP.

Key actions:

G-1.1

Continue to support Detroit River Canadian Cleanup office administration (office space, phone, supplies, photocopying) and the position of RAP Coordinator for writing and producing reports, organizing meetings, acting as a liaison in the community, supporting DRCC member projects, etc.

Estimated Cost	$100,000/year
Timeline	Annually
Participants	Environment Canada Ontario Ministry of the Environment RAP Coordinator Essex Region Conservation Authority
Related BUI(s)	All (indirectly)

G-1.2

Ensure the Detroit River Delisting and Information System is updated and maintained by hiring a data management person to collect and maintain data for the AOC on an annual basis.

Estimated Cost	$12,000/year (part-time, seasonally)
Timeline	Implemented by 2011 and maintained on an ongoing basis.
Participants	Environment Canada Ontario Ministry of the Environment Great Lakes Institute for Environmental Research RAP Coordinator
Related BUI(s)	All (indirectly)

HABITAT

Recommendation HAB-1
Develop a Habitat Management Plan for the Detroit River Canadian AOC.

Key actions:

HAB-1.1

Create an updated habitat inventory for the Detroit River AOC.

Estimated Cost	$25,000
Timeline	Completed by 2015
Participants	DRCC Habitat Work Group (Lead) RAP Coordinator Fisheries and Oceans Canada U.S. partners (as needed)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

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HAB-1.2

Develop/refine specific short-term and long-term goals for habitat protection, enhancement, and restoration (including shoreline softening).

Estimated Cost	In-kind staff time
Timeline	Completed by 2015
Participants	DRCC Habitat Work Group (Lead) RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

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HAB-1.3

Create a habitat monitoring plan for the Detroit River and its tributaries to be included in the Habitat Management Plan.

Estimated Cost	In-kind support
Timeline	Every 5 years
Participants	DRCC Habitat Work Group (Lead) DRCC Monitoring and Research Work Group RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

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HAB-1.4

Develop a shoreline management strategy with targets (to be included in the overall Habitat Management Plan) for the Detroit River AOC.

Estimated Cost	In-kind staff time
Timeline	Completed by 2015
Participants	DRCC Habitat Work Group (Lead) RAP Coordinator Others as required (e.g., Honeywell, Windsor Port Authority, Private Landowners)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

HAB-1.5

Prioritize aquatic and riparian habitat areas for restoration based on the 2002 Essex Region Biodiversity Conservation Strategy and the 2007 Priority Habitat Sites.

Estimated Cost	In-kind staff time
Timeline	Completed by 2015
Participants	DRCC Habitat Work Group (Lead) RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

Recommendation HAB-2
Implement the Habitat Management Plan for the Detroit River Canadian AOC.

Key actions:

HAB-2.1

Protect key critical habitats identified in the Habitat Management Plan by (but not limited to):

- Acquiring key habitats for conservation through easements, acquisition, etc.
- Implement protection concurrent with the development of the Habitat Management Plan where they address BUIs and/or the anticipated direction of the Plan.

Estimated Cost	Varies by project
Timeline	Ongoing (as opportunities arise)
Participants	AOC municipalities (Windsor, LaSalle, Amherstburg) DRCC Habitat Work Group Environment Canada Essex County Stewardship Network Essex Region Conservation Authority Ontario Ministry of Natural Resources Private landowners RAP Coordinator Others as required (e.g., Honeywell, Windsor Port Authority)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

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HAB-2.2

Restore/rehabilitate key critical habitats identified in the Habitat Management Plan by (but not limited to):

- Restoring and enhancing existing key habitats.
- Creating new habitat (aquatic, wetland, riparian, and terrestrial), whenever possible.
- Linking existing terrestrial habitats.
- Implement restoration/rehabilitation projects concurrent with the development of the Habitat Management Plan where they address BUIs and/or the anticipated direction of the Plan.

Estimated Cost	Varies by project
Timeline	Ongoing (as opportunities arise)
Participants	AOC municipalities (Windsor, LaSalle, Amherstburg) DRCC Habitat Work Group Environment Canada Essex County Stewardship Network Essex Region Conservation Authority Ontario Ministry of Natural Resources Private landowners RAP Coordinator Others as required (e.g., Honeywell, Windsor Port Authority)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

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HAB-2.3

Implement the shoreline management strategy by (but not limited to):

- Softening the Detroit River Canadian shoreline, whenever opportunities arise.
- Incorporating soft shoreline engineering and planting native vegetation in riverfront parks and privately owned land.
- Implement soft shoreline engineering projects concurrent with the development of the Habitat Management Plan where they address BUIs and/or the anticipated direction of the Plan.

Estimated Cost	Varies by project Approximately $1,200 per metre of shoreline
Timeline	Ongoing (as opportunities arise)
Participants	AOC municipalities (Windsor, LaSalle, Amherstburg) Brighton Beach Power DRCC Habitat Work Group Environment Canada Essex County Stewardship Network Essex Region Conservation Authority Ontario Ministry of Natural Resources Private landowners RAP Coordinator Windsor Port Authority Others as required
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

Recommendation HAB-3

Evaluate the Habitat Management Plan for the Detroit River Canadian AOC.

Key actions:

HAB-3.1

Evaluate quality and quantity of habitats in the Detroit River AOC and its watershed and modify Habitat Management Plan as required.

Estimated Cost	TBD
Timeline	Every 5 years
Participants	DRCC Habitat Work Group (Lead) DRCC Monitoring and Research Work Group RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

LOADINGS (Point and Non-Point Sources)

Recommendation NPS-1
Reduce urban non-point sources entering the Detroit River AOC.

Key actions:

NPS-1.1

Reduce urban non-point sources into the Detroit River AOC by (but not limited to):

- Continuing to support education and awareness activities associated with Ontario's cosmetic pesticide ban (e.g., the DRCC's *Go Natural: Pull, Don't Spray* campaign).
- Continuing to support education and awareness activities associated with other urban non-point sources of contaminants (e.g., fertilizers, liquids disposed of improperly).
- Maintaining municipal involvement with Environment Canada's road salt program and investigating opportunities to minimize the impacts of road salt.

Estimated Cost	In-kind support
Timeline	Ongoing (as opportunities arise)
Participants	AOC municipalities (Windsor, LaSalle, Amherstburg) Essex Region Conservation Authority Environment Canada Essex County Stewardship Network RAP Coordinator Private landowners
Related BUI(s)	Degradation of Fish and Wildlife Populations, Loss of Fish and Wildlife Habitat

Recommendation NPS-2

Reduce rural non-point sources in areas that have an impact on the Detroit River AOC.

Key actions:

NPS-2.1

Reduce rural non-point sources in areas that have an impact on the Detroit River AOC by:

- Identifying priority areas for non-point source projects to ensure that incentive grants are being directed where they will have the largest impact on the restoration of the Detroit River AOC.
- Working with landowners to promote and implement projects that reduce non-point source pollution (e.g., riparian vegetation, fragile land retirement, erosion control structures and conservation tillage) and encourage best management practices.
- Completing an Agricultural Resource Inventory and an inventory of livestock operations in the watershed.
- Promoting awareness among rural landowners regarding sources of non-point source contaminants and activities that reduce non-point source pollution.
- Supporting the completion of environmental farm plans and conservation farm plans.

Estimated Cost	$120,000/year
Timeline	Ongoing
Participants	AOC Municipalities (LaSalle and Amherstburg) Environment Canada Essex County Stewardship Network (Lead) Essex Region Conservation Authority (Lead) Ontario Ministry of Agriculture, Food and Rural Affairs Ontario Ministry of the Environment RAP Coordinator University of Windsor
Related BUI(s)	Degradation of Fish and Wildlife Populations, Degradation of Benthos, Beach Closings, Loss of Fish and Wildlife Habitat

NPS-2.2

Encourage innovative drain design and maintenance practices in areas that have an impact on the Detroit River AOC by (but not limited to):

- Hosting education workshops for drainage practitioners and by providing technical and financial assistance for drain construction and maintenance projects.[1]
- Providing technical and financial assistance to landowners to increase buffer strips[2]
- Encouraging municipalities and their drainage consultants to include aquatic habitat considerations and buffer strips in drain construction and maintenance projects.[3]

Estimated Cost Varies by project:

1. $100,000 annually
2. Cost included in NPS-2.1
3. In-kind support

Timeline Ongoing and as opportunities arise

Participants Essex Region Conservation Authority (Lead)
Essex County Stewardship Network
Ontario Ministry of Agriculture, Food and Rural Affairs
Ontario Ministry of Natural Resources
Private landowners
RAP Coordinator

Related BUI(s) Degradation of Fish and Wildlife Populations, Degradation of Benthos, Eutrophication or Undesirable Algae, Beach Closings, Degradation of Aesthetics, Degradation of Phytoplankton and Zooplankton Populations, Loss of Fish and Wildlife Habitat

NPS-2.3

Support the replacement of failing septic systems and promote the maintenance of functioning septic systems and minimize the number of septic systems in areas of the AOC watershed that have an impact on the Detroit River AOC by:

- Continuing to replace failing septic systems in the AOC watershed through the expansion of rural landowner septic system grant programs.
- Providing landowner education programs that promote septic system care, regular inspections and record keeping.
- Completing the implementation of Windsor's sanitary sewer installation program.
- Providing municipal sanitary sewer service to properties currently in private septage where densities and proximity of existing services permit.

