NIAGARA RIVER
Remedial Action Plan

Niagara River Remedial Action Plan Stage 2 Update

Prepared for:
The Niagara River Remedial Action Plan

December 2009

ABOVE THE RIVER

On the occasion of the one hundredth anniversary of the first treaty on water use between Canada and the United States held on the Rainbow Bridge at Niagara Falls, June 13th, 2009

A commemoration mid-bridge above a river
Shared by two countries is so clear a symbol
For meeting the other side half way
It doesn't matter if the wind off the lake
Blows away all the speeches and poems
Praising the fruits of concord between great nations.
Not one word heard, but still a statement
Is being made by the very fact of the rendezvous
That should leave the participants, when they head home
After an hour, glad to have been invited.
As for those who are losing an hour in line
As they wait in their cars at the blocked entrance,
Would-be shoppers and swimmers, seekers of vistas
Or a better luck, who knows? Maybe a few,
After their anger ebbs, will be moved enough
By the strange sight of a crowd on the bridge
High over the water to promise themselves
To bring the spirit of concord down to the street
They live on, ashamed now of their feud
With the messy neighbors they share a fence with.
If two countries can work out their differences,
Why not two families? Meanwhile, beneath the bridge,
The river still flows through a landscape
Scarred and unscarred, shunting the contents
Of one lake into another: rain water
And creek water, sewage raw and treated,
Industrial solvents and sediments, fish
That the careful prefer to leave untasted.
A flow now open to the filtering soil around it,
Now closed in hardened channels and drains.
A peaceful river that needs some help
So those who gather next on the bridge
Will be able to use it as a fine example
Of all a natural border is meant to be.
"See how the river," they'll say, "is moving along
Through towns and fields in need of nothing
But to flow tomorrow as it flows today."

Carl Dennis is the author of ten books of poetry, including, most recently, Unknown Friends (Penguin, 2007), and New and Selected Poems 1974 to 2004 (Penguin, 2004). His previous book, Practical Gods (Penguin, 2001), received the 2002 Pulitzer Prize in poetry. A recipient of fellowships from the Guggenheim Foundation and the National Endowment for the Arts, in 2000, he was awarded the Ruth Lilly Prize from Poetry Magazine and the Modern Poetry Association for his contribution to American poetry. He lives in Buffalo.

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Niagara River (Ontario) RAP Coordinating Committee:

- Jocelyn Baker, Niagara Peninsula Conservation Authority
- Valerie Cromie, RAP Coordinator
- Joad Durst, Ontario Ministry of Natural Resources
- Sandra Kok, Environment Canada
- Dan McDonell, Environment Canada
- Mary Ellen Scanlon, Ontario Ministry of the Environment

Stage 2 Review Committees

Assistance in the consultation process and the review of this report was also provided by:

Technical Committee:
For a list of members, see Appendix 1.

Steering Committee (2007) & Implementation Committee (2009):
For a list of members, see Appendix 2.

Public Advisory Committee (2007/2009):
For a list of members, see Appendix 3.

ACRONYMS

AGNPS	Agricultural Non-Point Source
AOC	Area of Concern
BUI	Beneficial Use Impairment
CAER	Community Awareness and Emergency Response
COA	Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem
CSO	Combined Sewer Overflow
DDT	Dichloro-diphenyl-trichloroethane
DFO	Department of Fisheries and Oceans
EC	Environment Canada
GIS	Geographical Information System
GLSF	Government of Canada's Great Lakes Sustainability Fund
GLWQA	Great Lakes Water Quality Agreement
HADD	Harmful Alteration, Disruption or Destruction
HHRA	Human Health Risk Assessment
IAC	International Advisory Committee
IBA	Important Bird Area
IJC	International Joint Commission
LaMP	Lakewide Management Plan
LMA	Land Management Area
MISA	Municipal Industrial Strategy for Abatement
MMP	Marsh Monitoring Program
MOE	Ministry of the Environment
MNR	Ministry of Natural Resources
NPC	Niagara Parks Commission
NPCA	Niagara Peninsula Conservation Authority
NR	Niagara Region (also known as Regional Municipality of Niagara)
NRAC	Niagara River Action Committee
NRTMP	Niagara River Toxics Management Plan
NWQPS	Niagara Water Quality Protection Strategy
NWRI	National Water Research Institute
NYSDEC	New York State Department of Environmental Conservation
OFAH	Ontario Federation of Anglers and Hunters
OMOA	Ontario Marine Operators Association
OPG	Ontario Power Generation
PAC	Public Advisory Committee
PAH	Polychlorinated Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCP	Pollution Control Plan
PPCP	Pollution Prevention and Control Planning
RAP	Remedial Action Plan
SWP	Source Water Protection
USEPA	United States Environmental Protection Agency
WPCP	Water Pollution Control Plant
WQIP	Water Quality Improvement Project
WWTP	Waste Water Treatment Plant

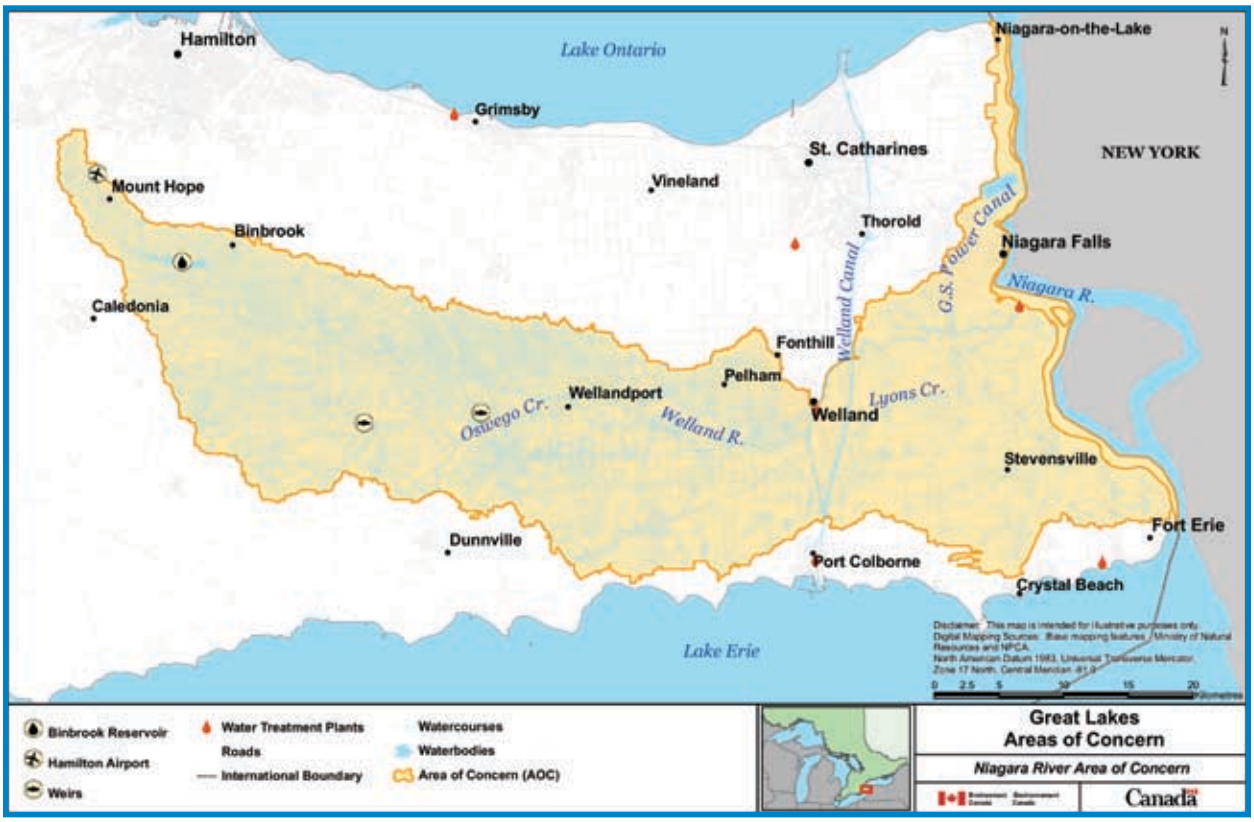
EXECUTIVE SUMMARY

There are a number of environmental hotspots around the Great Lakes as a result of historical pollution. Area of Concern (AOC) is the term used to identify those hotspots where the environment has been harmed to the point that it affects the use and enjoyment of water. In 1987, the governments of Canada and the United States identified 43 Areas of Concern. Twelve are Canadian and five are shared between Canada and the United States

Remedial Action Plans were developed and are being implemented to restore each of these AOCs. The plans follow a dynamic three-stage (Figure 1) process which includes the identification of environmental issues, also known as beneficial use impairments. There are 14 impairments which may be considered in each AOC. The beneficial use impairments identified in an AOC must be addressed before it can be delisted (i.e., removed from the list of AOC). Three (as of 2010) of the Canadian AOCs have been delisted.

Niagara River Area of Concern

The 58 km long Niagara River is the major waterway linking Lake Erie and Lake Ontario. The river was designated an AOC on both the Canadian and American sides but these areas are being managed separately. The Niagara River (Ontario) AOC extends along the entire length of the Canadian side of the Niagara River (including Niagara Falls) and also includes the Welland River Watershed (which makes up 80% of its area).



Niagara River (Ontario) AOC Boundaries

Issues identified in the Niagara River Area of Concern

The *Niagara River (Ontario) Remedial Action Plan Stage 2 Report* was released in 1995. It listed 16 goals and 37 recommendations and outlined a list of criteria for evaluating the restoration of beneficial uses. This process helped identify future actions needed to restore the AOC.

Some of the beneficial use impairments identified in the Niagara River (Ontario) AOC included:

- *Restrictions on fish and wildlife consumption*
- *Degradation of fish and wildlife populations*
- *Degradation of benthos (worms and insects that live at the bottom of the river)*
- *Eutrophication (increase in nutrients that results in decreased oxygen in the water) or undesirable algae*

These beneficial use impairments are the result of habitat destruction and a wide variety of **local contaminant sources** (e.g., urban sewage, stormwater runoff and industrial discharges, agricultural runoff, municipal sewage treatment, failing septic systems, and contaminated sediments).

In addition to these local sources, several of the impacts come from outside the Niagara River AOC (e.g., from Lake Erie, from the US side of the river, and/or from air deposition). These non-local contaminant sources, however, are beyond the scope of this Remedial Action Plan and are being addressed through other initiatives. One program set up to deal with these concerns is the Niagara River Toxics Management Plan. This binational plan's purpose is to reduce the concentrations of toxic pollutants in the Niagara River.

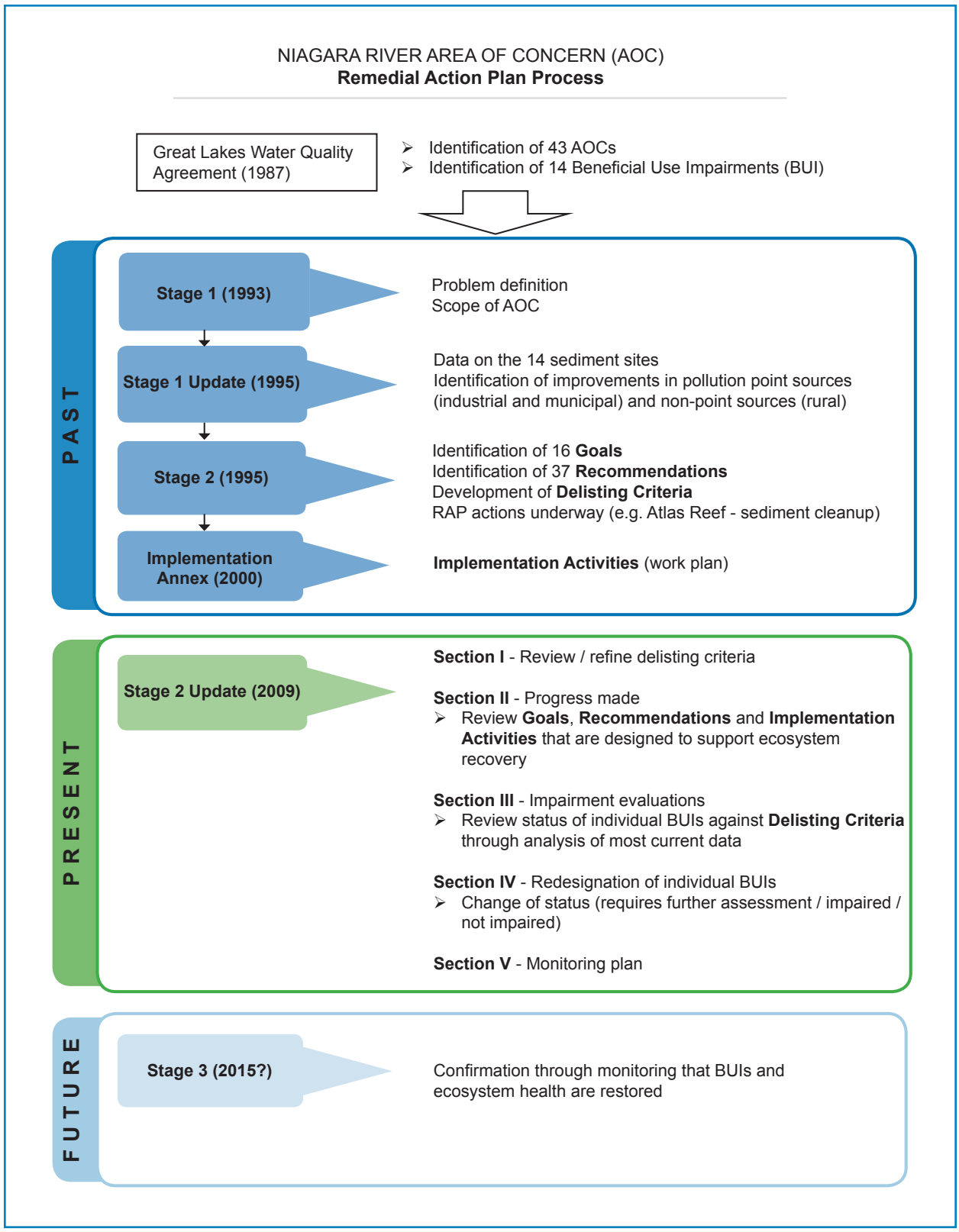


Figure 1: Remedial Action Plan Process for the Niagara River Area of Concern

Review of the Stage 2 Report

Since the release of the 1995 Stage 2 report, it is often asked:

> ***"What remains to be done in order to delist the Niagara River Area of Concern?"***
> ***&***
> ***"How long will it take to achieve delisting?"***

A full review of the Niagara River (Ontario) AOC's Remedial Action Plan Stage 2 began in 2004, with assistance from various local groups, industries, all levels of government and the general public. Assessed the status of implementation activities and the beneficial use impairments

- Identified any information gaps that require monitoring and assessment
- Focused all future actions under the Remedial Action Plan towards delisting

This review is important as many changes have occurred during the past 14 years including:

- Changes to the environmental conditions within the AOC
- Changes in remediation technologies and approaches
- Changes in programs and priorities of Remedial Action Plan partners
- Advances in analytical capabilities
- Advances in scientific understanding of environmental issues
- Changes in government policy and regulations

This *Niagara River Remedial Action Plan Stage 2 Update* replaces the 1995 Stage 2 report.

What was the Outcome of the review?

1) Progress made since the 1995 Stage 2 report

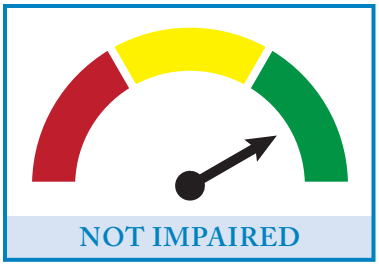
The original 16 Remedial Action Plan goals, established by the community, remained unchanged and valid.

Five of the 37 recommendations in the 1995 report have been addressed: seven are no longer applicable and six will be addressed in an updated monitoring plan. The remaining 19 were revised into a list of 12 new recommendations.

2) Charting a course to delisting

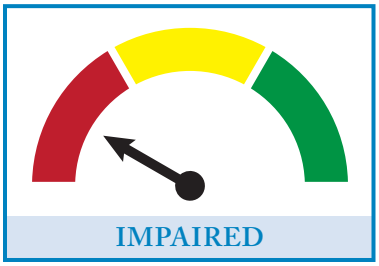
The delisting criteria (Table 1) are the performance measures for the AOC. They are the indicators that will be used to determine whether impairments have been restored. The 1995 delisting criteria were updated to reflect current standards which are considered to be scientifically defensible, specific, measurable and achievable. The new criteria can be found in the *Niagara River Remedial Action Plan Stage 2 Update report*.

The nine beneficial use impairments that were identified for this AOC were evaluated against the updated delisting criteria using the most current data. This evaluation resulted in the following update:



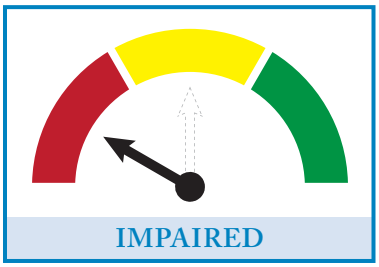
No Longer "Impaired"

- *Bird or animal deformities or reproduction problems*
- *Fish tumours & deformities*
- *Restrictions on fish and wildlife consumption* (just the wildlife component – the fish component continues to be impaired)
- *Restrictions on dredging activities* (this was originally incorrectly designated as impaired and has now been removed)



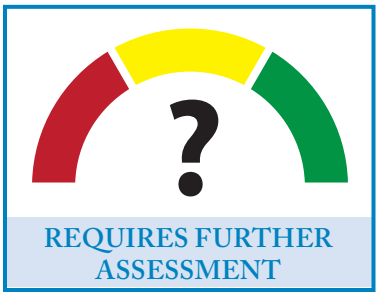
Continues to be "Impaired"

- *Degradation of benthos*
- *Beach closings*
- *Loss of fish and wildlife habitat*
- *Restrictions on fish consumption*
- *Degradation of fish populations*



From "Requires Further Assessment" to "Impaired"

- *Degradation of fish and wildlife populations* (just the degradation of wildlife populations component – resulting in the entire beneficial use impairment now being listed as impaired)
- *Eutrophication or undesirable algae* (just the undesirable algae component – resulting in the entire beneficial use impairment now being listed as impaired)



Continues to "Require Further Assessment"

- *Degradation of phytoplankton and zooplankton populations*

3) What remains to be done?

It was clear from this review that while a lot of positive work has been completed there is still work to be done in order to deal with the impairments listed on page viii. Some of the remaining key actions include:

1. Assessing and addressing sources of nutrients leading to eutrophication of the Welland River and its tributaries.
2. Restoring and protecting fish and wildlife habitat, including unique habitats rarely found in other parts of the Great Lakes basin, and reducing the impacts of hydroelectric operations at the Sir Adam Beck Generating Station on the river upstream of the Chippawa Power Canal.
3. Completing assessments for the beneficial use impairment *degradation of phytoplankton and zooplankton populations* and implementing appropriate actions for any other beneficial uses deemed impaired.
4. Completing assessment of Queens Royal Beach and implementing any required actions to reduce E.coli at this beach.
5. Developing and implementing an updated monitoring plan to help track progress of the beneficial use impairments and ensure they don't regress.
6. Based on community input and scientific studies, it was decided that a monitored natural recovery process is the most suitable approach to manage PCB-contaminated sediment in Lyons Creek East. Administrative controls will be developed and implemented to ensure that the sediments are not disturbed.

The review process also demonstrated how important actions by the community are to the Remedial Action Plan process. For example, the Niagara Water Strategy was initiated by the Region in 2003. It established various goals and objectives in response to stakeholder input. Those goals relevant to the Remedial Action Plan principally revolve around the need to maintain and protect water quality throughout the watershed area. Remedial Action Plan related activities proposed by the strategy include eliminating combined sewer overflows and identifying key environmental systems reliant on clean water. Projects related to the Niagara River Remedial Action Plan have been identified as key priority actions in the current work program.

Another significant example of local action is the successful work that the Niagara River Restoration Council (in partnership with the Niagara Peninsula Conservation Authority and Environment Canada) has achieved in restoring fish access to many of the tributaries in the Niagara River (Ontario) AOC. This project unlocked approximately 511 km of potential fish habitat (based on available GIS data). It is anticipated that this will assist in a greater number of fish being able to reach areas where they can reproduce.

These successes, and many more like them, illustrate how this Remedial Action Plan depends on support and leadership by its various partners and stakeholders to make progress towards removing the Niagara River from the list of Areas of Concern in the Great Lakes.

Table 1: Delisting Criteria for the Niagara River Area of Concern

Beneficial Use Impairment	Proposed Delisting Criteria (March 2009)	Status	Status change
1) Restrictions on Fish and Wildlife Consumption Typically broken into two sections when assessed: ◦ Fish Consumption	1. No restrictions on the consumption of sport fish in the Ontario portion of the AOC due to locally-controllable contaminant (PCBs and dioxin-like PCBs) sources. The probable sources of contaminants causing the restrictions will be considered; locally controllable contaminant sources will be addressed by the Niagara River RAP. Any regional or upstream sources that are likely the cause of remaining restrictions on sport fish consumption in the AOC will be identified and referred to a broader regional program (i.e., Lake Ontario Lakewide Management Plan, Lake Erie Lakewide Management Plan and Niagara River Toxic Management Plan). Restrictions on sport fish consumption in the AOC will be evaluated through comparison to restrictions present in appropriate fish species from a suitable non-AOC reference site or sites. 2. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife consumption, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.	Impaired	
◦ Wildlife Consumption	(Note: A delisting criteria was never developed as this BUI component was never shown to be Impaired only Requiring Further Analysis.)	Not Impaired	Status changed – See Stage 2 update section 3.4
2) Tainting of Fish and Wildlife Flavour		Not Impaired	

3) Degradation of Fish & Wildlife Populations Typically broken into four sections when assessed: • Degradation of Fish Populations • Body Burdens of Fish • Degradation of Wildlife Populations • Body Burdens of Wildlife	3. Maintenance of fish community populations, on the Canadian side of the Niagara River, at or above suitable non-AOC reference sites OR meets fish community objective(s) identified through a fisheries management plan by Ontario Ministry of Natural Resources. 4. Maintenance of wetland-dwelling wildlife populations and diversity at or above suitable non-AOC reference sites (as determined by indicators such as Indices of Biotic Integrity and/or community status assessments derived from Bird Studies Canada's Marsh Monitoring Program). 5. Maintenance of colonial nesting birds populations on the Canadian side of the Niagara River at or above suitable non-AOC reference sites, examined through the use of sentinel species (i.e., Black-crowned Night-Herons, Herring and/or Ring-billed Gulls). 6. Temporal trends in contaminant levels (PCBs and dioxin-like PCBs), examined through the use of sentinel species, (i.e., Herring Gull, night-heron, snapping turtle eggs, and/or livers of mink), are stable or declining. Spatial comparisons show that contaminant concentrations in the eggs of the above species in areas under the influence of the Niagara River (Ontario) AOC are equal to or less than those from sites removed from any influence of the AOC. If the whole body burden concentrations do exceed this level then they must not result in a population level affect to the bird and/or wildlife populations. 7. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife body burdens, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.	Impaired	

4) Fish Tumours and Other Deformities	(Note: A delisting criteria will be developed if this BUI is shown to be Impaired)	Not Impaired	Status changed – See Stage 2 update section 3.8
5) Bird or Animal Deformities or Reproduction Problems	8. When the types and frequency of deformities and/or reproduction impairments associated with contaminant exposure (PCBs and dioxinlike PCBs) are similar to those at a suitable non-AOC reference site or sites, examined through the use of sentinel species (i.e., snapping turtles, herring gulls). If the types and frequency of deformities and/or reproductive impairments exceed this target then they must not result in a population level affect to the bird and/or animal populations.	Not Impaired	Status changed – See Stage 2 update section 3.5
6) Degradation of Benthos Typically broken into two sections when assessed: • Dynamics of Benthic Populations • Body Burdens of Benthic Populations	9. When acute and chronic toxicity, community composition and abundance in the benthic community are similar to non-AOC reference sites. 10. When benthic invertebrate tissue contaminant (PCBs and dioxin-like PCBs) concentrations are comparable in the AOC to those at a suitable non-AOC reference sites for contaminants that biomagnifies in the aquatic food chain and/or in cases where benthic invertebrate tissue contaminant concentrations are greater than reference sites but are below concentrations considered to impair the beneficial uses associated with the consumption of fish and wildlife. 11. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to degradation of benthos, then a Contaminated Sediment Management Strategy must be in place including a risk management approach with appropriate monitoring and mitigation measures and/or administrative controls.	Impaired	
7) Restrictions on Dredging Activities	(Note: Changed to Not Impaired as per the decision on May 4, 1998 by the Canada-Ontario Agreement RAP Steering Committee.)	Not Impaired	Status changed – See Stage 2 update section 3.6

8) Eutrophication or Undesirable Algae	(Note: Delisting criteria will be developed and directed by the results of the Eutrophication Study.)	Impaired	
9) Restrictions on Drinking Water Consumption or Taste and Odour Problems		Not Impaired	
10) Beach Closings	12. Public beaches meet the following conditions: i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known; ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 *E. coli** /100ml), or is similar to a suitable non-AOC reference site, when assessed over a period of at least three to five years; iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.	Impaired	Status unchanged – See Stage 2 update section 3.7 for the evaluation
11) Degradation of Aesthetics		Not Impaired	
12) Added Costs to Agriculture or Industry		Not Impaired	

* - *Escherichia coli*

13) Degradation of Phytoplankton and Zooplankton Populations	(Note: A delisting criteria will be developed if this BUI is shown to be Impaired)	RFA	
14) Loss of Fish and Wildlife Habitat	13. The percentage by area of wetland cover within the AOC and the percentage by stream length of riparian buffers within the AOC are not significantly different when compared to suitable non-AOC reference sites. 14. 75% of the potential barriers to fish movement (as identified through the Niagara River AOC Fish Barriers Project 2001 – Phase 1 Photo Library) must be removed or remediated restoring access to potential spawning habitat. 15. The percentage of woodland and wetland habitat by area in the AOC, and the percentage of stream length with (at least) a 30m vegetated buffer in the AOC is not significantly different when compared to suitable non-AOC reference sites. 16. The percentage by area of wetland buffers (50, 120 and 240 m width) in the AOC and of core woodland areas (within 100 and 200m of forest edge) in the AOC is not significantly different when compared to suitable non-AOC reference sites. 17. The proximity, patch size, and patch density of key habitat types (forests and wetlands) in the AOC, is not significantly different when compared to suitable non-AOC reference sites. 18. The existing areal extent of unique wildlife habitats (Wainfleet Bog complex, Niagara Gorge) is at least 80% secured and managed for long-term conservation purposes. 19. Approval of Official Plan environmental policies for AOC municipalities that protect and enhance the natural heritage system, in conformity with the applicable Provincial or Regional natural heritage policies	Impaired	

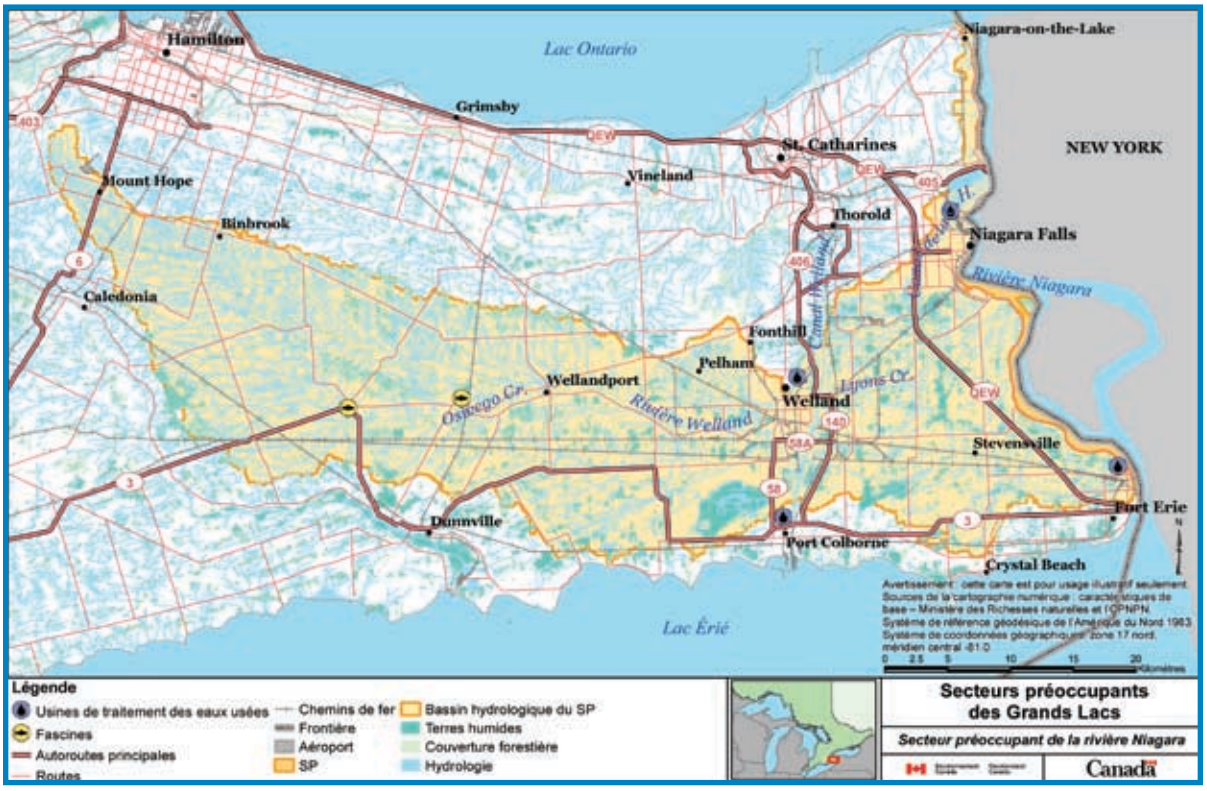
SOMMAIRE

On compte autour des Grands Lacs un certain nombre de secteurs sensibles qui sont le résultat de la pollution du passé. Le terme secteur préoccupant (SP) a été retenu pour désigner ces secteurs sensibles où l'environnement s'est dégradé au point où cela nuit à l'usage et à la jouissance des eaux. En 1987, les gouvernements du Canada et des États-Unis ont défini 43 secteurs préoccupants. Douze sont canadiens et cinq autres sont communs au Canada et aux États-Unis.

Des plans d'assainissement (PA) ont été élaborés et sont actuellement mis en oeuvre afin de restaurer chacun de ces secteurs préoccupants. Les plans suivent un processus dynamique en trois étapes (figure 1), qui comprend la définition des problèmes environnementaux, aussi connus sous le vocable d'altération des utilisations bénéfiques. On peut compter 14 altérations d'utilisation bénéfique pour chaque secteur préoccupant. Les altérations des utilisations bénéfiques d'un secteur préoccupant doivent être rétablies avant que le secteur puisse être retiré de la liste des secteurs préoccupants. Jusqu'à maintenant, deux secteurs préoccupants ont été retirés de la liste des secteurs préoccupants.

Secteur préoccupant de la rivière Niagara

La rivière Niagara, qui coule sur une distance de 58 km, est la principale voie d'eau reliant le lac Érié et le lac Ontario. La rivière a été désignée comme secteur préoccupant autant du côté canadien que du côté américain, mais ces deux secteurs sont gérés séparément. Le secteur préoccupant de la rivière Niagara (Ontario) s'étend sur toute la longueur de la portion canadienne de la rivière Niagara et comprend les chutes Niagara ainsi que le bassin versant de la rivière Welland (qui constitue 80 % du secteur préoccupant).



Limites du secteur préoccupant de la rivière Niagara (Ontario)

Problèmes relevés pour le secteur préoccupant de la rivière Niagara

Le rapport de deuxième étape du plan d'assainissement de la rivière Niagara (Ontario) *(Niagara River (Ontario) Remedial Action Plan Stage 2 Report)* a été publié en 1995. Il contient 16 objectifs et 37 recommandations et souligne la liste des critères devant servir à évaluer la restauration des utilisations bénéfiques. Ce processus a aidé à déterminer les autres mesures futures nécessaires pour restaurer le secteur préoccupant.

Voici quelques-unes des altérations des utilisations bénéfiques répertoriées dans le secteur préoccupant de la rivière Niagara (Ontario) :

- *restrictions de la consommation des espèces halieutiques et animales;*
- *dégradation des populations de poissons et d'animaux;*
- *dégradation du benthos* (vers et insectes qui vivent sur le fond de la rivière)*;*
- *eutrophisation* (augmentation des éléments nutritifs qui entraîne une diminution de la quantité d'oxygène dans l'eau) *ou apparition d'algues indésirables.*

Ces altérations des utilisations bénéfiques sont le résultat d'une destruction de l'habitat et sont causées par une grande variété de **sources locales de contaminants** (p. ex. eaux d'égout urbaines, écoulement des eaux de ruissellement et des eaux industrielles, ruissellement des terres agricoles, traitement des eaux usées municipales, fosses septiques défaillantes et sédiments contaminés).

En plus de ces sources locales, plusieurs des problèmes proviennent de l'extérieur du secteur préoccupant de la rivière Niagara (p. ex. du lac Érié, de la portion américaine de la rivière ou de dépôts aériens). Toutefois, ces **sources de contaminant**s non locales dépassent la portée du présent plan d'assainissement et seront traitées au moyen d'autres initiatives. Un des programmes mis de l'avant pour s'attaquer à ces préoccupations est le plan de gestion des toxiques de la Niagara (*Niagara River Toxics Management Plan* – NRTMP). L'objectif de ce plan binational est de réduire les concentrations de polluants toxiques dans la rivière Niagara.

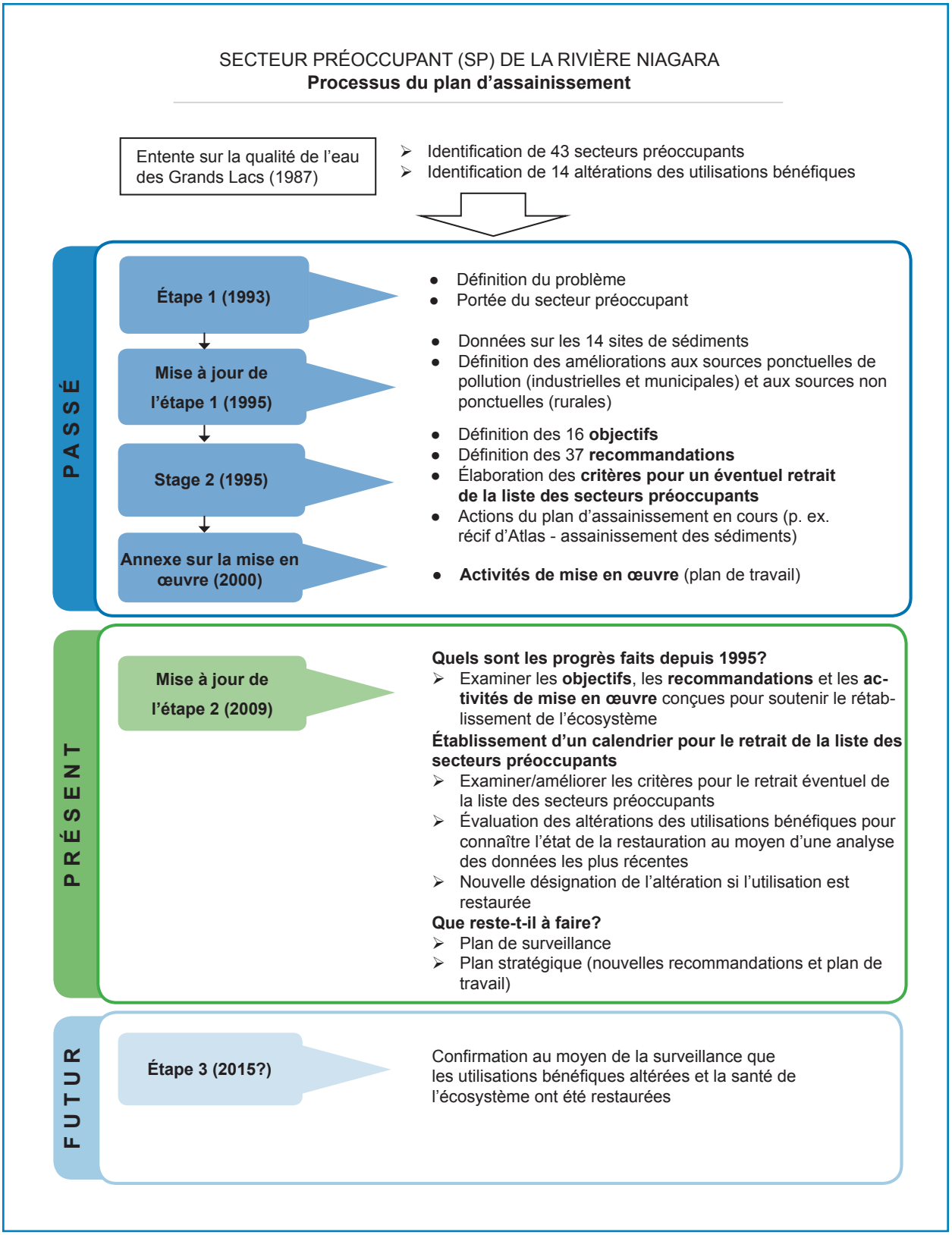


Figure 2 : Plan d'assainissement pour le secteur préoccupant de la rivière Niagara

Examen du rapport de deuxième étape

Depuis la publication du rapport de deuxième étape de 1995, les questions suivantes reviennent souvent :

> ***« Que reste-t-il à faire pour retirer la rivière Niagara de la liste des secteurs préoccupants? »***
>
> ***« Combien de temps faudra-t-il pour y arriver? »***

Un examen exhaustif du rapport de deuxième étape du plan d'assainissement pour le secteur préoccupant de la rivière Niagara (Ontario) a commencé en 2004, avec l'assistance de divers groupes locaux, secteurs industriels, paliers de gouvernement et intervenants du public en général. Cet examen visait les objectifs suivants :

- évaluer les progrès des activités de mise en oeuvre et les altérations des utilisations bénéfiques;
- cerner toute lacune en matière d'information nécessitant un suivi et une évaluation;
- axer toutes les futures mesures du plan d'assainissement vers l'objectif de retirer le secteur de la liste des secteurs préoccupants.

Cet examen est important étant donné que de nombreux changements sont survenus au cours des 14 dernières années, notamment :

- modification des conditions environnementales dans le secteur préoccupant;
- changements dans les technologies d'assainissement;
- changements dans les programmes et les priorités des partenaires au plan d'assainissement;
- progrès dans les capacités d'analyse;
- progrès dans la compréhension scientifique des questions environnementales;
- changements dans les politiques et règlements des gouvernements.

Le rapport de mise à jour de la deuxième étape du plan d'assainissement de la rivière Niagara *(Niagara River Remedial Action Plan Stage 2 Update)* remplacera l'ancien rapport de deuxième étape.

Qu'a donné cet examen du rapport de deuxième étape?

1) Progrès accomplis depuis le rapport de deuxième étape de 1995

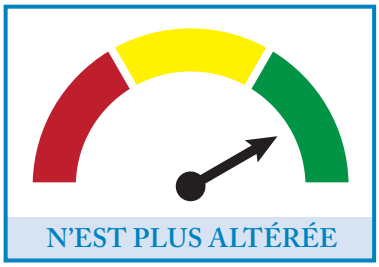
Les 16 objectifs du plan d'assainissement original, établis par la communauté, demeurent inchangés et valides.

Cinq des 37 recommandations du rapport de 1995 ont été adoptées, sept ne s'appliquent plus et six seront abordées dans un plan de mise en oeuvre mis à jour. Les 19 recommandations restantes ont été revues et intégrées à une liste de 12 nouvelles recommandations.

2) Établissement d'un calendrier pour le retrait du secteur de la liste des secteurs préoccupants

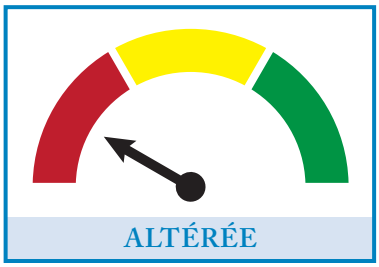
Les mesures de rendement définies pour un secteur préoccupant constituent les critères (tableau 1) régissant son éventuel retrait de la liste des secteurs préoccupants. Elles correspondent aux indicateurs qui seront utilisés pour déterminer si les altérations des utilisations bénéfiques ont été rétablies. Les critères de 1995 ont été mis à jour afin de tenir compte des normes actuelles, qui sont considérées comme étant scientifiquement défendables, précises, mesurables et réalisables. On pourra trouver la liste des nouveaux critères dans le rapport de mise à jour de la deuxième étape *(Niagara River Remedial Action Plan Stage 2 Update report)*.

Les neuf altérations des utilisations bénéfiques définies pour ce secteur préoccupant ont été évaluées en fonction des nouveaux critères en utilisant les données les plus récentes. Cette évaluation a donné lieu à la mise à jour qui suit :



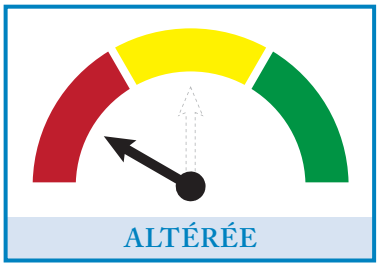
N'est plus « altérée »

- *déformations ou problèmes de reproduction chez les oiseaux ou animaux*
- *poissons affectés de tumeurs et autres déformations*
- *restrictions de la consommation des espèces halieutiques et animales* (volet touchant les espèces animales seulement – le volet relatif aux espèces halieutiques demeure altéré)
- *restriction des activités de dragage* (avait été par erreur incluse dans les altérations et a depuis été retirée de la liste).



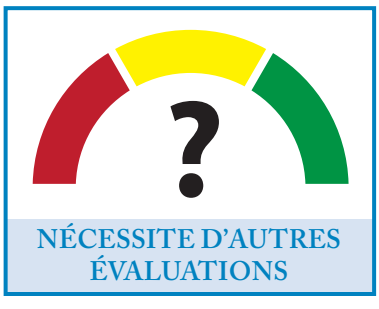
Toujours « altérée »

- *dégradation du fond des lacs et cours d'eau (benthos)*
- *fermetures de plages*
- *disparition des habitats des poissons et de la faune*
- *restrictions de la consommation des poissons*
- *dégradation des populations de poissons*



De « nécessite d'autres évaluations » à « altérée »

- *dégradation des populations naturelles de poissons et d'animaux* (volet touchant la dégradation des populations d'animaux seulement – cette utilisation bénéfique est maintenant considérée comme étant altérée)
- *eutrophisation ou apparition d'algues indésirables* (volet touchant l'apparition d'algues indésirables seulement – cette utilisation bénéfique est maintenant considérée comme étant altérée)



« Nécessite d'autres évaluations »

- *dégradation des populations de phytoplancton et de zooplancton*

3) Que reste-t-il à faire?

D'après cet examen, il est clair que même si beaucoup a été fait, il reste encore beaucoup à faire pour venir à bout des altérations énumérées ci-dessus. Voici quelques-unes des principales mesures qui demeurent :

1. Évaluer les sources d'éléments nutritifs qui mènent à l'eutrophisation de la rivière Welland et de ses affluents et s'y attaquer.
2. Restaurer et protéger l'habitat des poissons et des animaux sauvages, y compris les habitats uniques que l'on trouve rarement dans d'autres parties du bassin des Grands Lacs, et réduire les conséquences des activités hydroélectriques de la centrale Sir Adam Beck en amont du canal Chippawa.
3. Achever les évaluations concernant la dégradation des populations de phytoplancton et de zooplancton et mettre en oeuvre les mesures appropriées pour rétablir les autres utilisations bénéfiques qui ont été jugées comme étant altérées.
4. Achever l'évaluation de la plage Queens Royal et mettre en oeuvre les mesures nécessaires pour réduire la présence d'*E. coli* à cette plage.
5. Élaborer et mettre en oeuvre un nouveau plan de surveillance afin de faciliter le suivi des progrès relativement aux utilisations bénéfiques altérées et s'assurer que la situation ne se dégrade pas.
6. D'après les commentaires de la communauté et les études scientifiques, il a été décidé qu'un processus de rétablissement naturel surveillé constituait la méthode la plus appropriée pour gérer les sédiments contaminés aux BPC dans le ruisseau Lyons Est. Des mesures administratives seront élaborées et mises en oeuvre afin de s'assurer que les sédiments ne soient pas déplacés.

Le processus d'examen a également montré à quel point les actions de la communauté étaient importantes dans le processus lié au plan d'assainissement. Par exemple, la stratégie de la rivière Niagara a été lancée par cette région en 2003. Elle contient différents buts et objectifs en réponse aux commentaires des partenaires. Ces objectifs tournent principalement autour de la nécessité de maintenir et de protéger la qualité de l'eau dans tout le secteur du bassin versant. Les activités liées au plan d'assainissement et proposées dans la stratégie incluent l'élimination des débordements des égouts unitaires et l'établissement de la liste des principaux systèmes environnementaux qui dépendent d'une eau saine et abondante. Les projets liés au plan d'assainissement de la rivière Niagara sont considérés comme des mesures prioritaires clés dans le programme de travail actuel.

Comme autre exemple de l'importance des actions locales, citons les efforts fructueux du conseil de restauration de la Niagara (Niagara Restoration Council) (en partenariat avec la Niagara Peninsula Conservation Authority et Environnement Canada) qui ont permis de restaurer l'accès des poissons dans bon nombre des affluents dans le secteur préoccupant de la rivière Niagara (Ontario). Ce projet a aidé à libérer environ 511 km d'habitat potentiel pour les poissons (d'après les données du système d'information géographique disponibles). On pense que cela aidera un plus grand nombre de poissons à atteindre les secteurs où ils pourront se reproduire.

Table 2: Critères régissant le retrait de la rivière Niagara de la liste des secteurs préoccupants

Altération des utilisations bénéfiques	Critères proposés pour un éventuel retrait de la liste des secteurs préoccupants (mars 2009)	Situation	Changement à la situation
1) restrictions de la consommation des poissons et des animales Divisée en deux volets au moment de l'évaluation : ○ Consommation des poissons	1. Aucune restriction de la consommation des poissons de la pêche sportive dans la portion ontarienne du secteur préoccupant en raison de sources de contaminants contrôlables localement (BPC et BPC de type dioxine). Les sources probables de contaminants pouvant causer les restrictions seront prises en considération; les sources de contaminants contrôlables localement seront abordées dans le plan d'assainissement de la rivière Niagara. Les sources régionales ou en amont susceptibles de causer les restrictions restantes de la consommation des poissons de la pêche sportive dans le secteur préoccupant seront déterminées et examinées dans le cadre d'un programme régional élargi (plan de gestion du lac Ontario, plan de gestion du lac Érié, plan de gestion des toxiques de la rivière Niagara). Les restrictions de la consommation des poissons de la pêche sportive dans le secteur préoccupant seront évaluées au moyen de comparaisons avec les restrictions présentes pour des espèces de poissons appropriées dans des sites de référence ne constituant pas des secteurs préoccupants. 2. OU si un site contaminé (désigné par le Niagara River Contaminated Sediment Technical Advisory Group*) ne peut satisfaire aux critères décrits ci-dessus en ce qui touche la consommation des poissons et des animales, il faudra alors voir à mettre en place une stratégie de gestion des sédiments contaminés fondée sur les risques, avec tous les contrôles administratifs et toutes les mesures de surveillance et d'atténuation qui s'imposent.	Altérée	
○ Consommation des animales	(Remarque : des critères pour un éventuel retrait de la liste des secteurs préoccupants n'ont jamais été définis, puisque ce volet des altérations des utilisations bénéfiques n'a jamais été considéré comme étant altéré, mais comme nécessitant d'autres analyses.)	Pas altérée	La situation a changé – voir la section 3.4 du rapport de mise à jour de la deuxième étape
2) Modification de la saveur de la chair des poissons et animaux		Pas altérée	

3) Dégradation des populations naturelles de poissons et d'animaux Divisée en quatre volets au moment de l'évaluation : • Dégradation des populations de poissons • Charge corporelle des poissons • Dégradation des populations d'animaux • Charge corporelle des animaux	3. Maintien des populations locales de poissons, dans la portion canadienne de la rivière Niagara, à un niveau équivalent ou supérieur à celui des sites de référence ne constituant pas des secteurs préoccupants OU respect des objectifs locaux pour le poisson définis dans le plan de gestion des pêches du ministère des Ressources naturelles de l'Ontario. 4. Maintien des populations d'animaux des zones humides et diversité équivalente ou supérieure à celle de sites de référence appropriés ne constituant pas des secteurs préoccupants (déterminés au moyen d'indicateurs comme l'indice d'intégrité biotique ou des évaluations de la situation locale tirées du Programme de surveillance des marais d'Études d'Oiseaux Canada. 5. Maintien des populations d'oiseaux nicheurs dans la portion canadienne de la rivière Niagara à un niveau équivalent ou supérieur à celui de sites de référence appropriés ne constituant pas des secteurs préoccupants, évalué au moyen d'espèces sentinelles (bihoreau gris, goéland argenté, goéland à bec cerclé). 6. Tendances temporelles dans les niveaux de contamination (aux BPC et aux BPC du type dioxine), mesurées au moyen d'espèces sentinelles (goéland argenté, bihoreau, oeufs de la chélydre serpentine ou fois de visons), stables ou en déclin. Comparaisons spatiales montrant que les concentrations de contaminants dans les oeufs des espèces mentionnées ci-dessus dans les zones sous l'influence du secteur préoccupant de la rivière Niagara (Ontario) sont équivalentes ou inférieures à celles de sites retirés de toute influence du secteur préoccupant. Si les concentrations de la charge corporelle excèdent ce niveau, le niveau des populations ne doit pas affecter aux populations d'oiseaux ou d'animaux. 7. OU si un site contaminé (désigné par le Niagara River Contaminated Sediment Technical Advisory Group*) ne peut satisfaire aux critères décrits ci-dessus en ce qui touche la charge corporelle des oiseaux et des animaux, il faudra alors voir à mettre en place une stratégie de gestion des sédiments contaminés fondée sur les risques, avec tous les contrôles administratifs et toutes les mesures de surveillance et d'atténuation qui s'imposent.	Altérée	
4) Poissons affectés de tumeurs ou autres déformations	(Remarque : Des critères pour un éventuel retrait de la liste des secteurs préoccupants seront définis si cette utilisation bénéfique se révèle altérée.)	Pas altérée	La situation a changé – voir la section 3.8 du rapport de mise à jour de la deuxième étape

5) Déformations ou problèmes de reproduction chez les oiseaux ou animaux	8. Types et fréquence des déformations ou des problèmes de reproductions associés à une exposition aux contaminants (BPC et BPC du type dioxine) similaires à ceux de sites de référence appropriés ne constituant pas des secteurs préoccupants, évalués au moyen d'espèces sentinelles (chélydre serpentine, goéland argenté). Si les types et la fréquence des déformations ou des problèmes de reproduction excède ce niveau cible, le niveau des populations ne doit pas être affecté aux populations d'oiseaux ou d'animaux.	Pas altérée	La situation a changé – voir la section 3.5 du rapport de mise à jour de la deuxième étape
6) Dégradation du fond des lacs et cours d'eau (benthos) Divisée en deux volets au moment de l'évaluation : • Dynamique des populations benthiques • Charge corporelle des populations benthiques	9. Toxicité aiguë et chronique, composition communautaire et abondance de la communauté benthique similaires à celles de sites de référence appropriés ne constituant pas des secteurs préoccupants. 10. Niveaux de contaminants (BPC et BPC du type dioxine) dans les tissus d'invertébrés benthiques du secteur préoccupant comparables à ceux de sites de référence appropriés ne constituant pas des secteurs préoccupants, dans le cas des contaminants qui subissent une bioamplification dans la chaîne alimentaire aquatique. Si les concentrations de contaminants dans les tissus d'invertébrés benthiques sont supérieures à celles de sites de référence, elles doivent être inférieures aux niveaux considérés comme altérant les utilisations bénéfiques associées à la consommation de poissons ou d'animaux. 11. OU si un site contaminé (désigné par le Niagara River Contaminated Sediment Technical Advisory Group*) ne peut satisfaire aux critères décrits ci-dessus en ce qui touche la dégradation du benthos, il faudra alors voir à mettre en place une stratégie de gestion des sédiments contaminés fondée sur les risques, avec tous les contrôles administratifs et toutes les mesures de surveillance et d'atténuation qui s'imposent.	Altérée	
7) Restriction des activités de dragage	(Remarque : L'utilisation bénéfique est passée à « non altérée » en vertu de la décision du 4 mai 1988 entérinée par le Canada-Ontario Agreement RAP Steering Committee.)	Pas altérée	La situation a changé – voir la section 3.6 du rapport de mise à jour de la deuxième étape
8) Eutrophisation ou apparition d'algues indésirables	(Remarque : Des critères pour un éventuel retrait de la liste des secteurs préoccupants seront définis en fonction des résultats de l'étude sur l'eutrophisation.)	Altérée	
9) Restriction de la consommation d'eau potable, ou problèmes de goût ou d'odeur		Pas altérée	

10) Fermetures de plages	12. Plages publiques respectant les conditions suivantes : i) Les sources principales de pollution fécale qui pourraient contaminer les plages ou les eaux récréatives sont connues. ii) Moins de 20 % des moyennes géométriques des échantillons d'eau prélevés durant la saison de la baignade dépassent les objectifs provinciaux de qualité de l'eau (100 *E.coli*/100 mL), ou elles sont similaires à celles de sites de référence appropriés ne constituant pas des secteurs préoccupants, lorsqu'elles sont mesurées sur une période d'au moins trois à cinq ans. iii) Les dépassements graves des objectifs provinciaux de la qualité de l'eau sont rares et sont associés à des événements locaux comme d'importantes précipitations.	Altérée	La situation a changé – voir la section 3.7 du rapport de mise à jour de la deuxième étape
11) Dégradation esthétique		Pas altérée	
12) Frais additionnels pour l'agriculture ou l'industrie		Pas altérée	
13) Dégradation des populations de phytoplancton et de zooplancton	(Remarque : Des critères pour un éventuel retrait de la liste des secteurs préoccupants seront définis si cette utilisation bénéfique se révèle altérée)	Nécessite d'autres analyses	
14) Disparition des habitats des poissons et de la faunet	13. Le pourcentage de perte par rapport à la superficie du couvert humide dans le secteur préoccupant et le pourcentage de perte par rapport à la longueur des zones tampons riveraines du secteur préoccupant ne sont pas très différents de ceux de sites de référence appropriés ne constituant pas des secteurs préoccupants. 14. 75 % des obstacles potentiels au mouvement des poissons (définis dans le cadre de la phase 1 du projet sur les obstacles au mouvement des poissons du secteur préoccupant de la rivière Niagara) doivent être éliminés ou corrigés afin de rétablir l'accès aux secteurs de frai potentiels. 15. Le pourcentage de perte par rapport à la superficie de l'habitat boisé et humide dans le secteur préoccupant, et le pourcentage de perte par rapport à la longueur des zones tampons de végétation (au moins 30 m) dans le secteur préoccupant, ne sont pas très différents de ceux de sites de référence appropriés ne constituant pas des secteurs préoccupants. 16. Le pourcentage de perte par rapport à la superficie des zones tampons humides (50 m, 120 m et 240 m de largeur) dans le secteur préoccupant et à la superficie des terrains boisés essentiels (à moins de 100 m et de 120 m de la lisière de la forêt) du secteur préoccupant ne sont pas très différents de ceux de sites de référence appropriés ne constituant pas des secteurs préoccupants.	Altérée	

	17. La proximité, la dimension parcellaire et la densité parcellaire des types d'habitats clés (forêts et terres humides) dans le secteur préoccupant ne sont pas très différentes de celles de sites de référence appropriés ne constituant pas des secteurs préoccupants. 18. L'étendue aréale existante des habitats fauniquesuniques (complexe de la tourbière de Wainfleet, gorge du Niagara) est sécurisée et gérée dans une proportion d'au moins 80 % à des fins de conservation à long terme. 19. Approbation des politiques environnementales officielles pour les municipalités du secteur préoccupant qui travaillent à protéger et à améliorer le patrimoine naturel, dans le respect des politiques provinciales ou régionales qui s'appliquent en matière de patrimoine naturel.		