Estimated Cost	Up to $500,000 annually
Timeline	Ongoing until completed
Participants	AOC Municipalities (LaSalle & Amherstburg) (Lead) City of Windsor DRCC Education and Public Involvement Work Group Environment Canada Essex Region Conservation Authority Landowners Ontario Ministry of Municipal Affairs and Housing Ontario Ministry of the Environment Windsor-Essex County Health Unit
Related BUI(s)	Degradation of Fish and Wildlife Populations, Degradation of Benthos, Eutrophication or Undesirable Algae, Beach Closings, Degradation of Aesthetics, Degradation of Phytoplankton and Zooplankton Populations, Loss of Fish and Wildlife Habitat

Recommendation PS-1
Reduce point sources entering the Detroit River such as those from industrial and municipal dischargers.

Key actions:

PS-1.1

Reduce loadings from waste water treatment plants by (but not limited to):

- Upgrading the Little River waste water treatment plant (adding scum baffles).
- Supporting the completion of the Amherstburg waste water treatment plant upgrades.
- Supporting the enforcement of sewer use by-laws and update by-laws, as required.
- Supporting efforts to increase public awareness of problems with dumping chemicals into household drains (supporting the Toxics Reduction Strategy).

Estimated Cost	Varies by project; TBD
Timeline	Ongoing (as opportunities arise)
Participants	DRCC Steering and Implementation Committee Member Organizations Town of Amherstburg City of Windsor RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Fish Tumours or Other Deformities, Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Eutrophication or Undesirable Algae, Degradation of Phytoplankton and Zooplankton Populations

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PS-1.2

Investigate any opportunities to further reduce point source discharges, for example:

- Ensure that municipal and industrial dischargers remain in compliance with all federal and provincial regulations (as per their Certificate of Approval).

Estimated Cost	In-kind support
Timeline	Ongoing
Participants	AOC Municipalities (Windsor, LaSalle, Amherstburg) Industries Ontario Ministry of the Environment (Lead) RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Fish Tumours or Other Deformities, Bird or Animal Deformities or Reproductive Problems, Beach Closings, Degradation of Phytoplankton and Zooplankton Populations, Loss of Fish and Wildlife Habitat

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PS-1.3

Minimize or eliminate combined sewer overflows (CSOs) by (but not limited to):

- Constructing a Retention Treatment Basin in the City of Windsor (the Environmental Assessment is complete and the project has recently been funded).[1]
- Implementing a mandatory downspout disconnection program in all AOC municipalities.[2]
- Eliminating 'over-under' sewer and combined sewer systems in Amherstburg and Windsor.[3]
- Replacing existing sanitary systems in Amherstburg where water is entering the sanitary sewers.[4]
- Replacing deteriorated separated sewer systems in Windsor's Riverside area.[5]
- Implementing municipal 'illegal connections elimination' programs in all AOC municipalities.[6]

Estimated Cost Varies by project:

1. $60 million
2. $100,000 annually
3. $6 million annually
4. TBD
5. $1.5 million annually
6. $60,000 annually

Timeline 2011 (Retention Treatment Basin)
Ongoing (others)

Participants AOC Municipalities (Windsor, LaSalle, Amherstburg) (Lead)
DRCC Steering and Implementation Committee
RAP Coordinator
Government of Canada (RTB)
Province of Ontario (RTB)

Related BUI(s) Degradation of Fish and Wildlife Populations, Fish Tumours or Other Deformities, Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Eutrophication or Undesirable Algae, Beach Closings, Degradation of Aesthetics, Degradation of Phytoplankton and Zooplankton Populations

MONITORING AND RESEARCH

Recommendation MR-1
Develop a Monitoring and Research Plan for the Detroit River Canadian AOC.

Key actions:

MR-1.1

Create and begin implementing a Monitoring and Research Plan for the Detroit River Canadian AOC (which can be used for the Huron-Erie corridor).

Estimated Cost	In-kind
Timeline	Completed by 2015
Participants	DRCC Monitoring and Research Work Group (Lead) RAP Coordinator St. Clair River RAP Group
Related BUI(s)	All (indirectly)

MR-1.2

Secure long-term funding for the Detroit River AOC ecosystem monitoring program (to implement the Monitoring and Research Plan).

Estimated Cost	TBD
Timeline	Completed by 2015
Participants	DRCC Steering and Implementation Committee (Lead) Environment Canada Ontario Ministry of the Environment RAP Coordinator
Related BUI(s)	All (indirectly)

Recommendation MR-2
Implement the Monitoring and Research Plan for the Detroit River Canadian AOC.

Key actions:

MR-2.1

Conduct a study to determine reproductive success (and population condition) of Detroit River frogs (e.g., leopard frog).

Estimated Cost	$20,000
Timeline	2010
Participants	DRCC Monitoring and Research Work Group Environment Canada Science and Technology Branch (Lead) Great Lakes Institute for Environmental Research
Related BUI(s)	Degradation of Fish and Wildlife Populations, Bird or Animal Deformities or Reproductive Problems

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MR-2.2

Conduct a survey of industries and farms that utilize Detroit River water to re-assess the status of *Added Costs to Agriculture or Industry* using information from the Permit to Take Water (for industries) and by working with the Ontario Ministry of Agriculture, Food and Rural Affairs.

Estimated Cost	In-kind support
Timeline	2011
Lead	Detroit River water users (industrial, municipal and agricultural) DRCC Monitoring and Research Work Group (Lead) DRCC Education and Public Involvement Work Group Ontario Ministry of Agriculture, Food and Rural Affairs Ontario Ministry of the Environment
Related BUI(s)	Added Costs to Agriculture or Industry

MR-2.3

Conduct a river-wide survey of benthos to follow-up on the 1999 and 2004 assessments in the Detroit River.

Estimated Cost	TBD
Timeline	2010 & 2015
Participants	DRCC Monitoring and Research Work Group Great Lakes Institute for Environmental Research (Lead)
Related BUI(s)	Degradation of Benthos, Restrictions on Dredging Activities

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MR-2.4

Conduct weekly monitoring of White Sands Conservation Area and McKee Park for *E. coli* following the WECHU beach monitoring protocol (including methods, sampling frequency, and sampling dates) and compile WECHU *E. coli* data for Sandpoint and Holiday Beaches between June and September.

Estimated Cost	$1,200 and in-kind support
Timeline	Annually
Participants	DRCC Monitoring and Research Work Group Essex Region Conservation Authority (White Sands Conservation Area) (Lead) RAP Coordinator Windsor-Essex County Health Unit
Related BUI(s)	Beach Closings

MR-2.5

Communicate with water treatment plant managers in the AOC to confirm the status of *Restrictions on Drinking Water or Taste and Odour Problems*.

Estimated Cost	In-kind
Timeline	Completed by 2015
Participants	City of Windsor DRCC Monitoring and Research Work Group (Lead) Essex Region Conservation Authority (Source Water Protection) RAP Coordinator Town of Amherstburg
Related BUI(s)	Restrictions on Drinking Water Consumption or Taste and Odour Problems

MR-2.6

Conduct a study to identify reference locations and appropriate end points for identifying fish tumours. For example, there may be methods for early cancer detection in fish rather than waiting for 3 year old brown bullhead.

Estimated Cost	TBD
Timeline	2010-2011
Participants	DRCC Monitoring and Research Work Group Great Lakes Institute for Environmental Research Ontario Ministry of the Environment
Related BUI(s)	Fish Tumours or Other Deformities

MR-2.7

Assess the reproductive viability of black-crowned night herons in the Detroit River AOC versus a non-AOC site (e.g., Nottawasaga Island).

Estimated Cost	$9,000
Timeline	Completed by 2010
Participants	DRCC Monitoring and Research Work Group Environment Canada Canadian Wildlife Service (Lead) Great Lakes Institute for Environmental Research Ontario Ministry of the Environment United States Fish and Wildlife Service
Related BUI(s)	Degradation of Fish and Wildlife Populations, Bird or Animal Deformities or Reproductive Problems

MR-2.8

Survey Detroit River anglers (using the 2007 survey and protocol from St. Clair River AOC) to determine if there is an issue with fish and wildlife flavour and/or aesthetics in the Detroit River AOC.

Estimated Cost	$2,000
Timeline	2010-2011
Participants	DRCC Monitoring & Research Work Group (Lead) DRCC Education and Public Involvement Work Group Ontario Ministry of Natural Resources RAP Coordinator
Related BUI(s)	Restrictions on Fish and Wildlife Consumption, Tainting of Fish and Wildlife Flavour, Degradation of Aesthetics

MR-2.9

Determine if the Detroit River contributes to the eutrophication or algal growth problems in the western basin of Lake Erie.

Estimated Cost	$20,000
Timeline	2010
Participants	Environment Canada Essex Region Conservation Authority Great Lakes Institute for Environmental Research Ontario Ministry of Agriculture, Food and Rural Affairs Ontario Ministry of the Environment
Related BUI(s)	Degradation of Fish and Wildlife Populations, Eutrophication or Undesirable Algae, Restrictions on Drinking Water Consumption or Taste and Odour Problems, Beach Closings

MR-2.10

Undertake research into non-point source issues in the Detroit River AOC, for example:

- Determine if the impacts at the mouths of the Detroit River tributaries influence the quality of the Detroit River AOC (similar to the AnnAgNPS completed for the Canard River).
- Complete investigations of sources, transport, and fate of non-point sources of contaminants (similar to the completed Canard River study) and identify priorities for remediation actions.
- Coordinate an information session on air deposition impacts on water quality and conduct an AOC watershed study to determine contaminant deposition by air in the AOC.
- Continue investigation into emerging water quality issues associated with non-point sources of contaminants (e.g., metals, organic compounds) in association with Source Water Protection efforts.

Estimated Cost	TBD
Timeline	2015
Participants	DRCC Habitat Work Group DRCC Monitoring & Research Work Group Environment Canada (Lead) Essex Region Conservation Authority (Lead) Great Lakes Institute for Environmental Research Ontario Ministry of Agriculture, Food and Rural Affairs Ontario Ministry of Natural Resources Ontario Ministry of the Environment (Lead) RAP Coordinator
Related BUI(s)	Degradation of Fish and Wildlife Populations, Degradation of Benthos, Eutrophication or Undesirable Algae, Beach Closings, Degradation of Aesthetics, Degradation of Phytoplankton and Zooplankton Populations, Loss of Fish and Wildlife Habitat

MR-2.11

Conduct a study to confirm the appropriate fish species/ages to use for the assessment of *Restrictions on Fish and Wildlife Consumption*.

Estimated Cost	TBD
Timeline	2010
Participants	DRCC Monitoring & Research Work Group Great Lakes Institute for Environmental Research (Lead) Ontario Ministry of the Environment
Related BUI(s)	Restrictions on Fish and Wildlife Consumption

Recommendation MR-3
Evaluate the Monitoring and Research Plan for the Detroit River Canadian AOC.

Key actions:

MR-3.1

Informally monitor complaints related to aesthetics issued by the public to the MNR, MOE, ERCA, Windsor Port Authority, City of Windsor, Town of LaSalle, and Town of Amherstburg.

Estimated Cost	In-kind support
Timeline	Annual
Participants	AOC Municipalities (Windsor, LaSalle, Amherstburg) DRCC Monitoring and Research Work Group (Lead) DRCC Education and Public Involvement Work Group Essex Region Conservation Authority (Source Water Protection) RAP Coordinator Windsor Port Authority Others as required
Related BUI(s)	Degradation of Aesthetics

MR-3.2

Review data every 3-5 years in order to update the status of each BUI and to recommend future actions (e.g., delist, suggest remedial action, or implement a different study). Specifically:

- Review of fish contaminant data for indicator species listed in BUI #1.
- Review data to determine sources driving fish consumption advisories (BUI #1).
- Review results of angler survey and assess status of BUI #2 and #11.
- Review fish tumour data and assess status of BUI #4.
- Review data collected on the reproductive state of birds and animals (BUI #5) (e.g., black-crowned night herons, frogs, etc.).
- Review data and re-assess Eutrophication or Undesirable Algae (BUI #8).
- Collect data on drinking water taste & odour (with ERCA-SWP) and confirm status of BUI #9.
- Review *E. coli* data collected for reference beaches (BUI #10) and assess BUI status in 2011.
- Review data about costs to industry and agriculture (BUI #12) that utilize Detroit River water.

Estimated Cost	In-kind support
Timeline	Ongoing; every 3-5 years
Participants	DRCC Monitoring & Research Work Group (Lead) RAP Coordinator
Related BUI(s)	Restrictions on Fish and Wildlife Consumption, Tainting of Fish and Wildlife Flavour, Degradation of Fish and Wildlife Populations, Fish Tumours or Other Deformities, Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Eutrophication or Undesirable Algae, Restrictions on Drinking Water Consumption or Taste and Odour Problems, Beach Closings, Degradation of Aesthetics, Added Costs to Agriculture or Industry

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EDUCATION & PUBLIC INVOLVEMENT

Recommendation EPI-1
Inform and educate the public about the Detroit River.

Key actions:

EPI-1.1

Continue to communicate with the public by:

- Maintaining and updating the DRCC website.
- Distributing a monthly E-newsletter.
- Producing and distributing annual RAP update newsletter.
- Developing fact sheets and other publications.

Estimated Cost	$5,000/year
Timeline	Ongoing
Participants	Environment Canada Ontario Ministry of the Environment RAP Coordinator (Lead) DRCC Education and Public Involvement Work Group
Related BUI(s)	All (indirectly)

EPI-1.2

Educate the public about drinking water and storm/sewer projects, for example (but not limited to):

- Implement a car washing information campaign and fact sheet
- Support the “Yellow Fish Road” education program
- Create a campaign to inform the public about drinking tap water
- Develop short TV ads about Detroit River issues including CSOs, storm water, etc.

Estimated Cost	$10,000
Timeline	2010-2013
Participants	City of Windsor Essex Region Conservation Authority RAP Coordinator Town of LaSalle Town of Amherstburg DRCC Education and Public Involvement Work Group
Related BUI(s)	Degradation of Fish and Wildlife Populations, Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Degradation of Aesthetics, Degradation of Phytoplankton and Zooplankton Populations

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EPI-1.3

Create educational materials (e.g., lesson plans) about the Detroit River, based on the Ontario Curriculum, for teachers to incorporate into their classrooms.

Estimated Cost	$3,000
Timeline	2012
Participants	Conseil scolaire de district des écoles catholiques du Sud-Ouest Conseil scolaire de district du Centre-Sud-Ouest DRCC Education and Public Involvement Work Group (Lead) Greater Essex County District School Board Local teachers RAP Coordinator Windsor Port Authority Windsor-Essex Catholic District School Board
Related BUI(s)	All (indirectly)

EPI-1.4 (related to NPS 1.1)

Encourage citizens to practice natural (pesticide/fertilizer free) gardening and lawn care by (but not limited to):

- Naturalizing areas at riverfront parks (or within AOC watershed).
- Encouraging riparian landowners to install buffer strips.
- Encouraging municipalities to adopt natural lawn care on municipally-owned properties.
- Continuing to promote the DRCC's 2007 'Pull, Don't Spray' campaign.
- Hosting natural lawn care workshops.

Estimated Cost	$10,000
Timeline	Ongoing
Participants	AOC Municipalities (Windsor, LaSalle, Amherstburg) Essex County Stewardship Network Essex Region Conservation Authority RAP Coordinator (Lead)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Bird or Animal Deformities or Reproductive Problems, Degradation of Benthos, Eutrophication or Undesirable Algae, Degradation of Phytoplankton and Zooplankton Populations, Loss of Fish and Wildlife Habitat

Recommendation EPI-2
Host events that encourage public involvement and participation in Detroit River stewardship.

Key actions:

EPI-2.1

Continue to conduct community forest and prairie planting events (seedlings and large stock) in the Detroit River watershed (including Little River, Turkey Creek, and Canard River).

Estimated Cost	$15,000/year
Timeline	Ongoing
Participants	Essex County Field Naturalists' Club (Little River Enhancement Group) Essex County Stewardship Network Essex Region Conservation Authority (Lead) Environment Canada Friends of Turkey Creek Friends of Canard River Ontario Ministry of the Environment
Related BUI(s)	Degradation of Fish and Wildlife Populations, Degradation of Benthos, Beach Closings, Degradation of Aesthetics, Loss of Fish and Wildlife Habitat

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EPI-2.2

Continue to conduct community cleanups in the Detroit River watershed (including Little River, Turkey Creek, and Canard River).

Estimated Cost	$2,000/year
Timeline	Ongoing
Participants	Essex County Field Naturalists' Club (Little River Enhancement Group) Essex Region Conservation Authority Environment Canada Friends of Turkey Creek Friends of Canard River Ontario Ministry of the Environment RAP Coordinator (Lead)
Related BUI(s)	Degradation of Fish and Wildlife Populations, Degradation of Benthos, Beach Closings, Degradation of Aesthetics, Loss of Fish and Wildlife Habitat

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EPI-2.3

Plan and implement watershed tours to inform the public about important Detroit River watershed features and highlight RAP accomplishments.

Estimated Cost	$2,000
Timeline	2010-2011; 2013-2014
Participants	Citizens Environment Alliance (Lead) Detroit River Public Advisory Council Essex County Field Naturalists' Club Essex Region Conservation Authority Friends of Turkey Creek Friends of Canard River
Related BUI(s)	All (indirectly)

EPI-2.4

Continue to host Pêche Island Day, Detroit River seminars, movie events, and guest speakers (as opportunities arise).

Estimated Cost	$2,000 (and in-kind support)
Timeline	Ongoing
Participants	RAP Coordinator Citizens Environment Alliance BASF Corporation (Pêche Island Day) Ontario Ministry of Natural Resources (Pêche Island Day) AOC Municipalities (Windsor, LaSalle, Amherstburg) Essex County Stewardship Network Essex County Field Naturalists' Club Essex Region Conservation Authority (Friends of Watersheds) University of Windsor DRCC Education and Public Involvement Work Group (Lead)
Related BUI(s)	All (indirectly)

Recommendation EPI-3
Review and report on Detroit River Canadian RAP progress (audit).

Key actions:

EPI-3.1

Develop report cards that address progress on the Detroit River Canadian RAP.

Estimated Cost	$7,000 per report card (includes staff time and printing)
Timeline	Every 3-5 years
Participants	Detroit River Public Advisory Council
Related BUI(s)	All

EPI-3.2

Continue to support and participate in the biennial, binational State of the Strait conference which results in a report on the Detroit River and western Lake Erie ecosystem.

Estimated Cost	$1,000 plus in-kind support (DRCC)
Timeline	2011, 2013, 2015
Participants	AOC Municipalities DRCC Education and Public Involvement Work Group Environment Canada Essex Region Conservation Authority Ontario Ministry of Natural Resources Ontario Ministry of the Environment RAP Coordinator University of Windsor
Related BUI(s)	All (indirectly)

Recommendation EPI-4
Provide support/opposition and recommendations for documents or projects that relate to the Detroit River AOC (advocacy).