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

The Niagara River was designated by the federal and provincial governments in cooperation with the International Joint Commission (IJC) as one of 43 Areas of Concern (AOCs) requiring a Remedial Action Plan (RAP). Development of the RAP is a dynamic, three-stage process based on the framework established in Annex 2 of the 1987 Protocol of the Great Lakes Water Quality Agreement (GLWQA).

In accordance with the GLWQA, each Canadian AOC has developed a RAP that guides restoration and protection efforts. All RAPs must proceed through three stages. The government agencies are also required to ensure that the public is consulted in all actions undertaken.

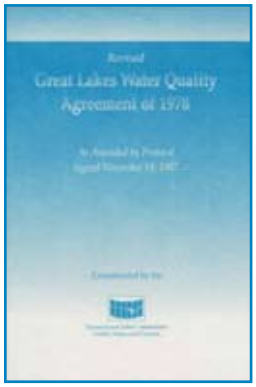


Figure 3: Revised GLWQA

Stage One: determine the severity and underlying causes of environmental degradation or impairment of beneficial uses that is the basis for the location being designated as an AOC.

Stage Two: identify and implement actions that will lead to the restoration and protection of beneficial uses and ecosystem health.

Stage Three: confirm, through monitoring, that identified beneficial uses and ecosystem health have been restored.

Delisting

When Stage Three is complete, the AOC is "delisted", that is, removed from the list of AOCs. Delisting an AOC means that the delisting criteria identified in the RAP have been achieved. The decision to delist an AOC is made by the federal, provincial, and local RAP participants, with advice from the International Joint Commission. As of 2010, of the 17 Areas of Concern in Canada, three have been delisted, Collingwood Harbour, Severn Sound and Wheatley Harbour.

What is the International Joint Commission?

The International Joint Commission (IJC) is an independent binational organization established by the Boundary Waters Treaty of 1909. Its purpose is to help prevent and resolve disputes relating to the use and quality of boundary waters and to advise Canada and the United States on related questions.

What is the Great Lakes Water Quality Agreement?

The Agreement, first signed in 1972 and renewed in 1978, expresses the commitment of Canada and the United States to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem and includes a number of objectives and guidelines to achieve these goals. It reaffirms the rights and obligation of Canada and the United States under the Boundary Waters Treaty and has become a major focus of Commission activity.

In 1987, a Protocol was signed amending the 1978 Agreement.

The Protocol called for the development and implementation of Remedial Action Plans (RAPs) to restore ecosystem health at 43 Areas of Concerns (AOCs) within the Great Lakes Basin. The Agreement has not been amended since 1987. Canada and the U.S. announced their intention to amend the GLWQA on June 13, 2009 at the Boundary Waters Treaty centennial celebrations.

Area of Concern means a geographic area that fails to meet the General or Specific Objectives of the Great Lakes Water Quality Agreement where such failure has caused or is likely to cause impairment of beneficial use or of the area's ability to support aquatic life. [3]

Beneficial Use Impairment (BUI) is the inability of an Area of Concern to support aquatic life or other beneficial uses for humans and wildlife (e.g., swimming, fishing, drinking water, ecological health, fish and wildlife habitat.)

The IJC has identified fourteen beneficial uses to use as criteria for designating AOCs.

1. Restrictions on Fish and Wildlife Consumption
2. Tainting of Fish and Wildlife Flavour
3. Degraded Fish and Wildlife Populations
4. Fish Tumours or Other Deformities
5. Bird or Animal Deformities or Reproduction Problems
6. Degradation of Benthos
7. Restrictions on Dredging Activities
8. Eutrophication or Undesirable Algae
9. Restrictions on Drinking Water Consumption, or Taste and Odour Problems
10. Beach Closings
11. Degradation of Aesthetics
12. Added Costs to Agriculture or Industry
13. Degradation of Phytoplankton and Zooplankton Populations
14. Loss of Fish and Wildlife Habitat

[3] Revised Great Lakes Water Quality Agreement of 1978

1.1 Description of the Area of Concern (AOC)

The Niagara River (Ontario) AOC lies within the Great Lakes basin and extends from Fort Erie (Lake Erie) to Niagara-on-the-Lake (Lake Ontario). It includes several small tributaries to the Upper Niagara River and the Welland River watershed (as shown in Figure 2). The Welland River watershed encompasses 81% of the Niagara River AOC; however, the river contributes less than 0.1% of the Niagara River's total flow.

The Niagara River has an annual average flow rate of 5,700 cubic metres per second and flows approximately 58 kilometres (or 36 miles) in a south to north direction. This flow accounts for 83% of the water flowing into Lake Ontario and significantly influences Lake Ontario's water quality and fish productivity. Velocity and flow in the river itself are regulated by a control structure above Niagara Falls, operated primarily to divert water for hydro-electric generation purposes (discussed further in Section 1.2.1). Flow over the falls at Niagara and through the power plants is governed by the 1953 Niagara River Treaty[1].

The Niagara River has many uses. These include a source of drinking water, fish and wildlife habitat, recreational activities, and power generation. It also provides employment to millions of people.[2] The river is also: the source of water for many industries and the receiver of their effluents; a receiver of the treated effluents of a number of municipalities that line both shores; a source of potable water for the City of Niagara Falls. Finally, both the Niagara and Welland Rivers are the receiving waters for stormwater discharges and combined sewer overflows from the older portions of urban areas within the AOC.

A brief history of pollution problems in the Niagara River AOC is provided in Appendix 4 - A Brief History of Pollution in the Niagara River and RAP Highlights.

The Niagara River, while providing a connecting channel, also presents a physical barrier (i.e., the falls) to navigation between the two lower Great Lakes. Consequently, a canal and series of locks were constructed around the Niagara Falls. The Welland Ship Canal is the current route by-passing the Niagara River and represents a second interconnecting channel between Lakes Erie and Ontario. It is used by both recreational and commercial vessels including ocean-going ships.

[1] Niagara River Remedial Action Plan. 1993. Stage 1: *Environmental Conditions and Problem Definition.*

[2] Niagara River Toxics Management Plan (NRTMP). September 2005. *Progress Report and Work Plan.*

Figure 4: Map of the Niagara River (Ontario) AOC

Quick Facts about the Niagara River AOC

- The Niagara River was designated as a binational AOC by the International Joint Commission in 1987.[8]
- Remedial Action Plans are being developed independently by the Canadian and U.S. sides to improve the overall health of the Niagara River.[8]
- The Niagara River corridor received the global designation as an Important Bird Area (IBA) in 1996.[9]
- The Niagara River AOC falls within the Carolinian life zone and contains, or is in proximity to, unique habitats for wildlife, most notably Wainfleet Bog, Niagara Gorge, and the Niagara Escarpment.
- Over 100 wetlands within the AOC are recognized as provincially significant wetlands.[10]

[8] International Joint Commission. June 2002. *Niagara River Area of Concern Status Assessment.*

[9] Niagara River Corridor IBA Working Group. 2002. IBA *Conservation Plan for the Niagara River Corridor IBA.*

[10] Environment Canada - Canadian Wildlife Service. 2006. *Current Status, Trends and Distributions of Aquatic Wildlife in the Niagara River (Ontario) Watershed.*

It is important to note that, although the Niagara River AOC encompasses the Niagara watershed on both sides of the border, RAPs are being developed separately in New York State and Ontario. The Ministry of the Environment (MOE) is the lead agency for the Ontario portion under the Canada-Ontario Agreement (COA) Respecting the Great Lakes Basin Ecosystem. The New York State Department of Environmental Conservation (NYSDEC) continues to be the lead agency for the New York State portion.

1.2 Land Uses in the Area of Concern

The major land uses in the AOC are rural with areas of urban development. The majority of the land base in Niagara is classified as prime agricultural land under the Canada Land Inventory. The combination of climate, physiography, soils and location make the Niagara region one of the most productive areas in Canada, and it ranks second in North America in terms of stability for producing stone fruit. These productive areas result in Niagara being recognized as one of the most significant agricultural areas in Canada. In addition to the climate and good soils, Niagara farmers have access to one of the world's largest supplies of fresh water. The richness of Niagara's physical attributes allows the area to produce much more than fruit and grapes; the greenhouse, poultry and egg, cash crop, livestock, and dairy commodity sectors also thrive in Niagara.[4]

The major urban centres in the AOC are the cities of Niagara Falls and Welland (with populations of 82,184 and 50,331 respectively [5]). Niagara Falls is the primary tourist destination in Ontario, receiving 50 percent of all travellers entering the province. Nearly 20 percent of all cross-border crossings from Canada to the United States are accommodated by the four major bridges spanning the Niagara River.[6] The geographic location and extent of the Niagara River (Ontario) AOC is shown on the previous page (figure 4).

[4] Regional Municipality of Niagara. July 25, 2003. *Regional Agricultural Economic Impact Study.*

[5] Statistics Canada Census 2006.

[6] Innovation in Canada: Innovation Performance – Niagara Region. www.innovationstrategy.gc.ca

1.2.1 The Welland River watershed

The Welland River watershed is the largest (total drainage area of 1,023 km^2) and most stressed watershed within the Canadian side of the AOC. With a significant vertical drop (78 m) over the first 55 km, and only a slight (4 m) drop over the lower 80 km, the Welland River is a meandering, sluggish river from Port Davidson downstream[7]. Runoff and wastewater inputs from agricultural and urban areas, the lack of riparian plants in some sections, the generally warm water temperatures, and the lack of any aeration sites such as rapids or waterfalls, result in low dissolved oxygen concentrations within sections of the river[11]. Consequently, as the largest tributary in the Niagara River AOC, it is the focus of many of the recommendations and implementation activities which are designed to support ecosystem recovery in the Niagara River RAP. This recovery is evaluated through the delisting criteria.

The Queenston-Chippawa Power Canal flows northward from the Welland River at a point six kilometres west of the junction with the Niagara River. This human made structure causes the entire flow of the Welland River to flow through the Power Canal. The operation of flow diverting control structures in the Niagara River also cause a portion of the Niagara River to flow into the natural outlet of the Welland River (moving upstream) and into the power canal.

This water diversion causes the section of the Welland River between Chippawa and the Queen Elizabeth Way (locally known as Chippawa Creek) to flow westward (upstream) once a day as a larger amount of water is impounded during the night. This regulated diversion of water in the lower Welland River creates a pattern of regular diurnal fluctuation in water levels that extends approximately 60 km upstream of the diversion. The Welland River now discharges to the Lower Niagara River via the tailraces of the power plants at Queenston.

This water flow alteration has resulted in impacts to the existing fish populations and their habitat.

[7] Niagara Peninsula Conservation Authority. November 1999. *Welland River Watershed Strategy.*

[11] Philips Engineering Ltd. November 2003. Draft Final Report. *Welland River Water Level Fluctuation Study.*

PAC History

Input from the Public Advisory Committee (PAC) guided the development of the Stage 1 and Stage 2 reports. The PAC then became incorporated as the Niagara River Restoration Council[12] to implement some of the Recommendations. Since then, the Council has been active in building stream buffers[13], as well as removing or remediating barriers to fish migration in streams within the AOC.[14] (See Appendix 3 – for the members of the PAC)

What Do They Mean?

Goals = Community derived milestones

Delisting Criteria = Performance targets which define the desired future state of the environment in AOCs, serving as targets for environmental response to clean-up activities.

To be effective, these criteria need to be measurable, achievable, and scientifically defensible.

Delisting criteria are defined by the RAP and agreed upon by RAP agencies and the public.

Recommendations = Actions to be accomplished to achieve performance targets

Implementation Activities = Compiled into a work plan

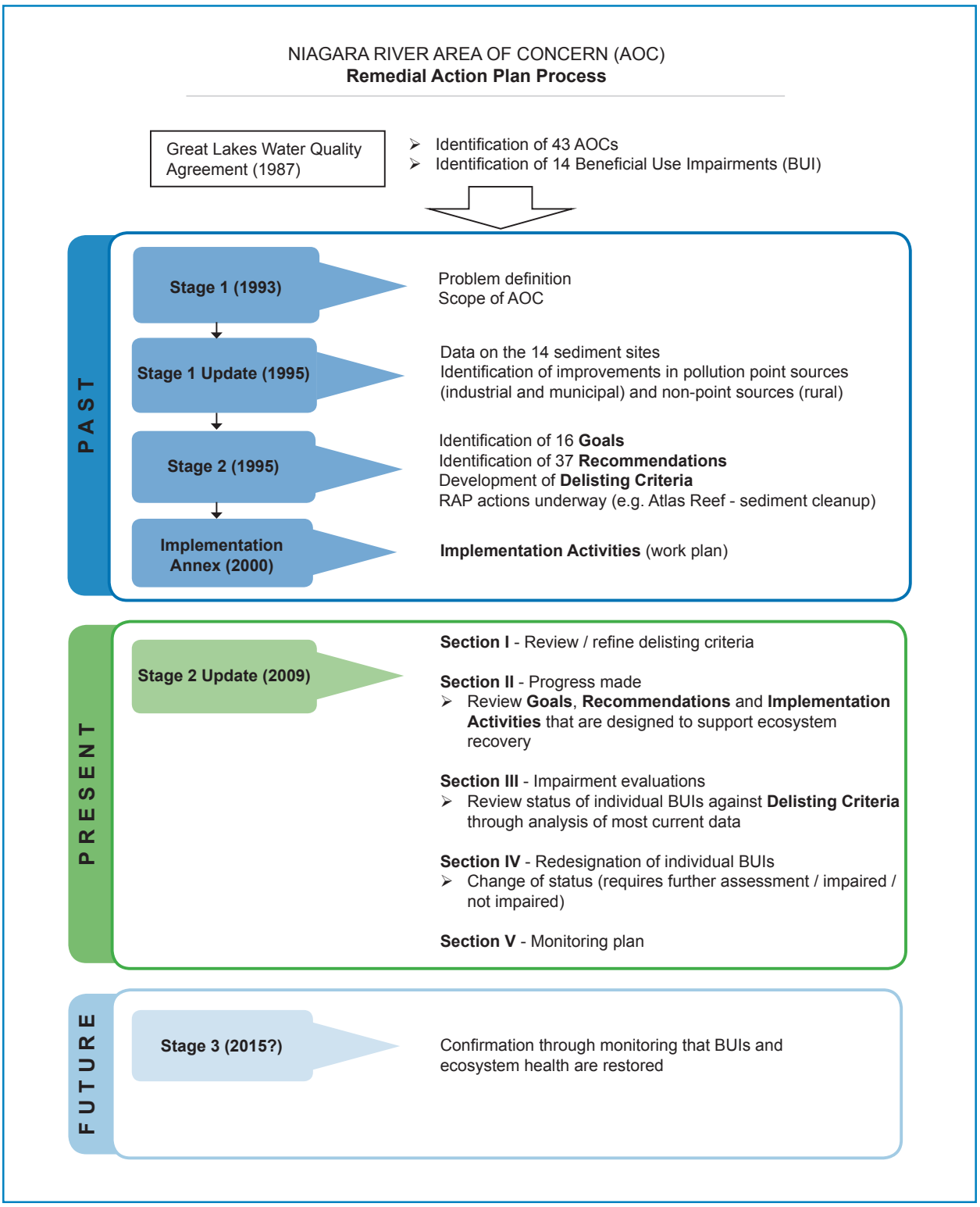
[12] www.niagararestoration.org

[13] Niagara Restoration Council. March 2005. *Niagara River Building Stream Buffers for Niagara's Rivers Project. 2004-2005 FINAL REPORT.*

[14] Niagara Restoration Council. December 2004. *Niagara River AOC Fish Barriers Project 2004.*

1.3 Brief overview of the Niagara River RAP

A history of the Niagara River RAP reports is outlined below.



The Niagara River (Ontario) AOC Remedial Action Plan process

The Niagara River AOC Stage 1 report[15] *("Environmental Conditions and Problem Definition")* was completed in September 1993. This report was followed by a Stage 1 Update report[16] detailing restoration initiatives underway by various RAP partners. The Stage 1 Update report[17] includes new information (e.g., studies) that was previously considered "outside" the scope of the Stage 1 report at the time. The purpose of these reports was to describe the current environmental conditions in the AOC, identify sources of contamination, and outline the extent of beneficial use impairments (BUIs). RAPs address local contaminant sources within the AOC. However, sources of problems outside the AOC may also contribute to BUIs, but dealing with these sources is beyond the scope of the RAP. Table 3 shows the connections between the sources of local contaminants.

Table 3: Niagara River (Ontario) Area of Concern: Causes of Beneficial Use Impairments within the AOC

BUIs	Fish Consumption Restrictions	Degradation of Fish Populations	Degradation of Wildlife Populations	Degradation of Benthos	Eutrophication	Undesirable Algae	Beach Closings	Loss of Fish Habitat	Loss of Wildlife Habitat
#	1	3	3	6	8	8	10	14	14
Sources of problem within AOC									
Industrial Point Sources	?			?					
Municipal Point Source	?	?			✓	✓	?	?	
Combined Sewer Overflows	?	?			✓	✓	?	?	
Urban Runoff		?			✓	✓	?	✓	
Rural Runoff		?	?		✓	✓	?	✓	
Sediments	✓			✓					
Spills	?	✓						?	
Natural Sources (e.g., Mercury)					?	?	?		
Fish Barriers		✓						✓	
Septic Systems					✓	✓	?		
Development Pressures		✓						✓	✓
Water Level Fluctuation		?	?		?	?		✓	

Legend: ✓ = **YES** ? = **MAYBE**

[15] Niagara River Remedial Action Plan. September 1993. *Stage 1: Environmental Conditions and Problem Definition.*
[16] Niagara River Remedial Action Plan. March 1995. *Stage 1 – UPDATE: Environmental Conditions and Problem Definition.*
[17] Niagara River Remedial Action Plan. March 1995. *Stage 1 – UPDATE: Environmental Conditions and Problem Definition.*

Table 4 below shows the sources of contaminants from outside the AOC and impacts on three of the beneficial uses.

Table 4: Niagara River (Ontario) Area of Concern: Causes of Beneficial Use Impairments outside the AOC

BUIs	Fish Consumption Restrictions	Degradation of Fish Populations	Degradation of Wildlife Populations	Degradation of Benthos	Eutrophication	Undesirable Algae	Beach Closings	Loss of Fish Habitat	Loss of Wildlife Habitat
#	1	3	3	6	8	8	10	14	14
Sources of problem within AOC									
Niagara River (NY) AOC	✓	?	?						
Atmospheric Sources	?								
Exotic Biological Species		✓	✓						
Lake Erie/Lake Ontario	✓	?							
Buffalo River AOC	?								

Legend: ✓ = **YES** ? = **MAYBE**

Input from a Public Advisory Committee (PAC) (1989 – 1998) guided the development of the Stage 1 and Stage 2 reports. From the Problem Definition presented in the Stage 1 Report, the PAC developed a set of 16 goals. These **Goals** (listed in section 2.0), formed the premise for and guided the development of the 37 recommendations in the 1995 Stage 2 report.

The **Stage 2 report** "*The Cleanup Connection*", was released in 1995. This report outlined the monitoring program needed to track project success and a RAP implementation structure. The 37 **recommendations**, selected through agency and public consultation, were chosen to help restore the impaired beneficial uses in the AOC (presented in Section 2.1). An action plan to address these recommendations in conjunction with implementation partners was then described in the *Implementation Annex*.

In 1999, the NPCA assumed the role of RAP Coordinator and thus coordinated the RAP team preparing the Niagara River RAP Implementation Annex,[18] identifying actions and stakeholders within the AOC. The **Implementation Annex** (completed in 2000) laid out implementation activities which included both a work plan and several new actions. This document also provided a framework for annual progress reporting and liaison with the appropriate RAP partners (listed in section 5.1).

This report (Stage 2 Update) is the most current information on the status of the AOC and thus replaces both the 1995 Stage 2 report and the Implementation Annex.

[18] Niagara River Remedial Action Plan. November 2000. *Implementation Annex.*

Since originally being designated an AOC in 1987 many actions have been undertaken in the AOC. Also, influencing factors have changed over time including environmental conditions, remediation technologies, analytical capabilities, and the scientific understanding of environmental issues. In 2004, the lead government agencies (EC, NPCA and MOE) initiated a review of the current state of the Niagara River AOC in Ontario. As a result of the review, the Stage 2 Update reports on the progress and accomplishments achieved to date in the RAP; the current status of the impairments in the AOC; the remaining actions needed to achieve delisting; and, describes how progress will be measured towards delisting.

Both of the Niagara River RAPs (Ontario and New York) also draw upon the Niagara River Toxics Management Plan (NRTMP) to support the reduction of toxic chemicals in the Niagara River. There are discussions underway on the principles and process for delisting binational AOCs. Further information on how these will apply to the Niagara River AOC is expected in the future.

1.4 Influences on the RAP since 1995

A number of initiatives and developments have taken place since 1995 that have an influence on the RAP. These influences affect the programs and priorities of RAP partners and agencies. These include a global designation for the Niagara River corridor, Provincial and Regional land use planning legislation, Welland River initiatives and Source Water Protection legislation. Below is a list of these initiatives and developments:

Global designation:

1996: The Niagara River corridor global designation as an Important Bird Area

Welland River initiatives:

1999: The Welland River Watershed Strategy
2007: Completion of the Welland River Water Level Fluctuation Study

Land use planning and development:

2005: *The Greenbelt Act*
2005: *Places to Grow Act*
2005: Provincial Policy Statement
2005: Niagara Region Policy Plan Amendment 187
2006: Niagara Peninsula Conservation Authority Administration of the Waterways, Valleylands and Wetlands Regulation (O. Reg. 155/06)
2009: Niagara 2031 – Regional Growth Management Strategy

What is the Niagara River Toxics Management Plan (NRTMP)?

In 1987, Environment Canada, the U.S. Environmental Protection Agency; the Ontario Ministry of the Environment and the New York State Department of Conservation – the "Four Parties" – signed the Niagara River Declaration of Intent (DOI). The purpose of the DOI is to reduce the concentrations of toxic pollutants in the Niagara River through the Niagara River Toxics Management Plan (NRTMP). Since then, the agencies for the two countries have continued pooling their resources and gathering more information on environmental conditions in and around the Niagara River.[20]

Eighteen "priority toxics" were specifically targeted for reduction, ten* of which were designated for 50% reduction from both point and non-point sources in Ontario and New York State by 1996 because they were thought to have significant Niagara River sources.[21] This target has been met or exceeded, except for certain toxics.

* - See Appendix 5 for further information on the NRTMP, the list of priority toxics and the Niagara River Mussel Biomonitoring Program.

[20] International Joint Commission. June 2002. *Niagara River Area of Concern Status Assessment*

[21] The Niagara River Toxics Management Plan. September 2005. *Progress Report and Work Plan.*

What is COA?

The Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) commits both levels of government to work together and with other groups and individuals to achieve the vision of a healthy, prosperous and sustainable Great Lakes Basin ecosystem for present and future generations.[22]

First signed in 1971, the seventh COA was signed on June 25, 2007 and currently expires on March 31, 2011. Annex 1 of the 2007 COA focuses on actions that directly support the restoration and protection of environmental quality and beneficial uses in the remaining AOCs.

A historical summary of milestones reached in the Niagara River RAP is provided in Appendix 4 – History of Pollutants and Highlights.

A **toxic substance** is defined by the IJC as one which can cause death, disease, behavioural abnormalities, cancer, genetic mutations, physiological or reproductive malfunctions or physical deformities in any organism or its offspring or which can become poisonous after concentration in the food chain or in combination with other substances.[23]

A *persistent* toxic substance in water is defined as a toxic substance with a half-life (time at which half of the original amount of chemical still exists) of greater than eight weeks.

[22] Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2004-2005 Biennial Progress Report.

[23] International Joint Commission. Revised *Great Lakes Water Quality Agreement* of 1978 as amended by Protocol signed November 18, 1987.

Water Quality Management:

2002: *Nutrient Management Act*
2003: Adoption and implementation of the Niagara Water Strategy
2004: Canadian Environmental Protection Act (CEPA, 1999) – Notice Requiring the Preparation and Implementation of Pollution Prevention Plans for Inorganic Chloramines and Chlorinated Wastewater Effluents.
2005: Introduction of Source Protection legislation and Ontario's F-5-5 CSO requirement
2006: Justice O'Connor's report (*A Strategy for Safe Drinking Water*)[19] and the *Clean Water Act*

Addressing Great Lakes Issues:

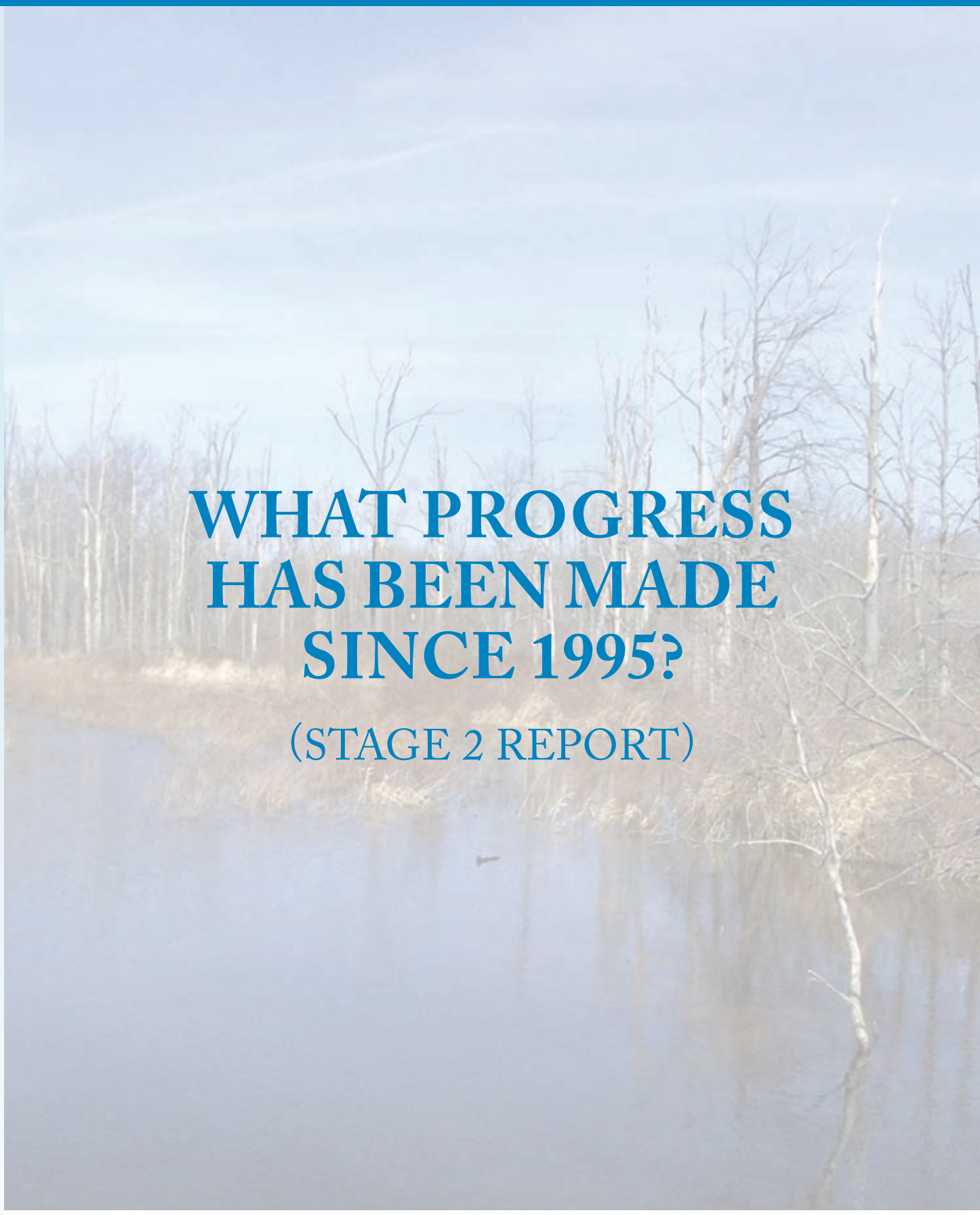
1987: Lakewide Management Plans for the Great Lakes (mandated under the Great Lakes Water Quality Agreement)
2002: International Joint Commission's Status Assessment of the Niagara River Area of Concern.
2002/07: Renewal of the Canada-Ontario Agreement (COA) Respecting the Great Lakes Water Quality Agreement

Binational Agreements:

1996: The Four Parties re-affirmed their commitment to the Niagara River Toxics Management Plan
1997: The Great Lakes Binational Toxics Strategy
2006: Review of the Great Lakes Water Quality Agreement

(For a complete description of the influences on the RAP see Appendix 6)

[19] Part Two (2002) Report of the Walkerton Inquiry: *A Strategy for Safe Drinking Water.* The Honourable Dennis R. O'Connor.



WHAT PROGRESS HAS BEEN MADE SINCE 1995?

(STAGE 2 REPORT)

2.0 REVIEW THE GOALS OF THE NIAGARA RIVER RAP

In 1995, the PAC identified environmental issues of concern in the Niagara River AOC. These issues were consolidated into a concise set of 16 goals in the Stage 2 report. These goals were used to guide the development of the RAP delisting criteria for restoring beneficial uses within the AOC. There was consensus during the review that the original goals would remain unchanged.

Table 5: Goals for the Niagara River AOC

1. Preserve and restore a good quality sustainability habitat in the Niagara River through the virtual elimination of the discharge of pollutants, with the ultimate goal of zero discharge of persistent bioaccumulative toxics.
2. Seek extensions to the NRTMP goal of a 50% reduction of 10 chemicals, for further reductions by the year 2000, with eventual complete elimination of toxic discharges.
3. Continually improve the quality of treated discharges of municipal and industrial sewage effluent, with no spills or discharges causing fish kills or other undesirable impacts.
4. Reduction and virtual elimination of Combined Sewer Overflows.
5. Improve environmental quality so that there are no adverse effects or risks to human, animal and plant life so that consumption guidelines are eliminated, and water can be used without restriction for all desired uses.
6. Remediate and restore the Niagara River ecosystem so that human health is protected from deterioration from persistent toxins and pathogens.
7. Control nutrient loading levels to a point that excessive weed and algal growth do not occur.
8. Reduce and maintain bacterial, visibility, and toxic chemical levels to permit safe swimming.
9. Ensure water quality is sufficiently free of contaminants to be suitable for potable water after treatment in a modern plant, for industrial uses with minimal treatment, and for agricultural use.
10. Identify and correct high erosion areas so that non-storm suspended solids are less than 80 mg/l, sedimentation is reduced on fish spawning beds, and all life levels of desirable fish species are unimpeded.
11. Maintain and improve fish and wildlife habitat to encourage populations at healthy, contaminant free, selfsustaining levels without fear of bio-accumulation.
12. Sustain and improve the compatible Niagara River recreational and scenic resources.
13. Maintain and improve the recreational and scenic resources through enhancements to the existing paths along the Niagara River and its tributaries, controls on the placement of fill along the gorge face, reduction of debris and litter on shore and in the water, the encouragement of natural regrowth, and the restoration of avian and other habitat along watercourses.
14. Aesthetic impact issues to be clearly addressed in any development in the AOC.
15. Reduce non-point sources of pollutants, including sediments, and eventually eliminate discharges of persistent bio-accumulative toxics.
16. Identify and correct contaminated sediment sites so that benthic community structure and toxicity is similar to unimpacted sites.

2.1 What work has been done (Recommendations and Implementation Activities)

In order to assess RAP progress, it was necessary to examine the Implementation Annex and identify the theme categories and implementation activities that were relevant to the RAP recommendations. (See Table 6 – next page). Each of these relevant initiatives was then reviewed to determine the status of their progress in the Niagara River AOC.

Did You Know?

The ***Yellow Fish Road Program*** is a nation-wide environmental educational initiative launched by Trout Unlimited Canada in 1991. Participants remind the community of the importance of clean water and of properly disposing of hazardous waste by painting yellow fish near storm drains and distributing brochures.[24] The program is coordinated locally by the NPCA and is being promoted throughout municipalities within the Niagara Peninsula.

[24] www.npca.ca/yellowfishroad.htm

Table 6: Summary of Theme Categories, Recommendations and Implementation Activities

Recommended Theme Categories (Implementation Annex)	Recommendations (Stage 2 report)	Implementation Activity (Implementation Annex)
Water Quality - Municipal	1. The Niagara River RAP become involved in Infrastructure Needs Studies.	A. Request that the Niagara Region provide an annual report of Wastewater Plant Monitoring, Pollution Control Plant Optimization and Water and Wastewater Projects completed in the Niagara River AOC.
	2. Enforce the Regional Sewer Use By-Law (By-Law #3308).	
	3. The Region of Niagara continue to work towards implementing a water pollution control plant optimization program for all its plants.	B. Liaison with the MOE to inform RAP partners and the public about regulatory monitoring efforts of Canadian point sources of persistent toxics.
	4. Enforce the MISA Municipal Program for Municipal Sewage Treatment Plants upon the promulgation of the MISA Municipal Regulation.	C. Encourage industry, business and local government participation in the Pollution Prevention Pledge and Accelerated Reduction and Elimination of Toxics programs.
	5. Landfills continue to be monitored regularly, as determined by monitoring.	
Water Quality – Rural	6. Prepare and Implement a rural non-point source (NPS) pollution remediation strategy.	D. Liaison with the Niagara Peninsula Conservation Authority Welland River Watershed Strategy activities and encourage the implementation of these strategies to all inland tributaries of the Niagara River Area of Concern.
	7. Farmers in the Niagara River AOC be encouraged to follow sound farming practices such as recommended in the Environmental Farm Plan program.	
	8. Additional funding per farm business be given to the Environmental Farm Plan Incentive Program operating in the Niagara River AOC.	E. Produce an annual progress report summarizing progress toward meeting the Action specified in the Welland River Watershed Strategy.
Sediment Quality	9. The lower Welland River (downstream of the Welland airport) be the priority focus of any sediment assessment.	F. Liaison with the Niagara District MOE to Review Contaminated Sediment data and to Develop Appropriate Action Plans
	10. Potentially contaminated locations be prioritized for review, assessment and remediation.	
	11. Test potentially contaminated sediment sites to confirm the absence / presence of contamination.	
Biota/Habitat/Land Use	12. Prepare a natural heritage strategy for the Niagara River AOC.	G. Liaison with the Niagara Parks Commission (NPC), Department of Fisheries and Oceans (DFO) and other stakeholders to pursue the objectives of the Niagara River RAP.
	13. The PAC will critically review government review processes to ensure that they embody the principles and objectives of the Niagara River RAP.	
	14. A regulation requiring treatment or exchange (or some other technique) to ensure that ballast water cannot be a way for the introduction of exotic species into the Niagara River AOC be enacted.	H. Produce an annual progress report summarizing progress toward identifying and improving habitat features along the Niagara River.
	15. Continue to protect habitat on both sides of the river as one ecosystem.	
	16. Municipal planning documents incorporate ecologically based policies and design criteria.	

Human Health	17. Develop a Niagara River Fish Consumption Advisory.	
	18. Conduct research to determine if consumption of water based wildlife is harmful to human health.	
Surveillance and Monitoring	19. Continue monitoring municipal point sources (e.g., sewage treatment plants) including but not restricted to NRTMP point source monitoring parameters.	
	20. Continue monitoring industrial point sources and publish results.	
	21. Develop and implement a Welland River and (Niagara River) Tributaries Monitoring Program.	
	22. Taste and odour program (results) be monitored (drinking water).	
	23. Continue all monitoring programs for drinking water.	
	24. Support and encourage participation in Canadian Wildlife Services' community based wildlife monitoring programs.	
	25. Implement a resident attitude monitoring program.	
Outreach and Education	26. Public education programs continue and new ones be developed as required.	I. Produce an annual persistent toxic load progress report summarizing data provided by RAP partners.
	27. Professional education programs continue and new ones be developed as required.	J. Co-ordinate and integrate public education and communication efforts with the Niagara River Toxics Management Plan (NRTMP).
General	28. Provincial and federal governments develop an integrated ecosystem approach to management for its agencies.	K. Produce an annual progress report summarizing progress toward meeting the Action specified in the Welland River Watershed Strategy.
	29. Provincial and federal governments establish specific government funding programs for RAP Implementation.	
	30. The Niagara River RAP endorse and encourage the process of multi-sectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.	L. Liaison with the Niagara Peninsula Conservation Authority Welland River Watershed Strategy activities.
	31. Establish a Geographic Information Systems repository for the Niagara River AOC.	M. Liaison and partnership with community groups. Building on existing strengths and formulating partnerships between government and non-profit organizations is the key objective of the Implementation Annex. Opportunities to form partnerships and task forces targeted toward developing specific action plans will be identified and pursued. Within these partnerships, the Niagara River RAP will strive to develop model "terms of reference" for projects completed by community liaison committees and sub-watershed strategies.
	32. Establish an International RAP.	
	33. Secure recognition of the remedial action plan as having fulfilled some of the requirements of the environmental assessment process.	
	34. Develop model "terms of reference" for remediation projects by community liaison committees.	
	35. The Ontario Ministry of Natural Resources develop an 'Introduction of Exotics' supplement to the Project Wild, Fishways and Focus on Forests programs.	
	36. Initiate the Niagara River RAP Implementation Structure.	
	37. Boat owners retain and dispose of grey water at marinas.	

2.2 Review of the Recommendations and Implementation Activities by Theme Categories

2.2.1 Water Quality – Municipal

1995 Recommendations:

#1: The Niagara River RAP become involved in Infrastructure Needs Studies (INS).

#2: Enforce the Regional Sewer Use By-Law (By-Law #3308)

#3: The Region of Niagara continue to work towards implementing a water pollution control plant optimization program for all its plants.

#4: Enforce the MISA Municipal Program for Municipal Sewage Treatment Plants upon the promulgation of the MISA Municipal Regulation.

Recommendations #1 - #4 in the Stage 2 report were developed to address the RAP goal of: *"Reduction and virtual elimination of Combined Sewer Overflows"* (see Appendix 7).

Note: The latest version of the Regional Sewer Use By-Law (#47-2008) contains mainly corrections of clerical errors. No new limits were introduced.

#5: Landfills continue to be monitored regularly, as determined by monitoring.

In the Stage 2 report, "this Recommendation calls for annual reporting for all five sites unless monitoring results warrant less frequent reporting…". The five sites included Atlas Landfill in Welland, Cytec Landfills (Welland and Niagara Falls), Bridge Street Landfill in Fort Erie and the CNR Landfill in Niagara Falls.

In 1992, detailed studies concluded that the five landfill sites were not sources of contaminants to the Niagara River and consequently were not a RAP issue. Four of the five sites are now closed. Should offsite contamination be detected at any point in the future, it will be addressed through Provincial abatement programs.

The Bridge Street Landfill in the Town of Fort Erie is still an active municipal site, subject to monitoring and annual reporting through the MOE Certificates of Approval.

In the Implementation Annex, the Glanbrook Landfill Site was flagged as a concern, although it was not one of the five landfills addressed by the RAP. The leachate from the site enters the City of Hamilton sewer system which discharges into the Hamilton Harbour AOC and thus is outside of the Niagara River AOCs scope.

Status of progress for Implementation activities:

A) Implementation activity: *Request that the Niagara Region provide an annual report of Wastewater Plant Monitoring, Pollution Control Plant Optimization and Water and Wastewater Projects completed in the Niagara River AOC.*

Niagara Region Water & Wastewater projects identified in the Stage 2 report have been completed and an update on their status is provided in Appendix 8. Additional projects impacting municipal wastewater quality completed or underway by Niagara Region is also provided in Appendix 7.

2.2.1.1 Pollution Prevention and Control Planning

One of the priority issues for the Niagara River RAP is the impact from combined sewer overflows (CSOs) in the watershed. In the Niagara River AOC, there are approximately 40 municipal combined sewer and/or storm outlets, with approximately 22 of these within the Welland River watershed upstream of the power canal.[25]

In the fall of 2000, the Niagara Region initiated an update of their 10- year (1995 – 2004) Water and Wastewater Master Servicing Plan[26]. The prime purpose of the report and associated studies was to develop a capital works program for the period of 2003 – 2012, together with a long-term vision for the water and wastewater systems. One of the specific conclusions of the study is that "combined sewer overflow is a major issue to be addressed throughout the region, if the Region and area municipalities are to support environmental enhancement." Also, one of the key recommendations is that "addressing Combined Sewer Overflows represents one of the most pressing needs in the region……."

CSOs are identified in the Stage 1 Reports as a priority concern. The MOE CSO Control Procedure F 5-5 requires an examination of non-structural and structural CSO control alternatives including source control; inflow/infiltration reduction; operation and maintenance improvements; control and collection structure improvements; storage and treatment strategies; and, sewer separation.[27] Municipalities are obliged to report to the MOE under F 5-5 on progress on their CSO improvements.

All municipalities within Areas of Concern have completed Pollution Control Plan (PCP) studies to address a variety of issues. In the Niagara River AOC, PCP studies have been completed in Fort Erie (1990), Niagara-on-the-Lake (1990), Niagara Falls (1996) and Welland (2001). All of these studies

[25] Mackay, Scott. April 27, 2005. Background Information, Technical Review and Proposals for Alteration of Impairment Status and/or Delisting Criteria. *Eutrophication and Undesirable Algae.*

[26] Regional Municipality of Niagara. *Water and Wastewater Master Servicing Plan Update (2003).*

[27] R.V.Anderson Associates Ltd. In association with XCG Consultants Ltd. June 2001. *City of Welland – CSO Study Environmental Assessment – Phase 2 Report.*

[28] Procedure F 5-5 is a supporting document for Guideline F-5: *"Levels of Treatment for Municipal and Private Sewage Treatment Works Discharging to Surface Waters."*

What is a Combined Sewer Overflow?

The older parts of many Canadian municipalities are served by combined sewers, which in dry weather collect wastewater and transport it directly to a wastewater treatment plant. However, in wet weather, inflows of stormwater or snowmelt can exceed the hydraulic capacity of the collection system. The excess flow is released as combined sewer overflows, in order to prevent basement flooding and damage to downstream pumping and treatment facilities.

Even though construction of new combined sewer systems was abandoned about a half century ago, the environmental problems associated with CSOs from these systems persist to this day. The Great Lakes region has been impacted by CSO discharges resulting in beach closures as well as impacts on water, sediment and aesthetic quality.[30]

Increasingly, municipal wastewater authorities in the Great Lakes region and throughout Canada are exploring new and innovative treatment technologies specifically designed for CSO.[31]

[30] Water Quality Research Journal of Canada, 2004. Volume 39, No. 4, 439 – 448.

[31] National Water Research Institute & Great Lakes Sustainability Fund. *Combined Sewer Overflow Treatment Technologies Manual.*

High Rate Treatment Facility in Niagara Falls

The Niagara Region and the City of Niagara Falls in 2007 completed construction of a new joint Central Pump Station - High Rate Treatment (HRT) facility at a cost of $26.6M.

The Central Pump Station - High Rate Treatment Project represents a significant increase in pumping capacity and associated CSO capture and treatment. This capture eliminates the Muddy Run CSO discharge to the Niagara River and represents a 12% decrease in CSO occurrences and a 62% reduction in CSO volume City wide.

The City of Niagara Falls and Niagara Region are extremely proud of the positive impact that the Central Pumping Station - High Rate Treatment facility will have on the natural environment for years to come.

(See Appendix 7 for further details)

concluded with extensive recommendations for new facilities, upgrades to existing facilities and improved operations. Implementation of Procedure F 5-5[28] by the municipalities within the AOC will substantially address RAP concerns related to CSOs.

In 2006, an audit and evaluation of CSOs was carried out by the Niagara Water Strategy and a report[29], containing a proposed CSO Management Action Plan, was circulated to the project Steering Committee Panel for discussion. The Plan was subsequently approved by Regional Council in fall 2007.

A brief summary of pollution prevention and control initiatives being undertaken by municipalities in the Niagara River AOC is provided in Appendix 7.

Municipalities are also using innovative technologies to help reduce the number of discharges of untreated waste water to the environment. One example is the construction of the new High Rate Treatment Facility in Niagara Falls.

B) Implementation activity: *Liaison with the MOE to inform RAP partners and the public about regulatory monitoring efforts of Canadian point sources of persistent toxics.*

In Ontario, the Ministry of the Environment operates the Municipal/Industrial Strategy for Abatement (MISA) program for addressing levels of persistent toxic substances in industrial direct discharges entering Ontario's waterways. The program focuses on nine industrial sectors, covering the major toxic polluters: petroleum, pulp and paper, metal mining, industrial minerals, metal casting, organic chemical manufacturing, inorganic chemical, iron and steel, and electric power generation.

Figure 5: Niagara Falls Central Pumping Stn. CSO-HRT Facility Opening

[29] Regional Niagara. September 2006. *Evaluation and Audit of Sanitary Combined Sewer Overflows.* Draft for Discussion.

The MISA regulations include monitoring and reporting requirements. MISA information is available on the MOE's Web site.[32]

The Niagara River Toxics Management Plan (NRTMP) is designed to reduce the concentrations of toxic pollutants in the Niagara River.[33] The results of monitoring Ontario point sources for ten years between 1986 and 1995 show loading reduction estimates of 99% for the 18 chemicals of concern (see Appendix 5). The NRTMP produces an annual progress report that is available to the public and hosts a public information session every three years.

C) Implementation activity: *Encourage industry, business and local government participation in the Pollution Prevention Pledge (P4) and Accelerated Reduction and Elimination of Toxics (ARET) programs.*

The Pollution Prevention Pledge (P4) and Accelerated Reduction and Elimination of Toxics[34] (ARET) programs no longer exist.

In the Niagara Region, six chemical companies participate in the Niagara Community Awareness and Emergency Response (CAER) program.[35] Information on chemical emissions reductions since 1993 is available at www.niagaracaer.com.

[32] www.ene.gov.on.ca

[33] *Niagara River Toxics Management Plan (NRTMP) Progress Report and Work Plan.* October 2007. Prepared by The Niagara River Secretariat.

[34] www.ec.gc.ca/nopp/aret

[35] www.niagaracaer.com

Eutrophication is a term used to describe nutrient pollution in water. High levels of nutrients, such as phosphorous and nitrogen, cause uncontrolled growth of aquatic plants, lowered levels of oxygen, and an environment in which many fish can not survive.[37]

Benthos are bottom dwelling organisms. Benthos comprise of:

- sessile animals such as sponges;
- some worms;
- many forms of attached algae;
- creeping forms such as snails and
- flatworms;
- burrowing forms which include most clams, worms, mayflies and midges.[38]

[37] Royal Commission on the Future of the Toronto Waterfront. 1992. REGENERATION. Totonto's Waterfront and The Sustainable City: Final Report.

[38] Remedial Action Plan for Hamilton Harbour. Stage 2 Update 2002.

2.2.2 Water Quality – Rural

1995 Recommendations:

#6: Prepare and implement a rural non-point source (NPS) pollution remediation strategy.

#7: Farmers in the Niagara River AOC be encouraged to follow sound farming practices such as recommended in the Environmental Farm Plan program.

#8: Additional funding per farm business be given to the Environmental Farm Plan Incentive Program operating in the Niagara River AOC.

For status of progress on these recommendations – see Appendix 10

Status of progress:
D) Implementation activity: *Liaison with the Niagara Peninsula Conservation Authority Welland River Watershed Strategy activities and encourage the implementation of these strategies to all inland tributaries of the Niagara River Area of Concern.*

Implementation actions in the Welland River Watershed Strategy include the following:

- Rural septic systems: The Water Quality Improvement Program (WQIP) for the Niagara River AOC as part of the RAP has been providing private landowners with stewardship incentives for over 15 years. The WQIP, formerly known as the Non-Point Source Implementation Strategy for Abatement, has evolved into a highly successful water quality improvement program.

- Forest Cover, Wetland and Riparian Habitat: The WQIP has also evolved into a highly successful wildlife habitat restoration program. Through substantial outreach and educational initiatives the WQIP has become well known in the community, promoting the benefits of land stewardship.

Governmental support in improving the Niagara Watershed has been a testimony to the public. Over the past 15 years, the WQIP has incorporated all relevant recommendations outlined in the RAP Implementation Annex.[36]

[36] Niagara Peninsula Conservation Authority. November 2000. *Niagara River Remedial Action Plan Implementation Annex.*

These recommendations include the following tasks:

- Education and Communication with the public to promote natural habitat restoration, and reduce non-point source pollution.
- Agricultural Stewardship and Monitoring Program for implementing best management farming practices (see Figure 6 – manure storage upgrade).
- Tree Planting Program focusing on increasing forest cover on private properties and the extent of riparian zones.
- Development of a Niagara River AOC restoration digital database.
- Development of educational information packages to ensure proper septic system practices.

Working in tandem with the Environmental Farm Plan project, the NPCA has completed numerous water quality improvement projects (e.g., 23 conservation farming projects, 2,515 livestock fenced from watercourses and 70 manure storages/improvements and wash water projects). The habitat component of this project has completed the restoration of 147 hectares of wetland habitat, over 53 km of riparian buffers and completed over 338 hectares of forest cover in the AOC. (See Appendix 9 for the current statistics.[39])

Figure 6: A new manure storage facility in the Niagara River AOC

[39] Niagara Peninsula Conservation Authority. March 31, 2009. GREAT LAKES SUSTAINABILITY FUND Year-end Report - Water Quality and Habitat Improvement Project for the Niagara River Area of Concern.

In addition to the NPCA, many other implementation partners have also completed habitat gains in the Niagara River AOC. A total value for the habitat accomplishments in the AOC are summarized in the table below.

Table 7: Habitat accomplishments in the Niagara River AOC

	Wetland habitat created (ha)	Riparian habitat created (km)	Forest habitat created (ha)
2009 Totals	153.0	73.0	343.3

In addition to these projects, stewardship initiatives have been carried out by Land Care Niagara[40] (LCN), through its Niagara Natural Heritage Ecological Wildlife Corridor Framework (NNHEF). The NNHEF is an annual wildlife habitat creation/water quality improvement/positive climate change activity of LCN's that includes restoration projects that benefit the Niagara AOC by increasing forest interior, connecting fragmented natural areas and increasing wildlife habitat.[41] To date this program has accomplished the planting of 720,000 trees covering at least 320 hectares within the AOC.

Note: These LCN values were not included in Table 7 due to the potential of double counting sites that were jointly planted by the NPCA and LCN.

E) Implementation activity: *Produce an annual progress report summarizing progress toward meeting the Action specified in the Welland River Watershed Strategy.*

Progress reporting is ongoing through data and reports prepared by the NPCA. Phase two of a project has been completed by the NPCA under the Great Lakes Sustainability Fund on the use of an Agricultural Non-Point Source (AGNPS) model in the Niagara River AOC as an aid to watershed management decision-making.[42] Due to the success of the pilot project in Oswego Creek, the NPCA will be using the AGNPS model and interface in watershed plans and strategies in the future. From the AGNPS model, critical areas that require water quality improvements in the Niagara River AOC are Buckhorn Creek, Elsie Creek, Little Forks Creek, Welland River West and Big Forks Creek, Sucker Creek and Oswego Creek.[43]

As a component to the Niagara Water Strategy, the NPCA completes watershed plans which report on the state of environmental health for watersheds prior to implementing a restoration program. The AGNPS model will be useful in developing the targets and priority areas for water quality improvements in the plans. The result will be a well-defined, comprehensive plan that has measurable objectives for improving water quality and habitat.

Currently within the Niagara River AOC, the One-Mile Creek Watershed Plan, the Fort Erie Creeks Watershed Plan, the South Niagara Falls Watershed Plan, the Niagara-on-the-Lake Watershed Plan and the Central Welland River Watershed Plan are complete. The Upper Welland River Watershed Plan is in progress.[44]

[40] www.landcareniagara.com

[41] Communication from Joad Durst, Area Supervisor - Niagara Area, Ontario Ministry of Natural Resources.

[42] Great Lakes Sustainability Fund. Year End Report Project #: 04-088. *Use of an Agricultural Non-Point Source model in the Niagara River AOC as an aid to watershed management decision-making.* Submitted March 15, 2005.

[43] Niagara Peninsula Conservation Authority. December 2004. Natural Heritage of the Niagara River AOC & Associated Subwatersheds. Prepared by Andrew Mack & Geoff Verkade.

[44] Personal conversation with Tara Metzger, NPCA

2.2.3 Sediment Quality

1995 Recommendations:

#9: The lower Welland River (downstream of the Welland airport) be the priority focus of any sediment assessment.

#10: Potentially contaminated locations be prioritized for review, assessment and remediation.

#11: Test potentially contaminated sediment sites to confirm the absence / presence of contamination.

Due to the fast flowing nature of the Niagara River, there are very few deposits of sediment and much of the sediment load is deposited in Lake Ontario. However, several areas in the tributaries feeding the Niagara River have had sediments contaminated with organic compounds or heavy metals.

The RAP Stage 1 Update report (1995) identified the degradation of benthos as directly related to contaminated sediments. In addition, contaminated sediments can also contribute to other BUIs such as: restrictions on fish and wildlife consumption, degraded fish populations and bird or animal deformities or reproductive problems. The Stage 1 update provided a description of the fourteen contaminated sites that had been identified and prioritized as Level 1, Level 2 and Level 3 sites based on the sediment conditions (see Table 8 – next page).

For status of progress on these recommendations – see Appendix 10

Status of progress:
F) Implementation activity: *Liaison with the Niagara District MOE to Review Contaminated Sediment data and to Develop Appropriate Action Plans.*

In 1995, a full-scale cleanup of the Welland River reef site was successfully completed.[45] The site was located just downstream of the Atlas discharge to the Welland River where deposits of mill scale, comprised mainly of the heavy metals chromium and nickel, had formed two reefs within the river.

These two reefs were identified as a significant source of contaminants to the Welland River.

[45] Acres international Ltd. December 1997. *The Full-Scale Welland River Reef Cleanup Project.* Project Assessment Report & Technical Reference Document.

What are PCBs?

Polychlorinated biphenyls (PCBs) continue to be pollutants of great concern in the Great Lakes Basin. First manufactured for commercial use in 1929[46], they were used as insulating fluid in electrical transformers and in production of hydraulic fluids, lubricants and inks. Generated and released into the environment as waste byproducts of chemical manufacturing and incineration, they include 209 related chemicals of varying toxicity. Although never manufactured in Canada, they were widely used in this country.[47] Manufacture and new uses of PCBs have been prohibited in the United States and Canada since 1977.[48]

Those PCBs which are considered to be the most toxic, based on combined health effects considerations, are referred to as "dioxin-like"[49] and their chemical structure is very similar to the more toxic forms of dioxins. See Appendix 7 for further information on "priority toxics" in the Great Lakes Basin.

Biota = the plant and animal life of a region.

[46] www.theweathernetwork.com
[47] http://www.ec.gc.ca/
[48] Royal Commission on the Future of the Toronto Waterfront. 1992. REGENERATION. Toronto's Waterfront and The Sustainable City: Final Report.
[49] www.greenfacts.org

Table 8: Niagara AOC Contaminated Sediment Areas – Status and Recommended Action

Name of Area	Potential Chemicals of Concern	Outcome of Detailed Assessment	Recommended Action
Level One Sites			
Welland River at Atlas Steel	Metals (Cr, Cu, Ni) PAHs	Remediation warranted.	Remediated (dredged) in 1995.
Lyons Creek West	PCBs, Arsenic, Zinc	Marginal risk to human health and biota identified. Not physically part of the Welland/ Niagara system.	Management strategy under development. Arsenic contaminated sediment and soil removed by Hydro One in September 2007.
Lyons Creek East	PCBs	Marginal risk to biota identified.	Monitored natural recovery was the selected management option (2008). This strategy will include administrative controls and a long-term monitoring plan.
Welland River - Port Robinson to Power Canal	Metals (Cr, Cu, Ni) PAHs, PCBs	No acute toxicity to biota observed. Localized growth impairment of some invertebrates possibly due to metal mixture of Cu, Cr and Ni. No changes at the population level expected.	Remedial efforts would have marginal benefit. Refer to AOC monitoring plan.
Level Two Sites			
Sir Adam Beck Reservoir	Metals	Concentrations low, negligible risk to biota.	No further action required.
Thompson's Creek	Metals	Elevated levels (copper) downstream of Cytec site but no observed effects on test organism.	No further action required.
Frenchman's Creek	Metals, Dioxins/Furans	No detectable risk to biota from PCDD/F and no transport of sediments from tributary to main creek.	No further action required.
Level Three Sites			
Welland River at Geon (Oxyvinyl)	Metals, Dioxins/Furans	No acute toxicity to biota observed. Localized growth impairment of some invertebrates possibly due to metal mixture of Cu, Cr and Ni. No changes at the population level expected.	Remedial efforts would have marginal benefit. Refer to AOC monitoring plan.
Black Creek Mouth	Metals (Arsenic)	No potential risks to biota.	No further action required.
Pell Creek Mouth	Metals, PAHs, PCBs	No potential risks to biota.	No further action required.
Chippawa Creek	Metals, PAHs, PCBs	Adverse effects or bioaccumulation unlikely.	No further action required.
Chippawa Power Canal	Metals, Dioxins/Furans	No potential risks to biota.	No further action required.
Niagara River at Queenston	Metals, Dioxins/Furans	Organic contaminants present but evidence that the majority of sediments being carried out into Lake Ontario with minor amounts accumulating.	Variety of possible sources precludes active remediation. Refer to NRTMP and ot her monitoringprograms.
Niagara River at NOTL	Metals, Dioxins/Furans	Risks low, effects on biota unlikely due to dynamic behaviour of sediments at the mouth of the river.	Further investigation or action not warranted. Refer to NRTMP and other monitoring programs.

Note: References for the information listed above (Niagara AOC Contaminated Sediment Areas[50] – Status and Recommended Action[51])

[50] Information compiled from Golder Associates Ltd. May 2004. Niagara River Area of Concern Contaminated Sediment Site Assessment Phase I and Phase II.

[51] Golder Associates Ltd. February 2005. *Niagara River Area of Concern Contaminated Sediment Site Assessment Phase III.*

Figure 7: Dredging deposits of mill-scale at the Welland River reef site in 1995

As mentioned above, priority areas for further assessment were identified and presented in the RAP Stage 1 Update report (1995). In 2003, a technical committee (the Niagara River Contaminated Sediment Technical Advisory Group) comprised of representatives from MOE, EC, NPCA, MNR and NR, was established and coordinated by the NPCA to evaluate contaminated sediment sites in the AOC[52]. From the results of the site assessments, four of the sites warranted further investigation. Results from further investigation indicated that Frenchman's Creek required no further action and the Welland River from Port Robinson to Power Canal would benefit little from any additional remedial action.[53] Similarly, it was assessed that remedial efforts would have marginal benefit at the Geon (Oxy Vinyls) site. For descriptions and recommended actions for the assessed sites see Table 8 (previous page).

The remaining two sites - Lyons Creek West and Lyons Creek East - are currently being addressed. Figure 8 shows the location of the Lyons Creek sites.

Originally, Lyons Creek flowed from southeast Welland and emptied into the Niagara River. From the 1940s through the 1960s, sewers servicing the City of Welland drained into Lyons Creek. In 1971, the Welland Canal By-Pass severed Lyons Creek, creating 2 separate watersheds: Lyons Creek West, which empties into the Welland Canal By-Pass; and, Lyons Creek East, which receives water that is pumped directly from the Welland Canal By-Pass.

[52] Golder Associates Ltd. May 2004. *Niagara River Area of Concern Contaminated Sediment Site Assessment Phase I and Phase II.*
[53] Golder Associates Ltd. February 2005. *Niagara River Area of Concern Contaminated Sediment Site Assessment Phase III.*

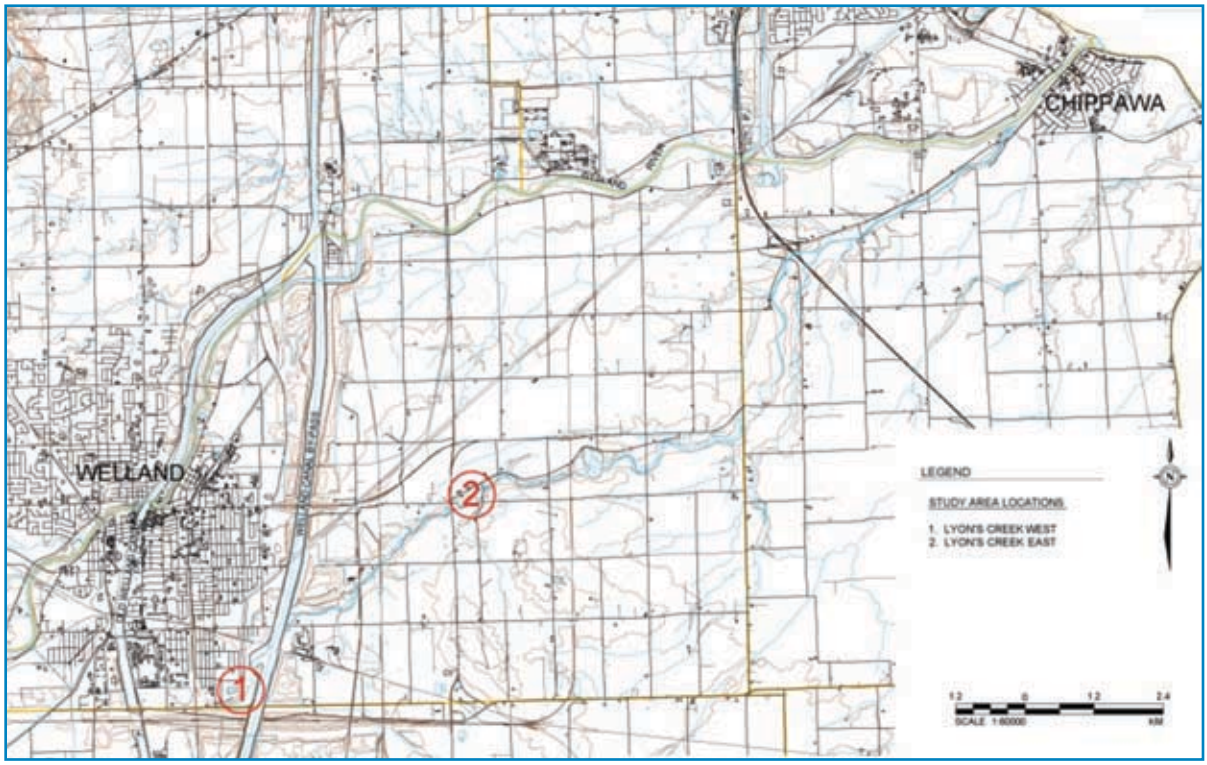


Figure 8: Lyons Creek West & East Study sites

Lyons Creek West

The property owners of this site are Hydro One, City of Welland and Transport Canada. The contaminants of concern at this site were arsenic and PCBs although it is not known to be a source of contamination to the Welland or Niagara Rivers. In 1994, Lyons Creek West was rerouted, leaving a portion of the former channel to dry up and grass over. Both sediments and soils in Lyons Creek West were found to contain elevated levels of arsenic, which posed potential human health risks.[54] PCBs, while not associated with human health risks, posed marginal ecological risks. The detailed assessments conducted on this site indicated that a sediment management strategy was required.

Sediment and soil with elevated arsenic concentrations were excavated from the Hydro One property and the site was backfilled in September 2007.[55] Therefore the human health risk was eliminated.[56]

Transport Canada owns most of the remaining area with PCB-contaminated sediment and soil, and is the lead agency in developing a sediment management strategy. Sediment management options are currently under investigation.

[54] Dillon Consulting Limited. November 2006. *Detailed Human Health Risk Assessment: Lyons Creek West* (Final Draft). Submitted to the Niagara Peninsula Conservation Authority.

[55] O'Connor Associates Environmental Inc. November 23, 2007. Letter to Hydro One Networks Inc. summarizing results of Right-Of-Way Drainage Ditch Remedial Excavation in Welland, Ontario.

[56] Dillon Consulting Limited. December 2007. *Detailed Human Health Risk Assessment: Lyons Creek West.* Submitted to the Niagara Peninsula Conservation Authority.

Lyons Creek East

Lyons Creek East sediments are contaminated with PCBs. The most elevated concentrations were detected closest to the Welland Canal By-Pass, with concentrations steadily decreasing the further east the sediments were sampled. Further investigations at the site included human health[57] and ecological[58, 59] risk assessments. The human health risk assessment concluded that there is no direct contact or exposure between people and sediments and that there is no evidence that there are risks to human health resulting from activities such as fishing and consumption of sport fish. Although the survey responses did not reveal fish consumption from the portion of the creek upstream of Buchner Road, anyone who wishes to consume fish from that area should consult the MOE's *Guide to Eating Ontario Sport Fish*[57]. The ecological assessments[59] indicated a marginal risk to biota. The detailed assessments conducted indicated that a sediment management strategy was required.

Figure 9: Lyons Creek East Wetland

The site-specific sediment management options evaluated for Lyons Creek East were: Monitored Natural Recovery, Enhanced Natural Recovery, Capping, and Removal and Wetland Restoration.

In 2006, a detailed inventory of wetland and aquatic features of the Lyons Creek East Wetlands[60] was undertaken. This was due to concerns expressed by the regulatory agencies about the impacts of potential remedial actions in the Provincially Significant Wetland complex. This study identified significant features that could potentially be affected by contaminant remediation works. These include rare plants, birds and fish species, as well as some species protected by species-at-risk legislation.

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[57] Dillon Consulting limited. November 2007. *Detailed Human Health Risk Assessment: Lyon's Creek East.* Submitted to the Niagara Peninsula Conservation Authority.

[58] Milani, Danielle & Rachael Fletcher. 2005. *PCB contamination and biological impacts in Lyon's Creek East: Implementation of a Canada-Ontario decision-making framework for contaminated sediments.* NWRI - Environment Canada and Biomonitoring Section – EMRB-MOE.

[59] Golder associates. August 2008. *Niagara River AOC Phase IV: Sediment Management Options for Lyons Creek East and West.* Submitted to Niagara Peninsula Conservation Authority.

[60] Dougan & Associates. March 2007. *Lyon's Creek East Wetland Inventory & Monitoring Study. Final Interim Report.* Prepared for the Niagara

In June 2007, as part of the sediment management strategy process, public information sessions were held during which the public provided their input on the sediment management options. Due to the interest expressed by citizens attending the Lyons Creek East Open House, a letter was sent to the community seeking volunteers to sit on a Community Liaison Committee (CLC). This Committee was then involved in the remediation planning process for Lyons Creek East. A schedule of monthly CLC meetings with topic presentations and discussion of specific agenda items was carried out from September 2007 until November 2008.

Monitored Natural Recovery is the sediment management option recommended for implementation at Lyons Creek East. In November 2008, a facilitated public open house was held to provide information on this management option which is protective of the habitat and species in the Provincially Significant Wetland. Letters of support for Monitored Natural Recovery were received from the key agencies: City of Welland, EC, MOE, NPCA, MNR and Niagara Region. The Welland Riverkeepers, a local environmental organization, also supported the option.

Monitored Natural Recovery requires both on-going long-term monitoring and the development of an administrative controls protocol.

MOE and EC are developing long-term monitoring plans. Monitoring will ensure that PCB concentrations and ecological risks continue to decrease over time.

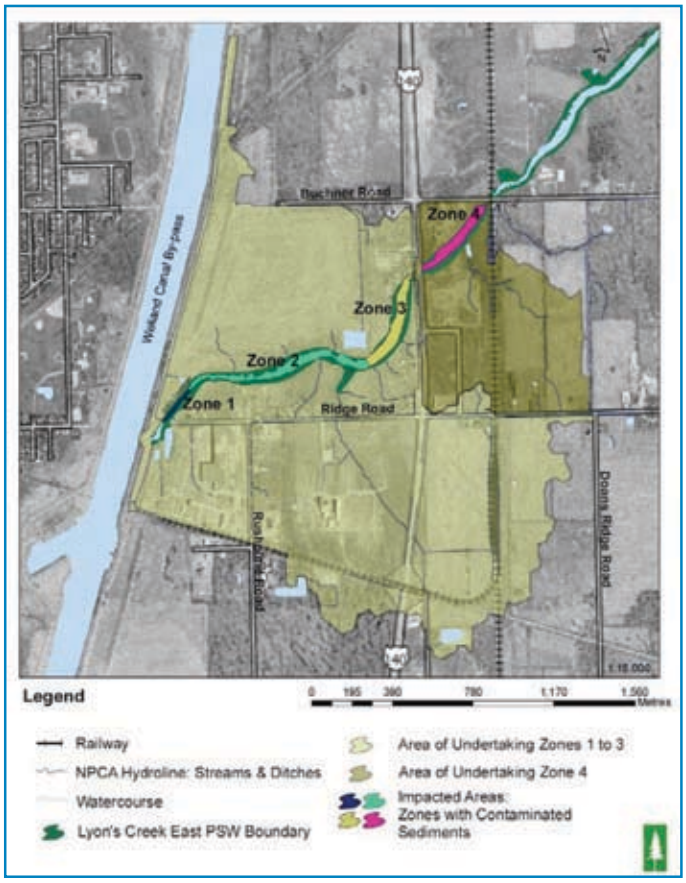

Figure 10: Lyon's Creek East Area of Undertaking for Administrative Controls

An Administrative Controls Protocol is being drafted for Lyons Creek East to restrict human activities that could potentially disturb contaminated sediments. Certain activities will be restricted in zones 1 through 4 (refer to Figure 10), and the surrounding watershed. It was decided by the TAG that the area downstream of Zone 4 (the railway bridge) did not need administrative controls but sport fish contaminant monitoring will continue.

The Administrative Controls Protocol is expected to be implemented in 2010.

2.2.4 Biota/Habitat/Land Use

1995 Recommendations:

#12: Prepare a natural heritage strategy for the Niagara River AOC.

Regional Policy Plan Amendment 187 (RPPA 187) identified a Regional Core Natural Heritage System and put in place policies to maintain, restore and, where possible, enhance the long term ecological health, integrity and biodiversity of the System. The policies address the linkages among natural heritage features and ground and surface water resources. The Core Natural Heritage System consists of:

a) Core Natural Areas (s provincially significant wetlands; provincially significant Life Science Areas of Natural and Scientific Interest (ANSIs); and significant habitat of threatened and endangered species, significant woodlands; significant wildlife habitat; significant habitat of species of concern; regionally significant Life Science ANSIs; other evaluated wetlands; significant valleylands; savannahs and tallgrass prairies; and alvars; and publicly owned conservation lands).

b) Potential Natural Heritage Corridors connecting the Core Natural Areas.

c) Greenbelt Natural Heritage and Water Resources Systems.

d) Fish Habitat.

The Core Natural Heritage System and associated policies are now being incorporated into the Official Plans of the local municipalities.

Natural Heritage Areas Inventory: There are many Environmentally Sensitive Areas (ESAs) and other natural treasures found within the NPCA's watershed. These areas support a rich diversity of natural features including significant habitats and geological formations, rare plants and animals, and important wildlife corridors. Through the years there has never been a comprehensive biological inventory of these areas. In light of that, a Natural Heritage Areas Inventory was recommended as a priority in the Niagara Water Strategy. Initiated in 2006, the NPCA, in collaboration with the Niagara Region, the Peninsula Field

Figure 11: A wetland in the Niagara River AOC

Significant features in the Niagara River

- Most of the provincially significant plant species found in the Niagara River are associated with coastal wetlands.
- Fifty-nine species of fish that use coastal wetlands on a permanent or temporary basis have been reported for the Niagara River. Niagara River wetlands also provide year-round habitat for three provincially significant fish species: Lake Chubsucker (protected by federal species at risk legislation), Grass Pickerel and Black Bullhead.
- Coastal wetlands of the Niagara River also provide habitat for a wide range of amphibians, reptiles, birds and mammals. The only reported occurrence in Ontario for both the Northern Dusky Salamander and the Alleghany Mountain Dusky Salamander are found in seeps along the river
- Niagara River wetlands also provide important nesting habitat for the provincially significant Black-crowned Night- Heron.[61]

[61] Canadian Wildlife Service & Ministry of Natural Resources. March 2003. *The Ontario Great Lakes Coastal Wetland Atlas A Summary of Information (1983-1997).*

Naturalists and others stakeholders, has been preparing a Natural Heritage Areas Inventory. From this work numerous significant species have also been identified.[62]

As well, starting in 2004, the Ministry of Natural Resources began a comprehensive update of wetland evaluations in the Regional Municipality of Niagara. This updating of wetland files is to ensure accurate and up-to-date wetland information and will be included in the Natural Areas Inventory. Most wetlands in Niagara had not been updated since the late 1980's. Wetlands are an important component of Ontario's landscapes and watersheds. They are productive and diverse habitats that provide a variety of economic, social and ecological benefits. Wetlands can contribute to groundwater recharge and discharge; the quality of surface waters; reductions in flood damages; opportunities for recreation, tourism and harvest of renewable products, and habitat for a wide variety of plant and animal species, including species-at-risk. The final report for the Natural Heritage Areas Inventory is expected in 2010.

#13: The PAC will critically review government review processes to ensure that they embody the principles and objectives of the Niagara River RAP.
#14: A regulation requiring treatment or exchange (or some other technique) to ensure that ballast water cannot be a way for the introduction of exotic species into the Niagara River AOC be enacted.
#15: Continue to protect habitat on both sides of the river as one ecosystem.
#16: Municipal planning documents incorporate ecologically based policies and design criteria.

For status of progress on these recommendations – see Appendix 10

Status of progress:
G) Implementation activity: *Liaison with the Niagara Parks Commission (NPC), Department of Fisheries and Oceans (DFO) and other stakeholders to pursue the objectives of the Niagara River RAP.*

Liaison with NPC: The NPCA and EC are project partners and provide advice and assistance to the NPC[63] in identifying and improving habitat features along the Niagara River. This work has included the following projects: Paradise Grove Oak Savannah Restoration; Niagara Glen Species at Risk Protection and Restoration Strategies; Ussher's Creek Rehabilitation Program; and the Niagara River Riparian Habitat Management Plan and Policy.

The NPCA also provided assistance with public consultation along the Niagara River Parkway and during NPC's Public Information Sessions in July 2004 re: NPC's Expansion of Parkland Restoration Projects.

Finally, the NPC has prepared an Environmental Land Management Plan that is anticipated to be released in 2010.

Liaison with DFO: The NPCA is under an Agreement with DFO to review all proposed projects in or near water to determine whether the project is likely to result in a harmful alteration, disruption or destruction (HADD) of fish habitat. The NPCA provides advice on possible measures to avoid a HADD, including the list of publications and factsheets on how to work closely with MNR and NPCA permitting staff to engage the relevant agencies for permits and review.

[62] Update provided by Deanna Lindblad, Project Co-ordinator, Niagara Peninsula Conservation Authority. February 26, 2008.
[63] www.niagaraparks.com

The NPCA's second responsibility with respect to fish habitat is to comment on development proposals. The majority of watercourses in the Niagara area have been given a fish habitat ranking by the MNR. Each rank has a respective setback requirement in order to protect fish habitat from the potential effects of development.

The NPCA is also currently working towards finalizing the Municipal Drain Classification Project. The project involved assessing the fish habitat, fish community and thermal characteristics of municipal drains in the Niagara jurisdiction. This classification will help assist municipalities in avoiding any harmful effects of drain maintenance activities on fish and fish habitat.

Liaison with the Niagara River Restoration Council: The NPCA and EC are partners in the Niagara River AOC Fish Barriers Project. To date, the Niagara River Restoration Council (NRC) has identified 209 potential barriers to fish migration and facilitated the removal of the following barriers[64].

Table 9: Fish Barrier Status Summary

Barrier Description (Total)	Status	Quantity
Critical (3)	Remediated	3
Major (87)	Remediated	21
	De-listed	23
	In-Progress	3
	Potential for Remediation	6
	Not Removable	13
	No Landowner Support	21
Minor (119)	Remediated	118
	Potential for Remediation	1
Total		**209**

A Case Study in Fish Barrier Mitigation

The Canborough Weir Bypass Channel and the Port Davidson Weir Bypass Channel were constructed in the 2002 and 2003, respectively. These were constructed to address the impediment to fish migration posed by the weirs during low flow conditions.

In 2003, the ability of these channels to facilitate the movement of fish around the Weirs was assessed by an independent consultant. The study focused on Northern Pike and used radio telemetry to prove that the fish could access and use the bypass channels during spawning migration and several months following spawning.

This study confirmed that these fish bypass channels effectively eliminated a low flow barrier to fish migration and reduced a RAP-identified impairment at these sites. This initiative demonstrated an increase in fish habitat access. (ref. Biotactic Ltd. 2003. Fish Bypass Channels)

This project clearly addresses the fish and wildlife habitat BUI. The project has successfully cleared all fish barriers in sixteen subwatersheds and removed all of the major/critical barriers in the AOC. This work has unlocked approximately 511 km of potential fish habitat, based on available GIS data[65]. Updates are provided in the NRC newsletters and on its Web site[66]. A Fish Barrier brochure was printed in winter 2004-2005 summarizing the ecological and economic importance of fish barrier removal. The project is expected to be completed in 2010.

[64] Niagara Restoration Council. December 2004. *Niagara River Area of Concern (AOC) Potential Fish Barrier Project.* Target Goal Achievement Report.

[65] Niagara Restoration Council. March 2009. *Niagara River Area of Concern (AOC) Potential Fish Barrier Project.* Target Goal Achievement Report.

[66] www.niagararestoration.org

Liaison with Niagara Region **(Niagara 2031: Regional Growth Management Strategy)**: Niagara 2031 is a major Regional planning initiative examining where and how Niagara should grow over the period to 2031. It provides a strategic approach to linking land use, infrastructure and capital investment to meet the Region's environmental, public health, social, cultural, financial and economic goals. Niagara 2031 also addresses Provincial requirements for compliance with the Provincial Policy Statement, the Places to Grow Act and the Growth Plan for the Greater Golden Horseshoe.

In February 2009 Regional Council adopted Option D, the Preferred Growth Management Option. Option D met Provincial policy objectives for containment of sprawl, intensification within existing built up areas, and higher Greenfield development densities. It demonstrated that growth could be accommodated within existing urban areas, even at the somewhat higher levels of population and employment forecast. It also met the Region's strategic objectives to shift a larger proportion of future growth to south Niagara.[67]

Liaison with MNR **(Niagara River Watershed Fish Community Assessment)**: In addition to the comprehensive update of wetland evaluations, the MNR has been conducting a comprehensive fisheries assessment within the AOC to:

- Assess fish community response to habitat improvements in watershed (i.e., fish barrier removal, wetland and shoreline enhancement projects, walleye restoration);
- Test fish community indices and their sensitivity to identified BUI (Impaired fish and wildlife habitat and populations). There are 3 specific impairment areas, Habitat quality and quantity, connectivity and Water quality and quantity;
- Assess changes in distribution and abundance of native rare species in AOC so that current distribution is maintained or enhanced;
- Collect fish samples for ongoing sport fish contamination monitoring (MOE).

The overall goal of this assessment is to improve the fish community structure and abundance in the AOC, by assessing the fish community's response toward several targeted habitat improvements.

A draft report is currently accessible and will be updated as new information becomes available.

H) Implementation activity: *Produce an annual progress report summarizing progress toward identifying and improving habitat features along the Niagara River.*

Progress reporting is made to EC through the Great Lakes Sustainability Fund[68] (GLSF) in all of the projects which receive funding in the Niagara River AOC.

[67] Niagara's Growth Management Strategy. *Niagara 2031- A Strategy for a healthy, sustainable future.* November 2006.
[68] www.sustainabilityfund.gc.ca

2.2.5 Human Health

1995 Recommendations:

#17: Develop a Niagara River Fish Consumption Advisory.

Status of progress:

In Ontario, sport fish consumption advisories are developed through the Sport Fish Contaminant Monitoring Program, which is conducted by MOE. Every other year the *Guide to Eating Ontario Sport Fish* gives consumption advice for sport and game fish found at more than 1,700 locations in the province. The advisories are based on human health protection guidelines developed by Health Canada.[69]

For the Niagara River AOC, advisories to limit consumption of sport fish continue because of contamination by toxic substances. In the Guide, there are consumption advisories for the Upper and Lower Niagara River, the Welland River, and Lyon's Creek.

Throughout 2004 – 2005, the NPCA and MOE conducted an outreach program to provide information about the Ontario Sport Fish Contaminant Monitoring Program to schools (grades K – 12) and special interest groups in the AOC. This successful program involved providing resource materials, such as fact sheets in various languages, to nearly 10,000 citizens[70].

Status of progress:

An assessment of the consumption of wildlife was completed as part of Fish and Wildlife Consumption BUI in this report (see Section 3.4). It should be noted that there are currently no published guidelines for the consumption of wildlife (unlike the fish consumption guidelines produced by MOE).

[69] Ontario Ministry of the Environment. 2007. *Guide to Eating Ontario Sport Fish 2009-2010.*

[70] Information provided by Brianne Wilson, Restoration Technician, NPCA.

Did You Know?

The Ministry of the Environment's sport fish consumption guidelines lists the contaminants for which the fish are tested. In the Welland River watershed, carp and channel catfish are tested for PCBs, mercury and dioxins/furans/dioxin-like PCBs.

Numerous species of fish are tested for PCBs and dioxins/furans/dioxin-like PCBs in the Niagara River. The lower Niagara River is the main focus of fish consumption advisories.[71]

[71] Ministry of the Environment. *Guide to Eating Ontario Sport Fish.* 2009-2010 edition.

2.2.6 Surveillance and Monitoring

1995 Recommendations:

#19: Continue monitoring municipal point sources (e.g., sewage treatment plants) including but not restricted to NRTMP point source monitoring parameters.

#20: Continue monitoring industrial point sources and publish results.

#21: Develop and implement a Welland River (and Niagara River) Tributaries Monitoring Program.

#22: Taste and odour program (results) be monitored (drinking water).

#23: Continue all monitoring programs for drinking water.

#24: Support and encourage participation in Canadian Wildlife Services' community based wildlife monitoring programs.

#25: Implement a resident attitude monitoring program.

Status of progress:
Niagara River Toxics Management Plan: In December 1996, Environment Canada, the U.S. Environmental Protection Agency Region II, the Ontario Ministry of the Environment and the 1987 New York State Department of Environmental Conservation re-affirmed their commitment to the Niagara River Toxics Management Plan (NRTMP). This commitment was "*to reduce toxic chemical inputs to the Niagara River to achieve ambient water quality that will protect human health, aquatic life, and wildlife, and while doing so, improve and protect water quality in Lake Ontario as well.*" [72]

The NRTMP is the source of data on contaminants for the Niagara River RAPs in Ontario and New York State. For further information see Appendix 5.

In the 2007 Progress Report of the NRTMP it summarizes that:

"Overall, the water quality of the river has improved significantly since the inception of the NRTMP in 1987. Based on a review of the most current trend information, the original goal of 50% reduction in the concentration of 10 of the 18 priority toxics either has been met or exceeded for all except PCBs, p,p'-DDE and the particulate phase PAHs. Despite this success, more work is needed to further reduce those compounds whose concentrations continue to statistically exceed the most stringent Agency criteria or standards (e.g., hexachlorobenzene, mirex) in order to meet the purpose of the 1996 Letter of Support."[73]

[72] Niagara River Toxics Management Plan. September 2005. Progress Report and Work Plan.

[73] Niagara River Secretariat. October 2007. Niagara River Toxics Management Progress Report and Work Plan.

[74] Niagara Peninsula Conservation Authority. 2007. *Water Quality Monitoring Program 2006 Annual Report.*

Tributaries Monitoring Program: In 2003, a partnership was established with the MOE through the *Provincial Water Quality Monitoring Network* (PWQMN) whereby the NPCA collects monthly water samples at six stations located within the NPCA watershed and the MOE provides laboratory services. The *PWQMN* was established in 1964 to collect surface water quality information from rivers and streams at strategic locations throughout Ontario. Over time, stations have been added and discontinued in response to changing MOE and program-specific needs. Two NPCA *PWQMN* stations are located on the Welland River.[74]

In 2003-2005, the Niagara River AOC Tributary Monitoring Program (an enhanced monitoring program in the AOC) was implemented through a partnership between the NPCA and MOE. The objectives of the program were (1) to establish baseline water quality conditions at selected tributaries and (2) to track changes in water quality at historic Welland River stations since the 1994/96 Welland River Water Quality Report. The annual reports[75,76] included a recommendation that long-term monitoring should be continued in order to firmly establish baseline water quality conditions for Niagara River tributaries and guide future restoration efforts within the watershed.

Wildlife monitoring programs: The NPCA's Water Quality Improvement Program regularly uses Environment Canada – Canadian Wildlife Service's Marsh Monitoring Program (MMP) to evaluate their constructed wetlands. This MMP data is also currently being studied by Bird Studies Canada to assess the status of several delisting criteria.

For a further status of progress on these recommendations – see Appendix 10

[75] Niagara Peninsula Conservation Authority. July 2004. *Niagara River AOC Tributary Monitoring Program 2003 Annual Report.*
[76] Niagara Peninsula Conservation Authority. June 2005. *Niagara River AOC Tributary Monitoring Program 2004 Annual Report.*

2.2.7 Outreach and Education

1995 Recommendations:

#26: Public education programs continue and new ones be developed as required.

#27: Professional education programs continue and new ones be developed as required.

Status of progress:
Following release of the Stage 2 (1995) report to the community, and to commemorate the RAP committees' efforts to restore Niagara's ecosystem for present and future generations, a permanent RAP plaque was unveiled in June 1997. This plaque is located beside the Niagara River at a location south of Niagara Falls near Ussher's Creek. The text on the plaque is included on the last page of the Stage 2 Update.

Figure 12: Stage 2 plaque on the Niagara River

For a further status of progress for these recommendations – see Appendix 10

I) Implementation activity: *Produce an annual persistent toxic load progress report summarizing data provided by RAP partners.*

The Niagara River Toxics Management Plan (NRTMP) produces an annual progress report.

J) Implementation activity: *Co-ordinate and integrate public education and communication efforts with the Niagara River Toxics Management Plan (NRTMP).*

Information on the NRTMP is provided in Appendix 5.

A public meeting was held in October 2007 at Grand Island, New York, to provide an update on the NRTMP and the Lake Ontario Lakewide Management Plan. The 2007 NRTMP progress report was released in January 2008. [77]

[77] Niagara River Toxics Management Plan. October 2007. *Progress Report and Work Plan.*

Educational campaigns: The NPCA's Outreach Program is ongoing and has been developed to promote the following:

- wetland/riparian and forest cover habitat restoration and/or establishment;
- environmentally friendly roadside ditch maintenance practices; and
- targeted educational programs on persistent toxin issues.

Presentations have been made to schools and community groups throughout the watershed on a variety of topics including water conservation, wetlands, environmental restoration and water quality. Opportunities to encourage citizens to become engaged in environmental activities are also promoted.

The Niagara Parks Commission (NPC) partnered with the NPCA to promote the improvement of habitat features along the Niagara River corridor. The strategy involved public information sessions and door-todoor contact with residents along the Niagara River Parkway to present NPC's expansion of parkland restoration projects under the Niagara River Riparian Habitat Management Plan & Policy project.

The Niagara Region and the NPCA are partners in the very successful *Niagara Children's Water Festival*, an annual 4-day event that brings together educators, government, industry and community representatives. The festival incorporates five basic themes: Water Conservation, Water Attitude, Water Technology, Water Protection and Water Science. See www.npca.ca for further information.

Figure 13: Children learning at the Niagara Children's Water Festival

Niagara River Repository: A collection of reports and documents about pollution in the Niagara River and the Niagara River RAP was established at the Niagara Falls (Ontario) Public Library in 1991. The Niagara River Repository is available to the public as reference material.

2.2.8 General

1995 Recommendations:

#28: Provincial and federal governments develop an integrated ecosystem approach to management for its agencies.

#29: Provincial and federal governments establish specific government funding programs for RAP Implementation.

#30: The Niagara River RAP endorse and encourage the process of multi-sectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.

#31: Establish a Geographic Information Systems repository for the Niagara River AOC.

#32: Establish an International RAP.

#33: Secure recognition of the remedial action plan as having fulfilled some of the requirements of the environmental assessment process.

#34: Develop model "terms of reference" for remediation projects by community liaison committees.

#35: The Ontario Ministry of Natural Resources develop an 'Introduction of Exotics' supplement to the Project Wild, Fishways and Focus on Forests programs.

#36: Initiate the Niagara River RAP Implementation Structure.

#37: Boat owners retain and dispose of grey water at marinas.

Status of progress:
The NPCA assumed the role of RAP Coordinator in 1999 and is funded through agreements with the MOE and EC. RAP deliverables and tasks are specified in these agreements between the NPCA, EC and MOE. Project initiatives and deliverables include: RAP coordination (including stakeholder liaison & public consultation and supervision of contractors); Tributary Water Quality Monitoring Plan and Niagara River AOC Monitoring Plan; coordination of the Contaminated Sediment Management Strategy for Lyon's Creek; preparation of the Stage 2 Update Report; development and implementation of the RAP Communications Plan; and, coordination and implementation of the new RAP monitoring and work plans. A new RAP implementation framework is in place.

For a further status of progress on these recommendations – see Appendix 10

K) Implementation activity: *Produce an annual progress report summarizing progress toward meeting the Action specified in the Welland River Watershed Strategy.*

In 1998, the Welland River Watershed Strategy[78] was initiated and guided by a Restoration Committee comprised of the NPCA and its watershed partners, along with governmental and non-governmental partners. These groups recognized the need to co-ordinate and monitor remediation efforts throughout the Welland River basin. The action plan for the strategy was incorporated into the Niagara River RAP Implementation Annex. [79]

The goal of the Strategy is: *"To restore the ecological health of the Welland River and its watershed".*

[78] Niagara Peninsula Conservation Authority. November 1999. *Welland River Watershed Strategy.*

NPCA resources and assistance in guiding, directing and prioritizing Welland River rehabilitation activities is facilitated through a GIS repository for the Niagara River. The NPCA has developed a comprehensive database to map and document "in the ground" restoration projects. The 'Restoration Database' is a practical product developed by GIS staff who worked closely with restoration staff to ensure that the design and functionality would meet their needs. The database thoroughly documents critical restoration project information such as location, project type, inventory of what was planted, material types and quantities, under what funding program, expenses incurred, and grant portion etc. Additionally, the data model includes design considerations that enable it to continuously monitor and track watershed improvements. This tracking of habitat statistics is possible by including restoration types for integration with existing habitat data. The Restoration Database is the RAP flagship GIS product as it is a tool that can quantify and report on the remediation effort and success of NPCA stewardship based restoration programs (see Appendix 9 for the current habitat statistics). [80]

This tracking database is used to report on projects in the NPCA's Water Quality Improvement Program (WQIP). In the past 5 years, approximately 70% of the projects under the WQIP have benefited wildlife habitat in addition to water quality. This tool allows the NPCA to summarize the improvement efforts and relate them to a watershed goal or benchmark to determine the degree of health for subwatersheds.[81] For this determination, comparisons of habitat parameters are made with Environment Canada's *Framework for Guiding Habitat Rehabilitation in the Great Lakes Areas of Concern.* [82]

L) Implementation activity: *Liaison with the Niagara Peninsula Conservation Authority Welland River Watershed Strategy activities.*

The Welland River Watershed Strategy for addressing man-made physical barriers and the water level fluctuations in the Welland River are:

- The Niagara River AOC Fish Barriers Project. (See Biota/Habitat/Land Use section 2.2.4)
- The Welland River Water Level Fluctuation Study.

Since 2001, the NPCA has held discussions with Ontario Power Generation (OPG) regarding possible solutions to eliminate or reduce the historical flow fluctuations that occur on the Welland River. In June 2007, after thorough consideration of alternative options to mitigate the impacts of Beck 3 (a new tunnel to the power plant), an agreement was reached. OPG agreed to contribute three million dollars to the NPCA to implement "soft engineering" restoration activities within the Welland River watershed.[83] These activities would include improving fish habitat and spawning areas, improving public access to the river, riparian projects and creating additional wetlands. The agreement conditions include that the NPCA provide an annual progress report.

M) Implementation activity: *Liaison and partnership with community groups. Building on existing strengths and formulating partnerships between government and non-profit organizations is the key objective*

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[79] Niagara Peninsula Conservation Authority. November 2000. *Niagara River Remedial Action Plan Implementation Annex.*
[80] NPCA 2004 *GIS Program Status and Direction Report.*
[81] NPCA. December 2004. *Natural Heritage Characterization of the Niagara River AOC & Associated Subwatersheds. A discussion on implementing a habitat restoration framework.*
[82] Environment Canada. 2004. *How Much Habitat is Enough?* Second edition of A Framework for Guiding Habitat Rehabilitiation in Great Lakes Areas of Concern.
[83] Reported by Jocelyn Baker, NPCA, at the RAP Team meeting on June 14, 2007.

of the Implementation Annex. Opportunities to form partnerships and task forces targeted toward developing specific action plans will be identified and pursued. Within these partnerships, the Niagara River RAP will strive to develop model "terms of reference" for projects completed by community liaison committees and subwatershed strategies.

The NPCA liaises and partners with many groups in the Niagara River watershed, both government and non-government organizations, and has compiled a database. The NPCA is working towards the establishment of community groups (such as "Friends of" groups) for each subwatershed of the RAP area. This will help extend restoration and water quality improvement activities beyond the limitations of government organizations. Also, the NPCA provides assistance and expertise to private landowners.

In 2003, the Niagara Region introduced the *Niagara Water Quality Protection Strategy* (now named the *Niagara Water Strategy*) through a partnership with the NPCA and the MOE. The intent of the Strategy is to work towards a common goal of protection, restoration and management of water resources across the Niagara watershed in conjunction with implementing partners.[84] The Niagara River RAP is represented on the Water Advisory Group of the Niagara Water Strategy.

In 2004, the Niagara River RAP began a review of the delisting criteria and possible impairments which involved the establishment of a Steering Committee and a Public Advisory Committee (PAC). The PAC was comprised of stakeholders from throughout the watershed. Stakeholders included nature clubs, soil and crop improvement associations, stewardship groups, industry, government agencies and academia. The initial Impairment review was completed in 2007 and details are provided in the working report: "Technical Review of Impairments and Delisting Criteria". A review and assessment of the 37 Recommendations in the Stage 2 report was completed concurrently. The Stage 2 review details on the Recommendations are provided in section 2.3 of this report. This working document also began the review of the delisting criteria and status of the BUIs (see section 3.0).

International liaison: The Niagara River RAP liaises with the Buffalo Niagara RIVERKEEPER[85] (formerly Friends of the Buffalo Niagara River) and participated in Watershed Stakeholder Restoration Planning Sessions in July 2004. One of the goals of the sessions was to develop a set of restoration goals for the Niagara River over the life of the Robert Moses Niagara Power Project license towards developing a Healthy Niagara Watershed Management Plan. The Niagara River RAP sent a letter of support in August, 2004. Since then, opportunities to network have been provided by cross-border forums organized by the Niagara Region and the Canadian Consulate in Buffalo.

In 2007, the Buffalo Niagara RIVERKEEPER invited a representative from the Niagara River (Ontario) RAP to participate on a committee to develop habitat conservation targets for the Buffalo River and Niagara River RAPs.[86]

In 2008, the NYSDEC received funding from the U.S. EPA to continue coordination of the Niagara River (U.S.) RAP and a Remedial Advisory Committee (RAC) has been established.[87]

[84] Niagara Region and Niagara Peninsula Conservation Authority. *2005 Niagara Watershed Report Card.*
[85] www.BNRiverkeeper.org
[86] Correspondence from Margaret Wooster, Buffalo Niagara Riverkeeper, to Valerie Cromie, dated March 1, 2007.
[87] Niagara River Remedial Action Plan. Remedial Advisory Committee (RAC) Implementation Meeting. June 19, 2008.

Since then, liaison and information sharing across the river has increased. The NRTMP also provides another forum for international liaison and it is a source of technical data to both the Ontario and New York Niagara River RAPs.

2 .3 Reviewing the 1995 Recommendations

In addition to the review of what work has been accomplished in the Niagara River AOC since 1995 a background paper, reviewing the Recommendations and proposing a revised list of recommendations, was completed in 2006 (Appendix 10).

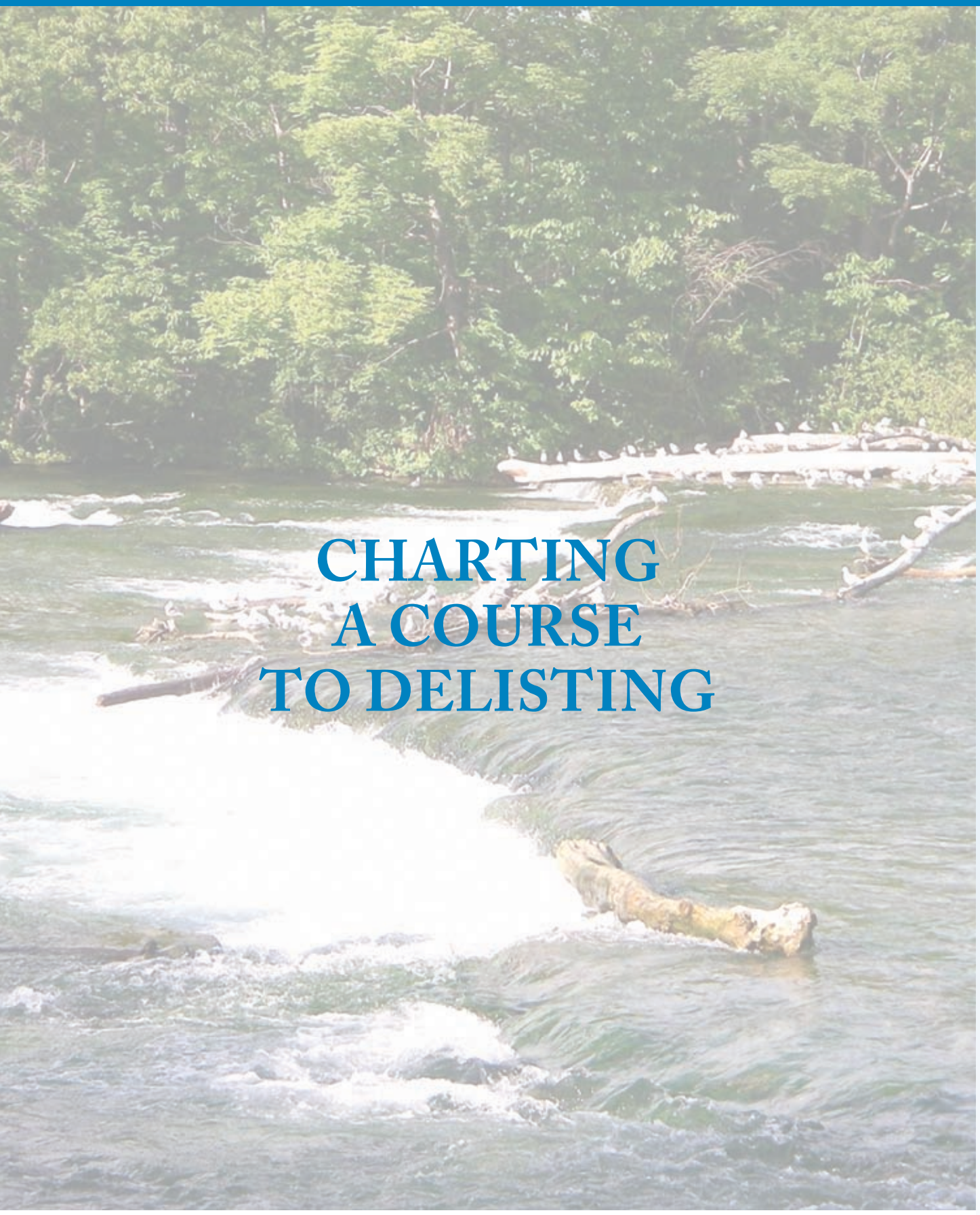
A summary of the completed recommendations and the new revised list of recommendations from the background paper can be found in the following table.

Table 10: Summary of the Status of the Recommendations and the List of New Recommendations

Recommended Theme Categories (Implementation Annex)	Recommendations (Stage 2)	Status	New Recommendations
Water Quality - Municipal	1. The Niagara River RAP become involved in Infrastructure Needs Studies	Revised	1. Implement municipal waste water quality projects through infrastructure upgrades, optimization and pollution prevention and control planning initiatives.
	2. Enforce the Regional Sewer Use By-Law (By-Law #3308)	Revised	
	3. The Region of Niagara continue to work towards implementing a water pollution control plant optimization program for all its plants.	Revised	
	4. Enforce the MISA Municipal Program for Municipal Sewage Treatment Plants upon the promulgation of the MISA Municipal Regulation.	Revised	
	5. Landfills continue to be monitored regularly.	Revised	
Water Quality - Rural	6. Prepare and Implement a rural non-point source (NPS) pollution remediation strategy.	Revised	2. Identify priority target areas for water quality and habitat improvement and encourage landowner participation through funding incentives, education, stewardship and outreach.
	7. Farmers in the Niagara River AOC be encouraged to follow sound farming practices such as recommended in the Environmental Farm Plan program.	Revised	
	8. Additional funding per farm business be given to the Environmental Farm Plan Incentive Program operating in the Niagara River AOC.	Revised	
Sediment Quality	9. The lower Welland River (downstream of the Welland airport) be the priority focus of any sediment assessment.	Completed	3. Implement the sediment remediation actions identified through the studies on contaminated sediment sites in the AOC.
	10. Potentially contaminated locations be prioritized for review, assessment and remediation	Revised	
	11. Test potentially contaminated sediment sites to confirm the absence / presence of contamination.	Completed	

Biota/Habitat/ Land Use	12. Prepare a natural heritage strategy for the Niagara River AOC.	Revised	4. Support the implementation of municipal natural heritage strategies within the Niagara River AOC.
	13. The PAC will critically review government review processes to ensure that they embody the principles and objectives of the Niagara River RAP	Redundant	
	14. A regulation requiring treatment or exchange (or some other technique) to ensure that ballast water cannot be a way for the introduction of exotic species into the Niagara River AOC be enacted.	Completed	
	15. Continue to protect habitat on both sides of the river as one ecosystem.	Revised	5. Continue to protect habitat on both sides of the river as one ecosystem and seek opportunities for international cooperation.
	16. Municipal planning documents incorporate ecologically based policies and design criteria.	Revised	
Human Health	17. Develop a Niagara River Fish Consumption Advisory.	Revised	6. While fish consumption advisories are necessary, adequately communicate and encourage the use of the government's "Guide to Eating Ontario Sport Fish".
	18. Conduct research to determine if consumption of water based wildlife is harmful to human health.	Revised	7. Prepare and communicate a consumption advisory until contaminant levels in snapping turtles from Lyons Creek are below the appropriate guidelines for protection of the health of human consumers.
Surveillance and Monitoring	19. Continue monitoring municipal point sources (e.g., sewage treatment plants) including but not restricted to NRTMP point source monitoring parameters.	Revised	8. The Niagara River RAP establish and support a monitoring plan.
	20. Continue monitoring industrial point sources and publish results.	Revised	
	21. Develop and implement a Welland River and (Niagara River) Tributaries Monitoring Program.	Revised	
	22. Taste and odour program (results) be monitored (drinking water).	Not Applicable	
	23. Continue all monitoring programs for drinking water.	Not Applicable	
	24. Support and encourage participation in Canadian Wildlife Services' community based wildlife monitoring programs.	Completed	
	25. Implement a resident attitude monitoring program.	Completed	

Outreach and Education	26. Public education programs continue and new ones be developed as required.	Revised	9. Develop and deliver education and community programs that address matters of interest to the RAP or that support RAP implementation.
	27. Professional education programs continue and new ones be developed as required.	Revised	
General	28. Provincial and federal governments develop an integrated ecosystem approach to management for its agencies.	Redundant	10. All levels of government continue providing resources for RAP initiatives and make projects in Great Lakes AOCs a priority for infrastructure funding.
	29. Provincial and federal governments establish specific government funding programs for RAP Implementation.	Revised	
	30. The Niagara River RAP endorse and encourage the process of multi-sectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.	Ongoing	11. The Niagara River RAP endorse and encourage the process of multisectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.
	31. Establish a Geographic Information Systems repository for the Niagara River AOC.	Revised	12. The NPCA maintain its G.I.S. restoration database as a tool in determining priority areas for remediation within the watershed and collaborate with NWQPS in G.I.S information management.
	32. Establish an International RAP.	Completed	
	33. Secure recognition of the remedial action plan as having fulfilled some of the requirements of the environmental assessment process	Not Applicable	
	34. Develop model "terms of reference" for remediation projects by community liaison committees.	Not Applicable	
	35. The Ontario Ministry of Natural Resources develop an 'Introduction of Exotics' supplement to the Project Wild, Fishways and Focus on Forests programs.	Not Applicable	
	36. Initiate the Niagara River RAP Implementation Structure.	Redundant	
	37. Boat owners retain and dispose of grey water at marinas.	Not Applicable	



CHARTING A COURSE TO DELISTING

3.0 CHARTING A COURSE TO DELISTING

Note: Information in the following section contains references to the data that was compiled in the working document: Niagara River (Ontario) Remedial Action Plan. *Technical Review of Impairments and Delisting Criteria.* Environment Canada. June 2007, (referred to as Technical Review 2007).

This section provides an assessment of the environmental response to the work that has been completed since 1995 (stage 2) and the 2000 Implementation Annex. As previously discussed in Section 2, many of the Stage 2 recommendations and actions have been implemented. Substantial progress has been made particularly in the areas of contaminated sediment management, fish habitat creation and municipal wastewater upgrades.

This assessment incorporates recent scientific knowledge and provides a clearer picture of what the environment should look like when local remedial efforts have achieved their delisting criteria. This review also identifies what needed to be done in order to delist the Niagara River (Ontario) AOC.

3.1 Scope of the Beneficial Use Impairment (BUI) review

The review of the 1995 Stage 2 report involved the following activities:

- review of the Canadian Cleanup Criteria (i.e., delisting criteria in Table 8 of the 1995 Stage 2 report)
- development of revised delisting criteria (see section 3.3);
- review and assessment of the status of the BUIs in the Niagara River AOC against the revised delisting criteria (see section 3.4);
- update of the work plan (see section 4.1) and the development of a plan for monitoring ecosystem restoration (see section 5).

3.2 How was the Delisting Criteria and BUI review done?

The delisting criteria were reviewed and refined to current standards which are considered to be scientifically defensible, specific, measurable and achievable.

This review involved consultation with three groups, which included:

(1) Steering Committee - made up of the lead agencies involved in the RAP (MOE, EC, MNR and NPCA) and other stakeholders.

(2) Technical subcommittees - scientists with local knowledge and/or scientific expertise from multiple agencies and organizations were contacted and asked to establish technical subcommittees to lead the technical reviews.

These technical subcommittees were asked to:

- establish a clear basis for evaluating impairment status for the Ontario portion of the AOC,
- undertake a full review of current impairment status based on the best available information,
- establish a clear and specific set of improved delisting criteria, maintaining original criteria where applicable; and,
- identify any gaps in monitoring or assessment information needed to assess impairment status or progress in attaining delisting criteria.

(3) Public Advisory Committee - comprised of various organizations and citizens to effectively involve the community in this review of the Stage 2 RAP (see Appendices 3 and 11).

The results of the technical reviews were presented to the Steering Committee as recommendations and suggested new delisting criteria. This work was then compiled in the Technical Review 2007 document[88] for presentation to, and input from, the PAC.

In 2008, the Niagara River RAP Coordinating Committee wrote a report to provide an explanation of how the new Niagara River AOC delisting criteria were adapted from the suggested criteria in the Technical Review 2007 (see Appendix 12).

From this review several modifications were made to the suggested delisting criteria. These modifications were due to the significant progress that had been made towards refining delisting criteria, as well as further progress made on implementation actions in the Niagara River AOC. In March 2009, the new delisting criteria were presented to the RAP Science Committee and the PAC for discussion and endorsement.

3.3 New Delisting Criteria

The refinement of the delisting criteria is intended to lead to a more efficient and effective implementation of remedial action, and better monitoring. Knowing specifically what will bring the AOC closer to delisting, through an improved set of delisting criteria, will help to better screen and prioritize remedial projects. This approach is consistent with what is being done in other Canadian AOCs. The table below shows the new delisting criteria for the Niagara River AOC.

Note: Delisting criteria for Eutrophication and Undesirable Algae could not be developed due to lack of information about the Welland River ecosystem. Additional assessment studies have been recommended by the reviewers in order to develop delisting criteria.