Key actions:

EPI-4.1

Review and comment on municipal official plans or other issues relating to the Detroit River.

Estimated Cost	In-kind support
Timeline	As needed
Participants	Detroit River Public Advisory Council
Related BUI(s)	All (indirectly)

EPI-4.2

Encourage municipalities to protect existing habitat and commit to restoring and enhancing natural heritage features in the Detroit River and its watershed.

Estimated Cost	In-kind support
Timeline	As needed
Participants	Detroit River Public Advisory Council
Related BUI(s)	All (indirectly)

WEB RESOURCES

Canada-Ontario Agreement
www.ec.gc.ca/CEPARegistry/documents/agree/Fin-COA07/2007COA_e.pdf

Canadian Heritage Rivers – Detroit River
www.chrs.ca/Rivers/Detroit/Detroit_e.php

Citizens Environment Alliance
www.citizensenvironmentalliance.org

Fisheries and Oceans Canada
www.dfo-mpo.gc.ca

Detroit River Canadian Cleanup
www.detroitriver.ca

Essex Region Conservation Authority
www.erca.org

Environment Canada
www.ec.gc.ca

Environment Canada: Our Great Lakes
http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En

Great Lakes Binational Toxics Strategy
http://binational.net/bns/menu-e.html

Great Lakes Water Quality Agreement
www.ijc.org/en/activities/consultations/glwqa/agreement.php

International Joint Commission
www.ijc.org

Ontario Ministry of the Environment
www.ene.gov.on.ca

Ontario Ministry of Natural Resources
www.mnr.gov.on.ca

State of the Strait
www.stateofthestrait.org

GLOSSARY AND COMMONLY USED ACRONYMS

AnnAgNPS	Annualized Agriculture Non-Point Source
ANSI	Area of Natural and Scientific Interest
Anthropogenic	Caused or produced by humans (e.g., certain types of pollution)
AOC	Area of Concern. A location in the Great Lakes-St. Lawrence Basin that has been identified as severely degraded. The area fails to meet water quality objectives listed in the Great Lakes Water Quality Agreement and local delisting criteria.
Bathymetry	The measurement of the depths of large bodies of water (e.g., lakes, oceans)
BCS	Biodiversity Conservation Strategy
Beneficial Use	The ability of living organisms (including humans) to use the Detroit River (or another location within the Great Lakes Basin) without adverse consequences. When a use is deemed impaired or does not meet the delisting criteria, it is referred to as a beneficial use impairment or BUI.
Benthos	Invertebrate communities that spend (at least) a portion of their life cycle at the bottom of lakes, streams, and rivers.
BMPs	Best Management Practices
Bioassay	A method of analysis performed to measure the effects of a substance on a living organism.
Biomagnification	The increase of concentration of a substance (e.g., DDT) that occurs in a food chain.
BSC	Bird Studies Canada
BUI	Beneficial Use Impairment
Carapace	The shell covering some, or all of, the dorsal (back) part of an animal such as a turtle.
CAW	Canadian Auto Workers
CEA	Citizens Environment Alliance
cfu	Colony Forming Units. Used in bacteriological analyses.
Cloverleaf	A road arrangement, resembling a four-leaf clover in form, for permitting easy traffic movement between two intersecting high-speed highways.
COA	Canada-Ontario Agreement
COFSP	Canada-Ontario Farm Stewardship Program
CSO	Combined Sewer Overflow
CWS	Canadian Wildlife Service
DDE	Dichlorodiphenyldichloroethylene. A persistent (long-lasting) chemical that is produced on the breakdown of DDT.

DDT	Dichlorodiphenyltrichloroethane. A persistent (long-lasting) chemical that was used as an insecticide until it was banned in Canada and the U.S. in the 1970s.
delisting	Removing an AOC from the list of Great Lakes Areas of Concern by meeting all delisting criteria for restoring beneficial uses.
DFO	Fisheries and Oceans Canada
DRCC	Detroit River Canadian Cleanup
DRCCC	Detroit River Canadian Cleanup Committee
DRDIS	Detroit River Delisting and Information System
E. coli	*Escherichia coli (*bacterium)
EC	Environment Canada
ECFNC	Essex County Field Naturalists' Club
ECSN	Essex County Stewardship Network
EFP	Environmental Farm Plan
Electrofishing	A method of fish sampling by using electricity to stun fish before they are collected. When performed correctly, this method does not permanently harm fish.
EMRB	Environmental Monitoring and Reporting Branch
ERCA	Essex Region Conservation Authority
Eutrophic	A description of a body of water (lake, river, stream) that has poor water quality due to large amounts of nutrients resulting in excessive algal growth. The opposite of oligotrophic.
EWSWA	Essex-Windsor Solid Waste Authority
Fry	A young or recently hatched fish.
GIS	Geographic Information System
GLAP	Great Lakes Action Plan
GLIER	Great Lakes Institute for Environmental Research
GLNPO	Great Lakes National Program Office
GLSF	Great Lakes Sustainability Fund
GLWQA	Great Lakes Water Quality Agreement
Genotoxic	Poisonous substance which harms an organism by damaging its DNA.
Geosmin	A naturally occurring chemical produced by blue-green algae and released when they die. When it is present, it gives water an unpleasant earthy taste or odour.
Histological	Of, or relating to, the study of tissues.
IJC	International Joint Commission

LaMPs	Lake wide Management Plans
Lil'Reg	Little River Enhancement Group
Macroinvertebrate	An invertebrate (lacks a spine) that is visible to the naked eye (e.g., mussels, crayfish, mayflies).
Macrophyte	An aquatic plant that grows in or near water. Macrophytes provide habitat for fish, produce oxygen, and can act as a food source for some animals.
M&R WG	Monitoring and Research Work Group (DRCC)
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
Mesotrophic	A description of a body of water (lake, river, stream) that is intermediate between oligotrophic and eutrophic. These bodies of water have moderate level of nutrients and algae production.
MIB	2-methylisoborneol. An organic chemical with a strong musty odour produced by blue-green algae. Related to taste and odour problems in drinking water.
MISA	Municipal /Industrial Strategy for Abatement
Monotypic	Only one species of a plant or animal.
MP	Member of Parliament
MPP	Member of Provincial Parliament
Non-point source	A type of pollution that does not have an obvious point at which is it entering the water (e.g., storm water runoff, failed septic systems, runoff from parking lots). Abbreviated as NPS.
NSERC	Natural Sciences and Engineering Research Council
Oligotrophic	A description of a body of water (lake, river, stream) that has good water quality due to low amounts of nutrients and low algal growth. The opposite of eutrophic.
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
OMNR	Ontario Ministry of Natural Resources
OMOE	Ontario Ministry of the Environment
OMOH	Ontario Ministry of Health
oocyte	Such as the cryptosporidium oocyte. A cyst produced by a parasite that is resistant to harsh environmental conditions but can germinate once ingested and cause illness.
OWWRC	Ontario Water Works Research Consortium
PAC	Public Advisory Council (DRCC)
PAH	Abbreviation for Polycyclic Aromatic Hydrocarbon or polynuclear aromatic hydrocarbon. A by-product of the incomplete burning of coal.
Part per billion (ppb)	A unit describing the concentration of a substance in water. 1 ppb is equal to 1 microgram in a litre.

Part per million (ppm)	A unit describing the concentration of a substance in water. 1 ppm is equal to 1 milligram in a litre.
Part per trillion (ppt)	A unit describing the concentration of a substance in water. 1 ppt is equal to 1 nanogram in a litre.
PCB	Polychlorinated biphenyl. A highly persistent (long-lasting) chemical that accumulates in sediment and in fatty tissues of living organisms.
Phenology	The study of the influences (seasonal or interannual) on animal life cycle events (e.g., migration, date of egg laying).
Point source	A type of pollution that comes from a direct, identifiable source of discharge (e.g., sewage treatment plants, factories). Abbreviated as PS.
Predation	A description of a biological interaction between a predator (hunter) and its prey (hunted).
PSQG	Provincial Sediment Quality Guidelines
PWGSC	Public Works and Government Services Canada
PWQO	Provincial Water Quality Objectives
RAP	Remedial Action Plan
RDC	Reference-Degraded Continuum
Riparian	An area or zone between land and water (usually a stream or river).
Scute	A bony plate that is similar to a scale. A turtle's carapace (shell) is formed by many scutes that have grown together. Other examples of scutes are found on the skin of a crocodile and on the feet of some birds.
Sentinel species	An indicator species that describes the condition of its environment.
SOLRIS	Southern Ontario Land Resource Information System
SWP	Source Water Protection
Taxon (pl. taxa)	A group of one or more organisms defined by a scientific category such as by species or genus.
TBD	To be determined
TDI	Tolerable Daily Intakes
TP	Total Phosphorus
Tributary	A smaller stream of water that drains into a larger one. For example, Turkey Creek is a tributary of the Detroit River.
UGLCCS	Upper Great Lakes Connecting Channels Study
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Watershed	An area of land that drains into a body of water. Watersheds are usually separated by a ridge of high land.