[88] The Niagara River (Ontario) Remedial Action Plan Team. April 12, 2006. *A Review of Impairments and Remediation Targets for the Niagara River (Ontario) Area of Concern.*

Table 11: Updated Niagara River (Ontario) AOC delisting criteria. Under the status changed column "X" signifies that the delisting criteria has been met under current conditions and a blank cell signifies that it has not yet been met

Beneficial Use Impairment	New Delisting Cirteria	Status	Status Change
1) Restrictions on Fish and Wildlife Consumption Typically broken into two sections when assessed: • Fish Consumption	1. No restrictions on the consumption of sport fish in the Ontario portion of the AOC due to locally-controllable contaminant (PCBs and dioxin-like PCBs) sources. The probable sources of contaminants causing the restrictions will be considered; locally-controllable contaminant sources will be addressed by the Niagara River RAP. Any regional or upstream sources that are likely the cause of remaining restrictions on sport fish consumption in the AOC will be identified and referred to a broader regional program (i.e., Lake Ontario Lakewide Management Plan, Lake Erie Lakewide Management Plan and Niagara River Toxic Management Plan). Restrictions on sport fish consumption in the AOC will be evaluated through comparison to restrictions present in appropriate fish species from a suitable non-AOC reference site or sites. 2. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife consumption, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.	Impaired	
• Wildlife Consumption	(Note: A delisting criteria was never developed as this BUI component was never shown to be Impaired only Requiring Further Analysis.)	Not Impaired	X
2) Tainting of Fish and Wildlife Flavour		Not Impaired	
3) Degradation of Fish & Wildlife Populations Typically broken into four sections when assessed: • Degradation of Fish Populations • Body Burdens of Fish • Degradation of Wildlife Populations • Body Burdens of Wildlife	3. Maintenance of fish community populations, on the Canadian side of the Niagara River, at or above suitable non-AOC reference sites OR meets fish community objective(s) identified through a fisheries management plan by Ontario Ministry of Natural Resources. 4. Maintenance of wetland-dwelling wildlife populations and diversity at or above suitable non-AOC reference sites (as determined by indicators such as Indices of Biotic Integrity and/or community status assessments derived from Bird Studies Canada's Marsh Monitoring Program). 5. Maintenance of colonial nesting birds populations on the Canadian side of the Niagara River at or above suitable non-AOC reference sites, examined through the use of sentinel species (i.e., Blackcrowned Night-Herons, Herring and/or Ring-billed Gulls).	Impaired	

	6. Temporal trends in contaminant levels (PCBs and dioxin-like PCBs), examined through the use of sentinel species, (i.e., Herring Gull, night-heron, snapping turtle eggs, and/or livers of mink), are stable or declining. Spatial comparisons show that contaminant concentrations in the eggs of the above species in areas under the influence of the Niagara River (Ontario) AOC are equal to or less than those from sites. removed from any influence of the AOC. If the whole body burden concentrations do exceed this level then they must not result in a population level affect to the bird and/or wildlife populations. 7. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife body burdens, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.		
4) Fish Tumours and Other Deformities	(Note: A delisting criteria will be developed if this BUI is shown to be Impaired)	Not Impaired	X
5) Bird or Animal Deformities or Reproduction Problems	8. When the types and frequency of deformities and/or reproduction impairments associated with contaminant exposure (PCBs and dioxin-like PCBs) are similar to those in a suitable non-AOC reference site or sites, examined through the use of sentinel species (i.e., snapping turtles, herring gulls). If the types and frequency of deformities and/or reproductive impairments exceed this target then they must not result in a population level affect to the bird and/or animal populations.	Not Impaired	X
6) Degradation of Benthos Typically broken into two sections when assessed: ○ Dynamics of Benthic Populations ○ Body Burdens of Benthic Populations	9. When acute and chronic toxicity, community composition and abundance in the benthic community are similar to non-AOC reference sites. 10. When benthic invertebrate tissue contaminant (PCBs and dioxin-like PCBs) concentrations are comparable in the AOC to those at suitable non-AOC reference sites for contaminants that biomagnifies in the aquatic food chain and/or in cases where benthic invertebrate tissue contaminant concentrations are greater than reference sites but are below concentrations considered to impair the beneficial uses associated with the consumption of fish and wildlife. 11. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to degradation of benthos, then a Contaminated Sediment Management Strategy must be in place including a risk management approach with appropriate monitoring and mitigation measures and/or administrative controls.	Impaired	
7) Restrictions on Dredging Activities	(Note: Changed to Not Impaired as per the decision on May 4, 1998 by Canada-Ontario Agreement RAP Steering Committee.)	Not Impaired	X

8) Eutrophication or Undesirable Algae	(Note: Delisting criteria will be developed and directed by the results of the Eutrophication Study)	Impaired	
9) Restrictions on Drinking Water Consumption or Taste and Odour Problems		Not Impaired	
10) Beach Closings	12. Public beaches meet the following conditions: i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known; ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 E. coli /100ml), or is similar to a suitable non-AOC reference site, when assessed over a period of at least three to five years; iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.	Impaired	
11) Degradation of Aesthetics		Not Impaired	
12) Added Costs to Agriculture or Industry		Not Impaired	
13) Degradation of Phytoplankton and Zooplankton Populations	(Note: Delisting criteria will be developed if this BUI is shown to be Impaired)	RFA	
14) Loss of Fish and Wildlife Habitat	13. The percentage by area of wetland cover within the AOC and the percentage by stream length of riparian buffers within the AOC are not significantly different as compared to suitable non-AOC reference sites. 14. 75% of the potential barriers to fish movement (as identified through the Niagara River AOC Fish Barriers Project 2001 – Phase 1 Photo Library) must be removed or remediated restoring access to potential spawning habitat. 15. The percentage of woodland and wetland habitat by area in the AOC, and the percentage of stream length with (at least) a 30m vegetated buffer in the AOC is not significantly different when compared to suitable non-AOC reference sites.	Impaired	

	16. The percentage by area of wetland buffers (50, 120 and 240 m width) in the AOC and of core woodland areas (within 100 and 200m of forest edge) in the AOC is not significantly different when compared to suitable non-AOC reference sites. 17. The proximity, patch size, and patch density of key habitat types (forests and wetlands) in the AOC is not significantly different when compared to suitable non-AOC reference sites. 18. The existing areal extent of unique wildlife habitats (Wainfleet Bog complex, Niagara Gorge) is at least 80% secured and managed for longterm conservation purposes. 19. Approval of Official Plan environmental policies for AOC municipalities that protect and enhance the natural heritage system, in conformity with the applicable Provincial or Regional natural heritage policies.		

3.3.1 Choosing Reference Site Locations

Reference site locations are generally chosen to be representative of average local environmental conditions and have physical characteristics comparable to those of the AOC. Individual reference sites may be chosen for each BUI or for each relevant delisting criterion as per the recommendations of the RAP Science Committee and Coordinating Committee.

3.3.2 Selection of Reference Sites for wildlife indicators

Ideally, suitable reference sites for AOCs would be locations just outside (preferably upstream) of the AOCs. The sites would represent similar environments as sampling areas located within the AOC, except for the sources of stressors associated with the AOC (e.g., contaminants, eutrophication, etc). For the wildlife used in the following wildlife assessments, suitable reference sites were not generally available in such close proximity to the Niagara River AOC. Consequently, more distant reference sites had to be selected. Generally, these distant reference sites were selected on the basis of low contaminant burdens, as well as the absence or low levels of other anthropogenic sources of stress. These reference sites would represent an idealized population, whose population status and health parameters should be independent of the effects of contaminants or other stressors present within the AOC. Three different types of wildlife were assessed: colonial waterbirds, mink and snapping turtles.

Colonial waterbirds have well defined breeding colonies, whose geographic locations are not necessarily convenient for ideal sampling. Monitoring of herring gulls are largely based upon the 15 colonies that are monitored by the Great Lakes Herring Gull Monitoring Program. Given the lack of a suitable local reference site, Chantry Island (Lake Huron) has generally been used as a reference site, largely due to the relatively low contaminant burdens found in the eggs from that colony. Chantry Island has traditionally been used as a reference site for previous studies for herring gulls.

Although mink are not constrained to well defined breeding areas like colonial waterbirds, the method of sampling put severe constraints upon the geographical area from which they were sampled.

Mink were sampled exclusively through trappers, mostly as bycatch in their attempts to capture more numerous muskrats and other species. Mink were obtained by Environment Canada by soliciting trappers to keep mink that were opportunistically caught during their normal trapping activities. Due to the low price of pelts, and the decline in the number of trappers, the ability to obtain suitable numbers of mink in areas immediately upstream or outside of the Niagara River AOC was minimal. Consequently, mink collected from eastern Lake Erie, in Haldimand Norfolk Regional Municipality, those collected within 7 km of Lake Erie, as well as those collected more than 10 km inland from Lake Ontario were used as reference mink.

Snapping turtles are found in most permanent wetlands; consequently they are found in areas that would be suitable as reference sites for the Niagara River AOC. However, the snapping turtle sampling design was based upon the Fish and Wildlife Health Effects Study (SWAT), in 2001, in which reference sites were selected in the same manner that was done for the herring gulls. In this study, Tiny Marsh was selected as one reference site, due to the low contaminant burdens in eggs. Similarly, Upper Canada Bird Sanctuary, which was the upstream reference site for the St Lawrence River (Cornwall) AOC, was also selected as a second (downstream) reference site for the Niagara River AOC.

3.4 BUI Assessment: Restrictions on Fish and Wildlife Consumption - only the Wildlife component

(designated only as Requiring Further Assessment)

Delisting Criteria:
Delisting criteria were not developed as this BUI component was never shown to be Impaired – only Requiring Further Analysis.

Wildlife consumption problems can be indicators for the effects of certain types of contaminants moving through the food chain eventually presenting a human health risk. Thus, this BUI refers to advisories to the public to restrict their consumption of specific kinds of wildlife or not to consume it at all. It does not refer to the risk of contaminant exposure to non-human consumers. Furthermore, this BUI is in relation to non-fish wildlife which are part of the aquatic ecosystems and there are currently no published guidelines for the consumption of wildlife (unlike the fish consumption guidelines produced by MOE). As previously mentioned in section 3.0, a review of this impairment was conducted as part of the working document (Technical Review 2007). To see the complete review please refer to Appendix 13.

This review concluded that the following wildlife are known or thought to be consumed in the Niagara River AOC:

- Snapping Turtles
- Migratory and resident waterfowl
- Muskrat

However, as there was a lack of information about the trapping and consumption of snapping turtle specifically at Lyon's Creek East and muskrat at Lyon's Creek West. These areas were identified as requiring further investigation based on the evaluations of the original 13 contaminated sites in the AOC (see section 2.2.3).

Thus, a survey was completed for aquatic wildlife consumption. This survey found that only a very small proportion of the population consumes aquatic wildlife in the AOC (3% of respondents in a sample of 618 people). From this small group of consumers, based on studies in other AOCs and in Quebec, it can be assumed that very few meals are consumed per year. Also it can be assumed that most of what is being consumed is likely meat from Mallards and Canada Geese. However, there was a small amount of anecdotal information mentioning the consumption of snapping turtle. Although there is little evidence that there is currently much consumption of turtles, a few residents had described past consumption of turtles some time in the past. However, although no year was given the consumption was not within recent years; also the frequency of consumption at the time is unknown.

Thus, there was no evidence found that the eggs of either turtle or waterfowl are regularly being consumed.

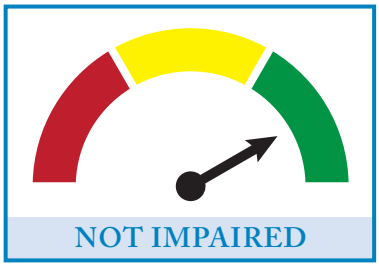
Although there was no evidence of the regular consumption of aquatic wildlife, the technical review looked at the contaminant levels in edible portions of migratory waterfowl, snapping turtles and their eggs. A screening-level human health risk assessment was also completed specifically in Lyons Creek.

Current evidence suggests that there is not widespread risk of adverse contaminant exposure to human consumers of aquatic wildlife in the AOC.

However, in response to the anecdotal information regarding the consumption of snapping turtles, the MOE sport fish consumption guidebook now includes guidance on snapping turtle consumption.

> *"Snapping turtles may contain high levels of contaminants in their fat, liver, eggs and, to a lesser extent, muscle. If you plan to consume snapping turtles, trim away the fat prior to cooking the meat or preparing soup. Also, avoid eating the liver and eggs of the turtle. Women of childbearing age and children under 15 should avoid eating any part of snapping turtles, including soups made with their meat."* [89]

Consequently, the RAP Coordinating Committee has concluded that this wildlife portion of the Fish and Wildlife Consumption Beneficial Use can be redesignated to "Not Impaired".



This Beneficial Use Impairment was reviewed by: Dr. Shane de Solla, Wildlife Conservation Biologist (Shane works on Wildlife Toxicology and Disease in the Water Science and Technology Directorate at Environment Canada)

[89] Ontario Ministry of the Environment, 2009. Guide to Eating Ontario Sport Fish 2009-2010 Edition. Queen's Printer for Ontario. Pg. 11

3.5 BUI Assessment: Bird or Animal Deformities or Reproduction Problems

Delisting Criteria:
When the types and frequency of deformities and/or reproduction impairments associated with contaminant exposure (PCBs and dioxin-like PCBs) is similar to a suitable non-AOC reference site or sites, examined through the use of sentinel species (i.e. snapping turtles, herring gulls). If the types and frequency of deformities and/or reproductive impairments exceed this target then they must not result in a population level affect to the bird and/or animal populations.

Deformities and reproductive problems can be indicators for the effects of certain types of contaminants on the health of fish and wildlife. They are important because they can negatively affect an individual animal's ability to survive and reproduce. If prevalent in an area, these problems may have the potential to negatively affect the entire local population of a given species.

As mentioned in section 3.0, a review of this impairment was conducted as part of the working document (Technical Review 2007) - to see the complete review please see Appendix 14.

This review raised the concerns regarding the contaminant body burdens in excess of reference sites/ levels and the lack of data to detect shifts in populations due to contaminant levels. However, both of these concerns are now addressed in the delisting criteria for the BUI Degradation of fish and wildlife populations and do not directly speak to this BUI.

However, this review did conclude that:

- there are no identified concerns with deformities/reproduction problems associated with contaminant exposure
- there are no identified concerns with the frequency of deformities/reproduction problems exceeds frequency for reference sites/background levels.

In 2009, an unpublished document (A review of the current status, trends and distributions of Aquatic Wildlife in the Niagara River (Ontario) Watershed by Kim Hughes, 2009) reviewed data that had recently been collect by Environment Canada's Canadian Wildlife Service. This included data on snapping turtles hatching success and deformity rates, mink organ indices and the health of herring gulls.

Snapping Turtles Hatching Success and Deformity Rates

Data was collected from 2002 to 2004 within the Niagara River AOC at Lyons Creek East and found the following results relating to hatching success and deformity rates of snapping turtles.[90]

The following figure shows the mean hatching success (SD) of snapping turtle eggs collected from Lyons Creek in the Niagara River AOC (dark shaded bar) and various sites in the Great Lakes basin including other AOCs from 2002-2004. With the exception of Algonquin and Tiny Marsh, sites are ordered from west to east. Means are based on number of clutches collected at each site (range=4-31).[91] Overall, hatching success of snapping turtle clutches varied significantly among the Great Lakes study sites (Figure 14).

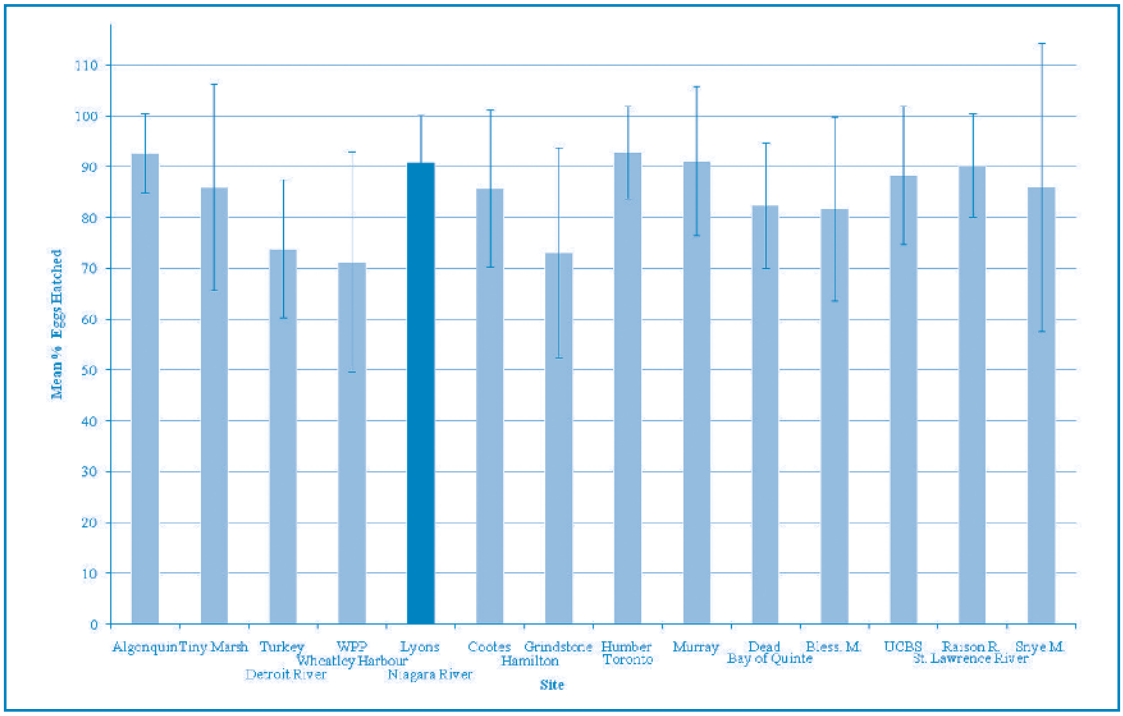


Figure 14: Mean hatching success of snapping turtle eggs

However, the hatching success of snapping turtle clutches collected from 2002 to 2004 within the Niagara River AOC at Lyons Creek East was high relative (mean 91%) to some other Great Lakes sites, and was similar to the reference sites Tiny Marsh (86.0%) and Upper Canada Bird Sanctuary (88.4%).

The following figure shows the mean deformity rate (SD) of hatchling snapping turtles collected from Lyons Creek East in the Niagara River Area of Concern (dark shaded bar) and various sites in the Great Lakes basin including other AOCs from 2002-2004. With the exception of Algonquin and Tiny Marsh, sites are ordered from west to east. Means are based on number of clutches collected at each site (range=4-31). Deformity rates of hatchling snapping turtles also varied significantly among the Great Lakes study sites (Figure 15). Similarly, deformity rates were similar between those from the Niagara River AOC (mean = 6.7%) and the Tiny Marsh reference sites (11.3%), but were lower than the deformity rates from the Upper Canada Bird Sanctuary (18.3%).

[90] A review of the current status, trends and distributions of Aquatic Wildlife in the Niagara River (Ontario) Watershed by Kim Hughes, 2009

[91] de Solla *et al.* 2008

In addition, of the 25 adult snapping turtles captured from Lyons Creek East, none were found to have deformities[92]. Deformities recorded included missing or extra marginal, dorsal or lateral scutes. Lyons Creek was the only AOC in which no deformities were recorded in adult turtles examined[93], whereas deformity rates were 7.0% and 11.8% at Tiny Marsh and Upper Canada Bird Sanctuary, respectively[94]. These estimates are conservative since all animals which exhibited evidence associated with a possible injury (e.g., missing nails, bent tail, etc.) were excluded from the assessment.

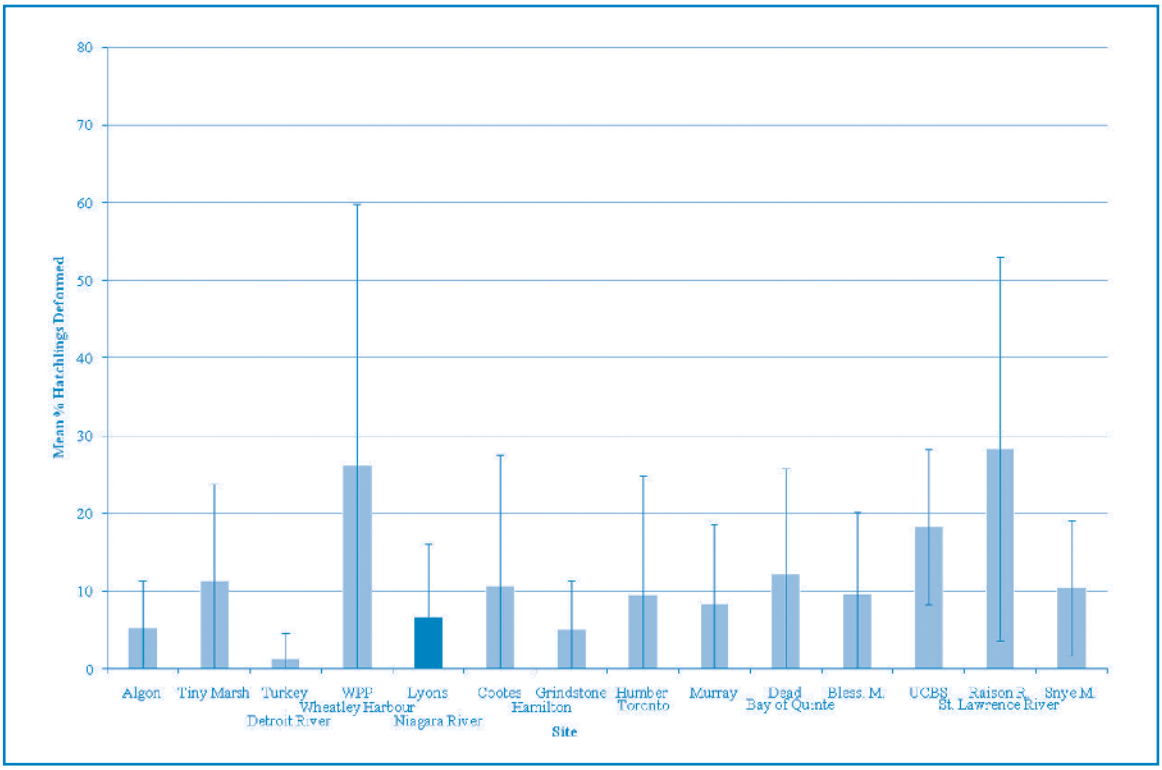


Figure 15: Mean deformity rate of hatchling snapping turtles.[92]

While reductions in reproduction and alterations in development of snapping turtles have been found in some Canadian Great Lakes AOCs, these were not evident in snapping turtles from Lyons Creek East where hatching success was high (91.0%), and hatchling deformity rate was low (6.7%) and both were statistically similar to the upstream Tiny Marsh reference site. In addition, no deformities were found in 25 adult snapping turtles examined from this site in 2002. While subtle physiological effects such as differences in clinical chemistry parameters have been reported in snapping turtles from Lyons Creek compared to reference sites[95], there have been no linkages between these measures and health effects such as alterations in growth, survival and reproduction. We cannot discount the existence of these alterations, but they were not obviously apparent or among those measured in this study. The delisting target of no exceedances in the frequency of deformities and impaired reproduction of snapping turtles from the Niagara River AOC relative to suitable non-AOC reference sites was met, as there is no evidence of population level affects to the turtle populations.

[92] de Solla *et al.* 2008
[93] de Solla *et al.* 2008
[94] de Solla *et al.* 2008
[95] Environment Canada 2007

Mink organ indices

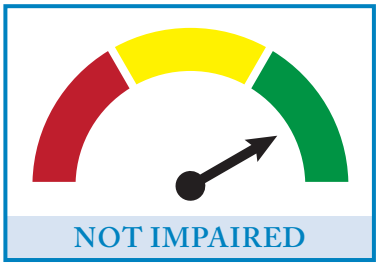
Other potential physiological effects of contaminant exposure in wildlife include changes in organ size and while mink from the Niagara River AOC had a significantly larger spleen index relative to mink from inland Ontario, this effect was not linked to contaminant exposure and may have been related to an infection. It is unclear to what extent the introduction of domesticated animals might influence the overall fitness and reproductive success of the breeding mink population in the Niagara River area since there is a known mink farm in the Municipality of Niagara from which domestic mink have escaped and mated with wild mink.[96] Currently, the genetic status of mink from the Niagara region, and elsewhere, are being assessed through genotypic fingerprinting.[97]

Health of Herring Gulls

While health effects associated with contaminant exposure have been documented in recent studies of herring gulls foraging in other AOCs in the lower Great Lakes[98], such effects in herring gulls from the Niagara River (Ontario) AOC could not be assessed due to inherent difficulties with accessing the colony for research purposes. Similarly, contaminant levels were generally low for gulls foraging within the AOC compared to other AOCs.

As the embryonic development of snapping turtles from the Niagara River (Ontario) AOC was similar or better than reference sites, and spleen size in mink was not associated with contaminant burdens. It was found that, the deformities and/or reproductive impairments do not exceed the target for populations from suitable non-AOC reference sites.

Consequently, the RAP Coordinating Committee has concluded that the Bird or Animal Deformities or Reproduction Problems Beneficial Use can be redesignated to "Not Impaired".



This Beneficial Use Impairment was reviewed by: Dr. Shane de Solla, Wildlife Conservation Biologist (Shane works on Wildlife Toxicology and Disease in the Water Science and Technology Directorate at Environment Canada).

[96] Kidd *et al.* 2009
[97] P. Martin, unpublished data, 2009
[98] Environment Canada 2003; Hughes 2009

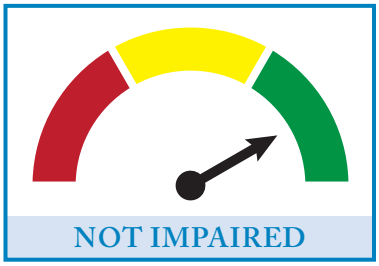
3.6 BUI Assessment: Restrictions on Dredging Activities

This impairment is socioeconomic in nature, relating to the additional cost which would have been transferred to proponents of navigational dredging projects in cases where open water disposal of dredged sediments would have been denied based on contaminant concentrations. However, open water disposal of dredgeate is no longer allowed in Ontario. Furthermore, in the Ontario watershed of the Niagara River (not including the Welland Canal, which is not considered part of the AOC), there are no sites where navigational dredging is required. On May 4th 1998, the COA RAP Steering Committee agreed that several AOCs, including the Niagara River AOC, should have the BUI redesignated as "not impaired" since navigational dredging was not an issue[99]. This decision was supported by a team of technical experts from MOE and Environment Canada, and by RAP participants in the affected AOCs. They concluded that environmental effects associated with contaminated sediments would be considered through the impairments:

- Degradation of benthos
- Restrictions on fish and wildlife consumption
- Fish tumours and other deformities

(See Appendix 15 - Canada-Ontario Agreement (COA) RAP Steering Committee. Unpublished meeting record regarding the BUI "Restrictions on Dredging Activities". May, 1998. Environment Canada and Ontario Ministry of the Environment.)

Consequently, the Niagara River RAP Coordinating Committee has updated the BUI status table to reflect this decision that the Restrictions on Dredging Activities beneficial use was never impaired.



3.7 BUI Assessment: Beach Closings

Delisting Criterion:
Public beaches meet the following conditions:
i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known;

As mentioned in section 3.0, a review of this impairment was conducted as part of a technical review working document *(Technical Review 2007)* - to see the complete review please see Appendix 16.

This review concluded that only 4 beaches were within the Niagara River AOC (the other four historic public beaches having been closed in recent years). These 4 beaches and the suspected prominent sources of fecal pollution are listed in the following Tables.

[99] COA RAP Steering Committee, 1998

Table 12: Binbrook Conservation Beach

Beach:	Binbrook Conservation Beach
Waterbody:	Upper Welland Canal
Approximate size of beach (sand/gravel area):	3, 900 m^2
Major prominent soure of fecal pollution (E. coli):	Water fowl using beach
Is there suspected human sewage sources of fecal pollution (E. coli)?	No

Table 13: Chippawa Conservation Beach

Beach:	Chippawa Conservation Beach
Waterbody:	Middle Welland River
Approximate size of beach (sand/gravel area):	760 m^2
Major prominent soure of fecal pollution (E. coli):	Water fowl using beach
Is there suspected human sewage sources of fecal pollution (E. coli)?	No

Table 14: Ball Street Beach

Beach:	Ball Street Beach
Waterbody:	Lower Niagara River
Approximate size of beach (sand/gravel area):	156 m^2
Major prominent soure of fecal pollution (E. coli):	No obvious source - not a priority beach for the Region of Niagara
Is there suspected human sewage sources of fecal pollution (E. coli)?	No

Table 15: Queens Royal Beach

Beach:	Queens Royal Beach
Waterbody:	Lower Niagara River
Approximate size of beach (sand/gravel area):	720 m^2
Major prominent soure of fecal pollution (E. coli):	Niagara-on-the-Lake Outfall (located at the southern end of the beach)
Is there suspected human sewage sources of fecal pollution (E. coli)?	Under Investigation

Analysis of the Queens Royal Beach Outfall

Figure 16: Outfall located at Queens Royal Beach

As part of the Stage 2 update it was identified that there is a stormwater overflow at the Queens Royal Beach. In 2009, the Niagara Region Public Health Department collected data on the *E. coli* levels for the outfall located at the Queens Royal Beach. This data is presented in the following graph (Figure 17) illustrating the *E. coli* geometric mean levels of the outfall in comparison to the adjacent beach (Queens Royal).

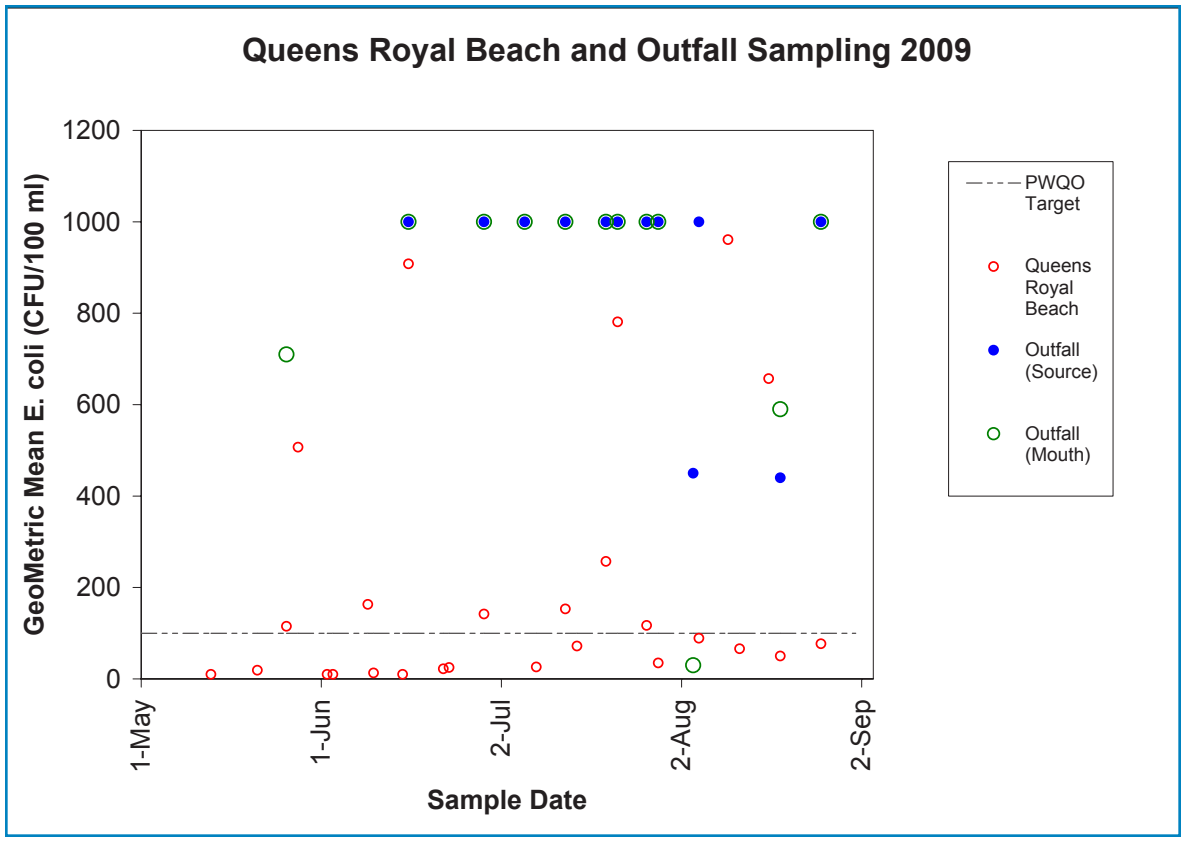


Figure 17: Magnitude of geometric mean *E. coli* exceedance Queens Royal Beach and Outfall, 2009

This review concludes that of the 4 beaches within the Niagara River AOC only one still has a suspected contributing source of E. coli to beach. At the Queens Royal Beach it appears that the outfall, which is adjacent to the beach, may be a contributing E. coli source. A further examination needs to take place to determine if:

- the *E. coli* is human origin or animal
- if the source to the beach can be successfully mitigated

Delisting Criteria:
ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 E. coli /100ml), or is similar to a suitable non-AOC reference site, when assessed over a period of at least three to five years;

The Technical Review 2007 also concluded that the Provincial Water Quality Objectives (PWQO) had been exceeded at various times at each of the individual AOC beaches during the period of 2003 to 2005. It showed that these exceedances did surpass the 20% limit, relative to the delisting criterion (number ii – listed above), at several of the beaches over the various years. This review showed that this criterion had not been consistently met for Binbrook Conservation beach, and was inconsistently met (only two out of three years for 2003-05) for Queens Royal and Ball Street beaches. However, it had been met for a consecutive three year period for the Chippawa Conservation beach demonstrating that the Chippawa Conservation beach had successfully achieved the delisting criterion (see Appendix 16). In 2009, another review was completed on data for the three beaches in the AOC that did not achieve this criterion during the Technical Review (see Figures 18 - 21).

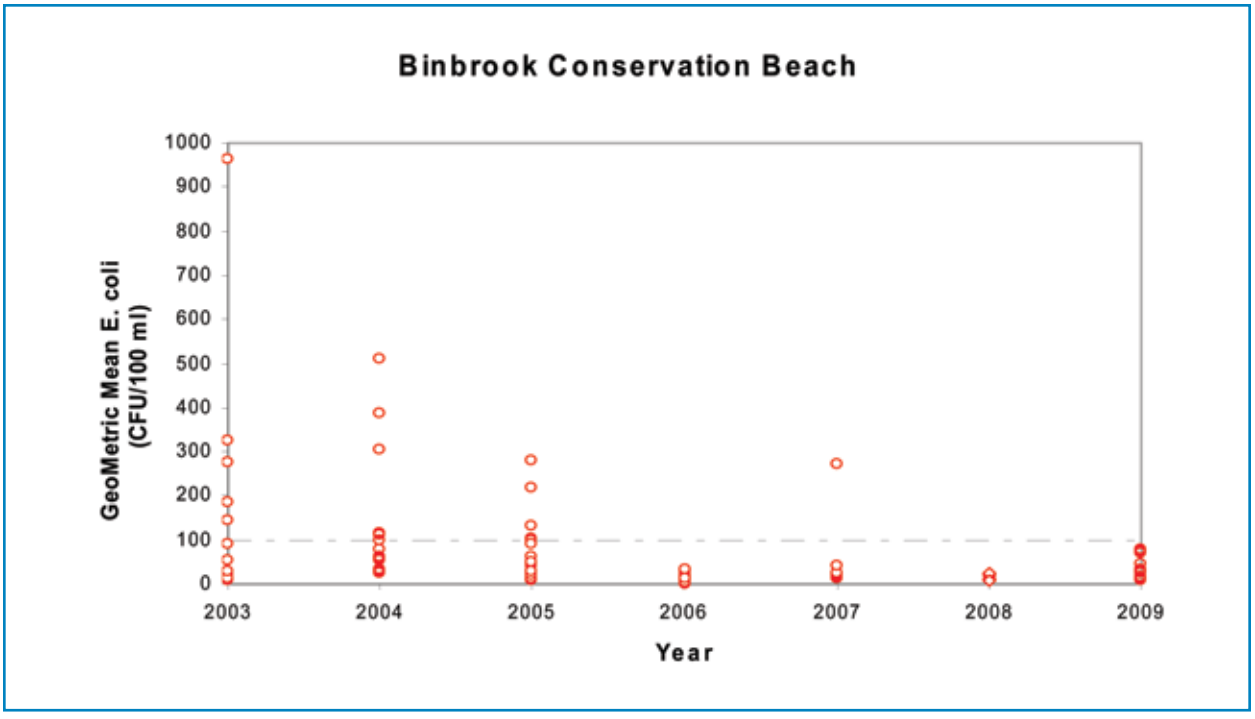


Figure 18: Magnitude of geometric mean *E. coli* exceedance for the Binbrook Conservation beach

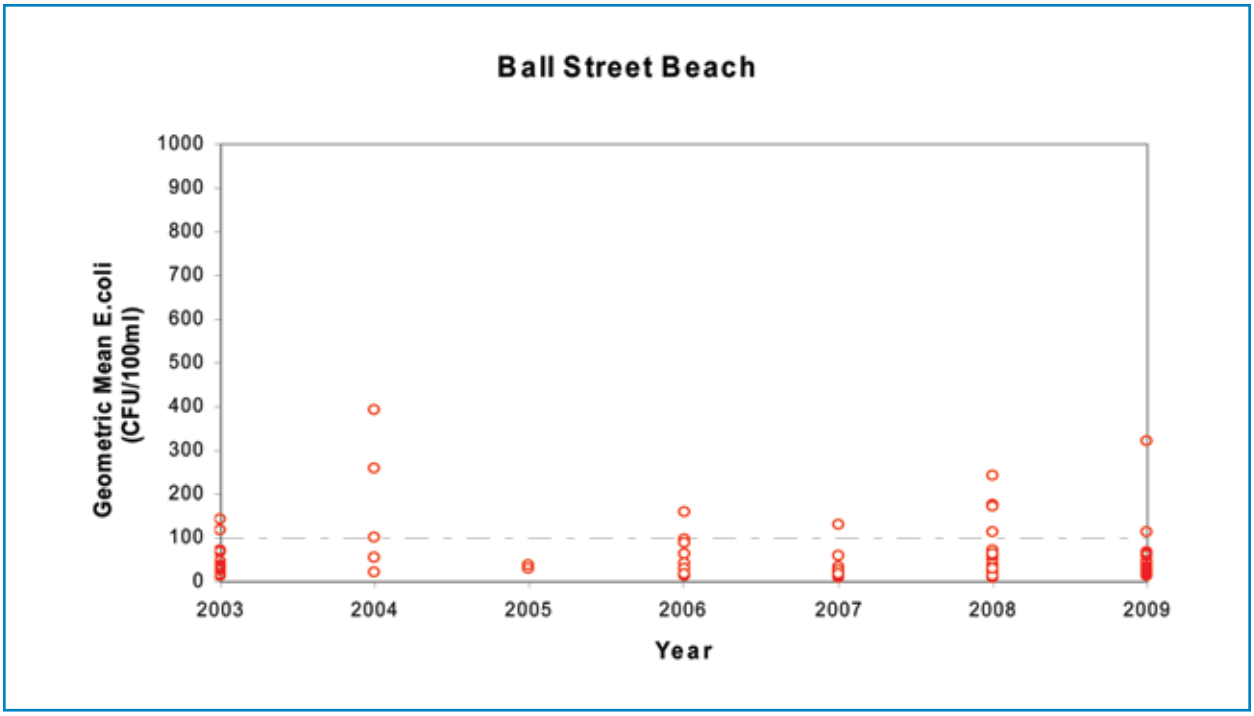


Figure 19: Magnitude of geometric mean E. coli exceedance for the Ball Street beach

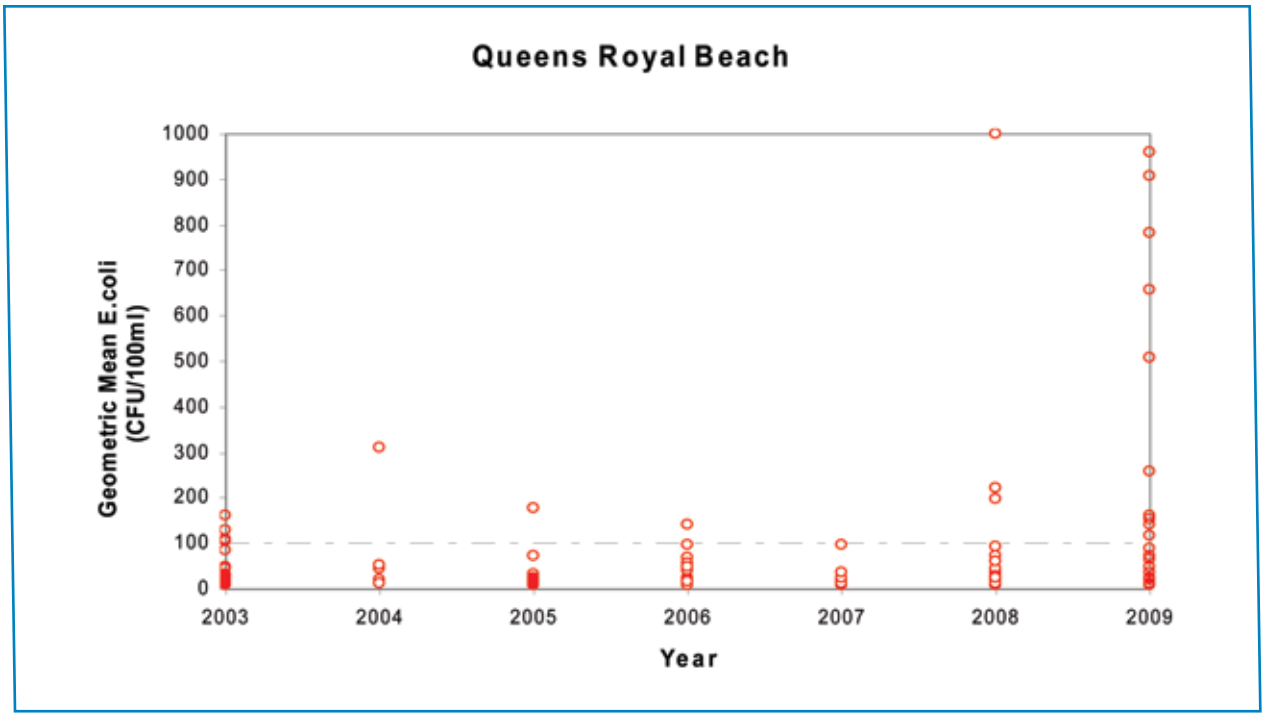


Figure 20: Magnitude of geometric mean E. coli exceedance for the Queens Royal Beach

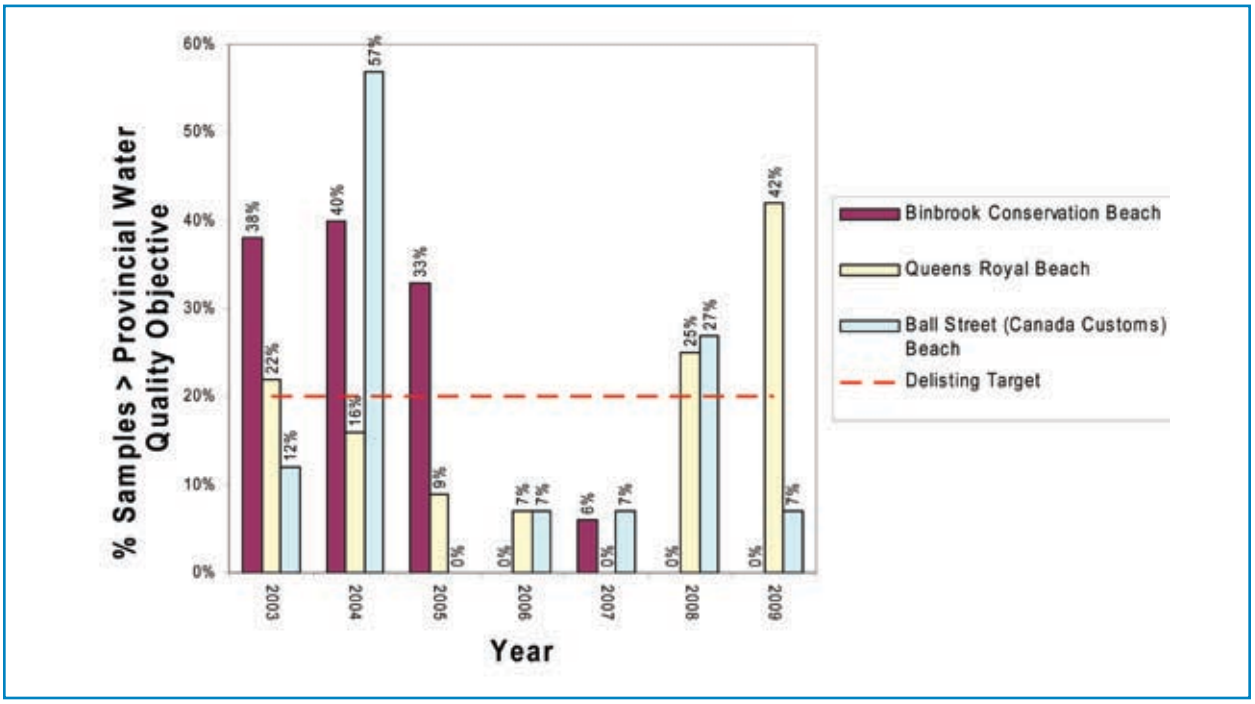


Figure 21: Performance of individual beaches within the Niagara River (Ontario) AOC between 2003 to 2008

It can be seen that the number of exceedances past the Provincial Water Quality Objective have improved since 2005 for the Binbrook Conservation and Ball Street beaches. At these beaches while there were a few cases where the 20% limit, relative to the delisting criterion, was surpassed - they were infrequent and rare. These exceedances were also predictably associated with local significant rainfall events (see next criterion). However, examining the data for the Queens Royal beach there appears to continue to be a concern since the number of exceedances appears to have increased in recent years.

Delisting Criterion:
iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.

While there were cases over the past 3 years where the 20% limit, relative to the delisting criterion, was surpassed - they were infrequent and rare at the Binbrook Conservation and Ball Street beaches. In 2008, the percentage of exceedances for Ball Street Beach was 27% and in 2009 was 7%. It is felt that the 2008 incidences at Ball Street beach were predictably associated with local significant rainfall events as during the summer of 2008. It should be noted that in 2008 right across Ontario there were extremes of rain events reported. It should also be noted that typically the *E. coli* numbers do not get as high at the Ball Street beach as at Queens Royal Beach.

Binbrook Beach is located within the Binbrook Reservoir Conservation Area in the upper Welland River watershed. The major source of fecal pollution *(E. coli)* impacting the beach water quality is from water fowl. Water quality at Binbrook beach is monitored through the City of Hamilton's Safe Water program during each swimming season.

However, at Queens Royal Beach the 2008 levels did not improve in 2009. As mentioned previously it is suspected that the prominent source for *E. coli* levels at the Queens Royal Beach is a storm water outfall located directly on the beach. [100]

A special point of concern was that on July 21st 2008, at the Queens Royal Beach the *E. coli* count exceeded 1,000 CFU/100ml (geometric mean). It should also be noted that over the 7 years shown above the incident in 2008 was the only incident where the count was this high directly at any of the beaches in the AOC. Although this level was found at the Queens Royal outfall several times in 2009.

The *E. coli* reduction achievements that have been accomplished at the beaches in the Niagara River AOC are due to the efforts by the Niagara Region, City of Hamilton and the NPCA. An example of these efforts is the innovative technique that was employed by the NPCA to control the sources of *E. coli*:

- At Binbrook Conservation beach alternative habitat was created for the geese (see side bar)
- At Chippawa Conservation Area beach goose waste is collected and disposed of.

Both of these efforts have had a direct impact on the reduction of beach closings in the AOC.

The Niagara River AOC has successfully achieved all of the delisting criteria at all the beaches except the Queens Royal Beach.

Due to the remaining issue at the Queens Royal Beach, the Niagara Region and the town of Niagara-on-the-Lake have agreed to complete further monitoring at this beach and take appropriate action. This task has been identified in the Niagara River RAP 5- year work plan.

Binbrook Conservation Beach
A success story

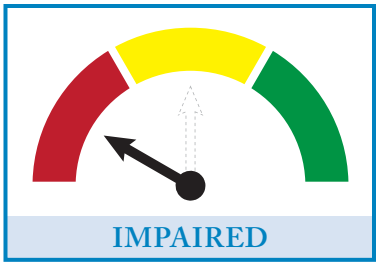
Over the years, the NPCA has implemented a variety of mitigative measures to address agricultural and rural issues that have impacted Binbrook Beach. For example, the NPCA implemented the Ministry of Environment and Energy's "Clean Up Rural Beaches" program (CURB), beginning in 1988. The program purpose was to prevent pollution from rural sources to reduce the frequency of rural beach postings in Ontario. Under CURB the ministry made funds available for projects such as improving manure storage, milkhouse washwater disposal systems, fencing and crossings to restrict livestock access, and private sewage systems. The program was implemented at Binbrook and surrounding area and was successful in reducing the number of beach closings to zero for three consecutive seasons. One of the key actions was to restrict gull access to the beach. This was accomplished by installing netting around the beach area.

In 1994, the NPCA initiated a "Rural Water Quality Program" to assist landowners to recognize and solve problems contributing to poor water quality. The program approach was modelled after CURB but expanded to include rural non-point source monitoring and remediation for sub-watersheds within the Niagara River Area of Concern. The program replaced CURB and its development was supported by Environment Canada, through the Great Lakes Cleanup Fund.[1]

More recently, since 2005, steps have been taken at Binbrook by the NPCA to move geese out of the beach area by providing alternative habitat more suitable for their requirements. This initiative, in combination with some other factors, is considered to be the main reason for the dramatic decrease in beach postings at Binbrook during 2006, 2007 and 2008. The success story is again reflected in the data for 2009 when the Binbrook Beach was open during the entire swimming season.

[100] (personal correspondence Glen Hudgin, Manager, Environmental Health, Niagara Region Public Health Department)

Consequently, the Niagara River RAP Coordinating Committee has concluded that the Beach Closings Beneficial Use continues to be impaired due to the Queens Royal Beach. However, further monitoring and actions in the work plan are now underway to address this remaining beach.



It is important to recognize that beach closings continue to occur in Southern Ontario due to a variety of causes including high *E. coli* levels. From June to the end of August, Niagara Region Public Health collects weekly water samples from the beaches which fall within their jurisdiction (Chippawa Conservation, Ball Street and Queen's Royal beaches). This is complemented by the City of Hamilton's Safe Water program which provides beach water quality updates on a regular basis from Victoria Day to Labour Day on beaches which fall within their jurisdiction (Binbrook Conservation beach).

When water sample tests show a particular beach is not safe for swimming, Public Health Officials post signs at the beach warning swimmers that it is not safe to enter the water. It is important to heed these warnings. Information regarding beach postings is updated every week from June to the end of August.

For the status of Niagara Region beaches, please visit the Niagara Region's website
www.niagararegion.ca
or to call the Beach Hotline at 1-888-505-6074 ext. 7789

For the status of the City of Hamilton beaches, call Safe Water Hotline at 905-546-2189

Delisting Criteria:
Delisting criteria were not developed as this BUI component was never shown to be Impaired - only Requiring Further Analysis.

This Beneficial Use Impairment was reviewed by: Dr. Tom Edge, Research Scientist (Study Leader for Waterborne pathogens in the Water Science and Technology Directorate at Environment Canada)

3.8 BUI Assessment: Fish Tumours and Other Deformities
(designated only as Requiring Further Assessment)

This BUI was first identified in the Stage 1 for the Niagara River AOC as Requiring Further Assessment. However, at that time there was very little data and/or anecdotal evidence (e.g., stakeholder complaints) demonstrating a concern regarding this BUI within the Canadian AOC boundaries. In 2009, several regulatory agencies were contacted to assess if they have had any new data or anecdotal evidence. It was found that:

- The Ontario Ministry of Natural Resources (MNR) had not received any complaints about tumours from the commercial, recreational or bait fishers in the area. Anything that has been observed was dismissed as lamprey scars or some kind of fungal infection[101].
- The Niagara Peninsula Conservation Authority has had no external tumours encountered during the Angler Diary (2002 to current)[102].

To help further address the concern relating to the lack of empirical evidence to evaluate the status of this Beneficial Use, brown bullheads (Ictalurus nebulosus) were collected from 2 locations (Black Creek, a nearfield site and Queenston, a farfield site). The fish used to assess this BUI were only from the Black Creek site though (nearfield) as it was assumed this would represent the worst case scenario.

Table 16: Sampling locations for fish tumours in the Niagara River (Ontario) AOC

Location		UTM Coordinates		# of Fish Collected in 2004	# of Fish Collected in 2008
Black Creek	Near field	N42 57.136	W78 58.128	40	61
Queenston	Far field	N43 11.016	W79 03.448	43	59

In 2009, a study was commissioned by Environment Canada with Dr. Paul Baumann to evaluate the status of this BUI in all of the Canadian AOCs (*Draft Assessment* of Fish Tumours and other deformities BUI for the Canadian AOCs, 2009 by Dr. P. Baumann). This study examined tumour prevalence in brown bullhead (Ictalurus nebulosus) fish within each of the AOCs and if so if it is significantly different from that at reference sites (e.g., a natural or background prevalence of tumours).

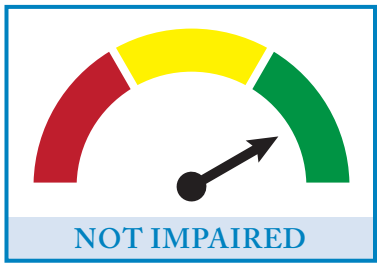
This study determined that liver neoplasms (cancers and "benign" tumours) are the best indicator of chemical carcinogens and that skin tumours would no longer be used as a primary evaluation criterion. Thus, it was decided that the assessment process would be driven by the prevalence of liver neoplasms in brown bullhead *(Ictalurus nebulosus)* fish in each of the AOC populations.

The data that was available for reference locations was combined to develop a total reference target for non-urbanized locations and urbanized locations. The non-urbanized reference target has a prevalence of 1.05% (N= 761) of liver neoplasm in brown bullheads *(Ictalurus nebulosus)*. It is this reference condition against which the data for the Niagara River AOC was compared, using a statistical significance value of P = 0.05.

[101] Personal Correspondence Randy Tippin, Lake CO MNR
[102] Personal Correspondence Jocelyn Baker/Ian Barrett, NPCA

The study found that the number of brown bullhead *(Ictalurus nebulosus)* fish with liver neoplasm is not statistically significant in the Niagara River AOC. Thus, Dr. Baumann's draft report concluded that this BUI was no different than the reference condition.

Consequently, the RAP Coordinating Committee has concluded that the Fish Tumours and Other Deformities Beneficial Use can be redesignated to "Not Impaired".



This Beneficial Use Impairment was reviewed by: Dr. Paul Baumann, (US Geological Survey, USA, retired and the Ohio State University, retired)

3.9 General Information about the other Beneficial Use Impairments

3.9.1 Revised status of partial BUIs

In addition to the above mentioned BUIs eight other impairments were reviewed (Technical Review 2007). Recommendations were made to change the impairment status of two other sections of BUIs.

1) **Degradation of wildlife populations component (under the Degradation of Fish and Wildlife Populations BUI)** – from Requires Further Assessment to Impaired resulting in the entire BUI now being listed as Impaired.

Colonial Waterbird survey in the Niagara River (Canada)

During the fourth decadal CWS Great Lakes colonial waterbird survey (2007), 915 nests (=breeding pairs) of three species: i) ring-billed gull (Larus delawarensis), ii) herring gull *(Larus argentatus)* and iii) black-crowned night-heron *(Nycticorax nycticorax)*, were found nesting on the Canadian side of the Niagara River (CWS unpublished; Table 17).

Table 17: Census data of colonial waterbird nests (=pairs) on the Canadian side of the Niagara during the 1st (1977), 2nd (1990/91), 3rd (1997-2000) and 4th (2007) surveys as part of the Great Lakes-wide decadal surveys conducted by the Canadian Wildlife Service

Species	Census Year				Annual Rate of Change
	1977	1990/91	1999	2007	
Ring-billed Gull	400	400	317	508	+6.1%
Herring Gull	35	104	88	29	-13.0%
Black-crowned Night-Heron	65	426	246	378	+5.5%
Total	**503**	**930**	**651**	**915**	-

Nests were counted at seven sites situated on natural habitat (i.e., small islands and rocks) and on artificial habitat (i.e., a gated control structure). Numbers of ring-billed gull nests have remained high at over 300 nests over the four survey periods and over the last two surveys increased by 60% from 317 nests in 1999 to 508 nests in 2007, representing an annual rate of increase equal to 6.1%[103]. Black-crowned night-heron nests which were relatively fewer in number during the first survey period in 1977 (65 nests) have at least tripled in number since that time and between the third and fourth decadal surveys increased in number by 54% from 246 nests in 1999 to 378 nests in 2007 at an annual rate of increase equal to 5.5%[104]. In contrast, herring gull nests peaked in 1990 at 104 nests at two sites and then declined dramatically since that time dropping by 67% from 88 nests to 29 nests between 1999 and 2007 at an annual rate of decline of -13.0%[105]. Herring gull populations may have declined due to limited habitat availability, due to floating debris restricting the total area of available ground nesting habitat for these gulls[106]. While there have been reports of botulism poisoning in gulls nesting on Lake Ontario, there have been no such cases in Ontario gulls collected from the Niagara River in 2007 or 2008 and only a few cases in birds from the eastern basin of Lake Erie prior to that time[107]. Overall, the total number of colonial waterbird nests on the Canadian side of the Niagara River increased from 651 nests in 1999 to 915 nests in 2007.

[103] Blokpoel and McKeating 1978; Blokpoel and Tessier 1996; CWS unpublished
[104] Blokpoel and McKeating 1978; Blokpoel and Tessier 1996; CWS unpublished
[105] Blokpoel and McKeating 1978; Blokpoel and Tessier 1996; CWS unpublished
[106] D.V. Weseloh pers. comm.
[107] Canadian Cooperative Wildlife Health Centre 2009
[108] Cuthbert and Wires 2008

Colonial Waterbird survey in the Niagara River (US)

During the fourth decadal colonial waterbird survey by the U.S. Fish and Wildlife Service (USFWS) on the U.S. side of the Niagara River in 2007, over 13 700 nests of seven colonial waterbird species were reported at six different sites on the River (Table 16, [108]). These included four species, double-crested cormorant, great blue heron, great egret and common tern. Compared to the small islands and rocky outcrops on Canadian side of the Niagara River, the U.S. side supports a much higher proportion of nesting birds due to a greater availability of suitable habitat. It is difficult to report on U.S. population trends between the third and fourth surveys since nest count data for this side of the River at this time are incomplete (data for two sites are not yet available in entirety).

Table 18: Census data of colonial waterbird nests (=pairs) on the U.S. side of the Niagara River (A) during the 1st (1977), 2nd (1989-1991), 3rd (1997/99) and 4th (2007/08) surveys as part of the Great Lakes-wide decadal surveys conducted by the U.S. Fish and Wildlife Service[109] . Data presented for the U.S. sides of the Niagara River and Lake Erie for the 4th survey are incomplete and hence no annual rates of change have been calculated.

Species	Census Year			
	1977	1989-91	1997/99	2007*
Ring-billed Gull	4 809	11 427	16 859	12 917
Double-crested Cormorant	0	0	49	552
Herring Gull	110	156	24	12
Black-crowned Night-Heron	0	0	38	98
Great Blue Heron	0	0	40	64
Great Egret	0	0	7	20
Common Tern	518	160	113	89
Total	**5 437**	**11 743**	**17 130**	**13 749**

* Data for fourth survey are incomplete as data for two sites has not yet been entered in entirety.

Numbers of nesting double-crested cormorants have increased since the first year they appeared, in 1992. Annual counts of double-crested cormorants on the U.S. side of the River indicate that nest numbers gradually increased over the next thirteen year period to a peak of 705 nests at five sites in 2005 and then subsequently declined to 552 nests at four sites in 2007 (Table 3;[110]). Following concerns of the impacts on other nesting colonial waterbird species, cormorant management activities have been implemented by NYSDEC since 1996 to reduce the success of nesting cormorants in this region as well as at some sites on the U.S. side of Lake Erie. It is unknown why there are no cormorants breeding on the Canadian side; it is unlikely due to a lack of habitat, and they may start breeding at any time on the Canadian side.

[109] Scharf and Shugart 1998; Cuthbert *et al.* 2001; Cuthbert and Wires 2008

[110] CWS and NYSDEC unpublished

Table 19: Census data of double crested cormorants (=pairs) on the U.S. side of the Niagara River (1992-2008)

Colony	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Goat I.								0	9	47	38	72	88	151	127	176	243
Buckhorn Weir	7	51	52	29	32	0	0	0	0	0	20	128	46	83	87	180	203
NiMo Crib													7	4	16	32	44
Motor I. *	0	0	0	0	0	18	0	0	0	0	26	57	28	12	20	0	0
Strawberry I. *	0	0	0	0	0	31	4	0	0	0	0	0	130	455	235	164	38
Total	**7**	**51**	**52**	**29**	**32**	**49**	**4**	**0**	**9**	**47**	**84**	**257**	**299**	**705**	**485**	**552**	**528**

Overall, the large declines in contaminant levels in herring gull eggs from the Niagara River in the last twenty years and the relatively stable numbers of nesting species suggests that contaminant-induced effects do not appear to be limiting factors at the population level for birds feeding in the AOC. Bald eagles have recently returned to nest on the Niagara River at Navy Island and successfully fledged eaglets in 2005, 2006 and 2008 providing additional support for the improved health of aquatic-feeding birds in the AOC[111].

Although herring gull numbers have declined, herons and cormorant numbers have increased. The most likely limiting factor for colonial waterbirds in general on the Canadian side is the limited natural nesting habitat.

2) **Undesirable Algae component (under the Eutrophication or Undesirable Algae BUI) –** from Not Impaired to Impaired resulting in the entire BUI now being listed as Impaired.

The Welland River watershed has poor water quality and attempts to mitigate the effects of altered water flow and introduce more favourable land-use practices have been implemented through the Welland River watershed Strategy. There is an absence of key evidence of how the Welland River system is responding biologically to excess phosphorus. Consequently delisting criteria could not be recommended at this time for the BUI "*Eutrophication and Undesirable Algae*".

Both benthic biomonitoring (BioMAP) and fisheries assessment data suggest an impaired aquatic ecosystem, but interpretation is complicated by other possible stressors such as water level fluctuations, habitat degradation, barriers (in the case of fish movement), or other factors such as depositional and suspended sediment. Currently, the Welland River Eutrophication Study is underway and will be completed in 2011. When complete, this study will assess the status of the Eutrophication and Undesirable Algae BUI and develop delisting criteria for it.

[111] Allair 2008

3.10 Monitoring recommendations

Despite the designation of additional impairments, overall the problem definition for the RAP is much more focused following this review, and in many cases, the scope of impairment has been narrowed. This is due to progress made to date, such as the results from the contaminated sites assessment and the completion of several RAP recommendations, and the increased clarity about the specific sources or causes of impairment.

Several information gaps and requirements were identified in the working document review. While monitoring recommendations from this review are implemented through a new monitoring plan, the information being gathered about the environment will help to answer the questions: "Have we met delisting criteria?" and if not "How much progress has been made, and what more needs to be done?"

See section 5 for further information on the RAP monitoring plan.

3.10.1 Further Assessment

Gaps in technical information have been identified and these are summarized below under fish, wildlife and water quality.

3.10.2 Fish

There is limited data available (e.g., detailed population characteristics and age structure data, and fish health and/or condition data) for fish populations both in Welland River East/Lyon's Creek, and in Welland River West/Binbrook Reservoir and the Niagara River. However, numerous projects have been underway to help address the limited data relating to fish populations. Some of these efforts include:

- the Angler diary project (complete),
- Niagara River Watershed Fish Community Assessment (underway)
- fish habitat inventory for the Niagara River (proposed)

The existing evidence suggests that aspects of the fish community are likely impaired due to some combination of stressors related to:

- impacts on habitat and riparian function
- poor water quality due to non-point source pollution
- flow reversals in the Welland River
- barriers to fish passage
- cultural eutrophication of the Welland River west of the Old Welland Canal.

These impacts appear to be manifesting in changes to the forage base and overall composition and dominance of different taxa in the fish community, although overall species richness is similar within similar types of sites. Hydrologic, hydraulic and chemical (eutrophication) changes to the Welland River and its tributaries also continue to have a negative effect on fish habitat and the aquatic ecosystem.

3.10.3 Wildlife

- There is limited data on wildlife with regards to the following:
- Status of native wildlife populations.
- Quantity of habitat relative to reference sites/delisting criteria
- Quality of habitat (including diversity) relative to reference sites/delisting criteria
- Access to and connectivity of habitat

Table 20: Sentinel species used for assessment purposes

Sentinel species or groups recommended to assess impairment status of wildlife populations in the AOC include:
• Colonial waterbirds (i.e., Black-crowned Night-Herons, Herring and/or Ring-billed Gulls)
• Wetland-dwelling wildlife (i.e., marsh birds)
• Contaminant level trends (i.e., Herring Gull, night-heron, snapping turtle eggs, and/or livers of mink)

There is no robust wildlife population assessment data for mink or turtles, but there is a large data set (decadal population numbers since 1977) for the colonial waterbirds within the Niagara River. There is also a study that is currently underway with Bird Studies Canada to examine wetland-dwelling wildlife populations (i.e., marsh birds and amphibians) comparing the AOC to reference sites.

3.10.4 Water Quality: Phytoplankton and zooplankton populations

When this BUI was first identified in the Stage 1 RAP report as Requiring Further Assessment there were no data or anecdotal evidence (e.g., stakeholder's complaints) provided demonstrating a concern.

To try and assess this BUI the NPCA has undertaken monitoring (Chlorophyll a) within the Welland River watershed as part of the Eutrophication Study.

3.11 Conclusions on RAP progress

The work completed in the Niagara River AOC has successfully restored several Beneficial Use Impairments. This achievement demonstrates that significant progress has been made in the AOC but work remains to be done. In the Niagara River AOC the new five year work plan must be implemented to address the new recommendations and remaining priorities. In particular several key actions are required in the following priorities:

1. **Addressing sources of nutrients to eutrophication of the Welland River and its tributaries and develop a set of delisting criteria.**
2. **Restoring and protecting fish and wildlife habitat, including unique habitats found rarely in other parts of the Great Lakes basin (e.g., by mitigating the impacts of hydroelectric operations at the Sir Adam Beck Generating Station on the river upstream of the Chippawa Power Canal).**
3. **Implementation of the monitored natural recovery strategy for PCB contaminated sediment at Lyon's Creek East (e.g., administrative controls protocol).**
4. **Complete assessments for beneficial use impairment status for Degradation of Phytoplankton and Zooplankton Populations and implement appropriate actions for any other deemed impaired.**

The Big Picture

The water of the Niagara River and its watershed is an integral part of the community and its inhabitants in the Niagara area. Diverse populations and significant numbers of aquatic wildlife rely on the river's resources and habitat. As a result of extensive remediation activities, rehabilitation projects, community awareness and participation by a large number of agencies, the Niagara River and its watershed continue to move in a direction which is cleaner and better supports the human and wildlife populations which depend on it.[113]

[113] Environment Canada. Canadian Wildlife Service 2006. *Current Status, Trends and Distributions of Aquatic Wildlife in the Niagara River (Ontario) Watershed.* Technical Report Series Number 452.

5. **Implementation of the updated monitoring plan to assess the status of the remaining Beneficial Use Impairments.**
6. **Complete assessment of Queens Royal Beach and implement required actions.**

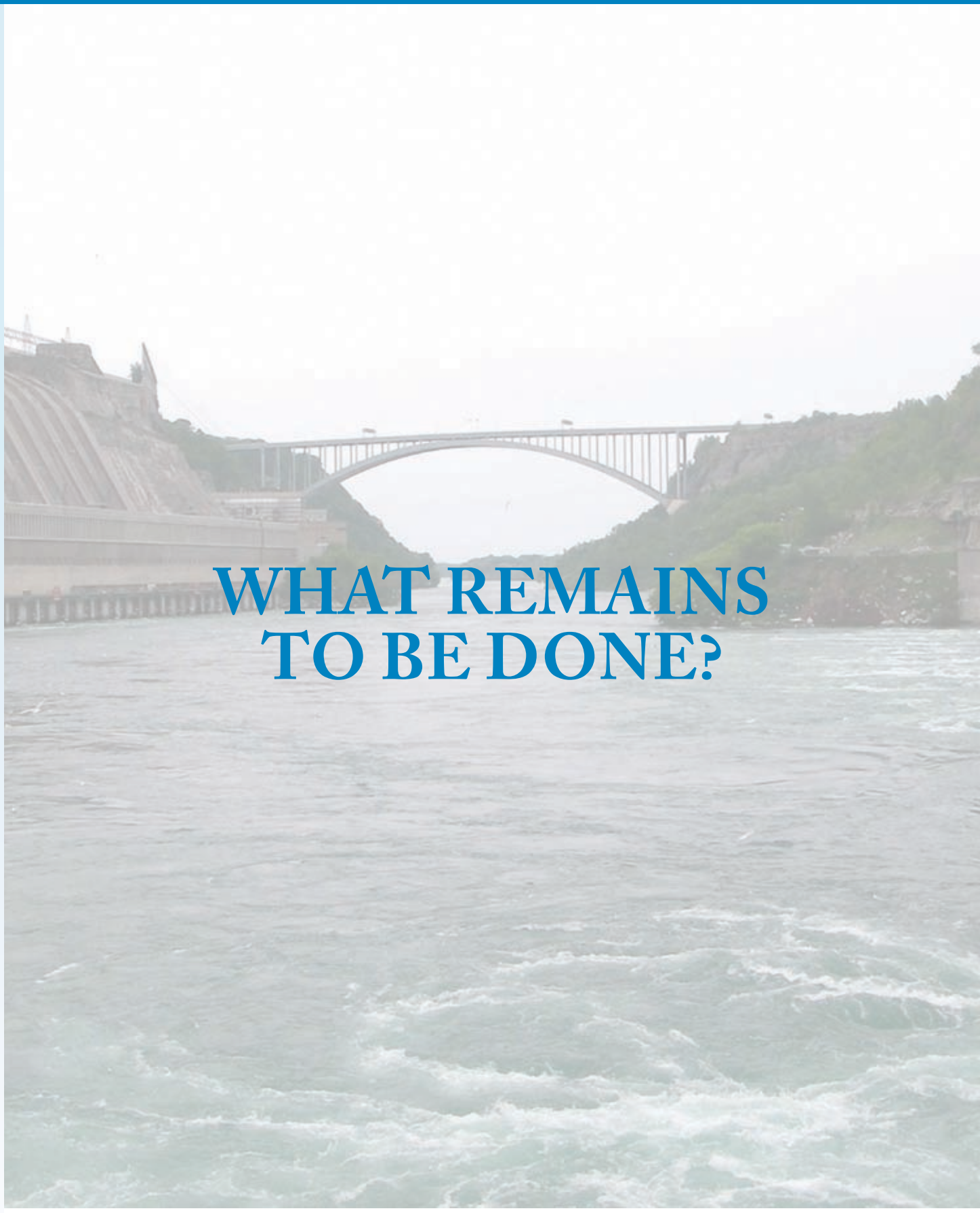
3.12 Community involvement in the Stage 2 review

Community involvement in the Stage 2 review was facilitated by establishment of a PAC. A representative of the PAC attended Steering Committee meetings and acted as a liaison between the two committees. Appendix 12 outlines the public consultation process and the endorsement of the PAC on the recommendations from the technical reviews.

Concurrent with the development of the Technical Review 2007, the Niagara River Coordinating Committee reviewed the 37 recommendations in the Stage 2 report, evaluated their status and proposed a list of revised recommendations in a Background paper[112] in June 2006. The PAC played a major role in the review of the proposed revised recommendations. (See Appendix 10 for the Background paper)

As a result of the PAC's involvement, a list of the new RAP recommendations and new delisting criteria now exist for the Niagara River (Ontario) AOC.

[112] Niagara River Remedial Action Plan (RAP) Recommendations and Proposed revised list of Recommendations. June 2006. *Background Paper.*



WHAT REMAINS TO BE DONE?

4.0 WHAT REMAINS TO BE DONE?

What emerged from the Stage 2 review is a current and more detailed picture of the state of the environment in the Ontario portion of the Niagara River AOC. The need for further data and information on fish, wildlife and water quality to complete some assessments has been identified.

To incorporate the recommendations resulting from the Stage 2 review, the next steps involve the development and implementation of a new 5 year RAP work plan and a monitoring plan. The RAP work plan will be implemented by RAP partners and will address the new RAP Recommendations. The RAP monitoring plan will help to guide data-gathering activities for the identified information gaps and facilitate monitoring and assessment of progress towards delisting the AOC. Progress in those projects that are currently underway and what remains to be done (e.g., implementation of administrative controls for the contaminated sediments at Lyon's Creek East) will be determined. Subsequently, any adjustments and additional actions will be included in the RAP work plan. In order to facilitate implementation of the monitoring and assessment recommendations, the new RAP Implementation Framework will be organized to identify the role of implementation committees and partners.

The new RAP Implementation Framework is discussed further in section 5.2.

4.1 Niagara River RAP Work Plan

In the following table, the new 12 recommendations are organized into the Beneficial Use Impairments and the lead implementing partners for the work plan are identified.

Table 21: List of revised recommendations and work plan partners

BUIs	Recommendations	Work Plan Partners
Eutrophication or Undesirable Algae Beach Closings	1. Implement municipal storm and waste water quality improvement projects through infrastructure upgrades, optimization, pollution prevention and control planning initiatives.	NPCA, Niagara Region, municipalities
Eutrophication or Undesirable Algae Loss of Fish and Wildlife Habitat	2. Identify priority target areas for water quality and habitat improvement and encourage landowner participation through funding incentives, education, and outreach.	NPCA, NRC, Niagara Region, OPG, NPC, Land Care Niagara, Haldimand Stewardship Council, municipalities, landowners
Degradation of Benthos Restrictions on Fish Consumption	3. Implement the sediment remediation actions identified through the management plans for contaminated sediment sites in the AOC.	EC, MOE, NPCA, Niagara Region, Hydro One, Transport Canada, City of Welland
Fish and Wildlife Habitat Fish and Wildlife Population Degradation	4. Support the implementation of municipal natural heritage strategies within the Niagara River AOC.	MNR, Niagara Region, NPCA, NPC, municipalities, NRC, Bird Studies Canada
Restrictions on Fish Consumption	5. While fish consumption advisories are necessary, adequately communicate and encourage the use of: (1) the government's "Guide to Eating Ontario Sport Fish" and (2) any advisories needed to protect human consumers from consumption of snapping turtle.	EC, MOE, MNR
All	6. Establish and support a monitoring plan for the RAP.	RAP coordinator, NPCA, MOE, EC, MNR
All	7. Develop and deliver education and community programs that address matters of interest to the RAP or that support RAP implementation.	RAP coordinator, NPCA, MOE, EC, MNR, municipalities, schools
All	8. Provincial and federal governments continue an integrated ecosystem approach to management for its agencies.	EC, MOE, MNR
All	9. All levels of government continue providing resources for RAP initiatives and make projects in Great Lakes AOCs a priority for infrastructure funding.	EC, MOE, Niagara Region, municipalities

All	10. The Niagara River RAP endorses and encourages the process of multisectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.	RAP Coordinator, NPCA, landowners
Fish and Wildlife Habitat Fish and Wildlife Population Degradation	11. The NPCA maintain its Geographical Information System (G.I.S) restoration database as a tool in determining priority areas for remediation within the watershed and collaborate with Niagara Water Strategy in G.I.S. information	NPCA, Niagara Region
Fish and Wildlife Habitat Fish and Wildlife Population Degradation	12. Continue to protect natural habitat on both sides of the Niagara River as one ecosystem and seek opportunities for international cooperation.	RAP Coordinator, NPC, NPCA

These categories and implementation partners will form the basis of the new RAP work plan. The work plan provides an important tool for RAP in planning, proposing, and reviewing the merits of the many projects and project ideas it deals with each year. Actions to address the recommendations under each category will be compiled and then implemented by stakeholders and RAP partners.

When new remedial projects are proposed or developed under the RAP, the main question is "Will implementing this project lead to improvements in the environment that bring the AOC closer to delisting?" Based on the accomplishments and project implementation undertaken by RAP partners, it is anticipated that all priority actions to restore the AOC can be completed within the next 5 years.

In order to meet this goal, the work plan will be developed to identify the actions essential to restoring the AOC. Plans are underway to develop a new implementation framework. The Implementation Committee is comprised of RAP partners and has been established to lead actions identified in the work plan (Appendix 11).

The new delisting criteria provide the achievable restoration targets that must be reached to accomplish delisting of the AOC. Through regular work plan reporting and monitoring of environmental conditions, it will be possible to measure progress in attaining the new delisting criteria. This, in turn, will provide evidence that the BUIs are being restored and justify the RAP process moving towards Stage 3 (i.e., delisting the AOC).

Based on the accomplishments and project implementation undertaken by agencies and RAP partners, it is anticipated that all priority actions to restore the AOC can be completed by 2015. A work plan is currently under development to prioritize which actions are essential to restoring the AOC.

The work plan includes an Eutrophication and Water Quality Assessment project for the Welland River that was initiated in 2007. The purpose of the project is to facilitate the development of delisting criteria for nutrients (i.e., phosphorus and nitrogen) in the Welland River watershed. When delisting criteria have been identified, then the appropriate monitoring plan may be developed and implemented.

5.0 MEASURING PROGRESS: THE RAP MONITORING PLAN

In order to assess progress in the recovery of the ecosystem from environmental degradation, and in response to remediation, monitoring and assessment programs are required. Through these programs*, many of which are ongoing, data is gathered which can be used to answer the questions *"has the environment recovered to the point that remediation is no longer required?"* and *"if not, how much recovery has occurred, if any?"* In order to answer these questions, RAP monitoring and assessment data are compared against delisting criteria. When all delisting criteria are met, the AOC can be delisted. Therefore, it is important that monitoring and assessment programs are designed to measure the same things on which delisting criteria are based.

Monitoring and assessment recommendations were made by technical reviewers as part of the delisting criteria review. Their recommendations have provided the basis for the development of a Niagara River RAP monitoring plan.[114] The purpose of the plan is to coordinate monitoring amongst the various agencies that carry it out, and identify priorities and needs for monitoring where programs are not already in place. Essentially, items under the Niagara RAP monitoring plan have been "bundled" into a number of projects. These projects are:

- Sport fish contaminants monitoring
- Wildlife monitoring
- Welland River fisheries assessment
- Eutrophication and water quality assessment
- Lyon's Creek East sediment recovery monitoring
- Fish and wildlife habitat assessment
- Niagara River Toxics Management Plan

A summary of the Niagara River RAP monitoring plan is presented in Table 22 (next page). For each of the projects, suggested implementation leads are identified along with the BUI(s) being addressed. Specific tasks for each project are outlined, and regular reporting to show progress towards delisting will be a key component.

Projects will be carried out to assess the BUI status of those BUIs that require further assessment, i.e., Phytoplankton & Zooplankton Populations.

** Note that monitoring toxics is undertaken through the Niagara River Toxics Management Plan.*

[114] Niagara RAP Monitoring Plan – Project Plans/Tasks, Implementation Partners and Priority. Draft document prepared by Scott Mackay, Environment Canada on January 22, 2007.

5.1 Implementation

As part of the review of the delisting criteria and BUIs, a number of recommendations were made for science-related activities (monitoring, assessment, and reporting) to be undertaken in the Niagara River (Ontario) AOC. Most of these recommendations involve some combination of the same partners to undertake the work, namely:

- Environment Canada (EC)
- Ontario Ministry of the Environment (MOE)
- Ontario Ministry of Natural Resources (MNR)
- The Niagara Peninsula Conservation Authority (NPCA)
- The Niagara Region (NR) or municipalities
- The Niagara River Toxics Management Plan (NRTMP)

To oversee implementation of science-related activities identified in the RAP Monitoring Plan, a RAP Science Committee, comprised of representatives of the above partners, has been struck. Under the auspices of the Niagara River (Ontario) RAP Coordinating Committee, the Science Committee convened in late 2007 to review and discuss the draft Terms of Reference.[115] The RAP Science Committee is an important component of the new RAP Implementation Framework (see section 5.2).

Table 22: Summary of the Niagara River RAP Monitoring Plan.[116]

Monitoring Project	Description	BUI(s) Addressed	Implementation Lead & Partners
Sport Fish Contaminants	Collection of sport fish from representative sections of AOC waterways and an analysis of edible portions for harmful pollutants.	Restrictions on Fish Consumption	**MOE-EMRB** MNR-Niagara Area, NPCA
Niagara River Toxics Management Plan	To reduce toxic chemical concentrations in the Niagara River by reducing inputs from sources along the river. There are three components to the plan: 1) Upstream/Downstream program 2) Biomonitoring using young of the year fish 3) Source trackdown and analysis screening using mussel monitoring	Restrictions on Fish Consumption	1) **Environment Canada** 2) **MOE - EMRB** 3) **MOE - EMRB**
Wildlife Monitoring	1) Coordination and implementation of monitoring and assessment related to wildlife populations and contaminants burdens. 2) Wetland-dwelling wildlife populations and diversity statistical comparisons of habitat conditions within versus outside the AOC (as determined by indicators such as Indices of Biotic Integrity and/or community status assessments derived from Bird Studies Canada's Marsh Monitoring Program).	Degradation of Fish and Wildlife Populations	1) **Environment Canada – Canadian Wildlife Service** 2) **Bird Studies Canada** MNR-Niagara Area, NPCA

[115] Environment Canada. August 2007. Niagara River (Ontario) Remedial Action Plan Monitoring Plan. Draft, Version 1.
[116] Environment Canada Restoration Programs. August 2007. *Niagara River (Ontario) RAP Monitoring Plan.* Draft, Version 1.

Fisheries Assessment	1) Coordination and implementation of regular assessments of the Welland River fish community, involving sampling both forage fish and top predators. 2) It will also assess the effectiveness of fish barrier removal efforts in restoring the natural distributions of select sentinel species.	Degradation of Fish Populations	1) **MNR - Niagara Area** 2) **NRC** NPCA
Eutrophication and Water Quality Assessment	Gathering of missing data about how the Welland River ecosystem is responding to nutrient inputs (e.g.- algal blooms or low oxygen levels), set delisting criteria for key parameters in the river, and set targets for tributary nutrient loads to meet the delisting criteria.	Eutrophication or Other Undesirable Algae	**NPCA** MOE-EMRB, MOE-South Central Region, Niagara Region
City of Welland STP upgrade studies	Complete further monitoring around the City of Welland CSOs and future possible upgrades.	Eutrophication or Other Undesirable Algae	Region of Niagara
Niagara on the Lake beach monitoring	Complete further monitoring at the Queen's Royal beach and its outfall in Niagara-on-the-Lake.	Beach Closings	Region of Niagara, Town of Niagara -on-the-Lake
Phytoplankton/ zooplankton population assessments	Currently these populations are identified as requiring further assessments in the Stage 2 Update. An assessment study needs to be developed.	Degradation of Phytoplankton and Zooplankton Populations	Not identified yet
Lyon's Creek East - Monitored Natural Recovery Strategy	Development and implementation of monitoring plans as part of the sediment management strategy for Lyons Creek East contaminated sediments. Monitoring will confirm the recovery of sediments and aquatic ecosystems.	Degradation of Benthos	**MOE** Environment Canada, NPCA, TC, City of Welland
Fish and Wildlife Habitat Assessment	Identification of suitable reference watersheds and statistical comparisons of habitat conditions within versus outside the AOC (using data from the Natural Heritage Areas Inventory).	Loss of Fish and Wildlife Habitat	**NPCA**, MNR-Niagara Area (wetlands), MOE, Environment Canada, Bird Studies Canada

5.2 New RAP Implementation Framework

In Annex 1 of the 2007 Canada-Ontario Agreement, Goal #2 states: "Make significant progress towards Remedial Action Plan (RAP) implementation, environmental recovery and restoration of beneficial uses in the remaining eleven AOCs." [117]

To facilitate implementation of the RAP in light of the 2007 COA, and to reflect the changes and progress in the RAP, a new RAP Implementation Framework is being established. Below is an overview of each of the components of the new RAP Implementation Framework:

The Niagara River RAP Coordinator will continue to provide the primary role in coordination of RAP responsibilities as outlined in the agreement with the RAP funding agencies. Through its network in the community, the RAP Coordinator will also provide a direct link to the community at large and facilitate public input. Community Liaison Committees will be struck as required. For example, a Community Liaison Committee was established in 2007 to participate in the decision-making for remediation of contaminated sediments in Lyon's Creek East. **RAP Coordinating Committee**

The Niagara River (Ontario) RAP Coordinating Committee is comprised of the RAP lead agencies (MOE, EC, MNR, NPCA) and the RAP Coordinator. The Committee will continue to provide the main coordination and oversight function for the RAP.

RAP Implementation Committee
The RAP Implementation Committee met initially in November 2008 and is comprised of the RAP Coordinating Committee members and other local stakeholders responsible for implementing actions in the RAP Work Plan. The RAP Implementation Committee will report on progress in the RAP Work Plan on a regular basis (see Appendix 2).

RAP Science Committee
The RAP Science Committee, established in August 2007, receives direction from, and provides information to, the RAP Coordinating Committee. The Science Committee oversees the monitoring and assessment projects (summarized in Table 22). The committee also provides a link to the NRTMP, through which research and monitoring activities providing technical data and progress in reductions of toxics loadings to the river are reported (see Appendix 5).

Special Focus Groups within the AOC (created to address specific AOC issues and will be disbanded when the issue is addressed):

Lyons Creek East Technical Advisory Group
The Lyons Creek East Technical Advisory Group was set up to examine the Lyons Creek East contaminated sediment site (within the Niagara River AOC) and develop a recommended mitigation/management approach. This group is comprised of technical experts from MOE, EC, NPCA, consultants, the City of Welland, the Niagara Region, Transport Canada and OMNR.

[117] Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2007.

Welland River Eutrophication Study Technical Working Group
The Welland River Eutrophication Study Technical Working Group was established to examine the response of the Welland River to nutrients and develop a recommended mitigation/management approach (which will include development of delisting criteria). This group is comprised of technical experts from MOE, EC, NPCA, the City of Welland and the Niagara Region.

Public Advisory Committee
Liaison Committees with the public will be established on an issue by issue basis as required.

APPENDIX 1:
Technical Reviewers From the Working Document Delisting Criteria and Impairments Review Niagara River (Ontario) RAP (Technical Review 2007)

Fish Consumption Restrictions
Mary Ellen Scanlon (lead), MOE South Central Region
Al Hayton, MOE Environmental Monitoring and Reporting Branch (EMRB)
Emily Awad, MOE-EMRB

Wildlife Consumption Restrictions, Wildlife Populations, Bird/Animal Deformities and Reproduction Problems
Shane De Solla (lead), Environment Canada, Conservation Strategies Division (CSD)
Laird Schutt, EC-CSD
Kim Fernie, EC-CSD
Cynthia Pekarik, EC-CSD
Tana McDaniel, EC-CSD
Pamela Martin, EC-CSD
Robert Townsend, New York State Department of Environmental Conservation
John Middleton, Brock University

Eutrophication and Other Undesirable Algae
Murray Charlton, EC National Water Research Institute (NWRI)
Martha Guy, EC National Guidelines and Standards Office
Aaron Todd, MOE EMRB
Todd Howell, MOE EMRB
Annie Michaud, Niagara Peninsula Conservation Authority (NPCA)
David Brown, Brock University

Beach Closings
Tom Edge, EC-NWRI
Murray Charlton, EC-NWRI
Annie Michaud, NPCA
Natasha Mihas, City of Hamilton Health Dept.
Glen Hudgins, Niagara Region Health Department
David Brown, Brock University

Wildlife Habitat
Greg Mayne (lead) EC Restoration Programs Division
Anne Yagi, MNR Niagara District
Julie Simard, MNR Headquarters
Ian Barrett, NPCA
John Middleton, Brock University
Kim Frohlich, NPCA

Fish Habitat and Fish Populations
Tom McDougall, MNR Lake Erie Management Unit
Anne Yagi, MNR Niagara District
Scott Brown, EC-NWRI
Ian Barrett, NPCA

Benthos and Restrictions on Dredging
Janette Anderson (lead) EC Restoration Programs Division
Rein Jaagumagi, Dillon Consulting
Jocelyn Baker, NPCA
Scott Mackay, EC Restoration Programs Division

APPENDIX 2: Steering Committee (2007) & RAP Implementation and Science Committees (2009)

Organization
Representative

Steering Committee Members who participated in Stage 2 (1995) review

Brock University
Fiona Hunter

Environment Canada
Janette Anderson
Scott MacKay

Fisheries & Oceans Canada
Amy Liu

Land Care Niagara
Stephen Prior

Niagara College
Andrea Sinclair

Niagara Parks Commission
Debbie Whitehouse

Niagara Peninsula Conservation Authority
Tony D'Amario
Jocelyn Baker
Valerie Cromie

Ontario Ministry of the Environment
Mary Ellen Scanlon

Ontario Ministry of Natural Resources
Joad Durst

Niagara Region – Health Department
Bill Hunter

Niagara Region – Planning Department
Bob Steele
Don Campbell

Niagara Region – Public Works
Sunil Sharma

RAP Implementation Committee Members (2009)

Brock University
Fiona Hunter (Biological Sciences)

Buffalo Niagara Riverkeeper
Margaret Wooster

City of Hamilton
Eric Mathews (Safe Water Program)

City of Niagara Falls
Brad Johnston (Municipal Works)
Geoff Holman (Municipal Works)

City of Welland
Akin Ogunkeye (Planning Division)
Erik Nickel (Engineering Services)
Lino Ventresca (Engineering Services)

Environment Canada
Dan McDonell
Sandra Kok

Land Care Niagara
Stephen Prior

New York State Dept. of Environmental Conservation
Mark Filipski (U.S. RAP Coordinator)

Niagara College
Andrea Sinclair

Niagara Parks Commission
Debbie Whitehouse
Mark Buma

Niagara Peninsula Conservation Authority
John Kukalis (Water Management)
Jocelyn Baker (Watershed Restoration Program)

Niagara River RAP Coordinator
Valerie Cromie

Niagara River Restoration Council
Corey Burant

Ontario Ministry of Agriculture, Food & Rural Affairs
Matt Wilson

Ontario Ministry of the Environment
Mary Ellen Scanlon

Ontario Ministry of Natural Resources
Joad Durst (Guelph District)
Jenn Esbjerg (COA Coordinator – Lake Erie)

Niagara Region
Betty Matthews-Malone (Water and Wastewater Department)
Drew Semple (Planning Department)
Don Campbell (Planning Department)
Glen Hudgin (Public Health Department)
Patrick Robson (Integrated Community Planning)

Town of Fort Erie
Sherri-Marie Millar

RAP Science Committee Members (2009)

Environment Canada
Dan McDonell
Sandra Kok
Brad Hill (Niagara River Toxics Management Plan)

Ontario Ministry of the Environment
Mary Ellen Scanlon
Tanya Labencki (Environmental Monitoring & Reporting Branch)

Ontario Ministry of Natural Resources
Anne Yagi

Niagara Peninsula Conservation Authority
Annie Michaud
Jocelyn Baker
Valerie Cromie

APPENDIX 3: Public Advisory Committee

Organization
Representative

Participated in the Stage 2 review of BUIs, Recommendations and DelistingCriteria

Welland River Keepers
Bridget Krajnak
Don Johnstone

Niagara Restoration Council
David Beamer
Corey Burant

Friends of One Mile Creek
Gerry Beneteau
Mike Belfie

Friends of Fort Erie's Creek
Yvonne Hopkins

Ontario Federation of Agriculture North
Albert Witteveen

Ontario Federation of Agriculture South
Helmut Rempel

Niagara North Soil & Crop Improvement Association
Mike Tomascin

Wentworth – Soil & Crop Improvement Association
Ron Pearce

Niagara South Soil & Crop Improvement Association
Gerry Veldhuizen (Liaison)

Haldimand Soil & Crop Improvement Association
Alvin Topp

Environmental Farm Plan
Mark Neufeld

Niagara Falls Nature Club
Janet Damude

Peninsula Field Naturalists
Roman Olszewski
John Potter

Bert Miller Nature Club
Rob Eberly
Cindy Mitchell

Fort Erie Conservation Club
Elmer Miskolczi
Connie Charron

Haldimand Stewardship Council
Kelly Tonellato

Land Care Niagara
Stephen Prior

Niagara Bassmasters
John Yancoulis

Buffalo Niagara Riverkeeper
Julie Barrett O'Neill
Margaret Wooster

Ontario Power Generation
Tony Van Oostrom
Doug Rodrigues

CYTEC
Ken Milo

Atlas Steels
Greg Cousins

Lubrizol Canada Ltd.
Bill Goodfellow (Liaison)

Oxy Vinyls Canada Inc.
Don Davidson

Niagara Region CAER Coordinator
John Dunn
Peter Collee

APPENDIX 4: A Brief History of Pollution in the Niagara River and RAP Highlights

The story of environmental degradation in the Niagara River that led to it being listed as one of the 43 most heavily polluted waters in the entire Great Lakes Basin spans many decades. It can be traced back to shortly after the Niagara Falls Power Company began operation in 1896. This event opened the opportunity for many large chemical industries to settle on the American side of the river to take advantage of the power. As early as the turn of the 20th century, large chemical companies (such as Carborundum, Allied, Union Carbide, Olin, Dupont, and Hooker) began forming a hedgerow of furnaces and smokestacks along the American side of the river in Niagara Falls. These dumped the unwanted by-products of everything from pesticides and paints to plastics and pharmaceuticals in and around the shores of the Niagara River.[118]

By the 1970s, there were roughly 700 chemical plants, steel mills, oil refineries and other industries discharging more than 250 million U.S. gallons of waste water into the Niagara River each day. One of the major dischargers was the Niagara Falls, N.Y. waste water treatment plant into which a number of large chemical firms poured their effluent before it was flushed into the river. The plant's carbon beds, designed to adsorb the hazardous chemicals in the effluent, caved in shortly after the plant opened in 1978. That left an estimated 60 million gallons of partially treated effluent – about 80 per cent of it coming from industries in the city – pouring into the river every day.

The most notorious of the hazardous waste dumps situated close to the Niagara River was Love Canal. One of the chemicals found in sludge leaking from the Love Canal site was the most potent strain of a family of chemicals known as dioxins and used in the defoliant Agent Orange during the Vietnam War. Some scientists described this brand of dioxin as "the most deadliest substance produced by man". About 215 known dumps containing approximately eight million tonnes of toxic waste were clustered within five kilometres of the Niagara River in Erie and Niagara counties, N.Y.

As time went by, the polluting got worse - not only by industries, but cities and towns on both sides of the border were dumping raw sewage into the river and, as a result, swamping it with infectious bacteria. The river's size and speed enforced the perception that the action of the falls purified or diluted waste to a point where it was no longer a problem. This argument continued to be used for discharging everything from municipal sewage to industrial chemicals into the river.

However, citizen concern was also growing from incidences and observations of polluting activities over the years. Incidences such as: industries dumping caustic substances into the river, drums of cyanide being sunk near the Buffalo Harbour (resulting in incidences of plumes of dead fish floating down the river), industrial effluents being discharged directly into the river from Niagara Falls (N.Y.) city sewers, and, eventually, manifestation of various human health issues.

[118] Reference: Pollution Probe. September 1999. *Niagara: A River to Save.*

In the spring of 1970, millions of people throughout North America observed the first Earth Day and environmental issues began to get more attention from the news media. By the end of that decade, Niagara-on-the-Lake residents, due to concern for their drinking water, supported a petition from an American group of citizens to oppose millions of litres of "treated" chemical wastes proposed to be discharged by an American company upstream. There were numerous demonstrations by environmentalists on both sides of the border before the company started to pump wastes to the river in 1981.

By this time, pressure was mounting from environmentalists and politicians on both sides of the border to proactively address the severe degradation of the Niagara River. The respective environmental government agencies (i.e., Environment Canada, the U.S. Environmental Protection Agency, the Ontario Ministry of the Environment and the New York State of Environmental Conservation) launched what would come to be known as the Niagara River Toxics Committee (NRTC) to oversee "a joint investigation of toxic chemicals entering the Niagara River" from both countries. While citizen groups battled over the cleanup of hazardous waste dumps in the U.S. courts, the committee pursued its investigation. And, by 1981, a few years after it was declared a "state of emergency" by U.S. President Jimmy Carter, more than 400 families had left the Love Canal area, never to return.

In late 1983, preliminary findings of the NRTC identified about 300 individual chemicals in water, sediment and fish in the Niagara River. The investigation seemed to confirm what residents on both sides of the river suspected all along – that the bulk of these chemicals (more than 80%) were coming from sources on the American side, Niagara and Erie counties, N.Y. The final report was released in 1984.[119]

The report provided the first comprehensive catalogue of sources of toxics contamination to the Niagara River. The report also provided a preliminary assessment of the environmental condition and the extent of degradation of the river and the nearshore area of Lake Ontario. As a result of its compelling findings, public and political pressure called for something to be done to make the cleanup of the toxic contaminants in the Niagara River a high priority. This resulted in the development of a four-agency plan for the management of toxic substances in the Niagara River, and in 1987 the Declaration of Intent for The Niagara River Toxics Management Plan (NRTMP) was signed by the agencies. The NRTMP (See Appendix 5) and the Niagara River RAP have developed concurrently, although the scope of the RAP is broader as it addresses the entire Niagara River ecosystem.

Another significant development at that time was the revision of the 1978 Great Lakes Water Quality Agreement and the addition of Annex 2 describing Areas of Concern, Remedial Action Plans and Lakewide Management Plans.[120]

[119] Report of the Niagara River Toxics Committee. October 1984

[120] International Joint Commission. Revised Great Lakes Water Quality Agreement of 1978 as amended by Protocol signed November 18, 1987.

Below is a summary of RAP highlights since then:

1988

- Series of public meetings, hosted by the Ministry of the Environment, to establish a Public Advisory Committee (PAC) for the Niagara River (Ontario) RAP.

1989

- First meeting of the Public Advisory Committee (PAC) in January 1989.

1990

- Establishment of the International Advisory Committee (IAC), comprised of members of the PAC and the U.S. Niagara River Action Committee (NRAC), in March 1990.

1990/91

- Series of workshops to identify impaired uses and develop Goals & Objectives as presented in the Stage 1 Report.

1993

- Final meeting of IAC in June 1993 (NRAC was disbanded).
- Release of the *Niagara River RAP Stage 1 report: Environmental Conditions and Problem Definition*, September 1993.
- Selection of remedial options through a series of workshops towards development of Recommendations.
- IJC Niagara River RAP Stage 1 Review meeting in December 1993.

1994

- Working Groups developed a comprehensive set of thirty-seven Recommendations under the following themes: Water Quality, Sediment, Biota/Habitat, Surveillance & Monitoring, and Stewardship & Education.
- Open Forum for public comment on the Recommendations in June 1994.
- Review of draft Stage 2 Report & development of implementation structure.

1995

- Release of the *Niagara River RAP Stage 1 – UPDATE: Environmental Conditions and Problem Definition*, March 1995.
- Release of the Niagara River RAP Stage 2 report: *The Cleanup Connection*, April 1995. The report presents the Recommendations necessary to address the impaired beneficial uses and achieve the environmental goals.
- Full-scale cleanup of contaminated sediment "reefs" in the Welland River.

1996

- Federal and Provincial responses to the Niagara River RAP Recommendations. These responses are documented in Appendix C of the Niagara River RAP Implementation Annex.

1997

- Unveiling of the Niagara River RAP Plaque at a site along the river (June 1997).

1998

- The PAC became incorporated as the Niagara River Restoration Council.

1999

- The Niagara Peninsula Conservation Authority (NPCA) assumed the responsibility as the RAP Coordinator through a three-party agreement with Environment Canada and the Ministry of the Environment.
- Release of the *Welland River Watershed Strategy*, November 1999.

2000-2004

- Release of the *Niagara River RAP Implementation Annex*, November 2000. The Annex presents a RAP implementation summary, the lead partners and an action plan, as laid out in Appendices A & B.

2004-2006

- Establishment of Public Advisory Committee and Steering Committee for full review of the Stage 2 report Recommendations, Delisting Criteria and Beneficial Use Impairments.
- Review of Delisting Criteria and Impairments by Technical Committees.
- Preparation of report providing results of Stage 2 technical review: Environment Canada. June 2007. Niagara River (Ontario) Remedial Action Plan. *Technical Review of Impairments and Delisting Criteria. (Final Draft)*
- Assessment of contaminated sediment sites in the Niagara River Area of Concern.

2005

- Review of status of implementation activities in the Implementation Annex.
- Preparation of the *Niagara River RAP Implementation Annex Update*.

2007

- Preparation of the RAP Stage 2 Update report.
- Development of new framework for implementation of RAP Monitoring Plan and Work Plan.
- Establishment of RAP Science Committee and initiation of the Welland River Eutrophication Study.
- Public consultation on remedial options for contaminated sediments at Lyon's Creek East and West sites.
- Establishment of Community Liaison Committee for Lyon's Creek East project.

2008

- Release of Human Health Risk Assessment reports for Lyon's Creek East and West.
- Release of Ecological Risk Assessment report for Lyon's Creek East and West.
- Wetland Inventory of Lyon's Creek East.
- Completion of sediment management options assessments for Lyon's Creek East and Lyon's Creek West.
- Public consultation on preferred remedial option for Lyon's Creek East.
- Completion of the Canada-Ontario Decision-Making Framework for the Assessment of Great Lakes Contaminated Sediment (Framework) for Lyon's Creek East.
- Decision to manage the contaminated sediment in Lyon's Creek East through Monitored Natural Recovery.
- Fisheries Community Monitoring and Implementation of Walleye restoration project in the Welland River West and habitat enhancement projects planned (with some already implemented).

2009

- Presentation for comments and review of Stage 2 Update to the PAC and implementers.
- Fish Barrier Mitigation project is completed.
- Natural Heritage Inventory of the Niagara River AOC report and mapping near completion.
- Initiation of a comprehensive review of the Welland Official Plan incorporating RAP supported policies for Natural Heritage, urban stormwater, etc.
- Completion of the Niagara River Watershed Fish Community Assessment (2003 to 2007) by the Ministry of Natural Resources. This report indicates that the Welland River Fish Community has begun moving along the path to recovery from the severe pollution in the 1960s (partially due to uncontrolled sewage discharge).

APPENDIX 5: The Niagara River Toxics Management Plan (NRTMP)

The Niagara River Toxics Committee report (NRTC) in 1984 provided the first comprehensive catalogue of sources of toxics contamination to the Niagara River. It also provided a preliminary assessment of the environmental condition and extent of degradation of the river and the nearshore area of Lake Ontario. Finally, it laid the basis for the development of a binational toxics reduction plan.

In 1987, Environment Canada, the U.S. Environmental Protection Agency (USEPA); the Ontario Ministry of the Environment and the New York State Department of Environmental Conservation (NYSDEC) – the "Four Parties" – signed the Niagara River Declaration of Intent (DOI). The purpose of the DOI is to reduce the concentrations of toxic pollutants in the Niagara River through the Niagara River Toxics Management Plan (NRTMP). Since then, the agencies for the two countries have continued pooling their resources and gathering more information on environmental conditions in and around the Niagara River, perhaps more than for any other water body in North America or, in the world.[121]

The NRTMP reflects the philosophy of the International Joint Commission; it states that "this (reduction) is consistent with the goal of virtual elimination of toxic discharges, as agreed upon in 1978 by the Governments of the United States and Canada under the Great Lakes Water Quality Agreement"[122]. Eighteen "priority toxics" were specifically targeted for reduction, ten (*) of which were designated for 50% reduction by 1996 because they were thought to have significant Niagara River sources.[123]

Table 1: Eighteen "priority toxics" identified in the Niagara River Toxics Management Plan

Arsenic	Lead
Benz(a)anthracene*	Mercury*
Benzo(b)fluoranthene*	Mirex
Benzo(a)pyrene*	Octachlorostyrene
Benzo(k)fluoranthene*	PCBs (total)*
Chlordane	DDT and Metabolites
Chrysene	Dioxin (2,3,7,8-TCDD)*
Dieldrin	Tetrachloroethylene*
Hexachlorobenzene*	Toxaphene

The Four parties re-affirmed their commitment to the NRTMP in a "Letter of Support" signed in December 1996. The revised goal, as stated in that letter, is *"to reduce toxic chemical inputs to the Niagara River to achieve ambient water quality that will protect human health, aquatic life, and wildlife, and while doing so, improve and protect water quality in Lake Ontario as well."* [124]

[121] International Joint Commission. June 2002. *Niagara River Area of Concern Status Assessment*
[122] The Niagara River Remedial Action Plan. September 1993. Stage 1: *Environmental Conditions and Problem Definitions.*
[123] The Niagara River Toxics Management Plan. September 2005. *Progress Report and Work Plan.*
[124] Niagara River Toxics Management Plan. September 2005. *Progress Report and Work Plan.*

Results show that statistically significant reductions in the concentrations and loads for most of the eighteen priority toxics have occurred. In many cases the reductions have been greater than 50%. Also, it is estimated that actions by the NYSDEC and USEPA to remediate hazardous waste sites have resulted in a reduction of potential inputs to the River from hazardous waste sites by about 90 percent since 1989. [125]

However, despite the successes to date, some chemicals are still at levels that exceed the most stringent agency water quality criteria in the River. Advisories to limit consumption of sport fish caught in the Niagara River continue because of contamination by toxic substances.[126] Staff at the Ministry of Natural Resources and Ministry of the Environment (MOE) collect the fish and send them to the MOE's laboratory in Toronto where they are analysed for a variety of substances, including mercury, PCBs, mirex, DDT and dioxins. The advisories continue to be based on health protection guidelines provided by Health Canada. [127]

The four parties hold periodic consultation with the public in the Niagara area to present progress reports and to outline new initiatives.[128] A progress report based on data collected over the fifteen-year period 1986/87 to 2000/01 was released in early September 2005. More recently, the Canadian and U.S. environmental agencies hosted a public meeting in October 2007 on Grand Island, New York. Progress made over the last twenty years through the NRTMP and the Lake Ontario Lakewide Management Plan was reported, including a hazardous waste site update (Niagara River), and the binational habitat conservation strategy for Lake Ontario.[129] The 2007 NRTMP Progress Report includes results from the Niagara River Upstream/Downstream Program and related biomonitoring programs.[130] The reporting schedule has been aligned with the public meeting schedule of once every three years.

In the latest report, the Four Parties commit to the following challenges:

- reviewing the list of NRTMP 18 "Priority Toxics" and consider a broader list of chemicals for measuring progress;
- considering mechanism(s) for addressing upstream sources of chemicals which already exceed their strictest agency criteria in the water entering the river from Lake Erie;
- exploring the future relationships between the NRTMP and the Lake Ontario and Lake Erie Lakewide Management Plans (LaMPs) and the Niagara River Remedial Action Plans (RAPs) in order to maximize efficient use of agency resources; and,
- continuing and, where necessary, enhancing track down efforts to identify potential new sources of toxic chemicals.

The NRTMP and the Niagara River RAP have developed concurrently, although the scope of the RAP is broader as it addresses the entire Niagara River ecosystem. The NRTMP is a source of technical data to the RAP.

[125] International Joint Commission. June 2002. *Niagara River Area of Concern Status Assessment*
[126] The New York Water Environmental Association, Inc. Fall 2000. *CLEARWATERS.* Vol.30, No.3.
[127] Ontario Ministry of the Environment. *Guide to Eating Ontario Sport Fish.* 2005-2006 edition.
[128] The Niagara River Remedial Action Plan. September 1993. Stage 1: *Environmental Conditions and Problem Definitions.*
[129] Lake Ontario Lakewide Management Plan Update '07.
[130] Niagara River Toxics Management Plan. October 2007. *Progress Report and Work Plan.*

Niagara River Mussel Biomonitoring Program:

Part of Ontario's commitment to the NRTMP is through routine and specialized biomonitoring of contaminants in the Niagara River using caged mussels (Elliptio complanata). The Niagara River mussel biomonitoring survey, conducted by the Ontario Ministry of the Environment, has been ongoing since 1980. Information provided by this study is part of an overall program to assess long-term trends in contaminant loadings from selected U.S. and Canadian sources along the Niagara River. The data from 2003 were consistent with previous mussel monitoring surveys.[131] Evidence of significant reductions of toxics in the river and tributaries is supported by this program.

[131] Ontario Ministry of the Environment. August 2006. *Niagara River Mussel Biomonitoring Program 2003.*

APPENDIX 6: Influences on the Niagara River RAP

Since the Niagara River RAP Stage 2 report was produced in 1995, a number of events have taken place and legislation has been introduced that have an influence on the RAP and the Area of Concern. Below is the date of introduction along with a brief description of these developments in chronological order.