WECHU	Windsor-Essex County Health Unit
WQS	Water Quality Standards
ZCI	Zoobenthic Condition Index

CONVERSION TABLES

LENGTH		
1 Kilometre	1,000 metres	0.621 miles
1 Metre	-	39.4 inches (3.28 feet)
1 Centimetre	0.01 metres	0.394 inches
1 Millimetre	0.001 metres	0.0394 inches

AREA		
1 hectare (ha)	10,000 m^2	2.471 acres

WEIGHT		
1 Metric ton	1,000 kilograms	-
1 Kilogram	1,000 grams	0.001 metric tons
1 Gram	1,000 milligrams	0.001 kilograms
1 Milligram	1,000 micrograms	0.001 grams
1 Microgram	1,000 nanograms	0.000001 grams
1 Nanogram	0.001 micrograms	0.000000001 grams

CONCENTRATIONS	
1 gram/litre	1 part per thousand
1 milligram/litre	1 part per million
1 microgram/litre	1 part per billion
1 nanogram/litre	1 part per trillion

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APPENDIX 1

DRCC Framework & Terms of Reference

2010

DETROIT RIVER CANADIAN CLEANUP
Management Framework and Terms of Reference
2010

Every five years, a review should be undertaken of this entire Management Framework and Terms of Reference to ensure that it is still meeting the needs of the cleanup effort in the AOC. In order to avoid a focus on process over action, substantial amendments to the Management Framework and Terms of Reference as a whole should generally be proposed at the five year review periods.

MANDATE:

To cleanup, enhance, restore and sustain the Detroit River ecosystem in order to remove it from the list of Great Lakes' Areas of Concern.

GUIDING AGREEMENTS/DOCUMENTS:

Canada-United States Great Lakes Water Quality Agreement

The Canada-United States Great Lakes Water Quality Agreement (GLWQA) was first signed in 1972 to commit both countries to address the pollution of their shared Great Lakes.

The GLWQA was revised in 1978 to address persistent toxic substances. It was revisited in the 1980s and amended by Protocol in 1987. One of the amendments in the Protocol called for the development and implementation of Remedial Action Plans (RAPs) to restore the ecosystem health in each of the 43 Areas of Concern (AOC). Since the GLWQA was signed three AOCs in Canada and one in the U.S. have been delisted, and two AOCs (one in Canada and one in the U.S.) have been listed as 'Areas in Recovery'.

Recognizing that each AOC suffers from different environmental problems, the RAPs are locally-driven and defined. There are three stages to the RAP program: Stage 1 is to identify problems, Stage 2 is to define remedial actions, and the Stage 3 is to identify the restoration of beneficial uses.

Beneficial uses that focus on human and aquatic ecosystem health guide restoration efforts. The GLWQA defines 14 beneficial uses that must be restored before an AOC can be delisted (i.e., removed from the list of Great Lakes AOCs). When a beneficial use is degraded, it is referred to as a beneficial use impairment (BUI).

Canada-Ontario Agreement: Respecting the Great Lakes Basin Ecosystem

The Canadian federal government and the Province of Ontario further demonstrated their commitment to the GLWQA to restore, conserve and protect the Great Lakes Basin ecosystem by signing the Canada-Ontario Agreement (COA): Respecting the Great Lakes Basin Ecosystem. First signed in 1971, the COA was most recently renewed in 2007.

The management of the COA is entrusted to a Management Committee that is co-chaired by Environment Canada and the Ontario Ministry of the Environment.

The COA focuses on implementing four annexes that related to addressing priority environmental issues in the Great Lakes Basin: Areas of Concern, Harmful Pollutants, Lake and Basin Sustainability, and Coordination of Monitoring, Research and Information. Each Annex specifies goals, results, and commitments.

The Annex on Areas of Concern addresses several initiatives to support the restoration and protection of environmental quality and beneficial uses in AOCs, including reducing municipal wastewater, reducing

rural pollution, developing contaminated sediment management strategies, restoring and protecting fish and wildlife habitat, fostering community participation, increasing knowledge through research and monitoring, and communicating progress.

Four Agency Letter of Commitment

There are three bi-national AOCs: St. Mary's River, St. Clair River, and the Detroit River.

In 1998, a Four Agency Letter of Commitment was signed by Environment Canada, United States Environmental Protection Agency, Ontario Ministry of the Environment, and Michigan Department of Environmental Quality to pledge their commitment to restore the shared AOCs. The Letter identifies roles and responsibilities of the Four Agencies for the three shared AOCs.

The Compendium of Position Papers (revised 2009) was developed to explain how the commitments of the Letter and the GLWQA will be applied to the AOCs.

The Detroit River RAP

Work on the Detroit River began as early as 1985 but a Stage 1 RAP Report was not produced until 1991. Soon after, work on a Stage 2 RAP was started but the report was never accepted by all RAP participants and was instead released as a RAP Update report in 1996. Since then, implementation of the Detroit River RAP has functioned separately on Canadian and American sides of the Detroit River.

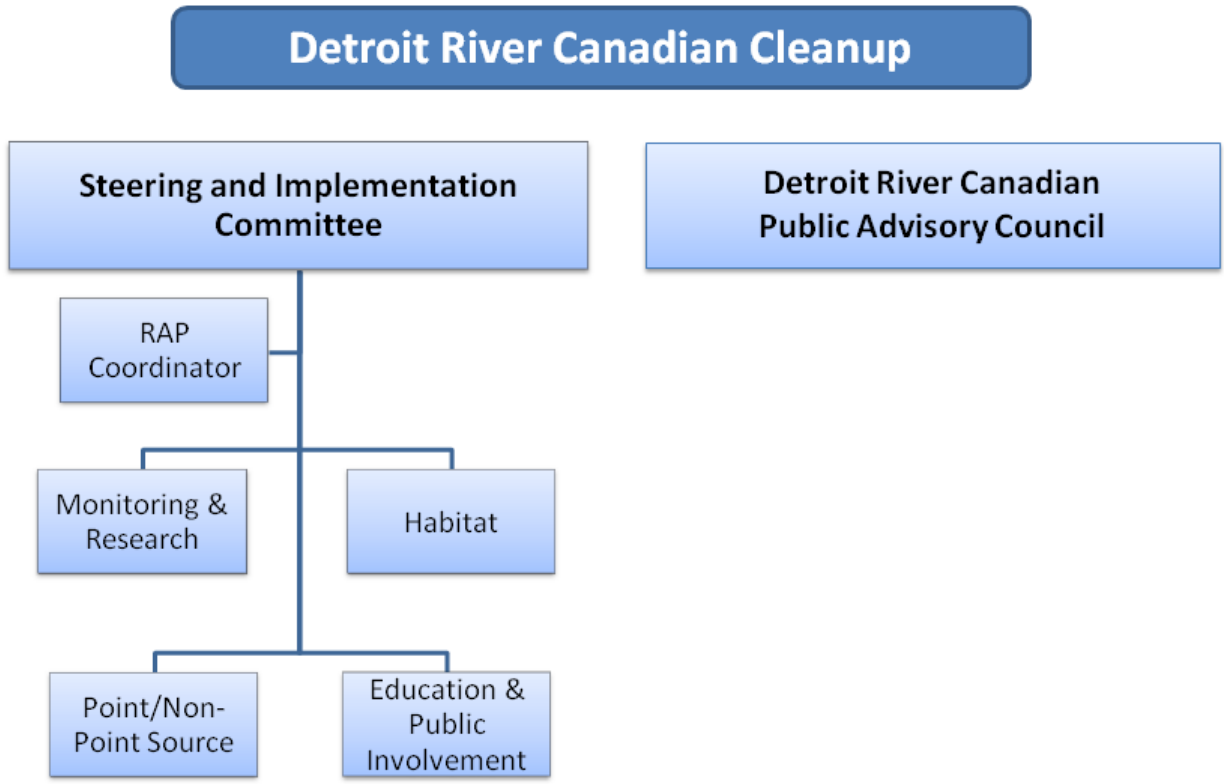
In 1998, the Detroit River Canadian Cleanup (DRCC; formerly Detroit River Canadian Cleanup Committee) was formed to implement the Canadian side of the Detroit River RAP. Between 1998 and 2008, over $200 million was spent on projects aimed at cleaning up, enhancing and restoring the Canadian side of the Detroit River.

In 2004, the DRCC was re-structured to facilitate implementation and to reinvigorate the remediation process in the Detroit River Canadian AOC. The DRCC is currently (2009-2010) comprised of two main groups: an Implementation/Outreach Group and a Public Advisory Council. The Implementation and Outreach Group (IOG) consists of three Committees: a Steering Committee, an Implementation Committee, and an Outreach Committee. The public advisory role is served by the Detroit River Canadian Public Advisory Council (DRPAC). A RAP Coordinator was hired in 2004 to support the entire DRCC structure and act as a focal point for the implementation of the RAP.

The 2004 *Framework and Constitution* noted that a review of the structure should be completed every 5 years. Therefore, in March 2009 a survey of DRCC members was conducted. Overall, the results of the survey were positive but identified some improvements that could be made to successfully implement the RAP. Comments were related to the structure of the initiative, communication within/among committees, and public engagement. On July 16, 2009, a motion was passed at a Steering Committee meeting requesting a proposed structure to better focus RAP implementation efforts based on the Draft Detroit River Canadian Stage 2 RAP Report. On the evening of April 14, 2010 the DRCC held a General Meeting to discuss the proposed changes and revisions to the DRCC's structure and Terms of Reference. Attendance was minimal but several issues (voting, industry involvement, participation on committees/work groups, role of the public and the DRPAC, how to proceed with revisions) were discussed. Overall, those in attendance were supportive of the revised structure and Terms of Reference with some minor revisions (clarifications) which have been incorporated into this document.