1996: Important Bird Area designation

The Niagara River corridor was the first globally significant Important Bird Area (IBA) to be jointly identified by cooperating organizations in Canada and the United States. It was formally dedicated in December 1996. The Niagara River annually supports one of the largest and most diverse concentrations of gulls in the world. Nature Canada and Bird Studies Canada are, together, the BirdLife partners for Canada. A conservation plan for the Niagara River Corridor IBA was prepared by the IBA Working Group in Fall 2002[132]. The plan outlines the conservation goals and objectives under the main areas of research, infrastructure, conservation and education/outreach. The responsible agency or group for actions needed to attain the goals is also listed, along with a summary of progress to date. The report is available at www.ibacanada.com/cpm_nrc.html

For IBA site summary, see www.bsc-eoc.org/iba/

1997: The Great Lakes Binational Toxics Strategy

Signed in 1997, the Great Lakes Binational Toxics Strategy (GLBTS) is an agreement between Canada and the United States to virtually eliminate persistent toxic substances from the Great Lakes environment[133]. The Strategy establishes reduction challenges for an initial list of persistent toxic substances targeted for virtual elimination: aldrin/dieldrin, benzo(a)pyrene, chlordane, DDT, hexachlorobenzene, alkyl-lead, mercury and compounds, mirex, octachlorostyrene, PCBs, dioxins and furans, and toxaphene. These substances have been associated with widespread, long-term adverse effects on wildlife in the Great Lakes, and, through their bioaccumulation, are of concern for human health[134]. The 2005 Annual Progress report presents a comprehensive summary of activities and accomplishments from 1997 through to 2005.[135]

For further information, see www.epa.gov/glnpo/

1999: The Welland River Watershed Strategy

The goal of the Welland River Watershed Strategy is "To restore the ecological health of the Welland River and its watershed". [136] A 10-year Watershed Action Plan was developed to provide strategic direction and ensure that the solutions would be implemented. The Welland River watershed

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[132] Niagara River Corridor IBA Working Group. Fall 2002. *IBA Conservation Plan for the Niagara River Corridor IBA.*
[133] Great Lakes Binational Toxics Strategy 2004.
[134] http://www.epa.gov/glnpo/p2/bnsintro.html
[135] Great Lakes Binational Toxics Strategy *2005 Annual Progress Report.*
[136] Niagara Peninsula Conservation Authority. November 1999. *Welland River Watershed Strategy.*

encompasses 81% of the Niagara River AOC. The watershed is plagued by many separate, yet interrelated problems so, in order to solve the problems in the Niagara River, it is imperative to address the issues facing the health of the Welland River watershed.

These physical and cultural constraints on the system and the related issues are in the following areas:

- Man-made Physical Barriers on the System
- Water Level Fluctuations in the Welland River
- Rural Land Management and Drainage Practices
- Urban Land Management and Drainage Practices
- Recreational Land Management and Drainage Practices

In November 2000, after assuming the role of RAP Coordinator, the NPCA produced Niagara River RAP Implementation Annex (see below). Due to the similarities between the goal of the Welland River Watershed Strategy and the Mission Statement for the Niagara River RAP, the implementation activities were integrated into the Action Plan laid out in the Annex.

1999: Welland River Water Level Fluctuation Study

The operating practices of Ontario Power Generation (OPG) within regulated limits at Grassy Island Pool in the Niagara River cause a water level fluctuation problem in the Welland River, the impact of which extends 60 km upstream to the Port Davidson Weir. The twice-daily vertical fluctuation of 30cm to 45cm has impacted on the river's ability to transport its sediment to an appropriate outlet or to maintain floodplain wetlands for fish habitat and erosion control purposes. The current situation creates a dilemma in that the river cannot drain effectively[137]. Sediment that is deposited at a delta in other river systems is continually suspended within the Welland River.

A Technical Liaison Committee (comprised of MNR, MOE, City of Welland, DFO, Environment Canada, OPG and NPCA) was formed in 1999 to oversee an assessment of methods to alleviate the water level fluctuation situation in the Welland River while at the same time not adversely impacting the daily operations of OPG.

Currently, OPG's Beck 3 project will involve construction of one tunnel (instead of two). An assessment of the impacts from the tunnel on water level fluctuations is underway and the outcome of that assessment will determine how the project relates to meeting the EA conditions of the hydroelectric power project. It is estimated that construction of the tunnel will not be completed before 2009.[138]

[137] Niagara Peninsula Conservation Authority. November 1999. *Welland River Watershed Strategy.*
[138] Review of Delisting Criteria and Possible Impairments – Public Advisory Committee Meeting Minutes. November 22, 2004.

2000: The Niagara River RAP Implementation Annex

The Niagara Peninsula Conservation Authority assumed the role of RAP Coordinator in 1999 through a three-party agreement with the federal and provincial governments. In November 2000, the Niagara River RAP Implementation Annex[139] was produced with the intent to compliment the goals, objectives and ecosystem approach vision expressed in the RAP Stage 2 report. The Annex identified agencies that are responsible for implementing Recommendations, and provided a schedule of activities, timelines and projected costs. This format enabled integration of the Stage 2 RAP with partners including the Niagara River Toxics Management Plan (NRTMP), the Ministry of the Environment, the Niagara Peninsula Conservation Authority programs, Federal, Provincial and Municipal governments, community groups and committees.

The RAP Stage 2 Recommendations were organized into the following six key theme categories:

1. Beneficial use impairment related to persistent toxic load to the Niagara River.
2. Stage 2 RAP goals related to improving recreational opportunities, aesthetics and habitat features on the Niagara River.
3. Beneficial use impairment of Niagara River tributaries as a result of issues unique to the Niagara River Area of Concern.
4. Beneficial use impairment due to stressors common to areas with similar rural and urban land management.
5. Recommendations that can not be implemented at the local level and are feasible to implement only at the Federal or Provincial level.
6. The Niagara River RAP Implementation framework.

Grouping the Recommendations into theme categories allowed for the creation of a successful and manageable implementation organization to work towards restoring beneficial uses.

Since the completion of the Stage 2 Report and the Annex, the Niagara River (Ontario) RAP is well into the implementation and monitoring phase of the RAP process.

2002 and 2007: The Canada – Ontario Agreement (COA)

The COA provides the long-standing mechanism through which the governments of Canada and Ontario work together, as well as with other groups and individuals, in the Basin to achieve the vision of a healthy, prosperous and sustainable Great Lakes Basin Ecosystem for present and future generations[140]. As a result, entire communities are mobilized to tackle pressing problems in their areas, benefiting the whole Great Lakes Basin ecosystem.

[139] Niagara Peninsula Conservation Authority. November 2000. *Niagara River Remedial Action Plan Implementation Annex.*
[140] Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2002-2003 Biennial Progress Report.

The first COA was signed in 1971; subsequent COAs were signed in 1976, 1982, 1986, 1994, 2002 and 2007. The current 2007 COA was signed on June 25, 2007 and consists of a framework agreement and four annexes. Annex 1 of the 2007 COA addresses initiatives that directly support the restoration and protection of environmental quality and beneficial uses in AOCs.[141]

2002: A Status Assessment Report by the IJC

The International Joint Commission submitted a report on the ongoing remedial and preventive efforts by responsible governments and organizations relative to restoring and protecting the water quality of the Niagara River in June 2002[142]. The Commission's Status Assessment confirmed successes as well as challenges in the restoration of beneficial uses within the Niagara River AOC. It also outlined the following recommendations:

- Quantify remaining needed remedial actions and associated budget requirements.
- Enhance coordination of efforts to restore Beneficial Uses.
- Enhance public outreach efforts.
- Consider appropriate technologies for long term solutions.

These recommendations are being taken into consideration throughout implementation and progress in the RAP.

2002: Nutrient Management Act

The Ontario Government introduced the *Nutrient Management Act* in 2002 in response to recommendations in Justice O'Connor's Report of the Walkerton Commission of Inquiry. It came into force in July 2003. The *Act* was developed by the Ministry of the Environment and the Ministry of Agriculture and Food as part of the government's Clean Water program. Under this *Act*, farmers must develop nutrient management plans to deal with animal waste and other substances that are kept on farm properties or spread on fields. Nutrient management plans help ensure that farms are managed in an environmentally responsible way to prevent contamination of lakes, streams and groundwater[143].

The *Nutrient Management Act* also impacts the management of municipal sewage biosolids and industrial biosolids and residuals. The Niagara Region land applies liquid biosolids generated at its wastewater treatment plants and in accordance with the regulation has prepared Nutrient Management Strategies for those facilities of an approved design capacity greater than 45,400 m^3 (wastewater flow) per day. Nutrient Management Plans exist for the Niagara Falls, Welland, Port Weller and Port Dalhousie WWTPs.

[141] Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2007.

[142] International Joint Commission. June 2002. *Niagara River Area of Concern Status Assessment.* Submitted to the Governments of the United States and Canada.

[143] www.ene.gov.on.ca

In 2005, the Niagara Region began dewatering and diverting 50% of its biosolids to Niagara Biosolids Corp. The dewatered biosolids are further treated by Niagara Biosolids Corp. through a heat and lime stabilization process. The end product is marketed through the *Canada Fertilizer Act* and sold to the farming community.

The Report of the Walkerton Commission of Inquiry, parts 1 and 2, on Mr. Justice O'Connor's recommendations regarding the need for nutrient control is available at: www.attorneygeneral.jus.gov.on.ca/english/about/pubs/walkerton/

2003: Adoption and implementation of the Niagara Water Strategy

The purpose of the Niagara Water Quality Protection Strategy (NWQPS) is "to develop a strategy composed of a set of prioritized actions that inherently consider all ongoing parallel initiatives by other stakeholders and to work toward a common purpose of *protecting, restoring,* and *managing* the Niagara area's water resources."[144]

In 2002, the NPCA and partners, the Niagara Region and the Ministry of the Environment, developed the Niagara Water Quality Protection Strategy, now referred to as the Niagara Water Strategy (NWS). The goals of the strategy are *"...to promote the sustainable use of Niagara water resources and to ensure safe and abundant water for current and future generations."*[145]

Hundreds of actions were recommended by stakeholders, the public and the consultant team during the strategy development period. To establish a framework for development and communication of the NWQPS and help focus strategy planning, five key themes were developed:

- **Human Health** - Clean and abundant drinking water for safe human consumption
- **Recreation** – Sufficient and clean water to support and sustain recreational uses
- **Property Risk and Liability** – Protection for residential, employment and public land uses from adverse flooding and erosion
- **Agriculture and Commerce** – Clean and abundant water for agriculture and economic opportunities
- **Natural Environment** – Sufficient water of a satisfactory quality in natural settings to restore and maintain healthy flora, fauna and ecosystem integrity[146]

[144] Regional Municipality of Niagara. October 2003. *Niagara Water Quality Protection Strategy. Technical Summary Report.*

[145] Niagara Water Strategy Annual Report 2006.

[146] Regional Niagara, Niagara Peninsula Conservation Authority, Ontario Ministry of the Environment. October 2002. Niagara Water Quality Protection Strategy. *Protecting Water in Niagara Now and in the Future.* (brochure).

In addition to more than 40 "indirect actions" (activities undertaken by Strategy partners and stakeholders, but not done by the Strategy directly), six priority "direct actions" were identified for implementation in 2005: Data and Monitoring Harmonization; Agricultural Best Management Practices; Combined Sewer Overflow Status Update; Stormwater Management and Erosion Control; Water Efficiency Program; and, Watershed Report Card.[147]

In 2006, the strategy was renamed as the Niagara Water Strategy (NWS). Direct Actions planned for 2006/2007 are: Co-ordination of Land Use Data Collection Efforts Amongst various Agencies and Municipalities; Agricultural Demonstration Projects Study; Stormwater Management to Address Beach Closures; Water Policy Investigation; Development of a Regional Pollution Discharge Elimination Program (RPDEP); and Develop Consistent Development Policies Across the Watershed as they Relate to the Management of Water Resources.

The first annual Niagara Watershed Report Card was released in March, 2006. A more comprehensive Report Card will be produced on a five-year basis.

Progress on the Strategy is communicated through the NWS newsletter and the RMON Web site.[148]

2004 – 2006: Review of the RAP Beneficial Use Impairments and Delisting Criteria and Assessment of Monitoring Requirements

The Niagara River RAP Stage 2 Report – "The Cleanup Connection" – was completed in 1995. It contains 37 Recommendations for cleaning up the AOC as well as proposed International Delisting Criteria and Canadian Cleanup Criteria. However, since then, many remediation activities have taken place within the AOC and many things have changed. Some of these changes include environmental conditions within the AOC, remediation technologies, analytical capabilities, and the programs and priorities of RAP partners.

In 2004, a Review of the Delisting Criteria and Possible Impairments was initiated. Two ad hoc committees (a Steering Committee and a Public Advisory Committee) were struck to assist with the review and work towards developing a revised list of well-defined, achievable delisting criteria. During 2005 and 2006, technical committees of scientists reviewed the designations of the beneficial uses for the AOC and suggested some changes. They also drafted new comprehensive delisting criteria and monitoring requirements to help the RAP move more effectively and efficiency towards delisting. Results of the technical reviews were circulated to the ad hoc committees for their input and endorsement. Details of the review are included in this report.

[147] Regional Municipality of Niagara. October 2003. *Niagara Water Quality Protection Strategy. Technical Summary Report.*
[148] www.regional.niagara.on.ca

2004: Canadian Environmental Protection Act (CEPA, 1999) – Notice Requiring the Preparation and Implementation of Pollution Prevention Plans for Inorganic Chloramines and Chlorinated Wastewater Effluents

Pollution Prevention (P2) is defined by the Canadian Council of Ministers of the Environment as the "use of processes, practices, materials, products or energy that avoids or minimizes the creation of pollutants and wastes at the source." Pollution prevention is a major component of the Canadian Environmental Protection Act (CEPA, 1999). A P2 Planning Notice was published by Environment Canada in the Canada Gazette, Part I on December 4, 2004 entitled: Notice Requiring the Preparation of and Implementation of Pollution Prevention Plans for Inorganic Chloramines and Chlorinated Wastewater Effluents. This notice applies to any Municipality (or company) that owns a wastewater treatment facility that discharges treated effluent where the following three criteria are met:

1. The annual average effluent discharge volume is at least 5,000 m^3/day;
2. The effluent is discharged to surface water;
3. The total residual chlorine in the effluent is greater than 0.02 mg/L.

As part of this program municipalities are required to prepare and implement pollution prevention (P2) plans for the reduction of chlorine residuals in municipal wastewater effluent. The deadline for achieving and maintaining a concentration of Total Chlorine (TRC) in the effluent less than or equal to 0.02 mg/L is December 15, 2009. A list and status of Niagara Region's P2 projects is provided in Appendix 7.

2005: Introduction and implementation of Source Protection legislation by the Province of Ontario

The goal of source protection is to safeguard human health by ensuring that current and future sources of drinking water in Ontario's lakes, rivers and groundwater are protected from potential contamination and depletion.

In 2002, following the Walkerton Public Inquiry, the O'Connor report outlined several recommendations related to protection of drinking water in Ontario. Watershed-based source protection was a key recommendation of the Walkerton Inquiry[149]. The report recommended using a multi-barrier approach, where source water protection (SWP) is considered the first barrier in ensuring safe drinking water. The report stated that the protection and enhancement of natural systems is one of the most effective ways of ensuring the safety of Ontario's drinking water.

Consequently, the provincial government released draft legislation in 2004 on the development and approval of watershed-based source water protection plans. In June 2007, the government enacted the legislation through the *Clean Water Act*. This will require source water protection plans to be prepared for all watersheds in Ontario by the stakeholders in each watershed. Source protection plans will identify risks of contamination or depletion to sources of drinking water and establish measures to reduce those risks[150].

[149] Part Two (2002) Report of the Walkerton Inquiry: *A Strategy for Safe Drinking Water.* The Honourable Dennis R. O'Connor.
[150] Ministry of the Environment. February 2004. *White Paper on Watershed-based Source Protection Planning.*

Currently the NPCA is undertaking a multi-year program to complete Watershed Management Plans for each of the watersheds in the NPCA jurisdiction. The NPCA is also completing a Watershed Characterization and Conceptual Water Budget. The Niagara Region, as the lead organization, is working with the NPCA to complete the surface water vulnerability analysis for each of the Region's water treatment plants. This includes delineating Intake Protection Zones (IPZs), applying vulnerability scores, identifying issues, inventorying threats, evaluating hazards and assessing risks in the IPZs. The work is being funded by the Ministry of Environment (MOE) and Ministry of Natural Resources (MNR).

2005: The Greenbelt Act

The provincial *Greenbelt Act* protects environmentally sensitive land and agricultural land in the Golden Horseshoe from urban development and sprawl. More than one million additional acres in the Golden Horseshoe will be protected by the greenbelt, for a total of 1.8 million acres, more than doubling the areas protected on the Oak Ridges Moraine and the Niagara Escarpment.[151]

Building on the Greenbelt initiative, the government over the past year has taken a number of additional actions to protect greenspace and agricultural land, curb sprawl and manage growth. Some of the key ones are:

- Places to Grow, which directs growth to urban centres and protects natural systems and agricultural areas beyond the Greenbelt
- Natural Spaces Program, which supports private landowners' efforts to preserve and restore natural areas
- New Provincial Policy Statement and proposed planning reform legislation
- Brownfields Ontario, which promotes the rehabilitation of former industrial sites for use by future generations.

2005: Places to Grow Act

The *Places to Grow Act* provides a framework for the government to coordinate planning and decision-making for long-term growth and infrastructure renewal in Ontario. It gives the province the power to designate geographical growth areas and to develop growth plans in collaboration with local officials and stakeholders to meet specific needs across the province. The need for effective growth planning is particularly urgent in the Greater Golden Horseshoe which stretches around Lake Ontario from Peterborough to Niagara and north to Barrie. The government anticipates that a final growth plan for the Greater Golden Horseshoe will be released later in 2007. This growth plan will complement the Greenbelt Plan. See www.pir.gov.on.ca

[151] www.mah.gov.on.ca

2005: Provincial Policy Statement

This Provincial Policy Statement was issued under Section 3 of the *Planning Act* and came into effect on March 1, 2005. It replaces the Provincial Policy Statement issued May 22, 1996, and amended February 1, 1997.

The Provincial Policy Statement provides policy direction on matters of provincial interest related to land use planning and development. As a key part of Ontario's policy-led planning system, the Provincial Policy Statement sets the policy foundation for regulating the development and use of land. It also supports the provincial goal to enhance the quality of life for the citizens of Ontario.

See www.mah.gov.on.ca/

2005: Niagara Regional Policy Plan Amendment 187

In December 2005, Niagara Regional Council adopted Regional Policy Plan Amendment 187 setting out new environmental policies for Niagara, consistent with the Provincial Policy Statement and the Greenbelt Plan. This is an important milestone as the existing environmental policies were more than 25 years old and no longer adequately addressed the public interest in environmental quality or the Regional Council's goals and strategic directions.[152]

Regional Policy Plan Amendment 187 establishes a comprehensive new policy framework for protecting and enhancing environmental quality. It embodies a landscape-based, ecosystem approach to planning. Implementation will involve partnerships among the Region, the Conservation Authority, the local municipalities, landowners, and Provincial and Federal agencies. The Region has been a leader in addressing water resource issues through the development of the Niagara Water Quality Protection Strategy. The Amendment is an important step forward in implementing the action programs recommended by the Strategy.

2009: Niagara – 2031 - Regional Growth Management Strategy

Niagara 2031 is a major Regional planning initiative examining where and how Niagara should grow over the period to 2031. It provides a strategic approach to linking land use, infrastructure and capital investment to meet the Region's environmental, public health, social, cultural, financial and economic goals. Niagara 2031 also addresses Provincial requirements for compliance with the Provincial Policy Statement, the Places to Grow Act and the Growth Plan for the Greater Golden Horseshoe.

In February 2009 Regional Council adopted Option D, the Preferred Growth Management Option. Option D met Provincial policy objectives for containment of sprawl, intensification within existing built up areas, and higher Greenfield development densities. It demonstrated that growth could be accommodated within existing urban areas, even at the somewhat higher levels of population and employment forecast. It also met the Region's strategic objectives to shift a larger proportion of future growth to south Niagara.

[152] www.regional.niagara.on.ca

Lakewide Management Plans for the Great Lakes

In the amended Great Lakes Water Quality Agreement of 1987, Canada and the United States, in consultation with State and Provincial Governments, agreed to develop and implement Lakewide Management Plans (LaMPs) for lake waters as well as Remedial Action Plans (RAPs) for Areas of Concern (AOCs). The LaMPs are intended to identify critical pollutants that impair beneficial uses in the lake proper and to develop strategies, recommendations and policy options to restore these beneficial uses. Although LaMPs are underway for each of the Great Lakes, those for Lakes Erie and Ontario have a more direct bearing on the Niagara River and are briefly described below:

Lake Ontario Lakewide Management Plan

The Lake Ontario LaMP is essentially a progression from the Lake Ontario Toxics Management Plan (LOTMP) in which the toxics problem in Lake Ontario was defined in the late 1980s. The completed LOTMP was published in 1989 and updates were completed in 1991 and 1993. In 1996, the Four Parties signed a Letter of Intent agreeing that the LaMP should provide the binational framework for environmental protection efforts in Lake Ontario and continue actions to move towards the restoration of beneficial uses and achievement of virtual elimination of critical pollutants.

For further information see: www.epa.gov/greatlakes/lakeont/

Lake Erie Lakewide Management Plan

The goal of the Lake Erie LaMP is to preserve, restore and protect the beneficial uses of Lake Erie. Although Environment Canada and the U.S. Environmental Protection Agency are the lead agencies for the LaMP, an array of federal, local, state and provincial agencies and stakeholders are involved to design and implement the Lake Erie LaMP. Of all the Great Lakes, Lake Erie is exposed to the greatest stress from urbanization, industrialization and agriculture, reflecting the fact that the Lake Erie basin supports the largest population.

A research and monitoring agenda was drafted as part of the 2004-2006 “Paths to Achievement” work plan. The LaMP plans to have all beneficial use impairments re-assessed in depth by 2008.

For further information see: www.epa.gov/greatlakes/lakeerie/

APPENDIX 7: Pollution Prevention and Control Planning in the Niagara River AOC

The Ministry of the Environment's Procedure F 5-5 requires municipalities to complete a Pollution Control Planning (PCP) study to meet the goals of the procedure. Many municipalities have completed PCP studies within Areas of Concern to address a variety of issues. Similarly, in the Niagara River AOC, PCP studies have been completed in Fort Erie, Niagara-on-the-Lake, Niagara Falls and Welland. All of these studies concluded with extensive recommendations for new facilities, upgrades to existing facilities and improved operations.[153]

Below is a brief summary of initiatives being undertaken by municipalities in the Niagara River AOC:

City of Welland:

Over the past 30 years, the City has partially separated many of their combined sewers and effectively eliminated overflows to the Welland River during dry weather periods. However, sewage flows still increase dramatically during wet weather periods due to groundwater infiltration and stormwater inflow. Currently, there are still approximately 24 CSO structures that discharge combined sewage into the Welland River during wet weather periods. In general, CSO discharges contribute a significant portion of event loadings for most pollutants into the Welland River. Computer modeling of the City of Welland sewer system indicates that currently only 64% of wet weather flow is captured and treated during an average year. The City of Welland is committed to achieving at least 90% control and is required to comply with MOE's CSO policy (i.e., Procedure F 5-5) as soon as possible. In order to do that, the City initiated a study to develop a comprehensive and strategic Pollution Prevention and Control Plan. The objective of this project is to provide a cost effective and practical long-term solution for CSO reduction to meet the requirements of Procedure F 5-5 in the interim and ultimately to meet the requirements of Procedure F 5-1 (i.e., virtual elimination of CSOs). In Phase 2 of the EA Processes, the alternative to Construct Primary Treatment Facility was defined as the preferred solution for CSO control. [154]

In 2009, the City of Welland and Niagara Region will jointly be completing a large sewer separation program (Ontario/Atlas/Wellington) to address basement flooding and CSO discharges to the Welland River. Following the completed sewer separation, the City will be undertaking a CSO flow monitoring/sampling program to re-assess the CSO capture rate and wastewater quality. It is expected that this sewer separation project will have a significant impact on the design and cost of the CSO high rate treatment project. [155]

The City has submitted an updated Pollution Prevention and Control Plan of implementation activities from 2006 through to 2015. [156]

Also, as of early 2006, the City has completed 90% residential downspout disconnections in an effort to reduce inflow/infiltration to the sanitary sewer system. [157]

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[153] Environment Canada. *Integrated Urban Water Pollution Control Planning – A Workshop in Conjunction with CAWQ Symposium.* Canada Centre for Inland Waters. Feb.10-11, 2004.

[154] City of Welland Combined Sewer Overflow Study. June 2003. Environmental Study Report. Prepared by R.V.Anderson Assoc. Ltd. & XCG Consultants.

[155] Communication from Norm Desilets, City of Welland. February 8, 2006.

Town of Fort Erie:

The Town of Fort Erie is serviced by separate sanitary and storm sewers. However, in the older areas of the Town, foundation drains and, in some cases, roof leaders are still connected to the sanitary sewer system. In addition, an aging sanitary sewer system and high groundwater levels in some areas have resulted in significant wet weather flows in the sanitary sewer system. The result has been overflows at major pumping stations during rainfall events.

The Town of Fort Erie initiated an update to the Pollution Control Planning and Infrastructure Study in 2003 (completed by end of 2004). The original PCP and Infrastructure Study was completed in conjunction with the Region of Niagara in 1990. The overall goal of the update is to develop measures to mitigate combined sewer overflows (CSOs) and develop a comprehensive and strategic pollution control and infrastructure plan for the Town of Fort Erie. [158]

By early 2006, the Town had completed 90% residential downspout disconnections in an effort to reduce inflow/infiltration into the sanitary sewer system and is commencing the disconnection of residential foundation drains.[159]

City of Niagara Falls:

The Muddy Run/Central Pumping Station CSO in the City of Niagara Falls accounts for approximately 40% of the total combined sewer overflow load to the Niagara River for an average year of rainfall. This particular overflow discharges directly to the Niagara River. The City's objective is to reduce the amount of City derived pollution from combined sewer overflows and stormwater discharges into the Niagara River. In co-operation with Environment Canada, Niagara Region and MOE, the City of Niagara Falls undertook an investigation of high-rate treatment in the form of vortex separators to control (minimize or eliminate) the combined sewer overflow at the Muddy Run/Central Pumping Station CSO site.[160]

In 2007, the Niagara Region and City of Niagara Falls completed construction of a new joint Central Pump Station - High Rate Treatment (HRT) facility. Associated Engineering was retained as the consultant for the design and contract administration of the project.

Incorporated into the construction of the new Central PS/HRT facility was a new Muddy Run Pumping Station, forcemains for both pumping stations, decommissioning of three pumping stations and construction of sanitary and storm sewers to allow for the separation of combined sewers and redirection of the sewers to new outlets all at a cost of $26.6 million.

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[156] Letter from Norm Desilets, City of Welland, to the Ministry of the Environment, dated March 23, 2006.
[157] Reported at meeting of NWQPS CSO Study Panel on March 2, 2006
[158] XCG Consultants Ltd. March 4, 2004. *Interim Report – Town of Fort Erie Pollution Control Planning Study Update.*
[159] Reported at meeting of NWQPS CSO Study Panel on March 2, 2006.
[160] City of Niagara Falls High Rate Treatment Facility Feasibility Study. June 1999. Final report. Prepared by CH2M Gore & Storrie Limited.

The new Central PS/HRT has a capacity of 1200 L/s with a Combined Sewer Overflow (CSO) vortex treatment facility designed for 90% volumetric control at the City's largest overflow by volume, the Muddy Run Central bypass. The High Rate Treatment Facility peak capacity is 3800 L/s of treated CSO discharge.

The HRT facility includes 2 - 13 m diameter, 8 m deep vortex tanks. During wet weather events the combined sewage enters the tanks tangentially at about mid-depth. This causes the sewage to spin which results in improved separation of solids. The treated sewage leaves the tanks over central overflow channel weirs. The separated solids are drawn off at the tank bottom. The underflow with the separated solids is pumped from a common HRT pumping well into the new Central pumping station for further pumping to the Niagara Region Water Pollution Control Plant.

The Central Pump Station - High Rate Treatment (HRT) Project represents a significant increase in pumping capacity and associated CSO capture and treatment. This capture eliminates the Muddy Run CSO discharge to the Niagara River resulting in an estimated CSO reduction of 34 occurrences and 577,839 m^3 discharge annually. This reduction represents a 12% decrease in CSO occurrences and a 62% reduction in CSO volume City wide.

The HRT facility was sized to provide 50% Total Suspended Solids (TSS) and 30% Biological Oxygen Demand (BOD) load reduction. In addition, the HRT facility was designed to allow for future installation of chemical feed equipment to further improve the treatment efficiency.

The City of Niagara Falls and the Niagara Region are extremely proud of the positive impact that the Central Pumping Station - High Rate Treatment facility will have on the natural environment for years to come.[161]

With regards to reducing inflow/infiltration, the City has been doing the disconnection of residential foundation drains for years and covers the whole cost.[162]

The City of Niagara Falls is undertaking a PCP and CSO Abatement Study.[163]

Town of Niagara-on-the-Lake:

The Town of Niagara-on-the-Lake experiences a large amount of infiltration and flows into the sanitary sewer system during wet weather events. This causes the sewer system to surcharge, which may result in basement flooding. The remediation plan includes correcting conditions which contribute to inflow, such as roof leaders discharging below grade, infiltration from laterals, broken pipes and other infrastructure deficiencies. The Town is working with Niagara Region to carry out flow monitoring that will assist in "before" and "after" analysis of the effectiveness of the measures.[164]

[161] Report from Bob Darrall, Infrastructure & Asset Manager, City of Niagara Falls. March 31, 2008.
[162] Reported at meeting of NWQPS CSO Study Panel on March 2, 2006.
[163] Reported during the Niagara Falls PCP Steering Committee Meeting #3, August 24, 2007.
[164] Handout at meeting of NWQPS CSO Study Panel on March 2, 2006. Table2: Current CSO Activities and Policies within the Niagara Watershed.

APPENDIX 8: Niagara Region Water and Wastewater Projects Identified in the 1995 Stage 2

Table 1: Update[165] to Niagara Region Water & Wastewater Projects (10 Year Capital Program) from Table 5 – Niagara River RAP 1995 Stage 2 Report

Project Title/Location	Status	Comments
Modification to Disinfection Systems at Niagara's Water Treatment Plants NIAGARA REGION	DONE	Backwash and process waste no longer discharged directly to the Niagara River. Supernatant discharged with less than 25mg/l suspended solids.
Modification to Disinfection Systems at Niagara's Water Treatment Plants NIAGARA REGION	DONE	Water Treatment Plants now use liquid chlorine (not chlorine gas) and some use Ultraviolet.
Welland Water Treatment Plant Improvements WELLAND	DONE	Equipment upgrades and operational improvements.
Water Master Servicing Strategy Study/Update NIAGARA REGION	DONE	Completed in 1995 and updated in 2003.
Wastewater Master Servicing Strategy Study/Update NIAGARA REGION	DONE	Completed in 1995 and updated in 2003.
Parkway Sewage Pumping Station Capacity Improvements FORT ERIE	DONE	Decommissioned since 1995.
Lakeshore Rd. Sewage Pumping Station Improvements FORT ERIE	Infrastructure improvement program approved in 2005[166]	Upsized the sewer going to the pumping station.
Dominion Rd. Sewage Pumping Station Improvements FORT ERIE	DONE	Town upgraded wet weather storage in 1999.
Ricardo/Melville/Front Pumping Station Improvements NIAGARA-ON-THE-LAKE	Ricardo/Front – DONE Melville - DECOMMISSIONED	Ricardo/Front – one station built approx. 5 years ago. Melville decommissioned since 1995.
Upgrading Stamford (Niagara Falls) Water Pollution Control Plant (WPCP) NIAGARA FALLS	DONE	Equipment upgrades and operational improvements.[167] Optimization of existing process.

[165] Updated information provided verbally by Niagara Regional and Municipal engineers in 2005.
[166] www.regional.niagara.on.ca/government/works/Capital-Projects.aspx
[167] Information provided by Mike Jarzembecki, Regional Municipality of Niagara. March 4, 2008.

McLeod Rd. Sewage Pumping Station and Forcemain Upgrade NIAGARA FALLS	DONE	Minimal capacity increase. No new forcemain being considered.
Welland WPCP Digester Improvements WELLAND	DONE	Equipment upgrades and operational improvements.
Kalar Rd. Pumping Station and Forcemain Upgrade NIAGARA FALLS	DONE	Completed in 1995. New forcemain redirected flow. Increased capacity. New standby generator.
Dorchester/Drummond Pumping Station Improvements NIAGARA FALLS	DONE	Completed in 1998. New station. Standby generator. Increased capacity.
Garner Rd. Sludge Holding Lagoon Upgrade NIAGARA FALLS	DONE	Additional steel storage tanks added, centrifuge installed and storm water management pond expanded.
Improvements to Sewage Pumping Station along River Road NIAGARA FALLS	DONE	New Central Pump Station, High Rate Treatment Facility and Improvements to Muddy Run Pump Station completed, reducing CSO discharges to the Niagara River.
Standby Power Provision at WPCP and Pumping Station NIAGARA REGION	DONE	Standby power added at Stamford, WPCP, Lundy's Lane pump station and Chippawa Lo-lift pump station.
Implementation of MISA Requirements at Regional Plants NIAGARA REGION	ONGOING	See Regional Niagara's "A Guide to the Sewer-Use By-Law".
CSO Control and Related Improvements NIAGARA REGION	ONGOING	DFA reported completed in 2007 identifying additional work.
Welland WPCP improvements WELLAND	DONE	Equipment upgrades and operational improvements.
Queenston WPCP Improvements NIAGARA-ON-THE-LAKE	DONE	Equipment upgrades and operational improvements.
Stevensville/Douglastown Treatment Lagoon Upgrade FORT ERIE	DONE	The Region added aeration in 1999/2000.
Improvements to Port Robinson Lagoon Facility. THOROLD	ONGOING	In 2006 flow diverted to Welland WPCP. Facility to be decommissioned in future.

APPENDIX 9: Water Quality and Habitat Improvement Project Accomplishments

The following results for water quality improvement projects implemented by the NPCA have been taken from:

GREAT LAKES SUSTAINABILITY FUND Year-end Report - Water Quality and Habitat Improvement Project for the Niagara River Area of Concern. March 27, 2009. PROJECT RESULTS

The following tables illustrate the benefits of this year's project in meeting the recommendations in the Niagara River RAP Stage 2 Report and the Canada-Ontario (COA) Initiatives both of which focus on the delisting of the Niagara River AOC.

Table 1: Summary of projects and deliverables achieved through the Niagara River AOC programs duration (2007)

Program Summary	Projects Completed to Date	
	Achieved	Hectares Restored
Number of conservation farming projects	23	
Number of livestock fenced from watercourse	2,515	155,840 kg N diverted
Length of stream fencing	22,236 m	N/A
Number of manure storages/improvements, wash water, etc.	70	N/A
Quantity of manure contained as a result of improved management practices	81,776 m^3/yr	N/A

Table 2: List of demonstration projects involving agricultural partners (2007)

Project Name	Number Completed
Manure Management	5
Grass Waterways	0
Rock Chutes & Outlets Stabilization	0
Windbreak/Shelterbelts	1
Streambank Stabilization using Bioengineering	1
Trickle Irrigation	1
Total BMP projects	**8**

Wetland Habitat (Hectares)

Fiscal year (date)	Total completed to date ** (ha)	Achieved during fiscal year (ha)
1994/95	0.54	0.54
1995/96	3.9	3.4
1996/97	15.2	11.3
1997/98	32.6	17.4
1998/99	44.3	11.7
1999/00	58.5	14.2
2000/01	64.6	6.1
2001/02	68.3	3.7
2002/03	87.9	19.6
2003/04	109.0	21.1
2004/05	124.7	15.7
2005/06	127.2	2.6
2006/07	139.0	11.8
2007/08	143.0	4.0
2008/09	147.0	6.4

Riparian Habitat (Kilometres)

Fiscal year (date)	Total completed to date ** (km)	Achieved during fiscal year (km)
1994/95	0.27	0.27
1995/96	2.0	1.7
1996/97	7.6	5.6
1997/98	16.3	8.7
1998/99	22.1	5.8
1999/00	28.5	6.4
2000/01	28.9	0.41
2001/02	31.2	2.3
2002/03	42.4	11.4
2003/04	46.4	4.0
2004/05	49.4	3.0
2005/06	50.5	1.1
2006/07	51.6	1.1
2007/08	52.6	1.0
2008/09	53.6	0.32

(Note: the numbers in this graph are calculated by individually measuring each side of the water corridor)

Delisting Criteria for the percentage of wetland cover and riparian buffers will be reached in the Niagara River AOC when the AOC subwatersheds are not significantly different in comparison to suitable non-AOC reference watersheds. Note - See the executive summary in this report for the recommended delisting criteria for the Niagara River (Ontario) AOC.

In the Niagara River AOC, priority subwatersheds for forest, wetland and riparian improvements include: Buckhorn Creek, Elsie Creek, Welland River West, Little Forks Creek and Big Forks Creek.

ForestHabitat (Hectares)

Fiscal year (date)	Total completed to date ** (ha)	Achieved during fiscal year (ha)
1995/96	3.9	3.9
1996/97	13.8	9.8
1997/98	32.4	18.6
1998/99	45.9	13.5
1999/00	80.7	34.8
2000/01	83.9	3.2
2001/02	119.6	35.7
2002/03	166.2	46.6
2003/04	193.8	27.6
2004/05	231.4	37.6
2005/06	256.4	25.0
2006/07	281.6	25.2
2007/08	310.3	28.7
2008/09	338.3	19.0

Similarly, for forest cover, delisting criteria will be reached in the Niagara River AOC when the AOC subwatersheds are not significantly different in comparison to suitable non-AOC reference watersheds.

In the Niagara River AOC, Oswego Creek and Sucker Creek are priority subwatersheds for reforestation and riparian improvements.

Land Care Niagara[168], in partnership with the Ontario Ministry of Natural Resources – Ontario Stewardship, provides information and natural resource stewardship services to the citizens of Niagara through various programs, one of which is the Niagara Natural Heritage Corridor Tree Planting Program.

[168] www.landcareniagara.com

NOTE: Details in this appendix were superceded by the Stage 2 review.

APPENDIX 10: Niagara River Remedial Action Plan (RAP) Recommendations and Proposed List of Recommendations (Background paper - June 26, 2006)

Purpose

The purpose of the review of the Niagara River RAP Recommendations is to determine their current status and report this information in the Stage 2 Update report. Over the past 11 years changes and influences on the RAP have necessitated a review and revision of the Recommendations.

This review will identify those Recommendations that have been completed; those that are considered to be redundant due to changes in circumstances over the past 10 years; those that should be revised and/or combined; and, those that should be included in the new action plan for the Area of Concern (AOC). A rationale on the status of each Recommendation will be provided in the Stage 2 Update report, including identification of those Recommendations that are beyond the scope of the RAP. The review will include public input to develop an updated list of Recommendations and actions required to delist the Niagara River (Ontario) AOC.

Background

The Niagara River Remedial Action Plan (RAP) Stage 2 report: The Cleanup Connection (1995) contains thirty-seven Recommendations to clean up the Niagara River (Ontario) AOC. Since then, many changes and initiatives have taken place during implementation of the RAP. Not long after the release of the Stage 2 report to the community at large, the former Public Advisory Committee (PAC) became incorporated in 1998 as the Niagara River Restoration Council and focussed its attention on implementation of some of the Recommendations. In 1999, the Niagara Peninsula Conservation Authority (NPCA) assumed the role of RAP Coordinator through a three-party agreement with Environment Canada and the Ministry of the Environment.

In November 2000, the Niagara River RAP Implementation Annex (action plan) was produced with the intent to compliment the goals, objectives and ecosystem approach vision expressed in the Stage 2 report. The work plan provided a concise account of the proposed and anticipated RAP partner and implementation activities. Since the completion of the Stage 2 Report and undertaking the action plan, the Niagara River (Ontario) RAP is well into the implementation and monitoring phase of the RAP process.

Review of the Recommendations

The Recommendations are grouped into the following categories: General, Water Quality – Municipal, Water Quality – Rural, Sediment Quality, Biota/Habitat Quality, Human Health, Surveillance & Monitoring, and Stewardship & Education.

The Niagara River Coordinating Committee, comprised of representatives from Environment Canada, the Ontario Ministry of the Environment (MOE), the Ontario Ministry of Natural Resources (MNR) and the Niagara Peninsula Conservation Authority, met to review and discuss the status of the 37 Recommendations laid out in the Stage 2 report.

The original Recommendations are shaded and presented under each of the categories followed by the results of the RAP Coordinating Committee's review. Table 1 provides a summary of the Committee's findings.

Water Quality - Municipal

It is proposed that Recommendations #1, 2, 3, and 4 should be updated into a single, new Recommendation pertaining to municipal wastewater infrastructure.

Suggested Revised Recommendation:
Implement municipal waste water quality improvement projects through infrastructure upgrades, optimization and pollution prevention and control planning initiatives.

1. The Niagara River RAP become involved in Infrastructure Needs Studies (INS).

Innovative demonstrations for stormwater management and different technologies to address Combined Sewer Overflows (CSOs) (e.g., CSO Muddy Run – pilot and full-scale Hirate treatment) are being tested in the Niagara River AOC. The National Water Research Institute (NWRI) is providing technical advice to the monitoring program for the High Rate Treatment demo at Niagara Falls. This project is well underway.

The Niagara River RAP will work with the NWQPS process to identify the key infrastructure priorities from a RAP perspective.

2. Enforce the Regional Sewer Use By-Law (By-Law #3308)

The Regional Sewer Use By-Law[169] permits the RMON to monitor and control contaminants discharged into the sewer system. It defines what is permitted to be discharged into a sewer, whether sanitary, combined, or storm sewers. In 2002, as part of the Sewer Use Program, the bylaw was revised to reflect the MOE's Model Sewer Use By-Law.

Enforcement is ongoing through the Niagara Region.

3. The Region of Niagara continue to work towards implementing a water pollution control plant optimization program for all its plants.

The RMON is in the process of implementing the optimization program throughout all the Water Pollution Control Plants (WPCP). This "Direct" action is listed under the Direct Energy, New Technology, Best Practices Program of the NWQPS Direct Action Summary for 2005 - 2014.

Implementation of this Recommendation is a high priority action for the RAP.

[169] Regional Niagara. Water and Wastewater Division. *A Guide to the Sewer Use By-Law.*
[170] www.ene.gov.on.ca/envision/water/misa/index.htm

4. The Region of Niagara continue to work towards implementing a water pollution control plant optimization program for all its plants.

Implementation of the Municipal Industrial Strategy for Abatement (MISA) requirements at the Niagara Region's Water Pollution Control Plants (WPCPs) is ongoing.

MOE enforces MISA. With the signing of the 1987, 1994 and 2002 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem, Ontario committed to the management of persistent toxic substances. The goal of the MISA program is "virtual elimination" of persistent toxic contaminants from all discharges into Ontario waterways.[170]

5. Landfills continue to be monitored regularly, as determined by monitoring results.

This Recommendation will be referred for consideration as part of the monitoring plan.

Water Quality - Rural

It is proposed that Recommendations #6, 7, 8 should be combined and revised into a single Recommendation pertaining to rural non-point source issues.

Suggested Revised Recommendation:
Identify priority target areas for water quality and habitat improvement and encourage landowner participation through funding incentives, education, stewardship and outreach.

6. Prepare and implement a rural non-point source (NPS) pollution remediation strategy.

The use of an Agricultural Non-Point Source (AGNPS) model as an aid to watershed management decision-making is working well in the Niagara River AOC. Oswego Creek is a pilot project for the AOC and mapping is complete.

Priority target areas have been identified but it is often difficult trying to get people (landowners) to participate. The definition of delisting criteria will help to establish targets (e.g., phosphorous). Phosphorous (P) levels in the Welland River are very high. Also, a comparison of non-AOC creeks to the Welland River will help to determine the extent of water quality degradation within the AOC.

7. Farmers in the Niagara River AOC be encouraged to follow sound farming practices such as recommended in the Environmental Farm Plan program.

8. Additional funding per farm business be given to the Environmental Farm Plan Incentive Program operating in the Niagara River AOC.

There are many small farms in the watershed. "Greencover" money is available to farmers, but the process takes time and needs to be endorsed at the local level. Septics are a very important issue in the AOC and there are efforts to get a septic and well program underway. The NPCA is working

with LandCare Niagara on this to make sure it's being addressed in the watershed. Also, members of NPCA staff sit on the NWQPS Better Management Practices committee.

Water quality is a major issue for the RAP program. It is well documented that flow reversal & the siphons are affecting the Welland River system.

An analysis of priority areas and cleanup actions are required to determine what remains to be done to delist the AOC.

Sediment

It is proposed that as Recommendations #9 &11 have been completed, there should be a Recommendation pertaining to a monitoring plan.

Suggested New Recommendation:
A monitoring plan be established and supported by the RAP.

9. The lower Welland River (downstream of the Welland airport) be the priority focus of any sediment assessment.

A full scale cleanup of the Welland River reef site was undertaken in 1995. Details of the project are contained in a December 1997 report by Acres International Ltd.: "*The Full-Scale Welland River Cleanup Project.* Project Assessment Report and Technical Reference Document".

Long term monitoring for this site could be included in a recommendation related to monitoring (see above).

This Recommendation can be identified as completed.

10. Potentially contaminated locations be prioritized for review, assessment and remediation.

Studies have been carried out to assess potentially contaminated sites within the AOC. Priority areas for further assessment were identified and presented in the RAP Stage I Update report (March 1995). Since then, a study has been undertaken to review the contaminants at each site and identify those sites where sediment remediation actions are required. Sediment management options are presently being examined for sites at Lyon's Creek East and West.

Therefore, this Recommendation should be revised.

Suggested Revised Recommendation:
Implement the sediment remediation actions identified through the studies on contaminated sediment sites in the AOC.

11. Test potentially contaminated sediment sites to confirm the absence / presence of contamination.

This work has been completed. For further information, see Golder Associates Ltd. May 2004. "*Niagara River Area of Concern Contaminated Sediment Site Assessment Phase I and Phase II.*"

This Recommendation can be identified as completed.

Biota/Habitat

It is proposed that a new Recommendation be prepared by combining #12 & #16.

Suggested Revised Recommendation:
Support the implementation of municipal natural heritage strategies within the Niagara River AOC.

12. Prepare a natural heritage strategy for the Niagara River AOC.

Planning authorities encompassing the AOC have developed environmental policies for their Official Plans. As an example, the RMON has developed a comprehensive new set of policies and a Core Natural Heritage Map for their Official Plan.

The environmental policies developed aim to maintain a Healthy Landscape throughout Niagara, while giving particular attention to natural features of special significance within the broader landscape. The Core Natural Heritage System is an essential component of a Healthy Landscape.

Environmental conservation is a cooperative effort involving landowners and residents, community organizations and all levels of government. The policies developed by municipalities provide the framework for this cooperative effort. Moreover, the Planning Act, the Provincial Policy Statement and the Greenbelt Plan, in conjunction with other Provincial policy, legislation and regulations, set out the Provincial framework for environmental planning and conservation.

Link with #16 – see below.

13. The PAC will critically review government review processes to ensure that they embody the principles and objectives of the Niagara River RAP.

This Recommendation is redundant as there is no permanent PAC. However, through the NPCA as RAP Coordinator, the RAP is included in municipal official plans and initiatives of the RMON, such as NWQPS. Generally, the RAP is represented in reviews of issues that affect the AOC.

This Recommendation should be considered redundant.

14. A regulation requiring treatment or exchange (or some other technique) to ensure that ballast water cannot be a way for the introduction of exotic species into the Niagara River AOC be enacted.

There is no further action required on this Recommendation and it should be identified as not applicable. It is beyond the scope of the RAP to enact or cause a regulation to be enacted. Also, it is not a local issue that the RAP can influence or control.

15. Continue to protect habitat on both sides of the river as one ecosystem.

In its role as RAP Co-ordinator the NPCA maintains cross-border liaison with the Buffalo Niagara RIVERKEEPER[171], (formerly Friends of the Buffalo Niagara River). This organization is currently responsible for co-ordination of the Buffalo River RAP. The creation of the U.S. Niagara River Greenway and the Alternative Settlement Process associated with the relicensing of the Niagara Power Facility are two examples of U.S. initiatives that may provide opportunities for cooperation with U.S. partners to discuss and act on habitat issues of mutual interest.

Regarding the proposed project on page 68 of Stage 2 report (i.e., the four parties to map the littoral zone habitat), this project was never implemented.

There are two separate RAPs for the Niagara River AOC; however, efforts will continue to seek out opportunities for international cooperation, as suggested through this Recommendation.

Suggested Revised Recommendation:
Continue to protect habitat on both sides of the river as one ecosystem and seek opportunities for international cooperation.

16. Municipal planning documents incorporate ecologically based policies and design criteria.

It is proposed that a new Recommendation be prepared by combining #12 & #16. (See #12 above for revised Recommendation.)

Human Health

17. Develop a Niagara River Fish Consumption Advisory.

A joint advisory will not be developed with New York State due to differences between the programs. There is a question about whether the risk of fish consumption is being communicated adequately to specific groups of the public in Ontario, such as children, women of child-bearing years, non-English speaking groups, etc.

This Recommendation should be revised.

Suggested Revised Recommendation:
While fish consumption advisories are necessary, adequately communicate and encourage the use of the government's "Guide to Eating Ontario Sport Fish".

18. Conduct research to determine if consumption of water based wildlife is harmful to human health.

In the Niagara River AOC, this impairment is based on consumption of snapping turtles in Lyons Creek.

There is a need to develop a sediment management strategy for Lyons Creek and implement it. It may be determined that consumption advisories are required until the sediments are clean.

[171] www.bnriverkeeper.org

This Recommendation should be revised.

Suggested Revised Recommendation:
Prepare and communicate a consumption advisory until contaminant levels in snapping turtles from Lyons Creek are below the appropriate guidelines for protection of the health of human consumers.

(This will be clarified further from results of the contaminated sediment study).

Surveillance & Monitoring

Recommendations #19 - 21 should be addressed in the updated monitoring plan.

19. Continue monitoring municipal point sources (e.g., sewage treatment plants) including but not restricted to NRTMP point source monitoring parameters.

20. Continue monitoring industrial point sources and publish results.

In the December 9, 1996 Provincial Response to the RAP, it was stated that the recommendation has been made to discontinue point source monitoring, based on indications that the 50% point source reduction goal had been met.[172]

21. Develop and implement a Welland River and (Niagara River) Tributaries Monitoring Program.

This Recommendation should be addressed in the new monitoring plan for the RAP.

An updated tributary monitoring plan is required.

22. Taste and odour program (results) be monitored (drinking water).

A rationale on why drinking water taste and odour is rated as "not impaired" may be required. Huge changes are taking place around the Great Lakes, some of which are the appearance of toxic algal species. This is outside the control of the AOC but it may crop up in the Niagara River AOC.

In 1999, The National Water Research Institute (NWRI) joined seven major municipalities, the Ontario Provincial Government (Ontario Clean Water Agency and Ontario Ministry of the Environment) and two University partners to form the Ontario Water Works Research Consortium. This cooperative group, a unique model in Canada, was first established to address taste and odour problems in Lake Ontario and the St. Lawrence River and, in the past five years, has made substantial progress towards understanding and predicting these outbreaks. In 2000, scientists expanded their research program to investigate the role played by large-scale water movements and shoreline nutrient inputs in recurring outbreaks.[173]

[172] Niagara River Remedial Action Plan Implementation Annex – Appendix C. November 2000
[173] www.nrwi.ca/researchintoaction/chapter6-p-e.html *Taste and Odour in Drinking Water.*.

The Western Lake Ontario Waterworks Consortium, comprised of the municipalities in the GTA and surrounding area, undertakes ongoing research to assist its members with the management and treatment of water. RMON has been an active partner in this initiative for many years and contributes funds annually.[174]

23. Continue all monitoring programs for drinking water.

The requirements for drinking water monitoring are established under the *Safe Drinking Water Act*[175], *2002,* and implemented by the service provider (the municipality). The purpose of the *Act* is to gather in one place all legislation and regulations relating to the treatment and distribution of drinking water.

There is no BUI so long as the quality of drinking water is in compliance with the regulations.

Part Two of Commissioner O'Connor's Walkerton Inquiry Report contains specific recommendations that were aimed at protecting water sources from contamination. A key recommendation is that drinking water sources be protected by developing watershedbased source-protection plans, and these plans would be required for all watersheds in Ontario. Source water protection legislation is expected to be enacted through the *Clean Water Act* in 2006. Conservation Authorities are playing a lead implementation role.

The Niagara Water Quality Protection Strategy (NWQPS) is, essentially, a source Protection Plan.[176]

24. Support and encourage participation in Canadian Wildlife Services' community based wildlife monitoring programs.

Due to the low numbers of volunteers in the Canadian Wildlife Service's (CWS) community based wildlife monitoring programs, CWS is looking at hiring another person to encourage more participation.

Volunteers play a major role in the annual bird count along the Niagara River. The Niagara River Corridor was designated as an Important Bird Area (IBA) in December 1996.[177] Annually, four species congregate in globally significant numbers along the river, as well as one of the largest and most diverse concentrations of gulls in the world.

Information from the delisting criteria review monitoring needs indicates that species diversity and population sizes of birds and amphibians in Niagara River AOC marshes are lower than at non-AOC reference sites. This is most likely due to the quantity and quality of wetland habitat.

[174] www.regional.niagara.on.ca Water & Wastewater Services Statistical Reports (2002): *Taste & Odour Research Regionwide.*
[175] www.ene.gov.on.ca/envision/water/sdwa/index.htm
[176] Niagara Water Quality Protection Strategy. October 2003. Phase 4 Report.
[177] Niagara River Corridor IBA Working Group. Fall 2002. *IBA Conservation Plan for the Niagara River Corridor IBA.*

The NPCA's Natural Heritage Areas Inventory will provide a snapshot of updated information based on a properly managed and systematic inventory process. The field inventory is expected to start in Spring/06 and it will probably take over one year to obtain a full inventory and establish a database. This activity could be included in the monitoring plan, with the Niagara Region and the NPCA as the lead agencies.

Recommendations for monitoring and assessment needs have been made by technical reviewers in the delisting criteria & possible impairments review.

25. Implement a resident attitude monitoring program.

As explained in the Stage 2 report, surveys were carried out by Environment Canada (1983) and RMON (1994). The NPCA has also carried out surveys from time to time. In the future, this type of assessment could be picked up through education programs, etc.

No further action is required for this recommendation and accordingly it should be identified as completed as part of NWQPS.

Stewardship & Education

It is proposed that Recs. #26 & 27 should be combined to form a single Recommendation that focuses on areas of interest to the RAP.

26. Public education programs continue and new ones be developed as required.

27. Professional education programs continue and new ones be developed as required.

Suggested Revised Recommendation:
Develop and deliver education and community programs that address matters of interest to the RAP or that support RAP implementation.

Action items could be included into the Niagara River RAP work plan.

General

28. Provincial and federal governments develop an integrated ecosystem approach to management for its agencies.

The Canada – U.S. Great Lakes Water Quality Agreement[178] (GLWQA) expresses the commitment of each country to restore and maintain the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem. In 1987, the addition of Annex 2 incorporated the development and implementation of RAPs for AOCs. Following the revisions to the GLWQA, the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) was revised to provide a more specific framework for restoring AOCs in Ontario (1994, 2002 and 2007 COAs).[179]

[178] International Joint Commission. *Revised Great Lakes Water Quality Agreement of 1978* as amended by Protocol signed November 18, 1987.
[179] Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem 2007.

This recommendation should be considered redundant.

29. Provincial and federal governments establish specific government funding programs for RAP Implementation.

RAPs are implemented through both special programs (e.g., Great Lakes Sustainability Fund, Great Lakes Renewal Fund, Canada-Ontario Agreement) and regular operating budgets of senior government agencies. Regional and local governments also fund projects that support RAP implementation, notably upgrades to municipal wastewater infrastructure.

The recommendation should be revised to encourage continued funding support from all government levels for RAP initiatives and to encourage infrastructure funding programs to place a priority on projects in Great Lakes AOCs.

Suggested Revised Recommendation:
All levels of government continue providing resources for RAP initiatives and make projects in Great Lakes AOCs a priority for infrastructure funding.

30. The Niagara River RAP endorse and encourage the process of multi-sectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.

There is a history of community liaison committees ("Friends of..") in the Niagara River AOC. They have functioned well at identifying and utilizing resources available to them and have the ability to involve the community. The former Niagara River RAP Public Advisory Committee was incorporated in 1998 and is currently known as the Niagara Restoration Council. The Friends of Fort Erie's Creeks focuses on Frenchman Creek and Black Creek, and the Friends of the Welland River are now known as the Welland River Keepers. Each of these committees has documentation on their restoration accomplishments. Further details can be obtained from the NPCA.

The Niagara Region in partnership with the Niagara Peninsula Conservation Authority and the Ministry of the Environment has developed a protection strategy for Niagara's water. The Niagara Water Quality Protection Strategy (NWQPS) is a multi-stakeholder initiative founded on public and agency consultation. Completed in the fall of 2003, it is an initiative to provide safe water for drinking, swimming and fishing for today and for future generations. An important feature of the Strategy is building on programs and activities already being carried out across the region by local stakeholders. Implementation of the Strategy will be successful only with the co-operation and partnership of municipalities, government agencies, local interest groups and the residents of Niagara[180]. Six Direct Actions were identified in 2005 under the areas of Agricultural Best Management Practices, Combined Sewer Overflow Assessment, Monitoring Data Harmonization, Water Efficiency, Stormwater & Erosion, and Niagara Watershed Report Card. A 2006 Direct Action Program and a 10 year forecast are currently under review, as well as the NWQPS Implementation Framework.

[180] Niagara Region and The Niagara Peninsula Conservation Authority. February 2004. The Niagara Water Quality Protection Strategy. *Water for Life in Niagara.*

This recommendation is ongoing through the NPCA and NWQPS.

31. Establish a Geographic Information Systems repository for the Niagara River AOC.

The NPCA has almost completed the establishment of a Geographical Information System (G.I.S.) restoration database. The RAP is a priority of the Conservation Authority and the G.I.S. tool will assist in determining priority areas for remediation within the watershed. The Restoration database is the RAP flagship GIS product as it is a tool that can quantify and report on the remediation effort and success of NPCA stewardship based Restoration programs. The NPCA's 2004 G.I.S Program Status and Direction Report highlights some of the NPCA's G.I.S. initiatives and successes.

A "clearing house" for the Niagara Water Quality Protection Strategy and water related information is being established. The clearing house is intended to provide document warehousing, G.I.S applications, and a monitoring data repository. An Information Management Working Group has been formed with representatives from the NPCA, MOE and RMON who have a G.I.S or data management background to work out the details on development and implementation of the clearing house.

This recommendation is not linked to delisting and the committee suggests that, in light of the developments that have taken place in G.I.S, it should be revised.

Suggested Revised Recommendation:
That the NPCA maintain its G.I.S. restoration database as a tool in determining priority areas for remediation within the watershed and collaborate with NWQPS in G.I.S. information management.

32. Establish an International RAP.

The creation of an International RAP for the Niagara River AOC has long been supported by Ontario, Canada and Niagara River RAP participants. The International Joint Commission (IJC) has consistently called for an International RAP in international boundary waters. However, New York State opposed the idea of an International RAP and this has resulted in two separate RAP efforts being undertaken for the Niagara River. Both RAPs operate within a broader context of intergovernmental cooperation. Joint initiatives include the Niagara River Toxics Management Plan (NRTMP) and the International Board of Control under the Niagara River Treaty.

The NRTMP[181] has been implemented since 1987 by four environmental agencies in Canada and the U.S., referred to as "The Four Parties" (i.e., Environment Canada, U.S. Environmental Protection Agency Region II, Ontario Ministry of the Environment, and the New York State Department of Environmental Conservation). The NRTMP is the program designed to reduce the concentrations of toxic pollutants in the Niagara River. Eighteen "priority toxics", ten of which were thought to have significant Niagara River sources, were specifically targeted for reduction. The Four Parties re-affirmed their commitment to the NRTMP in a "Letter of Support" signed in December, 1996.

Establishment of an international RAP is not essential for successful implementation of all remaining RAP actions in the Canadian portion of the AOC. A case for a partial delisting can be made if it can be demonstrated that the remaining beneficial use impairments in the Niagara River can be attributed only to sources and causes in the US portion of the AOC or from upstream in Lake Erie.

Cross-border efforts are underway by the Niagara Region (NR), Environment Canada and the Canadian Consulate in Buffalo. A bi-national Summit was held in May 2006 with the theme: "One Niagara – Our Shared Resource," and a proposed action plan to delist the Niagara River within the 2009 – 2012 timeframe was discussed.

No further action is suggested for this Recommendation and it should be considered completed to the best of our abilities. Efforts will focus on the development of a rationale for partial delisting.

Also, efforts will continue to seek out opportunities for international cooperation, as suggested through Recommendation #22.

33. Secure recognition of the remedial action plan as having fulfilled some of the requirements of the environmental assessment (EA) process.

Subsequent review of this Recommendation indicates that it is not achievable because the RAP does not satisfy the requirements of either the Federal Canadian Environmental Assessment Act or the Provincial Class Environmental Assessment process. Also, the recommendation does not move the AOC towards delisting; it is not supported by the regulatory agencies; and, it should be considered not applicable.

34. Develop model 'terms of reference' for remediation projects by community liaison committees.

This Recommendation is not relevant to delisting the AOC. Currently, there are many models of "terms of reference" and Best Management Practices (BMPs) available to community liaison committees.

[181] Niagara River Toxics Management Plan (NRTMP) *Progress Report and Work Plan.* September 2005.

This recommendation is vague and should be considered not applicable.

35. The Ontario Ministry of Natural Resources develop an 'Introduction of Exotics' supplement to the Project Wild, Fishways and Focus on Forests programs.

This Recommendation is not relevant to delisting the AOC.

OMNR has previously done work on exotics/invasive species, but no further work is planned. The Ontario Federation of Anglers & Hunters (OFAH) has lots of information.

The topics could be included in a future public education program.

36. Initiate the Niagara River RAP Implementation Structure.

The RAP Implementation Structure laid out in the Stage 2 report is now obsolete. Since 1999, the NPCA has been the RAP Coordinator through a three-party agreement with Environment Canada and the Ministry of the Environment. Through this agreement, an implementation mechanism is in place with links to other programs (e.g., NWQPS) and partnerships within the AOC.

It is anticipated that the implementation structure will change again according to the new work plan that will be developed from actions required to reach the targets identified under the new delisting criteria, and perhaps also depending on developments in implementation of the NWQPS.

This recommendation is redundant.

37. Boat owners retain and dispose of grey water at marinas.

No further action is required on this Recommendation as this issue does not impact the Niagara River AOC. Therefore, this Recommendation should be considered as not applicable.

The MOE has a "black water" regulation, but no "grey water" regulation. It also has a Clean Marine initiative with industry.

The Ontario Marine Operators Association (OMOA) along with over twenty marine industry professionals and Ontario's boaters' and anglers' associations formed the Clean Marine Partnership to develop a voluntary program of "Environmental Best Practices" for the marine industry that is recognized as the leader in North America. OMOA member marinas have been enrolling in the Clean Marine Program to ensure that their marinas are following these environmentally sound practices and protecting our waterways for all to enjoy.[182]

[182] OMOA Clean Marine Program. *It's our environment, let's protect it.* (brochure)

Table 1

Recommendations to Keep	Number	Action
General	#29	Revised into a new Recommendation re: funding
	#30	Ongoing through NPCA, NWQPS, SWP.
	#31	Revised into a new Recommendation
Water Quality - Municipal	#1, 2, 3, 4, 5	Revised into a single Recommendation.
Water Quality - Rural	#6, 7, 8	Revised into a single Recommendation.
Sediment Quality	#10	Revised into a new Recommendation
Biota/Habitat	#12, 16	Revised into a single Recommendation.
	#15	Revised Recommendation re: seek int'l opportunities.
Human Health	#17, 18	Revised each Recommendation.
Stewardship & Education	#26, 27	Revise into a single Recommendation that focuses on areas of interest to RAP.
Recommendations re: Monitoring	#19, 20, 21, 24	Address in updated monitoring plan
Recommendations Complete	#9, 11	Revised into a new, single Recommendation re: monitoring plan.
Recommendations - not applicable/ redundant	#32, 29, 33, 34, 36, 13, 14*, 22, 23, 25*, 37	* Topic could be included in an education program.

Suggested Revised Recommendations

Water Quality - Municipal

1 – 5. Implement municipal waste water quality improvement projects through infrastructure upgrades, optimization and pollution prevention and control planning initiatives.

Water Quality – Rural

6 – 8. Identify priority target areas for water quality and habitat improvement and encourage landowner participation through funding incentives, education, stewardship and outreach

Sediment Quality

10. Implement the sediment remediation actions identified through the studies on contaminated sediment sites in the AOC.

Biota/Habitat

12,16. Support the implementation of municipal natural heritage strategies within the Niagara River AOC

15. Continue to protect habitat on both sides of the river as one ecosystem and seek opportunities for international cooperation.

Human Health

17. While fish consumption advisories are necessary, adequately communicate and encourage the use of the government's "Guide to Eating Ontario Sport Fish".

18. Prepare and communicate a consumption advisory until contaminant levels in snapping turtles from Lyons Creek are below the appropriate guidelines for protection of the health of human consumers.

Surveillance & Monitoring

New Recommendation: A monitoring plan be established and supported by the RAP. (re: # 19-21).

Stewardship & Education

26,27. Develop and deliver education and community programs that address matters of interest to the RAP or that support RAP implementation.

General

29. All levels of government continue providing resources for RAP initiatives and make projects in Great Lakes AOCs a priority for infrastructure funding.

31. That the NPCA maintain its G.I.S. restoration database as a tool in determining priority areas for remediation within the watershed and collaborate with NWQPS in G.I.S. information management.

Proposed Revised List of Recommendations

1 (Water Quality)
Implement municipal waste water quality improvement projects through infrastructure upgrades, optimization and pollution prevention and control planning initiatives.

2 (Water Quality)
Identify priority target areas for water quality and habitat improvement and encourage landowner participation through funding incentives, education, stewardship and outreach.

3 (Sediment Quality)
Implement the sediment remediation actions identified through the studies on contaminated sediment sites in the AOC.

4 (Biota/Habitat)
Support the implementation of municipal natural heritage strategies within the Niagara River AOC.

5 (Biota/Habitat)
Continue to protect habitat on both sides of the river as one ecosystem and seek opportunities for international cooperation.

6 (Human Health)
While fish consumption advisories are necessary, adequately communicate and encourage the use of the government's "Guide to Eating Ontario Sport Fish".

7 (Human Health)
Prepare and communicate a consumption advisory until contaminant levels in snapping turtles from Lyons Creek are below the appropriate guidelines for protection of the health of human consumers.

8 (Surveillance & Monitoring)
A monitoring plan be established and supported by the RAP.

9 (Stewardship & Education)
Develop and deliver education and community programs that address matters of interest to the RAP or support RAP implementation.

10 (General)
All levels of government continue providing resources for RAP initiatives and make projects in Great Lakes AOCs a priority for infrastructure funding.

11 (General)
The Niagara River RAP endorse and encourage the process of multi-sectoral liaison committees as the vehicle to facilitate the satisfactory remediation of water quality in the Niagara River AOC.

12 (General)
The NPCA maintain its G.I.S. restoration database as a tool in determining priority areas for remediation within the watershed and collaborate with NWQPS in G.I.S. information management.

Note: According to Stage 2 report (p.25), those categories that directly address the BUIs are: urban sewage/stormwater infrastructure; industrial discharges; rural non-point sources; contaminated sediments; and, biota'habitat (Recs. # 4 – 8 above). Those in the remaining categories support the remediation efforts.

APPENDIX 11: Public Outreach and Stage 2 Update Consultation Activities

The NPCA continues to serve as a local client services centre for Niagara River RAP inquires and educational information, and where RAP reports, documents and files are maintained. Since taking on the role of RAP coordinator, the NPCA has been administering public outreach programs and communicating RAP-related program information to stakeholders and the public (including local school children). This outreach includes the production and distribution of fact sheets and educational information, media coverage, display materials, reports and publications.

In addition to RAP PowerPoint presentations, other general ones have been developed on the themes of water conservation, the ecosystem and wetlands, and restoration and water quality. As a component of the NPCA's Eco-school program carried out throughout the watershed, these educational topics highlight the benefits of water quality improvement and habitat restoration which compliment and support RAP targets and deliverables.

Specific RAP Outreach Activities

RAP Newsletters

Niagara River RAP Update 2002
Niagara River RAP Update 2004
Niagara River RAP Update 2008
Niagara River RAP Brochure 2009
Niagara River (Ontario) AOC Update 2010: Charting a Course to Delisting

Collectively, over 110,000 newsletters have been distributed throughout the watershed via newspapers (i.e. Niagara Falls Review, Welland Tribune, The Fort Erie Times, St. Catharines Standard, Lincoln Post Express, West Lincoln Review and Dunnville Chronicle); placed in libraries within the AOC in Niagara Falls, Fort Erie, Welland, Wellandport and Niagara-on-the-Lake, and handed out at RAP-related public events, stakeholder meetings, and U.S. RAP meetings.

RAP web site: www.npca.ca/water-management/nrap/

This web site has been updated to include the latest information on Niagara River RAP initiatives. It now also contains all of the RAP reports, including this report. Other reports containing scientific evidence relevant to the RAP are also being continually added.

Technical reports and community newsletters covering the study on the contaminated sediments in Lyons Creek East are also available on this web site.

RAP Display Events

Niagara Children's Water Festival
The Niagara Children's Water Festival is an annual September event attended by over 4,600 Grade 3 and 4 students, teachers and parent volunteers from throughout the Niagara River watershed. These attendees participate in a variety of activities focused on water conservation, water attitude, water technology, water protection and water science. The 4-day event is a joint initiative with the NPCA, Niagara Region, Ontario Power Generation and other partners. Since 2007, a "Public Day" has been added to the event when the entire community is invited to come out and learn how to contribute to a healthier environment.

Public Open Houses/Information Sessions

Niagara Water Quality Protection Strategy - 2005
The Niagara River RAP was represented at the Niagara Water Quality Protection Strategy Public Open house held at Niagara College. The event was attended by agency representatives, educators, students, organization representatives and interested citizens.

The Niagara River RAP was featured in the focus on Niagara section of the Niagara Region's *Water for Life* newsletter, spring 2005 edition.

2006/07
Five public open houses/ stakeholder meetings were held where RAP displays and information were provided to the public. The first was the launch of the Watershed Report Card (April) where the RAP program was highlighted and promoted. At the Smarter Niagara Summit (second stakeholders meeting held in Niagara Falls in May) the General Manager from NPCA, presented an overview of the watershed programs including RAP coordination role and partnerships. Three more open houses were held (February and March) at schools throughout the watershed. At these events the community was invited to come out and learn more about water quality and habitat improvement and RAP information was disseminated. Over 200 people attended and enjoyed these educational activities.

The Niagara River Toxics Management Plan - 2007 Public Meeting
The Canadian and U.S. environmental agencies hosted a public meeting on Grand Island, New York. The event marked the twentieth anniversary of the NRTMP, and information on the Niagara River RAP was available.

Lyons Creek East and West Public meetings - 2007
Public Open Houses were held at Lyons Creek East and West in June 2007 to present information to the communities on the projects and how they relate to the Niagara River RAP. In response to public concern, a public information session was held in November 2007 regarding flow in Lyon's Creek East. Subsequently, a fluvial geomorphology study was commenced in Spring 2008 under the NPCA's South Niagara Falls Watershed Study. The study is expected to be completed in 2010 and the results will contribute towards the monitored natural recovery strategy for Lyons Creek East. (Further information can be found in section 2.2.3).

The Boundary Waters Treaty Centennial Celebration - Niagara Falls - 2009
Throughout Boundary Waters Week, June 5 -14, the Niagara River Corridor was host to water-themed conferences, festivals, exhibitions and performances, guided hikes and tours – climaxing with the official celebration of the Boundary Waters Treaty on June 13 at the centre of the Rainbow Bridge at Niagara Falls. The ceremony was followed by a reception hosted by the Niagara Parks Commission at Oakes Theatre Garden adjacent to the bridge. Thousands of Canadian and U.S. citizens attended the event. The Niagara River RAP display and hand-out materials were featured at the reception.

RAP Outreach Presentations

Friends of Fort Erie's Creeks & Fort Erie Conservation Club - 2006.
The Friends of Fort Erie's Creeks hosted a RAP presentation during a joint meeting with the Fort Erie Conservation Club in March 2006. Approximately sixty members attended.

A.D. Latornell Conservation Symposium - 2007
A presentation on the challenges and opportunities in the Niagara River RAP was made at the A.D. Latornell Conservation Symposium in November 2007, where the theme was: "Your Watersheds, Our Great Lakes". The symposium is one of Ontario's largest annual conferences focusing on environmental and conservation issues, and it hosts approximately 1,000 guests. It is attended by students, citizen environmentalists, policy-makers, practitioners and other committed individuals.

Shaw Film Festival - 2009
In collaboration with a representative from the Canadian Consulate General in Buffalo, the RAP Coordinator addressed the audience at the Shaw Festival on February 23 at the showing of the documentary: Flow: For the Love of Water. The public outreach opportunity was coordinated across the Niagara River to launch the BWT100 celebrations; promote the Niagara River RAP; promote the NPCA's 50th anniversary; and, announce *Our Shared Waters Web site* (www.oursharedwaters.com).

Niagara Restoration Council (NRC) AGM - 2009
An update on the status of the RAP was presented at the October annual general meeting of the NRC. The group was originally formed by members from the original Public Advisory Committee in 1998. Since then it has carried out numerous habitat restoration projects with partners throughout the AOC to help to achieve RAP targets.

Friends of Fort Erie's Creeks – 2010
A presentation on the challenges and opportunities for delisting the Niagara River (Ontario) AOC was presented during the organization's February Speaker's Series, as announced in *Water Watcher*, January 2010, Volume 1, Number 1.

RAP Night of Good News - 2010
The public was invited to come out and learn about environmental initiatives that have been happening in the Niagara River and Welland River watersheds. Presentations were given on the Natural Areas Inventory project (NPCA), the Niagara River AOC Fish Barrier Project (NRC) and upstream/ downstream monitoring of the Niagara River as part of the NRTMP (EC). The presentations were followed by awards of certificates of appreciation to the NPCA and the NRC. The event was hosted by the NPCA and the NPC.

Stage 2 Update Consultation Activities

The Public Advisory Committee

The Public Advisory Committee (PAC) met during 2004 – 2006 and in 2009 to provide their input in the review of the delisting criteria, the beneficial use impairments and the Recommendations laid out in the Stage 2 (1995) report. Below is an overview of the meeting schedule and purpose:

Meeting Date	Purpose
*July 19, 2004	Presentation of the review process & role of the PAC[183]
*November 22, 2004	Summary of information[184] for each of the impairments & progress in establishing the Technical committees.
March 1, 2006	Presentation on the RAP at a meeting with the Friends of Fort Erie's Creeks and the Fort Erie Conservation Club.
*May 2, 2006	Meeting with PAC representatives from the Ontario Federation of Agriculture to discuss and clarify recommendations from Technical Committees.
*May 8, 2006	Presentation & discussion on the results of the delisting criteria/impairments review by the Technical committees.[185]
*June 26, 2006	Review of Stage 2 recommendations and List of proposed revised recommendations and rationale. [186]
*April 23, 2009	Approval of new delisting criteria prepared by the Niagara River Coordinating Committee

*** Meeting minutes recorded and filed at the NPCA.**

A Public Summary Document of the findings and recommendations from the technical reviews was sent to the PAC for their consideration prior to the May 8, 2006 meeting.

At the meeting, after presentation of the technical reviewers' recommendations, the PAC was asked the following four questions:

Qu.1. *From the information provided, do you feel you have a good sense of what is proposed and the reasons why? Was it clear and understandable?*

Qu.2. *Do you have any problems with the recommendations put forward?*

Qu.3. *Do you have any problems with the status changes on impairments?*

Qu.4. *Do you have any objections to the targets?*

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[183] Mackay, Scott, Environment Canada. July 12, 2004. Niagara River (Ontario) Remedial Action Plan. 2004-2005 Review of Delisting Criteria and Possible Impairments. *Discussion Paper for Public Advisory Committee Members.*

[184] Mackay, Scott. Environment Canada. November 12, 2004. Niagara River Remedial Action Plan. Review of Delisting Criteria and Possible Impairments. *Progress and Information Summary.*

[185] The Niagara River (Ontario) Remedial Action Plan. April 12, 2006. *A Review of Impairments and Remediation Targets for the Niagara River (Ontario) Area of Concern.* (Summary Document).

[186] Niagara River Remedial Action Plan (RAP) Recommendations and Proposed revised list of Recommendations. *Background Paper.*

There was an unanimous response from the PAC that they understood the information and had no problems with the recommendations put forward, the status changes on impairments or the targets (delisting criteria). These responses are recorded in the May 8, 2006 meeting minutes.

Review of the 37 RAP Recommendations in the Stage 2 (1995) report
The review of the thirty-seven Recommendations in the Stage 2 (1995) report was initiated by the Niagara River RAP Coordinating Committee (i.e. NPCA, MOE, EC and MNR). These Recommendations and their review are listed in Appendix 8. Recommendations that were considered redundant, completed and not applicable were identified. In some cases, the committee recommended revising and/or combining some of the Recommendations. A rationale for the committee's proposed revisions was prepared in each case, and a proposed new list of Recommendations was developed. The proposed revisions and recommendations were outlined in a background paper[187] (see Appendix 13).

The background paper was presented to the PAC at a special meeting in June 2006 to obtain their input and endorsement. As a result of the meeting, a list of new Recommendations was endorsed. This list of new Recommendations is provided in Table 6 (Section 2.1). These new Recommendations will guide the development of a strategic work plan towards delisting the AOC.

The Steering Committee

The Steering Committee was mainly comprised of various government agency representatives and a member of the PAC to act as a liaison (Appendix 2). Below is an overview of the Committee's meeting schedule:

Meeting Date	Purpose
*June 24, 2004	Presentation of the review process & role of the Steering Committee[188]
*November 22, 2004	Summary of information for each of the impairments & progress in establishing the Technical committees.[189]
*December 12, 2005	Presentation of Technical review results[190] and ongoing reviews.
*December 12, 2006	Review and endorsement of the Technical Review Report.

When the Niagara River AOC Implementation Committee was established in 2008 it was comprised of many of the Steering Committees members.

[187] Niagara River Remedial Action Plan (RAP). June 26, 2006. Recommendations and Proposed revised list of Recommendations. *Background Paper.*
[188] Mackay, Scott, Environment Canada. June 24, 2004. Niagara River (Ontario) Remedial Action Plan. Review of Delisting Criteria and Possible Impairments. *Terms of Reference – Version 2.0.*
[189] Mackay, Scott. Environment Canada. November 12, 2004. Niagara River Remedial Action Plan. Review of Delisting Criteria and Possible Impairments. *Progress and Information Summary.*
[190] Mackay, Scott. Environment Canada. December 12, 2005. Niagara River (Ontario) RAP. Review of Delisting Criteria and Possible Impairments. Steering Committee Meeting #3 – Review of Results. *Supplementary Data Booklet.*

The Implementation Committee

The Implementation Committee is mainly comprised of various government agency representatives and key stakeholders in the AOC (Appendix 2). Below is an overview of the Committee's meeting schedule:

Meeting Date	Purpose
*November 27, 2008	Development of draft RAP work plan and review/ comment on the draft Stage 2 update report
*April 23, 2009	Revising the draft RAP work plan
*February 4, 2010	Confirmation of new RAP Work Plan

*** Meeting minutes recorded and filed at the NPCA**

Stage 2 Update Report Review Comments

This document was reviewed by a wide variety of agencies and organizations. These include:

- Niagara Falls Nature Club
- Niagara South Federation of Agriculture
- Peninsula Field Naturalists
- Niagara Region – Public Works, Water * wastewater
- Niagara Region – Integrated Community Planning
- City of Welland – Public Works
- City of Niagara Falls – Municipal Works
- Niagara Parks Commission
- New York State Department of Environmental Conservation
- Environment Canada
- Ontario Ministry of the Environment
- Ontario Ministry of Natural Resources
- Fisheries and Oceans Canada
- Niagara Peninsula Conservation Authority

Note: The comments received (and responses from the Coordinating Committee to the comments) are compiled in a separate document.

Formal Support for the Stage 2 Update Report

At the time of printing this document the following organizations had given their formal support:

May 19, 2010 – NPCA Board of Directors received an updated presentation and they verbally supported the new RAP direction.

May 26, 2010 – Niagara Region's Integrated Community Planning Committee (in collaboration with Public Works and Public Health Departments) received an updated presentation and approved staff's recommendation to accept the Stage 2 Update.

June 3, 2010 – Niagara Region Council ratified the staff's recommendation.

July 15, 2010 – Niagara Parks Commission approved staff's recommendation: "……as stakeholders in the Niagara River (Ontario) Remedial Action Plan will, in good faith and insofar as possible, work towards implementation of those actions for which they have a lead, or partnering role."

APPENDIX 12: The Niagara River AOC Coordinating Committee's Recommended Delisting Criteria

Date: March 2009

The purpose of this document is to inform you (members of the Science Committee and PAC) of the recommended delisting criteria that has been endorsed by the Coordinating Committee for the Niagara River (Ontario) Area of Concern (AOC) for incorporation into the 2009 Stage 2 Update. This document also provides an explanation of how the recommended delisting criteria were adapted from the suggested criteria in the working document "Technical Review of Impairments and Delisting Criteria – Niagara River (Ontario) Remedial Action Plan" (Technical Review working document). The suggested criteria were originally developed with the assistance of the various Niagara River (Ontario) Area of Concern (AOC) Remedial Action Plan (RAP) technical teams and were reviewed by Coordinating Committee and the Public Advisory Committee (PAC).

As you may be aware, delisting criteria are developed on a site-specific basis by the various government agencies, in conjunction with the public. These criteria are used as environmental targets for evaluating remedial measure implementation and effectiveness. They must correspond to the 14 possible Beneficial Use Impairments as outlined by the Great Lakes Water Quality Agreement (GLWQA). The previous delisting criteria for Niagara, developed in the original Stage 2 (1995), served as a guiding principle for the Remedial Action Plan (RAP); however, in many cases they could not be measured in order to determine whether the health of the ecosystem had been restored. "Delisting criteria should be premised on the following fundamental underlying qualities:

1) Locally defined use goals and environmental objectives;
2) Applicable federal and provincial objectives, guidelines, standards and/or policies related to the RAP;
3) The Principles and Objectives embodied in the GLWQA" (The Canada-Ontario Guide to Producing and Reviewing Remedial Action Plan Stage 2 and Stage 3 Reports, revised 2003)

Ideally, these criteria should also have the following qualities: specific, measurable, achievable and scientifically defensible.

In 2007, the Technical Review working document was drafted. Since then, there has been significant progress towards refining delisting criteria for Great Lakes Canadian AOCs, as well as progress on implementation actions in the Niagara River AOC. Progress towards implementation of priority RAP actions includes:

- Completion of the detailed assessment for the 14 potentially contaminated sediment areas identified in the Stage 1 and Stage 2 documents;
- Completion of the Canada-Ontario Decision-Making Framework for the Assessment of Great Lakes Contaminated Sediment (Framework) for Lyon's Creek East;
- Completion of Environmental and Human Health Risk Assessments for Lyons Creek East and Lyons Creek East and West;
- Completion of sediment management options assessments for Lyons Creek East and Lyons Creek West;
- Ongoing public consultation meetings on Lyons Creek East;
- Decision to manage the contaminated sediment in Lyons Creek East through Monitored Natural Recovery;

- Completion of a new work plan for the Niagara River AOC;
- Completion of a draft monitoring plan for the Niagara River AOC;
- Fish barrier mitigation program is 80% complete;
- Natural Heritage Inventory of the Niagara River AOC report and mapping near completion;
- Monitoring and data that has been collected through the Welland River Eutrophication Study;
- Fisheries Community Monitoring and Implementation of Walleye restoration project in the Welland River West and habitat enhancement projects planned (with some already implemented);
- Initiation of a comprehensive review of the Welland Official Plan incorporating RAP supported policies for Natural Heritage, urban stormwater, etc.
- Completion of the Niagara River Watershed Fish Community Assessment (2003 to 2007) by the Ministry of Natural Resources. This report indicates that the Welland River Fish Community has begun moving along the path to recovery from the severe pollution in the 1960s (partially due to uncontrolled sewage discharge)

Based on the aforementioned progress and review of suggested Delisting Criteria, the Coordinating Committee recommended updating the criteria.

The recommended Delisting Criteria in this document also utilize a standard definition of reference site. Reference site conditions are important as they are the baseline by which meeting environmental delisting targets will be gauged. One should bear in mind that AOCs were designated in 1987 because they were deemed to be more degraded compared to non- AOC sites. With many AOCs making substantial progress in implementing restoration actions, there is a need for greater clarity with regards to measuring when delisting has been attained. Hence, current thinking is that reference conditions will be based on conditions in areas that are outside of the AOC and have similar physiographic characteristics and land use pressures. This document also ensures consistency with the wording and usage of a reference site between the various Beneficial Use Impairments (BUIs). Specific locations for reference sites that will be chosen for each of the delisting criteria are still under review.

These recommended Delisting Criteria will be presented to the general public of the Niagara River AOC for their review and comment during the review of the Stage 2 Update (2009).

Sincerely,

Valerie Cromie
(Niagara River AOC RAP Coordinator)

On behalf of the Niagara River AOC Coordinating Committee

Summary of Delisting Criteria (NI = Not Impaired; RFA = Requires Further Assessment)

Beneficial Use Impairment	Stage 1 Status (1993)	Stage 2 Status (1995)	Suggested Delisting Criteria (June 2007)	Proposed Delisting Criteria (March 2009)
1) Restrictions on fish and wildlife consumption Typically broken into two sections when assessed: ○ fish consumption	Impaired	Impaired	○ There be no restrictions on the consumption of fish in the Ontario portion of the AOC. The probable source of contaminants causing the restrictions will be considered, and comparisons will be made with contaminant levels in appropriate fish species from a suitable non-AOC reference site or sites.	1. No restrictions on the consumption of sport fish in the Ontario portion of the AOC due to locally-controllable contaminant (PCBs and dioxin-like PCBs) sources. The probable sources of contaminants causing the restrictions will be considered; locally-controllable contaminant sources will be addressed by the Niagara River RAP. Any regional or upstream sources that are likely the cause of remaining restrictions on sport fish consumption in the AOC will be identified and referred to a broader regional program (i.e., Lake Ontario Lakewide Management Plan, Lake Erie Lakewide Management Plan and Niagara River Toxic Management Plan). Restrictions on sport fish consumption in the AOC will be evaluated through comparison to restrictions present in appropriate fish species from a suitable non-AOC reference site or sites. 2. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife consumption, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.
○ wildlife consumption	RFA	RFA		(Note: A delisting criteria will be developed if this BUI component is shown to be Impaired)
2) Tainting of fish and wildlife flavour	NI	NI		

3) Degradation of fish & wildlife populations Typically broken into four sections when assessed: • Degradation of fish populations • Body burdens of fish • Degradation of wildlife populations • Body burdens of wildlife	Impaired	Impaired	• Index of Biotic Integrity (IBI) scores of fair to good (using a suitable IBI developed for Great Lakes tributaries and littoral zones) and/or individual IBI metric values are similar to suitable non-AOC Great Lakes reference sites, for fish communities in each section of the Ontario portion of the AOC. • Regular fisheries assessments show, over a period of five years: • For top predators, a population structure with a range of size and age categories, demonstrating continued recruitment, over 5 years of annual sampling. ▪ For top predators, a condition index not significantly different from Great Lakes non-AOC reference sites. ▪ For forage species, species richness is comparable to suitable non-AOC Great Lakes reference sites with a predominance of native species • Whole body burden concentrations of PCBs and dioxin-like PCBs in benthic fish species should notexceed suitable thresholds for the protection of aquatic life, or should not be significantly different from suitable non-AOC reference sites. • Maintenance of marsh bird and amphibian populations and diversity at or above Great Lakes non-AOC averages as determined by the Marsh Monitoring Program of Bird Studies Canada in wetlands within the Ontario portion of the AOC. • Maintain no net loss of populations of Blackcrowned Night-Herons and Herring and Ring-billed Gulls at colonies on the Canadian side of the Niagara River • Temporal trends in contaminant levels in Herring Gull, night-heron, and snapping turtle eggs, as well as in the livers of mink are stable or declining. Spatial comparisons show that contaminant concentrations in eggs of the above species in areas under the influence of the Niagara River (Ontario) AOC are equal to or less than those from sites removed from any influence of the AOC.	3. Maintenance of fish community populations, on the Canadian side of the Niagara River, at or above suitable non-AOC reference sites OR meets fish community objective(s) identified through a fisheries management plan by Ontario Ministry of Natural Resources. 4. Maintenance of wetland-dwelling wildlife populations and diversity at or above suitable non-AOC reference sites (as determined by indicators such as Indices of Biotic Integrity and/or community status assessments derived from Bird Studies Canada's Marsh Monitoring Program). 5. Maintenance of colonial nesting birds populations on the Canadian side of the Niagara River at or above suitable non-AOC reference sites, examined through the use of sentinel species (i.e., Black-crowned Night-Herons, Herring and/or Ring-billed Gulls). 6. Temporal trends in contaminant levels (PCBs and dioxin-like PCBs), examined through the use of sentinel species, (i.e., Herring Gull, night-heron, snapping turtle eggs, and/or livers of mink), are stable or declining. Spatial comparisons show that contaminant concentrations in the eggs of the above species in areas under the influence of the Niagara River (Ontario) AOC are equal to or less than those from sites removed from any influence of the AOC. If the whole body burden concentrations do exceed this level then they must not result in a population level affect to the bird and/or wildlife populations. 7. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to fish and wildlife body burdens, then a risk based Contaminated Sediment Management Strategy must be in place with appropriate monitoring and mitigation measures and/or administrative controls.

4) Fish Tumours and Other Deformities	RFA	RFA	None	(Note: A delisting criteria will be developed if this BUI is shown to be Impaired)
5) Bird or Animal Deformities or Reproductive Problems	RFA	Impaired	None	8. When the types and frequency of deformities and/or reproduction impairments associated with contaminant exposure (PCBs and dioxin-like PCBs) is similar to in a suitable non-AOC reference site or sites, examined through the use of sentinel species (i.e., snapping turtles, herring gulls). If the types and frequency of deformities and/or reproductive impairments do exceed this target then they must not result in a population level affect to the bird and/or animal populations.
6) Degradation of Benthos Typically broken into two sections when assessed: ○ Dynamics of benthic populations ○ Body burdens of benthic populations	Impaired	Impaired	○ Benthic community structure, diversity, and abundance are comparable for sites with similar habitat (sediment, grain size, water velocity) in the AOC in comparison to suitable reference sites. ○ For sites with contaminants above the Provincial Sediment Quality Guidelines Severe Effect Level (SEL) only - when acute and/or chronic effects on benthos attributable to trace metals or organics are no greater than at suitable reference sites. ○ When benthic invertebrate tissue contaminant concentrations are comparable in the AOC to those at suitable reference sites, for the contaminants of concern (contaminants that biomagnify in the aquatic food chain), or in cases where benthic invertebrate tissue contaminant concentrations are greater than reference sites but are below concentrations considered to impair the beneficial uses associated with the consumption of fish and wildlife. ○ When Sediment Management Strategies for required sites, as designated by the Niagara River Contaminated Sediment Technical Advisory Group*, have been developed and implemented, and meet the standards described above.	9. When acute and chronic toxicity, community composition and abundance in the benthic community are similar to non-AOC reference sites. 10. When benthic invertebrate tissue contaminant (PCBs and dioxin-like PCBs) concentrations are comparable in the AOC to those at a suitable non-AOC reference sites for contaminants that biomagnifies in the aquatic food chain and/or in cases where benthic invertebrate tissue contaminant concentrations are greater than reference sites but are below concentrations considered to impair the beneficial uses associated with the consumption of fish and wildlife. 11. OR if a contaminated site (as designated by the Niagara River Contaminated Sediment Technical Advisory Group*) fails to meet the criteria described above in regard to degradation of benthos, then a Contaminated Sediment Management Strategy must be in place including a risk management approach with appropriate monitoring and mitigation measures and/or administrative controls.

7) Restrictions on Dredging Activities	Impaired	Impaired	None	Changed to Not Impaired as per the decision on May 4, 1998 by Canadian Ontario Agreement RAP Steering Committee.
8) Eutrophication or Undesirable Algae	Impaired	Impaired	None	(Note: Delisting criteria will be developed and directed by the results of the Eutrophication Study which will be completed in 2010.)
9) Restrictions on Drinking Water Consumption or Taste and Odour Problems	NI	NI		
10) Beach Closings		Impaired	○ Public beaches meet the following conditions: i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known; ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 *E. coli* /100ml); iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events. ○ 90% of the wet-weather (peak) flow and all dry weather flow in combined sewer systems istreated to WPCP levels, on an annual basis	12. Public beaches meet the following conditions: i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known; ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 *E. coli* /100ml), or is similar to a suitable non-AOC reference site, when assessed over a period of at least three to five years; iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.
11) Degradation of Aesthetics	NI	NI		
12) Added Costs to Agriculture or Industry	NI	NI		
13) Degradation of Phytoplankton and Zooplankton Populations	RFA	RFA	None	(Note: A delisting criteria will be developed if this BUI is shown to be Impaired)

14) Loss of Fish and Wildlife Habitat	Impaired	Impaired	○ Median annual total suspended solids and/or turbidity is not significantly different at water quality sampling stations in AOC tributary watersheds in comparison to suitable non-AOC reference watersheds within the Lake Erie Lowlands ecoregion, when assessed over a period of at least three to five years. ○ Dissolved oxygen, and un-ionized ammonia rarely surpass thresholds for the protection of aquatic life at water quality sampling stations in AOC tributary watersheds, when assessed over a period of at least three to five years. ○ The percentage by area of wetland cover and the percentage by stream length of riparian buffers are not significantly different within AOC subwatersheds in comparison to suitable non-AOC reference watersheds within the Lake Erie Lowlands ecoregion. ○ The distributions of emerald shiner, yellow perch, and spawning northern pike in AOC tributary watersheds approximate expected distributions in the absence of physical barriers. ○ Presence / abundance of obligate phytophyllic fish species is stable or expanding in areas identified as current or historic wetland. ○ The percentage of woodland and wetland habitat by area, and the percentage of stream length with (at least) a 30m vegetated buffer is not significantly different within the Ontario portion of the AOC as compared to adjacent reference watersheds within the Lake Erie Lowlands ecoregion. ○ Wetlands in the Ontario portion of the AOC are not impaired in their ability to support a diversity and abundance of wetland-dwelling aquatic wildlife based on an Index of Biotic Integrity (IBI) approach, involving a comparison of all sites of interest to reference conditions. ○ The percentage by area of wetland buffers (50, 120 and 240 m width) and of core woodland areas (within 100 and 200m of forest edge) is not significantly different within the Ontario portion of the AOC as compared to adjacent watersheds within the Lake Erie Lowlands ecoregion. ○ The proximity, patch size, and patch density of key habitat types (forests and wetlands), is not significantly different within the Ontario portion of the AOC as compared to adjacent watersheds within the Lake Erie Lowlands ecoregion. ○ The existing areal extent of unique wildlife habitats (Wainfleet Bog complex, Niagara Gorge) is at least 80% secured and managed for longterm conservation purposes. ○ Approval of Regional Official Plan environmental policies to protect and enhance the natural heritage system, and approval of local Official Plan policies and zoning bylaws in conformity with the Regional policies.	13. The percentage by area of wetland cover within the AOC and the percentage by stream length of riparian buffers within the AOC are not significantly different as compared to suitable non-AOC reference sites. 14. 75% of the potential barriers to fish movement (as identified through the Niagara River AOC Fish Barriers Project 2001 – Phase 1 Photo Library) must be removed or remediated restoring access to potential spawning habitat. . 15. The percentage of woodland and wetland habitat by area in the AOC, and the percentage of stream length with (at least) a 30m vegetated buffer in the AOC is not significantly different when compared to a suitable non-AOC reference sites. 16. The percentage by area of wetland buffers (50, 120 and 240 m width) in the AOC and of core woodland areas (within 100 and 200m of forest edge) in the AOC is not significantly different when compared to a suitable non-AOC reference sites. 17. The proximity, patch size, and patch density of key habitat types (forests and wetlands) in the AOC, is not significantly different when compared to a suitable non-AOC reference sites. 18. The existing areal extent of unique wildlife habitats (Wainfleet Bog complex, Niagara Gorge) is at least 80% secured and managed for long-term conservation purposes. 19. Approval of Official Plan environmental policies for AOC municipalities that protect and enhance the natural heritage system, in conformity with the applicable Provincial or Regional natural heritage policies.

Rationale for the Recommended Revised New Delisting Criteria for the Niagara River (Ontario) Area of Concern

1) Beneficial Use Impairment (BUI): Restrictions on Fish and Wildlife Consumption
STAGE 2 STATUS – Impaired

Coordinating Committee's Review:
The wording of the suggested delisting criteria did not specify that the Niagara River RAP is focused on sport fish restrictions due to local sources. Thus, a wording change was recommended to bring the delisting criteria in line with the intention of RAPs, focusing on local issues rather than regional issues. Contaminants contributing to sport fish consumption restrictions inland locations in the RAP may be from regional atmospheric deposition, and in the Niagara River, from upstream sources and/or the Niagara River (New York) AOC. Evaluation of this BUI in the Niagara River (Ontario) RAP may require a qualitative comparison with reference site(s) to evaluate what restrictions are due to local sources, and hence, the redesignation status of this BUI.

A delisting criterion was added for the consumption of wildlife and one was added relating to the complexity that is present at sites where they are being managed by the Contaminated Sediment Technical Advisory Group. This delisting criterion should reflect the decision to implement Monitored Natural Recovery, the sediment management strategy for Lyon's Creek East recommended by the Niagara River Contaminated Sediment Technical Advisory Group, and agreed to by the Niagara River RAP Committee and the public through the Lyon's Creek East Community Liaison Committee.

2) BUI: Tainting of Fish and Wildlife Flavour
STAGE 2 STATUS – Not Impaired

3) BUI: Degradation of Fish and Wildlife Populations
STAGE 2 STATUS – Impaired

Coordinating Committee's Review:
As found in the Stage 1 RAP report, the original scope of this BUI concern was caused by the reduction in fish populations for sturgeon, emerald shiners and northern pike. However, the Delisting Criteria should remain flexible enough to incorporate any sentinel species which may assist in the assessment of this BUI. These criteria should also acknowledge that, whether these impacts are due to body burdens or other locally attributable factors, it is important that the impacts to fish population must be shown at a population level rather than a individual level. Regarding the wildlife population component of this BUI, the Stage 1 listed the concern as being:

- Population differences between Navy Island and the mainland deer;
- Suspected declining levels of colonial nesting birds along the lower Niagara River AOC due to contaminants
- Suspected population impacts from loss of habitat (i.e., wetlands, riparian, etc).

The recommended delisting criteria have been expanded to address wildlife population impacts beyond just Navy Island deer population due to the suspected impacts from loss of habitat. It is important that the impacts to wildlife population must be shown at a population level rather then an individual level.

Finally, the delisting criteria should also reflect the decision to implement Monitored Natural Recovery, the sediment management strategy for Lyon's Creek East recommended by the Niagara River Contaminated Sediment Technical Advisory Group, and agreed to by the Niagara River RAP Committee and the public through the Lyon's Creek East Community Liaison Committee.

4) BUI: Fish Tumours or other deformities
STAGE 2 STATUS – Requires Further Assessment

Coordinating Committee's Review:
This BUI has never been listed as Impaired. The original scope of the concern for this Beneficial Use Impairment in the Stage 1 listed evidence of elevated frequency of tumours and gonadal neoplasms in wild carp-goldfish hybrids but the link to the environmental condition has never been determined. The need for delisting criteria/target will be determined if the tumour incident rate from fish collected from the Niagara AOC (e.g., a sentinel species) is found to be higher than that from a Non-AOC reference site.

5) BUI: Bird or Other Animal Deformities or Reproductive Problems
STAGE 2 STATUS - Impaired

Coordinating Committee's Review:
In the Stage 2 RAP report, this BUI was considered to be impaired in relation to bird and animal deformities. Based on the review completed in the 2007 Technical Review working document and the 2008 results from the Environmental Risk Assessment for Lyon's Creek East contaminated site assessment, the Science Committee decided that delisting criteria were needed for this BUI. Through the review of the 2007 Technical Review working document it was found that only 2 of the 4 key factors listed in the decision matrix should be included as delisting criteria. The other two factors that were examined in the report should be assessed through the Degradation of Fish and Wildlife Populations BUI. These two factors are:

- Contaminant body burdens in excess of reference sites/levels
- Individuals with deformities show health effects? Shift in population characteristics?

This change will prevent unnecessary duplication of similar delisting criteria in multiple BUIs.

6) BUI: Degradation of Benthos
STAGE 2 STATUS – Impaired

Coordinating Committee's Review:
In the Stage 1 and Stage 2 RAP reports it was found that this BUI was considered to be impaired in relation to the 14 identified contaminated sites. A current review of the delisting criteria for benthic invertebrate populations in other AOCs has resulted in a standardized wording related to the composition and abundance of benthic invertebrates. Use of this standardized wording is recommended for the Niagara River AOC. The delisting criteria should also reflect the decision to implement Monitored Natural Recovery, the sediment management strategy for Lyon's Creek East recommended by the Niagara River Contaminated Sediment Technical Advisory Group, and agreed to by the Niagara River RAP Committee and the public through the Lyon's Creek East Community Liaison Committee.

7) Beneficial Use Impairment: Restrictions on dredging activities
STAGE 2 STATUS - Impaired

Coordinating Committee's Review:
This impairment is socioeconomic in nature, relating to the additional cost which would have been transferred to proponents of navigational dredging projects in cases where open water disposal of dredged sediments would have been denied based on contaminant concentrations. Open water disposal of dredgeate is no longer allowed in Ontario. Furthermore, in the Ontario watershed of the Niagara River (not including the Welland Canal, which is not considered part of the AOC), there are no sites where navigational dredging is required. On May 4, 1998, the COA RAP Steering Committee agreed that several AOCs, including the Niagara River AOC, should have the BUI redesignated as "not impaired" since navigational dredging was not an issue (COA RAP Steering Committee, 1998). This decision was supported by a team of technical experts from MOE and Environment Canada, and by RAP participants in the affected AOCs. They concluded that environmental effects associated with contaminated sediments would be considered through the impairments:

- Degradation of benthos
- Restrictions on fish and wildlife consumption
- Fish tumours and other deformities

References

Canada-Ontario Agreement (COA) RAP Steering Committee. 1998. Unpublished meeting record regarding the BUI "Restrictions on Dredging". May, 1998. Environment Canada and Ontario Ministry of the Environment.

8) Beneficial Use Impairment: Eutrophication or Undesirable Algae
STAGE 2 STATUS - Impaired

Coordinating Committee's Review:
As found in the Stage 1 RAP report, the original concern for this BUI was identified as high nutrient levels in the slower moving portions of the Welland River watershed. These high nutrient levels have created areas of abundant macrophyte and algal growth. No delisting criteria were proposed for this BUI by the Technical Team as they felt it required additional analysis. This analysis is currently underway through the Welland River Eutrophication Study and this study will propose a set of delisting criteria in 2010 – this review only examines the Welland River as eutrophication is not a concern in the Niagara River.

9) Beneficial Use Impairment: Restrictions on Drinking Water Consumption or Taste and Odour Problems
STAGE 2 STATUS – Not Impaired

10) Beneficial Use Impairment: Beach Closings
STAGE 2 STATUS - Impaired

Coordinating Committee's Review:
The recommended delisting criteria follow the methodology as outlined in the Beach Blue Flag monitoring program. It was felt that the suggested delisting criteria relating to wet-weather flows should be removed as it related to an implementation action rather than a BUI. The recommended criterion may be achieved through a variety of actions of which the reduction of wet-weather flows is only one of. The recommended delisting criteria both in this BUI and in the Eutrophication and/or Undesirable Algae BUI will assess the success of such an action.

11) Beneficial Use Impairment: Degradation of Aesthetics
STAGE 2 STATUS – Not Impaired

12) Beneficial Use Impairment: Added Costs to Agriculture or Industry
STAGE 2 STATUS – Not Impaired

13) Beneficial Use Impairment: Degradation of Phytoplankton and Zooplankton Populations
STAGE 2 STATUS – Requires Further Assessment

Coordinating Committee's Review:
This BUI has never been listed as Impaired. A delisting criteria/target will only be developed when an assessment of the health of phytoplankton and zooplankton populations in the AOC demonstrates that it is different than an unimpacted (non-AOC) reference site and requires further action.

14) Beneficial Use Impairment: Loss of Fish and Wildlife Habitat
STAGE 2 STATUS – Impaired

Coordinating Committee's Review:
As found in the Stage 1 RAP report, the original scope of the concern for this BUI was evidence of loss of fish habitat, (specifically for emerald shiner, yellow perch and spawning northern pike). The scope also included the loss of wildlife habitat in general, as the result of destruction of and encroachment on vast areas of natural terrain reducing usable habitat for fish, birds and wildlife. The Stage 1 report also specifically refers to the loss of shoreline habitat and wetlands through shoreline reconstruction and development. In general the suggested delisting criteria were accepted. However, minor edits were made to simplify the criteria and to make the format for these Delisting Criteria consistent with previous criteria and other AOC delisting criteria. Proposed criterion relating specifically to water quality were removed as they will be addressed in the Eutrophication or Undesirable Algae criteria. The exception to this was the criterion relating to total suspended solids and turbidity as they may directly affect fish habitat by covering spawning beds.

APPENDIX 13: Restrictions on Wildlife Consumption Technical Review

The following people comprised the technical review committee for this impairment:

Shane de Solla, EC (lead)
Laird Schutt, EC
Kim Fernie, EC
Cynthia Pekarik, EC
Tana McDaniel, EC
Pamela Martin, EC
Robert Townsend, NYSDEC
John Middleton, Brock University
Anne Yagi, MNR Niagara District

The committee's feedback was provided in a written report which was used as the basis for writing this appendix.

1.0 Basis for Evaluating Impairment Status

This BUI refers to advisories to the public to restrict their consumption of specific kinds of wildlife or not to consume it at all. It does not refer to the risk of contaminant exposure to non-human consumers. Furthermore, the BUI is in relation to non-fish wildlife which are part of aquatic ecosystems. Wild game species such as deer, hare, or wild turkey are not included, as they are not part of food chains where the primary route of contaminant exposure would be through the consumption of fish or aquatic invertebrates, or in some cases aquatic vegetation (e.g., cattails). Key factors in the assessment of this impairment include:

1. *Contaminant body burdens* - contaminant concentrations in edible tissue (i.e., muscle, eggs) within wildlife in the AOC relative to reference sites and/or guidelines.
2. *Reported restrictions on wildlife consumption* - current restrictions on wildlife in the AOC relative to reference sites (if applicable).

If hunting or trapping for relevant aquatic wildlife species is permitted in the AOC, and contaminants in edible portions of those wildlife exceed guidelines for consumption leading to advisories against consumption, the BUI is considered *impaired*. If contaminants causing advisories have a source or cause outside the AOC, then the BUI is considered *impaired but not due to local sources*. When important evidence is missing or results are inconclusive, the status of requires further assessment is recommended. If there are no advisories to restrict wildlife consumption, the status of *not impaired* is recommended.

Health Canada is responsible for determining what concentrations of chemical intake are safe for human consumption of wild-caught food, and to issue advisories to the public about the risks of consumption. In some cases, provincial programs have been developed to monitor and report on contaminant concentrations in fish (the MOE Sportfish Consumption Guidelines and monitoring program) and moose and deer (program conducted by MNR), with input from Health Canada. There is no such program in place for aquatic wildlife.

2.0 Available Evidence to Assess Impairment Status Information on Wildlife Species Consumed and Consumption Patterns in the AOC

The Health Canada Great Lakes Health Effects group undertook a project from 1995-98 to survey fish and wildlife consumption patterns in lower Great Lakes AOCs, namely the St. Clair River, Detroit River, Niagara River, Hamilton Harbour, and Toronto and Region AOCs. However, wildlife consumption patterns were only reported for St. Clair River, Detroit River and Toronto. Although the Niagara River AOC was not surveyed, assuming some similarities amongst AOCs, the following general information about wildlife consumed and consumption patterns in the lower Great Lakes can be inferred from the relevant project reports (Dawson 1998a and 1998b, Kraft, 1998):

- The proportion of interviewees who consumed aquatic wildlife was low, ranging from 11% in the St. Clair River AOC, to 8% in the Detroit River AOC, 3% in the Niagara River and Toronto and Region AOCs, and 1% in the Hamilton Harbour AOC.
- Those that ate aquatic wildlife did not eat much annually, with approximately 80% of interviewees who consumed wildlife eating less than 11 meals a year, and 50-60% eating less than 5 meals per year.
- Only 60-70% of wildlife consumers who were interviewed reported eating wildlife that were taken within their respective AOCs.
- In all cases, the most popular species for consumption were Mallards and Canada Geese. Other duck species were taken much more infrequently, and other kinds of wildlife were taken by less than 5% of the wildlife consumers interviewed. In terms of the latter group:
  - In the St. Clair River AOC, 5% of wildlife consumers reported eating turtle, 4% reported eating frogs, and a single interviewee reported eating waterfowl eggs.
  - In the Detroit River AOC, one wildlife consumer reported eating frogs.
  - In the Toronto and Region AOC, 4% of wildlife consumers reported eating frogs, and 2% reported eating turtle eggs.

Under the Human Health component of St. Lawrence Vision 2000, the public health research unit of the Centre hospitalier universitaire de Québec (CHUQ), carried out a study in the fall of 1999 on several aspects of waterfowl consumption by hunters. The study findings can be summarized as follows (Duchesne et al. 2001):

- On average, hunters consumed 7.5 meals of waterfowl annually.
- Regional differences in consumption existed between the middle St. Lawrence area and the estuary and Gulf of St. Lawrence.
- In the areas closest to the Great Lakes (Montreal and Lac Saint-Pierre), similar to the AOC examples discussed above, the largest proportion of waterfowl taken were geese (approx. 60% of respondents), and dabbling ducks (approx. 90% of respondents). Consumption of diving ducks was represented in 10-25% of responses.