PROPOSED DETROIT RIVER CANADIAN CLEANUP STRUCTURE

Details on committee and council structures are given in the following sections.



STEERING AND IMPLEMENTATION COMMITTEE TERMS OF REFERENCE

Overarching Principles:

- Accountability
- Approval and direction for allocation of resources (oversight)
- Direction/vision of overall RAP process
- Implementation
- Coordination
- Transparency
- Information and reporting on RAP activities

Roles/responsibilities:

- To provide oversight and to ensure that remedial actions/projects are completed in a timely manner by the accountable organization(s).
- To review and decide on upcoming implementation priorities (based on an annual work plan created by the Work Groups and submitted by the RAP Coordinator).
- To coordinate commitments for the implementation of remedial actions.
- To locate and commit to funding for remedial actions and ensure that staff are in place for the implementation of those projects.
- To provide direction for the Work Groups (as needed).
- To ensure linkage to the Four Agency Framework.
- To report on the progress in the AOC in order to enhance public awareness of the Detroit River RAP through an annual report and by hosting an Annual General Meeting.

Meetings

- Any person is invited to attend Steering and Implementation Committee meetings to observe and express any opinion they may have; however, decision-making is limited to member organizations.
- Meeting dates, locations and records will continue to be posted on the DRCC's website.
- Meetings are three times per year (more if deemed necessary):
    - May/June
        - Annual General Meeting to receive updates on the last year's projects
        - Communicate progress and next steps (to be taken into consideration for the following Oct/Nov meeting)
        - Release Annual Report (from previous fiscal year)
        - Opportunity to network/meet-and-greet with other DRCC members (potential tour of Detroit River project sites).
    - October/November
        - Review and discuss annual work plan for proposed projects for the following fiscal year (based on a five-year Work Plan).
        - Discuss and decide on priority projects for upcoming fiscal year.
        - Review funding allocations (deficit/surplus) and discuss resource allocation (staff/funding) for upcoming projects.
        - Provide feedback on work plans to the Work Groups.
        - Obtain project progress reports.

- January
  - Obtain the revised annual work plan from Work Groups.
  - Approve the annual work plan for proposed projects for the upcoming fiscal year
  - Confirm commitments for funding and other resources (staff, etc.).
  - Obtain project progress reports.

Details on Organization Representation:

- Member organizations should be those with a mandated responsibility to the RAP process through the GLWQA, COA, Four Agency Framework or official plans.
- Organizations should be able to commit resources (staff and funding) to project implementation.
- Individual representatives should be able to speak on behalf of their organization.
- Key role to play in the development, implementation, and monitoring of projects intended to restore beneficial uses in the AOC.

Member Organizations

- Environment Canada (Co-Chair)
- Ontario Ministry of the Environment (Co-Chair)
- Ontario Ministry of Natural Resources
- City of Windsor
- Town of LaSalle
- Town of Amherstburg
- Essex Region Conservation Authority
- University of Windsor (Rep. from Great Lakes Institute for Environmental Research)
- Detroit River Canadian Public Advisory Council Chair
- Windsor Port Authority
- Industry representative (2)
- *Resource staff (as needed; non-voting)*
- Others as required

Decision-making:

- Decisions are made by consensus; however, voting may be required (at the Co-chairs discretion) when consensus cannot be reached.
- Decisions are to be recorded clearly in meeting records.
- If voting is necessary, only one representative is appointed to vote on behalf of the organization
- Each organization may send more than one representative to meetings to speak on the organization's behalf but the additional personnel act only as resource individuals.
- Industry representatives will choose one voting member to represent their voice for the DRCC.
- If the voting representative is unable to attend a meeting, either the organization or the representative may appoint another individual to take their place.
- Upon retirement or change of a voting representative, the member organization shall appoint a successor voting representative and advise the RAP Coordinator of the change.

Work Groups

Work Groups can be struck on an as-needed-basis to work on specific tasks that represent the recommendations in the Stage 2 RAP Report (i.e., Habitat, Monitoring and Research, Point and Non-Point Source Pollution, etc.). Membership within a particular Work Group should relate to that individual's or organization's expertise. In doing so, there will be more focus on achieving recommendations to restore beneficial uses. Relevant member organizations should be added as needed.

RAP Coordinator Work Group (Supervisory Group)

Meetings will be annually to evaluate the Coordinator's position and to identify the upcoming priorities for the position. Meetings can also be at the call of the RAP Coordinator, as needed.

Membership:
Environment Canada
Ontario Ministry of the Environment
Essex Region Conservation Authority
Detroit River Canadian RAP Coordinator
Public Advisory Council Chair

Role of the Work Group:

- To acts as a contact point between the RAP Coordinator and the Steering and Implementation Committee.
- To provide guidance for minor issues related to the Coordinator's everyday duties and decide when items should be brought to the Steering and Implementation Committee for discussion.
- To work with the Coordinator to identify his/her priority actions for the upcoming year (to be brought to the Steering and Implementation Committee with the annual work plan for approval). The work group would meet annually to evaluate the Coordinator's position and develop proposed priority actions for the upcoming year to be brought forward to the Steering and Implementation Committee with the annual work plan.

Role of the RAP Coordinator:

- To assist with coordinating and implementing activities and initiatives to achieve remediation goals listed in the Stage 2 RAP Report.
- To work with the Steering and Implementation Committee and its work groups to develop and deliver work plans and related documents addressing priority actions.
- To network and act as a RAP liaison between DRCC member organizations, work groups, in the community, with the US RAP Group, the public, media, and others.
- To engage local groups in the RAP process through events, activities, reports, factsheets, etc.
- To provide secretariat services and meeting support for the Steering and Implementation Committee (including work groups) as well as the Public Advisory Council.
- To provide technical support for the DRCC's website and Detroit River Delisting and Information System.
- Other activities as required.

Habitat Work Group

Membership:
Fisheries and Oceans Canada
Ducks Unlimited Canada
Environment Canada
Essex County Stewardship Network
Essex Region Conservation Authority
Ontario Ministry of Natural Resources
University of Windsor

Role of the Work Group:

- To lead the implementation of habitat-related projects in the Detroit River AOC.
- To provide science-based analysis and advice regarding habitat activities in the Detroit River AOC.
- To assist the Monitoring and Research Work Group in the assessment of the Loss of Fish and Wildlife Habitat BUI, every three years.

Monitoring and Research Work Group

Membership:
City of Windsor
Environment Canada
Essex Region Conservation Authority
Great Lakes Institute for Environmental Research
Ontario Ministry of Natural Resources
Ontario Ministry of the Environment
United States Environmental Protection Agency

Role of the Work Group:

- To lead the implementation of monitoring and research projects in the Detroit River AOC.
- To provide science-based analysis and advice regarding monitoring, research, and assessment activities in the Detroit River AOC.
- To produce an assessment of Detroit River BUIs every three years.

Education and Public Involvement Work Group

Meetings should occur in the evenings to accommodate members that cannot attend during the day.

Membership:
Canadian Auto Workers
Citizens Environment Alliance
City of Windsor
Environment Canada
Ontario Ministry of the Environment
Essex Region Conservation Authority
Essex County Field Naturalists Club
Friends of Canard River
Friends of Turkey Creek
Little River Committee (ECFNC)
Public Advisory Council

Role of the Work Group:

- To lead the implementation of education and public involvement recommendations of the RAP.
- To work closely with the Public Advisory Council to assess the public's perception of the Detroit River.
- To develop materials directly related to implemented projects.

Loadings (Point/Non-point Source Pollution) Work Group

Membership:
City of Windsor (WWTP)
Essex Region Conservation Authority
Great Lakes Institute for Environmental Research
Ministry of the Environment (Windsor)
Ontario Ministry of Agriculture, Food and Rural Affairs
Town of Amherstburg (WWTP)
Town of LaSalle (WWTP)
Industries (direct dischargers)

Role of the Work Group:

- To lead the implementation of projects that relate to the reduction of point and non-point source pollution in the Detroit River AOC.

DETROIT RIVER CANADIAN PUBLIC ADVISORY COUNCIL TERMS OF REFERENCE

The Detroit River Canadian Public Advisory Council (PAC) is comprised of individuals with an interest in the health of the Detroit River. Although individuals representing agencies with responsibilities for RAP implementation are encouraged to attend PAC meetings to receive feedback from the public, they should do so only as resource individuals.

Role/Responsibilities of the Council:

- Provide a route through which the public can provide input on the cleanup of the Detroit River.
- Assess the public's perception of the Detroit River's environmental status.
- Promote community action through engaging events and projects as identified in the Stage 2 RAP Report.
- Produce reports critically evaluating the progress of RAP implementation.
- Share reports with the Steering and Implementation Committee, local politicians, as well as to the public-at-large.
- Attend the DRCC Annual General Meeting and Steering and Implementation Committee meetings to speak on behalf of the public for the Detroit River RAP and to provide updates on PAC activities and needs.

Role of the Chair(s) is to:

- Provide overall leadership to the Council.
- Call, set the agenda for, and oversee the conduct of meetings,
- Attend RAP Implementation Team meetings to ensure that implementation activities are progressing in a positive direction.
- Sign letters and speak on behalf of the Council.

Elections:

- A Chair and Vice-Chair will be elected or re-elected annually by members and shall hold office until replaced in a subsequent election.
- Only one member of each organization is entitled to stand for election and vote on behalf of that organization.
- To be elected, a candidate must receive a majority of votes cast. Should a majority not be achieved after the first round of voting, the candidate with the lowest number of votes will be dropped and further votes will be held until a majority is reached.

Voting:

- Only one representative is appointed to vote on behalf of the organization
- Each organization may send more than one representative to meetings to speak on the organization's behalf but the additional personnel act only as resource individuals.
- If the voting representative is unable to attend a meeting, either the organization or the representative may appoint another individual to take their place.
- Upon retirement or change of a voting representative, the member organization shall appoint a successor voting representative and advise the RAP Coordinator of the change.

Meetings:

- Chair and vice-chair elected by members
- Meetings should take place regularly, at the call of the Chair
- Scheduled in the evenings to maximize public participation opportunities.
- Open to the public
- The meeting organization, records, and distribution thereof will be the responsibility of the RAP Coordinator.
- If desired, a joint meeting may be held with the Education and Public Involvement Work Group. If such a meeting is held, it will be chaired jointly by both Chairs.

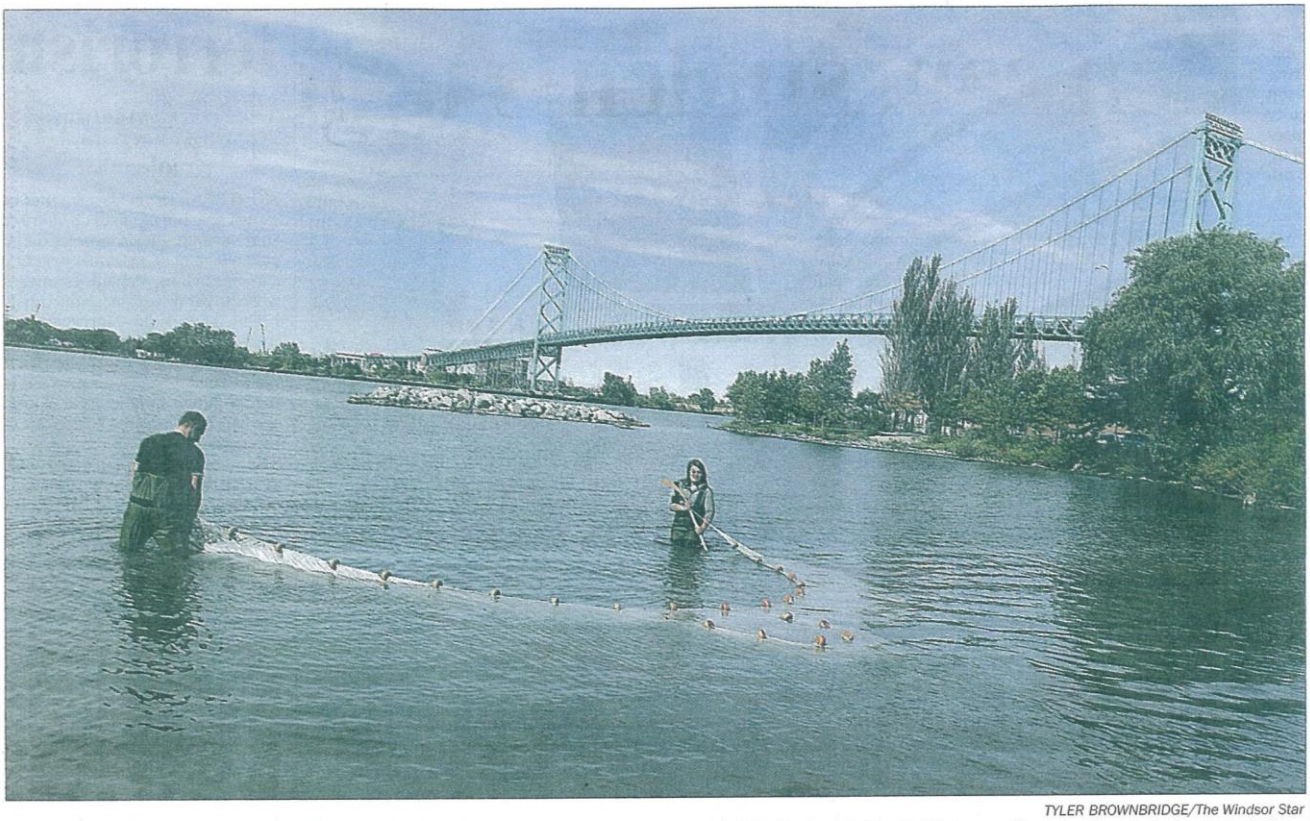
Member Organizations

Membership in the Detroit River Canadian PAC is inclusive and open to any individual interested in the Detroit River. Individuals representing agencies involved in RAP Implementation are encouraged to attend meetings but should participate only as resource individuals.

- Canadian Auto Workers
- Citizens-at-large
- Citizens Environment Alliance
- Detroit River U.S. PAC Representative
- Essex County Field Naturalists Club
- Windsor and District Labour Council
- Windsor Essex County Environmental Committee
- Essex County Federation of Agriculture *(no active member)*
- Essex County Woodlot Owners Association *(no active member)*
- First Nations groups *(no active member)*
- Friends of Canard River *(no active member)*
- Friends of Turkey Creek *(no active member)*
- Great Lakes Institute for Environmental Research *(no active member)*
- Windsor-Essex County Canoe Club *(no active member)*
- Windsor and District Chamber of Commerce *(no active member)*

APPENDIX 2

Newspaper Clippings Related to the draft Stage 2 RAP Report



TYLER BROWNBRIDGE/The Windsor Star

University of Windsor students Nurfad Nadarevic and Jordan Ciuro use a seine net to catch fish in the Detroit River in Windsor on Thursday. The students are part of a biology of fish class and were using the nets to count fish.

River cleanup price tag $79M

5-year plan takes aim at hot spots

SHARON HILL
The Windsor Star

Almost $79 million worth of work is needed to help the Detroit River move closer to getting off a list of toxic hot spots, says a new five-year plan for cleaning up the strait.

Some of the 45 recommendations include looking at fish tumours and leopard frog reproduction to see if the river is getting cleaner. About $60 million of the work over five years is a massive retention basin in Windsor to keep raw sewage from heading into the river during storms.

The $79 million worth of proposed work would be on top of an estimated $205 million spent between 1998 and 2008 on the river.

"The river is still polluted but is a lot better than it was," remedial action plan co-ordinator Natalie Green said Thursday.

The 51-kilometre Detroit River was listed as a toxic hot spot or one of 43 Great Lakes areas of concern in 1987. Work on cleaning up the river began around that time and by 1998 the Canadian side was getting more attention with the Detroit River Canadian Cleanup.

Green, who works for that partnership, said the latest plan is stage two of three in a remedial action plan to clean up the river.

Of the 14 beneficial uses listed in 1991 as marks against the river, only two have been crossed off the list: good tasting drinking water and a lack of algae blooms in the Detroit River.

Taste and odour problems from the 1990s that were thought to be related to a chemical secreted by blue green algae are now gone, she said. That chemical is no longer present in the water. The taste issue isn't about chlorine or people's preferences, she cautioned.

COMMENT ONLINE

The Detroit River Canadian Remedial Action Plan Report is available at www.detroitriver.ca and people can comment online at that site on what they'd like to see in the cleanup plan. Public meetings on the report are in Amherstburg Oct. 27 at a location to be determined, LaSalle Oct. 28 at the Vollmer Recreation Complex and Windsor Oct. 29 at Mackenzie Hall. The open houses will be held between 3:30 and 7:30 p.m. Written comments should be sent before Nov. 9 to Natalie Green, 311-360 Fairview Ave. W. in Essex, N8M 1Y6 or by e-mail to postmaster@detroitriver.ca.

Fish tumours, restrictions on fish consumption, beach closings and loss of fish and wildlife habitat are some of the things that continue to be listed as problems.

Matthew Child, director of watershed restoration with the Essex Region Conservation Authority, helped write parts of the report. He said it's a helpful document to justify more help for the Detroit River.

He said there were dramatic improvements in the 1970s and 1980s but that has levelled off and it will take too long to delist the river as an area of concern if work continues at the same pace.

"We need to be doing more and we need to be doing it more intensively," Child said.

Green said it's difficult to gauge when the river could get off the list of hot spots. She said the river could be bumped up to an area of recovery in 10 years.

Residents can help the river by not putting pesticides and fertilizers on their lawns, not dumping chemicals in the sewers and washing cars on their lawns or at car washes where the soapy water can be collected and not sent to the river.

The five-year plan recommends studying the reproduction of black-crowned night herons. In the past contaminants in the river such as DDT softened egg shells. The leopard frog is another good species to study since it starts its life in water, Green said. Researchers can check to see if they are finding frogs with deformities.

The river has some recent success stories. In 2005, the first spawning by lake whitefish in the Detroit River in almost a century was documented and this spring lake sturgeon eggs were found on a spawning bed built for them at Fighting Island.

OPINION

Detroit River

Think of it as infrastructure

When we think of infrastructure, it's usually bridges, roads, sewers and communication systems that come to mind. Most of us wouldn't think of the Detroit River, but in reality it fits the traditional definition of infrastructure, which are those things that provide a foundation to support and sustain the economy, and simply provide a better quality of life.

It's fair to say many of us don't appreciate the river as much as we should. Consider how Antoine de la Mothe Cadillac, French explorer and founder of Detroit, described the Detroit River in 1702:

"This river is scattered over, from one lake to another both on the mainland and the islands, with large clusters of trees surrounded by charming meadows. Game is very common, as are geese, and all kinds of wild ducks. There are swans everywhere, there are quails, woodcocks, pheasants and rabbits, turkeys, partridges, hazelhens and a stupendous amount of turtle doves. This country is so temperate, so fertile and so beautiful that it may justly be called 'The Earthly Paradise of North America."

Over time, however, the habitat and the quality of water was allowed to deteriorate as pollution from industry, sewers and septic tanks began to take a toll on the flora and fauna — even threatening the drinking water along the 51-kilometre stretch of water.

Finally, just over 35 years ago, Washington and Ottawa began recognizing pollution problems in the Great Lakes and, in particular, the Detroit River that was singled out as an "area of concern." Since then, a great deal of money and effort have been spent on improving water quality.

However, the battle to clean up the river is far from over. Which takes us to Detroit River Canadian Remedial Action Plan (RAP) report, and its just-released five-year, $79-million plan to continue the process.

And one of the key initiatives in the report is a clear recognition by three levels of government that the Detroit River is an essential piece of infrastructure, one that is critical to our livelihoods and future.

Ottawa, Queen's Park and the city are splitting the $60-million price tag to build a football-sized retention basin that will prevent sewage from flowing into the river during storms. Appropriately, the project falls under the senior governments' infrastructure spending initiative.

Environmental groups have long criticized Windsor as one of the top polluters of the Great Lakes when it comes to raw sewage, and overflows can happen up to 50 times a year. The basin should solve this serious problem.

The five-year plan — which is very much a local effort that depends on local support — also includes an emphasis on restoring and protecting wetlands and wildlife habitats, monitoring fish and birds to see how the river cleanup is proceeding, and a public education component aimed at reminding local residents they can help the water quality, for example, by keeping chemicals out of the sewer or even washing cars on lawns or at car washes where soapy water can be collected an not sent into the river.

Remedial Action Plan co-ordinator Natalie Green says it's hard to say when the river will be taken off the hot spot list, but it could be an area of recovery in 10 years. In simple terms, Green says the water "is a lot better than it was." That's reason enough to convince governments at all levels to back the RAP report and ensure the Detroit River is an environmental priority.

MONDAY, OCTOBER 26, 2009

River cleanup group hosting open houses

In their attempt to clean up, enhance and sustain the Detroit River ecosystem, the Detroit River Canadian Cleanup is hosting a public open house in Amherstburg on Tuesday, LaSalle on Wednesday and Windsor on Thursday.

The DRCC will present a draft of the Stage 2 Remedial Action Plan report, expecting feedback from the public. A final copy of the report will be available online at www.detroitriver.ca by spring 2010.

The Stage 2 RAP report is meant to identify and prioritize the remaining actions required to restore the Detroit's River uses and to remove the river from the Great Lakes Area of concerns.

Comments on this issue are to be submitted in writing by e-mail, fax, mail or by using the online interactive module at www.detroitriver.ca

Written comments must be submitted by Nov. 9, 4 p.m. to Natalie Green, RAP co-ordinator of Detroit River Canadian Cleanup, 311-360 Fairview Ave. W., Essex, Ont., N8M 1Y6, fax: 519-776-8688, e-mail: postmaster@detroitriver.ca

The Windsor Star

APPENDIX 3

Public Consultation Comments

Comments received during the Public Consultation Period
September 23, 2009 to November 9, 2009

Received through the Interactive Module on Oct. 28/09:

"I coordinate Bird Studies Canada's Great Lakes Marsh Monitoring Program (MMP), which as has a long history operating in AOCs, including the Detroit River (Ontario) AOC. We have previously reported on the health of wetland habitats in the AOC, based on marsh bird and anuran community condition, in the Timmermans et al. (2004) report cited in the Stage 2 Report. I believe that we can again play an active role in contributing to the efforts of the DRCC and other AOC stakeholders to meet certain established delisting criteria associated with the Degradation of Fish and Wildlife Populations BUI and/or the Loss of Fish and Wildlife Habitat BUI.

Recently, we have worked with the St. Lawrence River (Ontario) AOC to update the AOC wetland assessment contained in the Timmermans et al. (2004) report (which is based on MMP data collected between 1995 and 2002) to include data collected between 2003 and 2008, providing a means to identify current wetland habitat functionality status and track wetland habitat recovery in the AOC. We are also currently engaged in a more in-depth project for the Niagara River (Ontario) AOC, funded by the Great Lakes Sustainability Fund. This project will also update the wetland health assessments found in the Timmermans et al. (2004) report, but also incorporates the use of aquatic macroinvertebrate, marsh bird and anuran-based Indices of Biotic Integrity (IBIs) to rank relative marsh habitat health in the AOC relative to reference conditions. This project supported Bird Studies Canada to conduct wetland-based aquatic macroinvertebrate sampling, water quality sampling, and surrounding land use analysis to contribute to these analyses. This project also incorporated a volunteer recruitment drive, featuring volunteer orientation workshops, in order to maximize MMP-based bird and amphibian data collection in the AOC. The Stage 2 RAP report indicates the need for studies of wildlife populations using measures of diversity, such as biotic indices, and indicator species. Bird Studies Canada can directly contribute to this need with respect to wetland-based bird and anuran communities using either of the approaches described above for other AOCs (using existing MMP data for analyses or actively enhancing AOC survey activity through a special project), or through some other plan. The MMP bird and amphibian monitoring protocols have been adopted as part of the Great Lakes Coastal Wetland Monitoring Plan, a binational, multi-agency plan to implement standardized, Great Lakes basin-wide monitoring protocols for coastal wetlands.

The MMP can also contribute additional population and community information about the Northern Leopard Frog, a Detroit River RAP indicator species. Certain other AOCs in the Great Lakes basin (e.g., Bay of Quinte, Rochester Embayment, Muskegon Lake) have developed delisting criteria that require wetlands, based on their bird or anuran communities, to not be impaired with respect to non-AOC Great Lakes basin averages. We have been working closely with those groups to meet their information needs. We would also welcome closer involvement with the DRCC and other Detroit River (ON) RAP stakeholders to actively monitor and assess wetland habitat in the AOC and its surrounding watershed. We currently benefit from the active involvement of Caroline Biribauer of the ERCA, who is serving as a volunteer regional MMP coordinator for us in the area. Her involvement can help benefit long-term survey coverage in the region.

Thank you for the opportunity to comment on the Stage 2 RAP report. If you have any comments or questions about this, please feel free to contact me at the email address provided."

Response:

"The Marsh Monitoring Program is acknowledged in the draft Detroit River Canadian Stage 2 Remedial Action Plan Report (Chapter 5; Existing Monitoring Programs). Furthermore, as annual work plans are developed to identify specific actions that relate to recommendations in the RAP Report, more details about partnerships will be developed. When opportunities arise that relate to Marsh Monitoring, we will contact Bird Studies Canada and/or the Regional Coordinator, Caroline Biribauer. Thank you for your continued efforts and interest in the Detroit River Area of Concern."

Received by mail on Nov. 4/09

"My husband and I are wholeheartedly in favour of doing whatever is necessary to make the Detroit River more than a garbage etc. dump. We have an asset that has been used, indiscriminately, for too, too many years."

Response:

"We appreciate your support for cleaning up the Detroit River in order to remove it from the list of Great Lakes Areas of Concern."

Received by Email on Sept.24/09

"I hope that the yellow bloom that has plagued Lake Erie these last three weeks is going to be addressed. I woke up again this morning to find the lake shore is greenish yellow. Some days it was so expansive that all I could see from the shore was yellow pea soup like gunk on the top of the lake. It stretched as far as the eye could see."

Response:

"The Stage 2 Remedial Action Plan deals specifically with issues in the Detroit River Canadian Area of Concern. Recent scientific evidence shows that algal blooms are not a problem in the Detroit River itself. Issues relating to Lake Erie are addressed through a separate management plan called the 'Lake Erie Lakewide Management Plan (LaMP)'. If you would like to know more about the Lake Erie LaMP or other issues relating to Lake Erie, please visit http://binational.net/erie/intro-e.html."

APPENDIX 4

Remedial Action Plan Report Approval Process

Listed below are the steps taken by the DRCC to complete this Detroit River Canadian Remedial Action Plan Stage 2 Report.

- A Stage 2 Writing Team was formed from representatives of DRCC member organizations.
- The Writing Team prepared drafts of the RAP Report in consultation with the DRCC Committees and Expert Work Groups at various stages in the writing process.
- A draft was endorsed by all DRCC Committees.
- The draft RAP Stage 2 Report was released for a 45 day public review period and posted on the DRCC's website for review and comment. The DRCC hosted a special event for the kickoff of the public review period and Open Houses to obtain the public's input.
- A summary of comments was prepared and reviewed by the Writing Team.
- The executive summary was translated into French.
- The DRCC Steering Committee endorsed the revised RAP Report and agreed to have it forwarded to the COA Annex Implementation Committee member agencies for their review and comments.
- Due to the binational nature of the RAP, the Canadian Report was also forwarded to the U.S. representatives of the Four Agency Management Group (U.S. EPA and MDEQ) and the Detroit River American Public Advisory Council for their comments.
- Comments were reviewed and discussed by the Writing Team. Appropriate revisions were incorporated.
- The RAP Report was posted on the Province of Ontario's Environmental Registry for 30 days (information only; no comments collected) and forwarded to the COA Management Committee Co-Chairs to present to the International Joint Commission for review.
- The final RAP Report was printed and released for distribution.