The following wildlife are known or thought to be consumed (based on anecdotal evidence) in the Niagara River AOC (Dillon Consulting Ltd. 2004, A. Yagi MNR, pers. comm):

- Snapping Turtle
- Migratory and resident waterfowl
- Muskrat

An internet search and review of existing literature (Braune et. al. 1999, Dillon Consulting Ltd. 2004) found that only the muscle of these species is typically cooked and eaten, with skin, fat, and viscera removed. No evidence was found that the eggs of either turtle or waterfowl are regularly consumed.

2.2 Contaminants in Edible Portions of Migratory Waterfowl

Environment Canada sampled for contaminants in pectoral muscle in migratory waterfowl from the Niagara River AOC, as part of a large cross-Canada study for contaminants in waterfowl and gamebirds in the late 1980s (Braune et. al. 1999). Species of waterfowl taken from the AOC were the diving ducks Common Goldeneye and Long-tailed Duck (formerly known as Oldsquaw). Contaminants measured included DDE, PCBs, dieldrin, mirex, chlordane, mercury, heptachlor epoxide, HCB, and cadmium. Contaminants were analysed in pooled samples of pectoral muscle, rather than the muscle of individual birds, except in select cases where only one individual of a species was taken from a particular area.

Results for the Niagara AOC and select areas in the Great Lakes-St. Lawrence River basin are shown in table 1. Health Canada's guidelines for chemical residues in poultry (defined by Health Canada as the meat of any bird for human consumption) are also shown. For the Niagara River AOC, results show that concentrations (ug/g) of all contaminants were low, were not associated with adverse effects in birds, and did not pose a health hazard to consumers. It should be noted that the species taken for contaminant analysis do not breed locally, but rather are seasonal migrants which may also overwinter in some cases in the AOC. Due to their migratory ranges, and their potential to be exposed to contaminants in other areas, these waterfowl species are not necessarily good indicators of the risk of local sources of contaminants to human consumers.

Table 1: Concentrations of contaminants (µg/g) in pectoral muscle of waterfowl from the Niagara AOC and other areas of the Great Lakes- St. Lawrence River basin (Braune et al. 1999). N represents the number of birds analyzed in the pooled sample. Health Canada guidelines for poultry are also included for reference.

Location	Specia	N	DDE	Sum PCBs	Dieldrin	Mirex	Total Chlordane	H.E.[1]	HCB[2]	Hg	Cd
Health Canada Max. Acceptable Concentration	**Poultry**		**5**	**3**	**0.3**	**0.1**	**0.3**	**0.3**	**N/A**	**N/A**	**N/A**
Niagara AOC (Queenston)	Common Goldeneye	1	0.079	0.181	0.006	0.021	0.001	0.001	0.006	0.460	0.023
	Long-tailed Duck	4	0.208	0.421	0.033	0.026	0.031	0.008	0.012	0.233	0.110
Eastern Lake Erie (Long Point)	Mallard	1	0.003	0.002	Tr	nd	0.001	nd	nd	N/A	N/A
		5	0.004	0.006	Tr	nd	0.002	nd	tr	0.046	0.011
		10	0.003	0.002	Tr	nd	tr	nd	tr	<0.05	0.020
		10	0.003	0.003	Nd	nd	tr	tr	tr	<0.05	<0.02
		8	0.003	0.003	Nd	nd	tr	tr	tr	<0.06	<0.18
Western Lake Erie (Rondeau Park)	Mallard	9	0.004	0.007	Nd	nd	tr	tr	tr	N/A	N/A
		6	0.0019	0.005	0.006	nd	tr	tr	tr	<0.07	<0.19
	Canada Goose	1	0.004	0.003	Tr	nd	tr	tr	tr	<0.07	<0.21
St. Lawrence River AOC (Cornwall/ Lake St. Francis)	Mallard	5	0.003	0.006	Tr	tr	tr	nd	tr	<0.05	0.030
		6	0.006	0.026	0.001	tr	0.001	nd	tr	<0.05	0.030
		1	0.001	0.001	Nd	nd	tr	nd	tr	<0.05	<0.02
		8	0.006	0.018	Tr	tr	tr	tr	0.001	<0.05	<0.02
		7	0.001	0.004	Tr	tr	tr	tr	tr	<0.05	<0.02
		10	0.006	0.016	Tr	tr	0.001	nd	tr	<0.05	<0.02

Waterfowl species which breed in the AOC may be better indicators for this BUI include (A. Yagi, MNR pers.comm.):

- Canada Geese
- Wood Duck
- Blue-winged Teal
- Mallard

The use of locally-breeding species as indicators for AOC environmental quality is consistent with advice provided by Environment Canada on the wildlife consumption BUI (Environment Canada, 1995):

"Concerning waterfowl…only those that breed in the AOC, or which are resident in the AOC long enough to [potentially] accumulate toxic doses of metals/contaminants need be evaluated by the RAP from a contaminant uptake standpoint."

To provide some indication of potential contaminant concentrations in the locally-breeding species which are most likely to be consumed in the AOC (Mallard, Canada Goose), data from other areas in the Great Lakes-St. Lawrence River basin from the Braune et al. (1999) study are also shown in table 10. These are data from Western Lake Erie and the St. Lawrence River AOC, both of which are proximal to areas of PCB-contaminated sediment similar to the Lyons Creek site (Wheatley Harbour, Ontario and Massena, New York). Data from a site at Long Point on Eastern Lake Erie, relatively close to the Niagara River

AOC, is also shown. Concentrations are for the most part undetectable or very low. Canada Geese and Mallard do not feed exclusively on benthic invertebrates or fish, but are generalist omnivores, in contrast to the diving ducks taken from the Niagara River AOC. Based on diet, it is unlikely that contaminant concentrations in dabbling ducks or Canada Geese from the Niagara River AOC will approach concentrations which exceed the Health Canada guidelines for human consumption (B. Braune, pers. comm.).

Neither toxaphene nor dioxins/furans were analyzed for waterfowl in the Braune et al. (1999) study. However, toxaphene concentrations are likely too low to be of concern (Hughes, 2006).

The results of the study undertaken by Braune et. al. (1999) showed, for a large sample (800 pooled samples) of waterfowl eggs, pectoral muscle and liver tissue taken all over Canada, that organochlorine and metals concentrations were either not detected or found at very low concentrations. The highest concentrations were found in birds that feed at the highest trophic levels, for example mergansers, loons, and gulls, and which are not typically taken for consumption (see section 2.1 above). The results of the Braune et al. (1999) study and a number of others led Health Canada in 1998 to conclude, that:

"…contaminant levels found in samples of pectoral muscle of ducks, geese, and other gamebirds analyzed, do not pose a risk to the health of human consumers."

2.3 Contaminants in Snapping Turtles and their Eggs (Hughes, 2004; Fernie and de Solla, 2004

Contaminants in Snapping Turtles and their eggs were assessed by MNR Wildlife Branch in 1988-89 in the Welland River watershed (Hebert et al. 1993), and by Environment Canada in 2002 in the Lyons Creek watershed. Total DDT, total PCBs, and mirex were measured in turtle muscle in 1988-89, and PCBs, non-ortho PCBs, dioxins and furans and OC pesticides were measured in turtle eggs in 2002.

A summary of results is as follows:

- Welland River 1988-89- mean concentrations of all contaminants in snapping turtle muscle were low (DDT- 0.0019 ug/g, PCBs- 0.132 ug/g, mirex- 0.0004 ug/g), and within the range of levels found in snapping turtle at other Southern Ontario locations. Age of sampled turtles was unknown.
- Lyons Creek East 2002- Eggs of five snapping turtle clutches had significantly higher sum PCBs (mean concentration of 1.214 ug/g) compared to the Wheatley Harbour AOC and two reference sites (Tiny Marsh, Severn Sound and Algonquin Park). Some of the TEQs exceeded CCME Environmental Quality guidelines for the protection of wildlife. The high levels of PCBs in this watershed are related to an area of Aroclor 1254-contaminated sediment at the head of the creek. It should be noted that reference site data from Eastern Lake Erie was not available, and would probably have provided a more appropriate comparison to Lyons Creek sample sites, from a RAP perspective.

2.4 Lyons Creek Risk Assessments

A screening-level human health risk assessment (HHRA) was conducted by Dillon Consulting Ltd. (2005) for the Lyons Creek East area. They summarized available data on snapping turtle consumption and estimated exposure to consumers based on estimated rates and patterns of consumption. Only one past assessment was cited on PCBs in snapping turtle muscle, eggs, heart and liver undertaken by MOE in 1996. For the reasons outlined in section 2.0 above, only consumption of muscle was considered in the HHRA. Rates and amounts of snapping turtle consumption for Lyons Creek residents were not available

so they were estimated based on Health Canada data and daily intake recommendations for First Nations populations and hunters. Even with these very conservative assumptions, likely to have inflated the risk, they concluded that:

- Snapping turtle consumption from Lyons Creek East made a very minor (less than 5%) contribution to total incremental increases in lifetime cancer risk from PCB exposure.
- Consumption of snapping turtle meat is not likely to represent a significant route of exposure to PCBs.

Community surveys conducted as part of a detailed HHRA for Lyons Creek East found that no respondents indicated they currently consumed snapping turtles or their eggs from within the study area or had done so in the past (Dillon Consulting Ltd., 2006b). Non-residents were not surveyed and some anecdotal information suggests that non-residents may be trapping and consuming turtles from the area.

Screening-level and detailed ecological risk assessments (ERA) were completed in 2004 and 2005 for all areas of contaminated sediment noted in the RAP Stage 2 Report (Golder Associates 2003 and 2004). In terms of the risk of bioaccumulation/biomagnification of metals, mercury, or organochlorines in wildlife via the benthic food chain, or in the case of muskrat, via consumption of cattails, the only sites of concern were Lyons Creek East and West. At Lyons Creek West, a potential risk to muskrat of PCB and arsenic exposure through cattail consumption was noted, with exposure estimates exceeding the screening-level No Observable Adverse Effect Levels (NOAEL) for white-tailed deer (most conservative benchmark available).

Concentrations in muskrat were estimated based on measured concentrations in cattails. It is unknown if, as a result, muskrat PCB and arsenic body burdens would pose a health risk to human consumers.

A detailed HHRA was conducted for Lyons Creek West by Dillon Consulting Ltd. (2006b). They did not assess the risk of exposure to contaminants via fish and wildlife consumption, as a result of their finding (as stated in their report) that:

"The site is not used for local food production, nor is there evidence that berries or other wild foods, including fish, are collected from the site."

This conclusion was based on site visits and observations of an absence of established footpaths and human traffic, as well as heavy vegetative cover including abundant poison ivy.

2.4.1 Legal Allowances for Hunting and Trapping in the Lyons Creek East and West Areas

As regulated by MNR and lower-tier municipal by-laws, the following allowances are made for trapping and hunting in the Lyons Creek East and West areas (MNR area WMU 89A) (J. Durst MNR, pers. comm.):

- trapping of wildlife is permitted in both areas
- shooting of nuisance wildlife is permitted on the lands of farmers and nursery owners in both areas, subject to a safe distance (150 m) away from residential dwellings
- Other discharges of firearms are not permitted in the Lyons Creek West area, and are only permitted in the vicinity of Lyons Creek East between a point just east of Cook's Mills and the Black Road crossing just east of the QEW, as per City of Welland and City of Niagara Falls firearm discharge by-laws.

3.0 Current Status of the Impairment

This BUI is listed as "not known" in the RAP Stage 2 report. There are no consumption advisories which have been issued by Health Canada for the AOC for any wildlife species. Current evidence suggests that there is not widespread risk of adverse contaminant exposure to human consumers of aquatic wildlife in the AOC. Furthermore, a survey for aquatic wildlife consumption found only a very small proportion of the population consumes aquatic wildlife in the AOC (3% of respondents in a sample of 618 people) (Sheeshka 1998). From this small group of consumers, based on studies in other AOCs and in Quebec, very few meals are consumed per year, and most of what is consumed is likely the meat of Mallard and Canada Goose.

Contaminants in waterfowl pectoral muscle are not thought to be of concern based on results from sampling undertaken as part of a national study in the late 1980s, at which point contaminant levels would have been higher in the AOC environment (and across Canada, perhaps with the exception of mercury) than present day conditions. The study included samples from the AOC which had safe concentrations of organochlorines, mercury and cadmium. As a result of the report, and several others, Health Canada advised that contaminant residues in waterfowl pectoral muscle do not pose a risk to human consumers in Canada. Locally breeding waterfowl (Canada Geese, Blue-winged Teal, Mallard, Wood Duck) have not been tested for contaminants, but these species are dabbling ducks for the most part, rather than diving ducks or colonial waterbirds. Due to their feeding preferences, dabbling ducks are not at risk of accumulating contaminants to the same degree that diving ducks or fish-eating colonial waterbirds are (Braune et al. 1999). Braune et. al.'s (1999) conclusions indicated that, amongst Canadian waterfowl species commonly hunted, only Glaucous Gull in northern Quebec posed any risk to human health, and only diving ducks and other fish-eating waterbirds had contaminant burdens which approached concentrations of concern. The locally breeding waterfowl species listed above are not known to consume zebra mussels in any quantity either, a shift in diet which has led to greater contaminant uptake amongst some species of waterfowl in the Great Lakes (Lambert, 1998). For the sake of comparison, data for Mallard and Canada Goose from western Lake Erie and the St. Lawrence River AOC from the Braune et. al (1999) study were examined. These are areas which are proximal to sites with PCB-contaminated sediments, and pooled samples for these species showed low (two to three orders of magnitude below guidelines) to undetectable concentrations of all contaminants.

Although PCB concentrations were elevated in the eggs of snapping turtle trapped at Lyons Creek East in 2002, a screening level HHRA, even with very conservative assumptions, found very limited potential risk to consumers of snapping turtle meat. A detailed HHRA for the same site found no evidence that area residents were consuming snapping turtles.

ERAs at Lyons Creek West found potential risks to muskrat of exposure to PCBs and arsenic via cattail consumption, but it is unknown whether body burdens pose a risk to human consumers. ERAs conducted for all other contaminated sediment sites in the AOC indicated no risks of contaminant bioaccumulation/ biomagnification which would pose a risk to consumers in higher trophic levels.

An HHRA at Lyons Creek West found that there was no evidence that fish or wildlife were being taken from the site for human consumption. However, this information was based solely on site visits rather than community surveys of any kind.

Based on available evidence, an impairment status of "not impaired" is recommended. However, given the lack of information about the trapping and consumption of snapping turtle at Lyons Creek East, and muskrat at Lyons Creek West, it may be desireable to pursue strategies to communicate risk of contaminant exposure, and ways to mitigate risk (e.g., trimming fat and disposing of drippings from cooked meat) to the public, and/or restrict human access to sites of concern.

4.0 Review of and Recommendations for Monitoring and Assessment

The following are the committee's recommendations with regard to monitoring of this impairment:

- Surveys to confirm whether muskrat are being trapped at Lyons Creek West, and Snapping Turtle is being trapped at Lyons Creek East, by either local residents (Lyons Creek West only) or non-residents for human consumption.
- Reassessment of PCB concentrations in snapping turtle eggs pending management of contaminated sediment at Lyons Creek East and development of a plan to track ecosystem recovery.

5.0 References

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APPENDIX 14: Bird (or other animal) Deformities or Reproduction Problems Technical Review

The following people comprised the technical review committee for this impairment:

Shane de Solla, EC (lead)
Laird Schutt, EC
Kim Fernie, EC
Cynthia Pekarik, EC
Tana McDaniel, EC
Pamela Martin, EC
Robert Townsend, NYSDEC
John Middleton, Brock University

The committee's feedback was provided in a written report which was used as the basis for writing this appendix.

1.0 Basis for Evaluating Impairment Status

This BUI refers to rates and types of deformities and reproduction problems occurring in nonfish wildlife species, which are known or thought to be associated with exposure to contaminants. Furthermore, non-fish wildlife species of interest are those which are part of aquatic ecosystems, and for whom the primary route of exposure to contaminants would be dermal exposure, and/or through the consumption of fish or aquatic invertebrates. Finally, deformities/reproduction problems must be associated with contaminants which currently or historically have a source within the Ontario portion of the AOC to be considered impaired. The following are key factors in assessing the impairment:

1. *Contaminant levels in indicator species, including temporal and spatial trends* - Do contaminant body burdens in indicator populations living/feeding in the AOC exceed thresholds for known incidence of deformities/reproduction problems in indicator species of interest?
2. *Types of deformities/reproduction problems* - Are deformities or reproduction problems present in indicator populations of a type associated with exposure to contaminants? Are these types known or thought to affect an individual's survival to life expectancy or ability to successfully reproduce?
3. *Frequencies of deformities/reproduction problems* - Are deformities/reproduction problems occurring at frequencies greater than established background levels or than at suitable non-AOC reference sites?
4. *Individual health or population-level effects* - Are individuals with deformities exhibiting health effects or do indicators show a shift in population characteristics consistent with increased mortality or reproduction problems?

If contaminant levels in indicator species exceed levels of concern, and/or if they harbour deformities and/or reproduction problems which exceed frequencies of concern, and if these species demonstrate individual or population-level health effects, then an impairment status of impaired is recommended. If none of these conditions are present, then an impairment status of not impaired is recommended. If these conditions are present but sources or causes within the AOC are not implicated, or they are no worse that at reference sites, then an impairment status of impaired but not due to local sources or impaired but no more degraded than reference sites is recommended, as applicable. If important evidence is missing or results are inconclusive then an impairment status of requires further assessment is recommended.

1.1 Sentinel Species for Evaluating Impairment

A number of species or groups are considered as sentinels for this impairment due to one or more of the following criteria:

- Respond to exposure to toxic contaminants and known to develop specific types of deformities/ reproduction problems as a result
- Physical association with bottom sediments (e.g., burrowing, feeding)
- Small home ranges
- Spend the majority of their lives within the AOC
- Sampled in ongoing monitoring or assessment activities
- Exposed to elevated levels of contaminants which biomagnify, though high proportion of fish or benthic invertebrates in diet
- Part of aquatic ecosystems
- Can be sampled/assessed non-lethally

Sentinel species or groups which meet a reasonable number of these criteria are as follows:

- Snapping Turtle
- Colonial waterbirds
- Mink

1.2 Spatial Context for Evaluating Impairment Status

There are two spatial scales which are considered in evaluating this BUI. The first is the Ontario portion of the AOC, which is the coarsest scale in assessing impairment. The second is a particular site or group of sites where elevated levels of deformities/reproduction problems have been determined for a sentinel species/group. The latter represents a more finite scale for evaluating impairment.

Impairment status is evaluated in a hierarchical fashion from the smaller spatial scale to the larger. Therefore, the AOC is considered unimpaired when all or most sites are considered unimpaired based on the framework shown in table 22 above.

Within the AOC, there is a further distinction between areas where animals are exposed to water or sediment-associated contaminants which have their source wholly within the AOC, versus areas where they may be exposed to contaminants arising from U.S. or upstream Lake Erie sources. In this case, sites along the Niagara River are considered as exposed to contaminants from U.S. and Lake Erie sources, while other sites are not. This is an important distinction because the RAP is only capable of addressing stressors and associated beneficial use impairments which have their source/cause within the Ontario portion of the AOC.

2.0 Available Evidence to Assess Impairment Status

2.1 Contaminant Levels in Indicator Species

2.1.1 Colonial Waterbird Egg Contaminants Monitoring (Hughes, 2004)

Environment Canada also monitors contaminants in the eggs of colonial waterbird species at colonies from the Canadian side of the Niagara River, as well as other colonies in the Great Lakes. Egg contaminants monitoring is carried out annually at an unnamed island between Grand Island and Niagara Falls. The data record for the AOC is annually from 1979 for Herring Gull and for 1982, 1986, 1989, and 2000 for Black-crowned Night-heron. Contaminants measured since 1979 include DDE, PCBs, dieldrin, total chlordane, mercury, heptachlor epoxide, HCB, TCDD. Brominated Diphenyl Ethers (BDEs) have been measured since 2000. A summary of results is as follows, and results are discussed in more detail in Appendix E, section 2.2.1:

- Levels that fall within the range of other Great Lakes annual monitoring colonies (AMCs). Levels were higher than at the immediate upstream site at Port Colborne (L. Erie). They were substantially higher than Port Colborne for mirex, chlordane, HCB, and dioxin. There are significant sources for these contaminants on the US side of the Niagara River.
- Levels of sum PCBs and DDE were higher than other compounds (> 0.07 ug/g).
- Levels of all compounds are below levels considered to elicit population-level effects.
- Temporal trends show levels for all compounds have decreased substantially since 1979.

2.1.2 Contaminants in Snapping Turtles and their Eggs (Hughes, 2004; Fernie and de Solla, 2004)

Contaminants in Snapping Turtles and their eggs were assessed by MNR Wildlife Branch in 1988-89 in the Welland River watershed (Hebert et al. 1993), and by Environment Canada in 2002 in the Lyons Creek watershed. Total DDT, total PCBs, and mirex was measured in turtle muscle in 1988-89, and PCBs, non-ortho PCBs, dioxins and furans and OC pesticides were measured in turtle eggs in 2002.

A summary of results is as follows:

- Welland River 1988-89- mean concentrations of all contaminants were low (DDT- 0.0019 ug/g, PCBs- 0.132 ug/g, mirex- 0.0004 ug/g), below fish consumption guidelines and within the range of levels found in snapping turtle at other Southern Ontario locations. Age of sampled turtles was not reported.
- Lyons Creek East 2002- Eggs of five snapping turtle clutches had significantly higher sum PCBs (mean concentration of 1.214 ug/g) compared to the Wheatley Harbour AOC and two reference sites (Tiny Marsh, Severn Sound and Algonquin Park). Some of the TEQs exceeded CCME Environmental Quality guidelines for the protection of wildlife. The high levels of PCBs in this watershed are related to an area of PCB-contaminated sediment at the head of the creek.

2.1.3 Contaminants in Mink (source - Hughes, 2004)

Haffner et al (1998) and Environment Canada sampled contaminants in mink in 1988-89 and 2001-04 respectively. Haffner et al. sampled mink in Wainfleet township in the southern part of the Welland watershed, while CSD sampled mink from the Stevensville area and in the Lyons Creek watershed within the AOC, as well as at two Lake Erie reference sites along the shoreline near Dunnville (Grand River watershed) and inland. Contaminants measured in the livers of mink were DDE, sum PCBs, PCB 1254:1260, dieldrin, mirex, oxy-chlordane, heptachlor epoxide and HCB. Results are compared across years and sites in table 1 below.

Table 1: Mean concentrations of contaminants (+SE, µg/g) in mink livers collected in 1988 and 1989 from Wainfleet township in the Niagara District (Haffner et al. 1998) and in 2001-2004 from Black Creek and Lyons Creek in the Niagara River basin (CWS, unpublished). Data from the eastern Lake Erie Basin, and inland sites within the Lake Erie watershed are included as reference areas. N denotes the number of individuals.

Year	Site	N[1]	DDE	Sum PCBs	PCB 1254:1260	Dieldrin	Mirex	Oxy-chlodane	H.E.[2]	HCB[3]
1988/ 1989	Niagara AOC	8	0.050± 0.027	n/a	0.287± 0.129	0.0003± 0.0002	0.0015± 0.0004	0.0035± 0.0012	0.0007± 0.0002	0.0001± 0.0004
2001-2004	Niagara AOC	7	0.091± 0.076	0.889± 0.712	2.46± 2.013	0.0043± 0.0022	0.0022± 0.0005	0.0218± 0.0074	0.0008± 0.0004	0.0003± 0.0002
1999-2002	Lake Erie	9 (12)	0.028± 0.009	0.221± 0.088	0.484± 0.204	0.0021± 0.0008	0.0006± 0.0000	0.0226± 0.0097	0.0004± 0.0002	n/a
1999-2001	Inland	4 (14)	0.007± 0.003	0.084± 0.020	0.060± 0.026	ND	ND	0.0030± 0.0018	ND	n/a

[1]= sample size in parentheses are for PCBs
[2]= heptachlor epoxide
[3]=hexachlorobenzene

A summary of results is as follows:

- PCB levels were highest of all the contaminants sampled. As with snapping turtle, the congener pattern in 1988/89 samples suggested exposure to an Aroclor 1254 source. This pattern is not present in mink from 2001 from the Black Creek watershed, but two mink (2001-2004) from the Lyons Creek and Welland Canal near Lyons Creek had elevated concentrations of some PCB congeners associated with Aroclor 1254, compared to mink from elsewhere in the Great Lakes (Martin et al. in press).
- Concentrations of PCBs associated with reproductive problems as determined in the laboratory was 0.98 ug/g PCBs (Restum et al. 1998). One mink from Lyons Creek had concentrations of sum PCBs that exceeded this value (5.15 ug/g). No mink from the inland sites had PCBs exceeding 0.98 ug/g, but 1 mink out of 12 from the eastern basis of Lake Erie exceeded this value (0.995 ug/g). Although the mean sum PCBs and Aroclor equivalents of all mink from Lyons Creek exceed 0.98 ug/g, it was due to the one high value, and all other mink were below this threshold. Due to the high variability in sum PCBs concentrations, presumably due to local sources, it is not possible to infer any temporal trends in contaminant concentrations from 1988/89 to 2001-2004; there were no significant differences in PCBs among the Niagara River AOC, eastern basin of Lake Erie, and inland sites.

- Levels of other contaminants were not of concern, although unlike at Lyons Creek, heptachlor epoxide, mirex, dieldrin and octachlorostyrene were below detection limits at the Lake Erie inland sites.

2.2 Types and Frequencies of Deformities/Reproduction Problems and Individual Health Endpoints

2.2.1 Snapping Turtles and their Eggs (Fernie and de Solla, 2004)

Environment Canada carried out assessments related to the physiological health and incidences of deformities and reproduction problems in Snapping Turtles in 2002. Sampling was carried out in the Lyons Creek watershed, at Wheatley Harbour AOC, and at reference sites in the former Severn Sound AOC (Tiny Marsh) and in Algonquin Park. Parameters measured were:

- Clinical chemistry endpoints related to kidney function, nitrogen metabolism, liver function, bone dynamics, antioxidant status, lipid metabolism, and glucose levels in adult male turtles
- Hatching success of incubated eggs
- Deformity rates in hatchlings

A summary of results is as follows:

- Compared to adult males from AOC and non-AOC reference sites, turtles from Lyons Creek showed suppressed measures related to kidney function, bone dynamics, lipid metabolism, and a reduced ability to compensate for free radicals relating to oxidative stress. They also had elevated measures related to nitrogen metabolism, also indicative of kidney dysfunction.
- Despite substantially elevated PCB levels in eggs, there was no evidence of reduced hatching success of eggs, or increase in deformity rates of hatchlings.

3.0 Current Status of the Impairment

The status of this BUI in 1995 as listed in the RAP stage 2 report was "impaired" for deformities and "not known" for reproduction problems. Based on the evidence presented above, and summarized in the following four sections, it is recommended that the impairment be listed as "requires further assessment". A summary of impairment status based on weighing available evidence under the three key factors used to assess the impairment in combination, is shown in table 2 below. The "requires further assessment" result is based on using the decision matrix shown in section 1.0.

4.0 Review of and Recommendations for Delisting Criteria

As the impairment status of this BUI is not conclusively "impaired", no new delisting criteria are recommended at this time. Should additional evidence suggest a conclusive impairment, it is recommended that delisting criteria be developed.

5.0 Review of and Recommendations for Monitoring and Assessment

The following are recommended to track progress in restoring this BUI, or to enhance knowledge about the status of the impairment:

- Development and assessment of endpoints indicating risk of developing reproductive problems or deformities, and/or on population status of snapping turtles from Lyons Creek in comparison to reference sites.

6.0 References

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Table 2: Results of impairment assessment for the Bird (or other animal) Deformities or Reproduction Problems BUI, based on the decision matrix presented in section 1.0 above and available evidence to assess the impairment as summarized in section 2.0

Key Factor	Result	Comments
Contaminant body burdens in excess of reference sites/levels?	Yes	For PCBs in snapping turtle eggs from Lyons Creek clutches. PCB levels in one mink from Lyons Creek exceeded literature-based thresholds for reproduction problems.
Deformities/ reproduction problems of a type associated with contaminant exposure?	No	No hatchling deformities or reproductive impairment in Lyons Creek snapping turtle clutches.
Frequency of deformities/ reproduction problems exceeds frequency for reference sites/ background levels?	No	No hatchling deformities or reproductive impairment in Lyons Creek snapping turtle clutches.
Individuals with deformities show health effects? Shift in population characteristics?	Additional Information Needed	No clinical chemistry endpoints data available to suggest whether there is a risk of turtles developing deformities or reproduction problems. No rigorous population data available for either snapping turtle or mink.
Overall Impairment Assessment	**Requires Further Assessment**	

APPENDIX 15: Status of the Restrictions on Dredging Activities in the Niagara River (Ontario) AOC

FAXED TO COA STEERING COMMITTEE MEMBERS: FOR FINALIZATION COMMENTS : MAY 4, 1998 ON OUR CONFERENCE CALL. Thank you, from Gail Krantzberg

Issue: "Restrictions on Dredging" has been classified as an impaired beneficial use based on a comparison of sediment chemistry to provincial chemical guidelines. In the absence of navigational dredging requirements, consensus is being sought to state that this category of beneficial use is not impaired.

Recommendation:

Restrictions on dredging is not an impairment in Nipigon Bay, Jackfish Bay, Spanish Harbour, Severn Sound, Niagara River and Bay of Quinte. There is no navigational dredging in locations where contaminants exceed the provincial Lowest Effect Level. Routine upland disposal for small scale dredging operations does not constitute an impairment.

Background:

* COA RAP Steering Committee has held technical reviews for Nipigon Bay, Jackfish Bay and Spanish Harbour. In the absence of the need for navigational dredging, the technical team concluded that this use is not impaired.
* The same rational would result in redesignating this beneficial use as unimpaired in Severn Sound, Niagara River, and Bay of Quinte.
* The environmental significance of having chemicals in sediment that exceed the provincial Lowest Effect Level is considered in conjunction with degraded benthos, consumption advisories, tumours and other deformities, and other categories of beneficial uses.

Conclusion:

The following technical experts concur with the recommendation:

Duncan Boyd, MOE Dr. Scott Painter, EC
Rein Jaagumagi, MOE Rimi Kalinauskas, EC
Dr. Gail Krantzberg, MOE

As a result, restrictions on dredging is no longer considered impaired in Severn Sound, Niagara River, and Bay of Quinte. The RAP participants in those Areas of Concern agreed that the designation was inappropriately assigned in consultations in 1997.

APPENDIX 16: Beach Closings Technical Review

The following individuals comprised the technical review committee for this impairment:

Tom Edge, EC-NWRI (lead)
David Brown, Brock University
Murray Charlton, EC- NWRI
Glen Hudgin, Public Health- NR
Scott Mackay, EC- RPD
Annie Michaud, NPCA
Natasha Mihas, Public Health- City of Hamilton
Susan Weir, Laboratory Services- MOE

The committee's feedback was provided in a written report which was used as the basis for writing this appendix.

1.0 Basis for Evaluating Impairment Status

This BUI refers to the impacts of anthropogenic sources of bacterial pollution on recreational water quality. Specifically, it refers to impacts which are occurring within, and anthropogenic sources which arise within, the Ontario portion of the AOC. The direct impacts from bacterial pollution relevant to this BUI relate to public health advisories ("postings") at designated public beaches.

The following are key factors in assessing the impairment:

1. *Records of public beach postings for E. coli exceedances and magnitude of E. coli exceedances* - Are public beaches being posted at a frequency and duration, and are exceedances of the *E. coli* PWQO of a magnitude, which is indicative of a chronic bacterial contamination problem*?
2. *Association of the above with human activity, including from livestock and companion animals* - Are sources of bacterial contamination likely from within the AOC and are they related to human activity, including from livestock or companion animals?

If beach water quality at AOC beaches is indicative of a chronic bacterial contamination problem as defined in the footnote below, then an impairment status of *impaired* is recommended. If beach water quality is not indicative of a chronic contamination problem, or if there is clear evidence that the source of contamination is not anthropogenic, then an impairment status of *not impaired* is recommended. If chronic bacterial contamination at beaches is anthropogenic, but not due to sources/causes within the AOC then an impairment status of *impaired but not due to local sources* is recommended. If important evidence is missing, or results are inconclusive, then an impairment status of *requires further assessment* is recommended.

* A chronic bacterial contamination problem can be defined, by inference through water quality measurements or related records of public beach postings, as an unnaturally high concentration of fecal indicator bacteria (i.e.- *E.coli*) in the water column for extended durations of time and/or at an elevated frequency of such events.

1.1 Spatial Context for Evaluating Impairment

There are two spatial scales which are considered in evaluating this BUI. The first is the Ontario portion of the AOC, which is the coarsest scale in assessing impairment. The second is a particular public beach, representing a more finite scale for evaluating impairment. Impairment status is evaluated in a hierarchical fashion from the smaller spatial scale to the larger. Therefore, the AOC is considered unimpaired when all or most sites are considered unimpaired based on the framework shown in table 34 above.

Within the AOC, there is a further distinction between areas exposed to *E. coli* which have their source wholly within the AOC, versus areas where they may be exposed to contaminants arising from U.S. or upstream Lake Erie sources. In this case, sites along the Niagara River are considered as exposed to U.S. and Lake Erie sources, while other sites are not. This is an important distinction because the RAP is only capable of addressing stressors and associated beneficial use impairments which have their source/cause within the Ontario portion of the AOC, and will refer to other programs (e.g., U.S. RAPs, Lake Erie LaMP) to address sources from outside the AOC.

Based on the above, impairment will be evaluated by beach, and then for the Welland River and Niagara River as separate zones within the AOC.

2.0 Available Evidence to Assess Impairment Status

In support of the decision framework above, available background information is provided for the following:

- Location of public beaches in the AOC
- Records of beach postings/PWQO exceedances at public beaches
- Estimates and sources of *E. coli* loading from different sectors in the AOC

2.1 Location and Monitoring of Public Beaches in the AOC

Currently, there are four public beaches in the Niagara River AOC (Table 1). Four additional historic public beaches, namely King's Bridge Park Beach, Dufferin Islands Beach, Bowen Road Beach and Princess Street Beach, which were located on the Niagara River, have been permanently closed in recent years by The Niagara Parks Commission for reasons unrelated to water quality and they are no longer public beaches.

Table 1: Location of current and historic (marked with two asterisks) public beaches in the Niagara River (Ontario) AOC. In this table, NPCA= Niagara Peninsula Conservation Authority, NPC= Niagara Parks Commission, NOTL= Niagara-on-the-Lake, and NR= Niagara Region

Beach Name	Waterbody	Property Owner	Length (m)	Latitude (°N)	Longitude (°W)
Binbrook Conservation Beach	Welland River	NPCA	107	43.10	79.85
Bowen Road Beach**	Niagara River	NPC	50	42.92	78.92
Ball Street Beach*	Niagara River	Town of NOTL	20	43.20	79.15
Chippawa Conservation Beach	Welland River	NPCA	135	42.99	79.52
Dufferin Island Beach**	Niagara River	NPC	16	43.07	79.07
King's Bridge Park Beach**	Niagara River	NPC	91	42.93	79.20
Princess Street Beach**	Niagara River	NPC	103	42.91	78.91
Queens Royal Beach	Niagara River	Town of NOTL	122	43.25	79.07

* enrolled in the NR's beach monitoring program since 1999
** permanently closed in recent years by the Niagara Parks Commission

Ball Street Beach, which is located downstream of the Niagara River near the Town of Niagara-on-the-lake, has been enrolled in the Niagara Region's (NR) beach monitoring program since 1999. Water quality monitoring and beach posting data has been recorded for 17 consecutive years (1989-2005) at the remaining three public beaches (Figure 1).

Of the three beaches which have been monitored consecutively, two are monitored by the Public Health Department of the Niagara Region, and one (Binbrook Conservation Beach) is monitored by the Department of Public Health and Community Services in the city of Hamilton. There are no public beaches in the jurisdiction of Haldimand County. Binbrook Conservation and Chippawa Conservation Beach are located within Conservation Areas managed by the Niagara Peninsula Conservation Authority.

For the purposes of assessing impairment and developing delisting criteria, it is important to separate out those beaches which are influenced by bacteria which have their source within the AOC, and those which may also be exposed to sources from outside of the AOC (from Lake Erie, Lake Ontario and/or U.S. Niagara River sources). Thus Queens Royal Beach on the Niagara River, which is subject to sources from outside of the Ontario portion of the AOC will be assessed separately from the beaches located in the Welland River watershed.

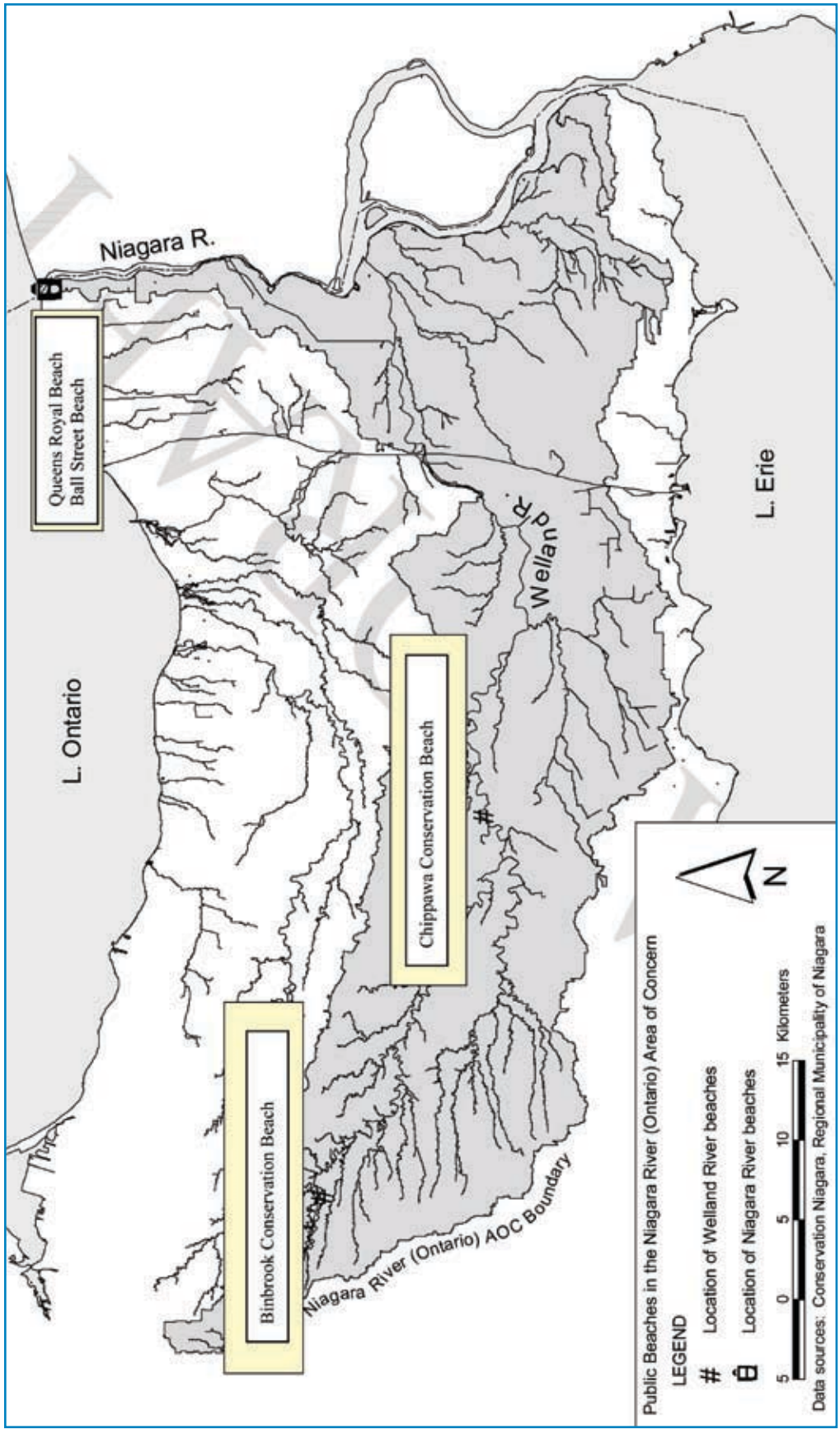


Figure 1: Locations of current public beaches in the Welland River watershed (as indicated by closed circle symbols) and Niagara River (as indicated by closed star symbols) portions of the AOC

Thus, Niagara River beaches are:

- Ball Street beach
- Queens Royal Beach

Beaches within the Welland River watershed are:

- Binbrook Conservation beach
- Chippawa Conservation beach

2.3 Records of Beach Postings at Public Beaches

The following are based on data from the Niagara Regional and City of Hamilton Health Units. The total number of days that individual beaches were posted for the period 1989-1994 and 1995-2005 (figures 2 and 3) and the total number of postings per year (figures 4 and 5) for Niagara River and Welland watershed beaches are shown below.

The periods 1989-1994 and 1995-2005 are shown separately because of differences in sampling protocol and fecal bacterial indicator used. The MOHLTC sampling protocol changed in 1994 from sampling fecal coliforms to sampling for *E. coli*, and in addition to a new indicator, sampling frequency may have increased at some beaches as a result of the new protocol. During the 1990s, the Glanbrook Conservation Committee carried out a number of efforts to reduce bacterial contamination and algal blooms at Binbrook Reservoir which has likely led to the reduction in beach postings at that site.

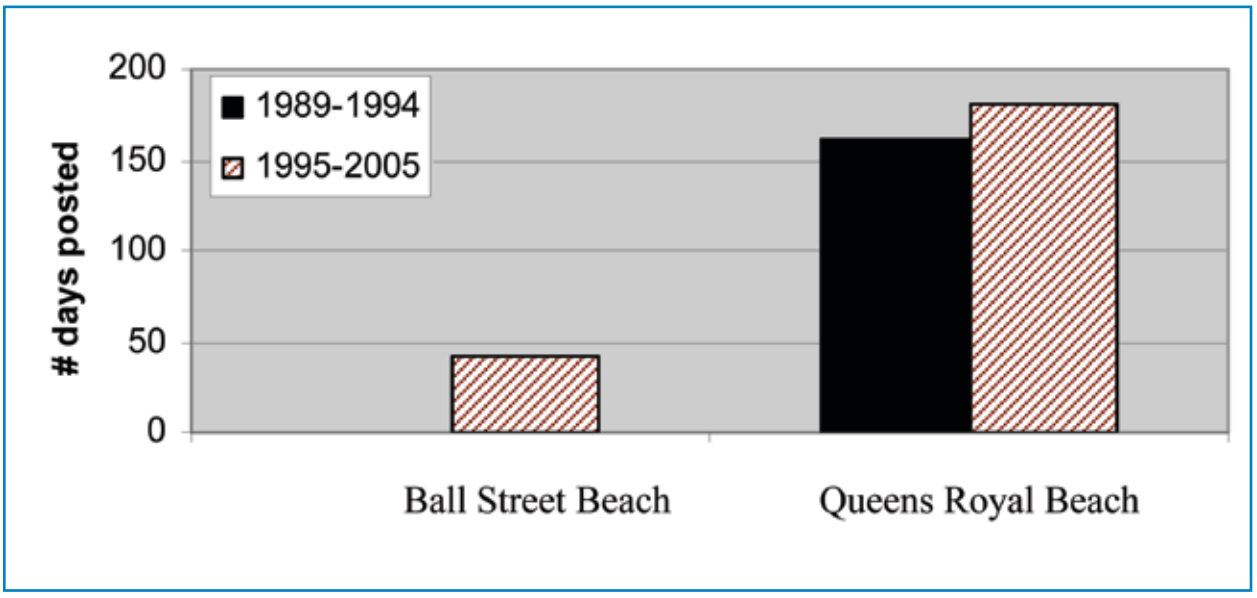


Figure 2: Total number of days during the swimming season that public beaches on the Ontario side of the Niagara River were posted during the periods 1989-1994 and 1995-2005. Note that Ball Street beach has only been monitored since 1999 by the Niagara Regional Health Unit.

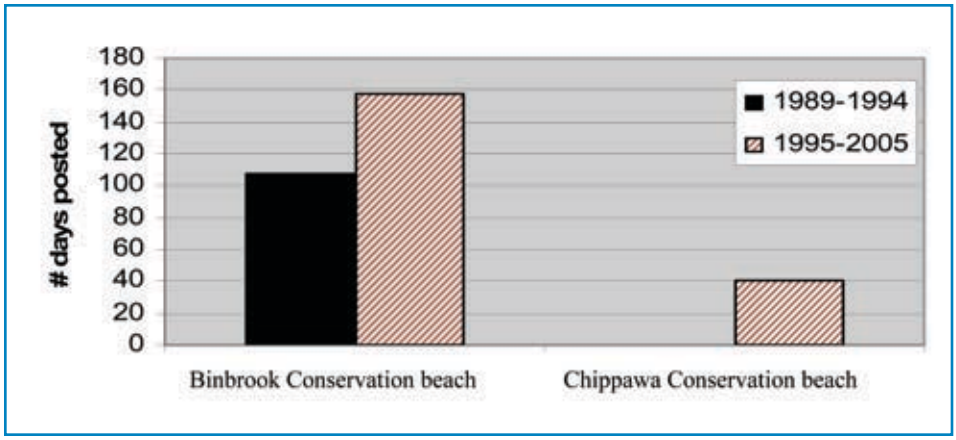


Figure 3: Total number of days during the swimming season that public beaches in the Welland River watershed were posted during the periods 1989-1994 and 1995-2005.

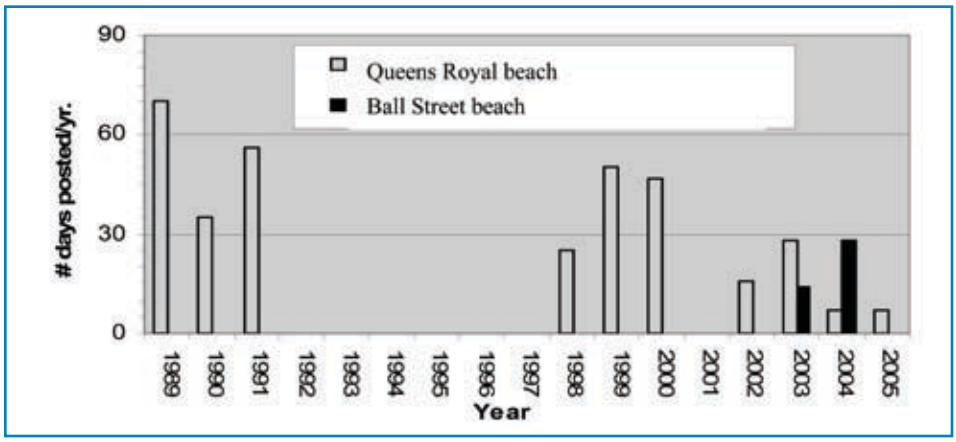


Figure 4: Total number of days per year that public beaches were posted on the Ontario side of the Niagara River. Note that Ball Street beach has only been monitored since 1999 by the Niagara Regional Health Unit.

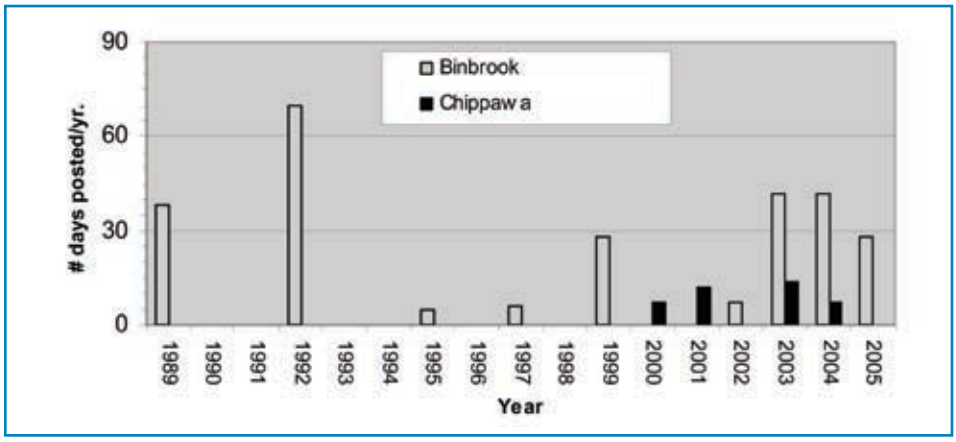


Figure 5: Total number of days per year that public beaches were posted in the Welland River watershed.

They carried out the following actions to reduce bacterial inputs to the reservoir:

- Septic systems were repaired as necessary
- Water conservation was encouraged amongst area residents and farms
- Cattle access to watercourses were eliminated by fencing
- Improved manure storage facilities were encouraged and implemented at high priority locations
- Improved milkhouse washwater treatment was implemented at local dairy farms
- An overhead gull screen was constructed across the beach
- Groomed grass areas were created away from beach areas for use by Canada Geese
- No-till areas were encouraged adjacent to watercourses on farmers fields
- Buffer zones were created along watercourses and shorelines

The magnitude of *E. coli* exceedances is also an important indicator of health risk at individual beaches. Figure 6a-d plots geometric mean *E. coli* concentrations by year for each of the public beaches in the AOC. Results show that the majority of exceedances of the PWQO still fall below Health Canada's Canadian Recreational Water Quality Guideline of 200 *E. coli* CFU/100 ml, but at Binbrook Conservation beach a larger percentage of the results exceed this guideline as well, falling mostly within the 200-600 *E. coli* CFU/100 ml range.

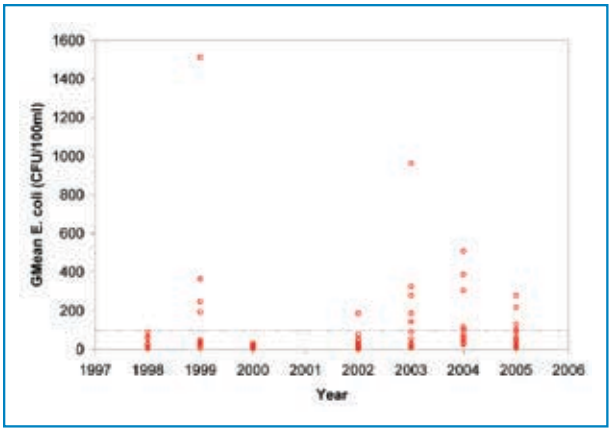
2.5 Estimates and Sources of *E. coli* Loading from Different Sectors in the AOC

The following are taken from the Niagara Water Quality Protection Strategy technical reports (Niagara Region, 2003). A simple mass balance model was used to estimate loadings of different point and non-point source pollutants from different types of land-use (urban, agricultural, and open space/parks/forest), including *E. coli* counts, on an annual basis. The counts per year were divided by the total area of land-use to standardize the data for comparison purposes. Results are shown in table 2.

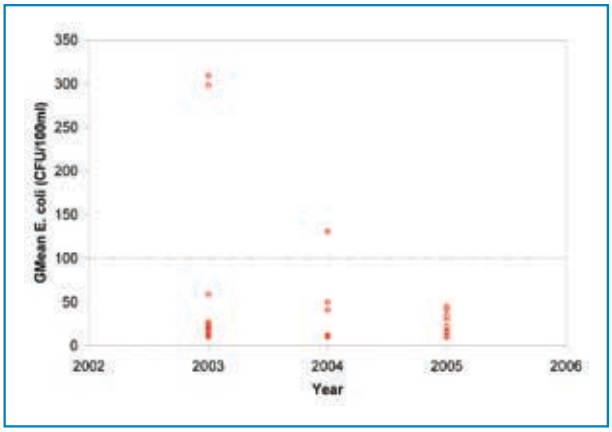
Table 2: Annual *E. coli* loads estimated from mass balance modelling by land-use type and/or source for the Niagara River (Ontario) AOC. Loads for STPs within the AOC were not available, so the relative contributions of other land-uses to the total *E. coli* load are overestimated. Area refers to the cumulative area occupied by a given land-use type within the AOC, and Total Area refers to the sum of areas of all land-use types. SW=stormwater, CSO=combined sewer overflows, STP=sewage treatment plant.

Land-Use	Area (sq. km)	% of Total Area	*E. coli* (counts/sq. km/yr)	*E. coli* (counts/yr)	% of Total
Urban SW				1.83E+15	20.4
Urban CSO				9.44E+14	10.6
Urban STP				Unknown	Unknown
Urban (Total w/out STP)	20.50	1.71	1.35E+14	2.77E+15	31.0
Agriculture	760.37	63.47	7.76E+12	5.90E+15	65.9
Other	417.03	34.81	6.62E+14	2.76E+14	3.1

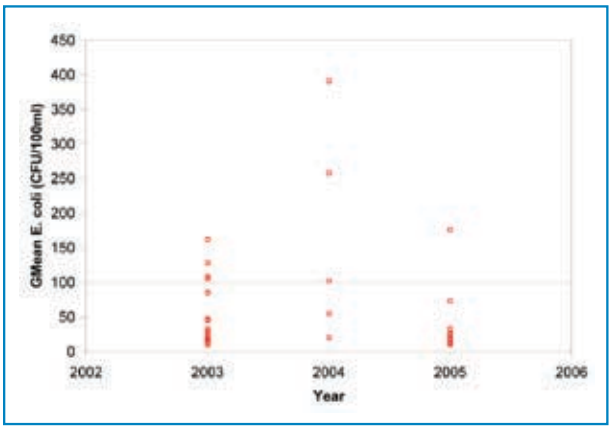
Source: after data from Regional Municipality of Niagara (2003).



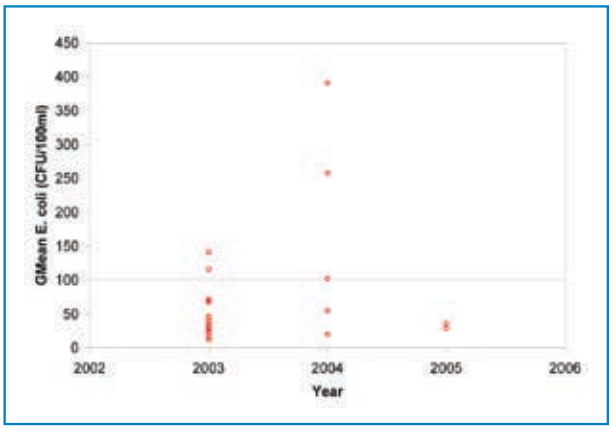
a) Binbrook Conservation



b) Chippawa Conservation



c) Queens Royal



d) Ball Street

Figure 6a-d: Magnitude of geometric mean E. coli exceedances for public beaches in the Niagara River (Ontario) AOC for the period 1998-2005 (Binbrook Reservoir) and 2003-2005 (all other public beaches)

Even without STP inputs accounted for, urban areas are shown to contribute substantially more *E. coli* per unit area than agricultural and rural areas in the AOC (almost two orders of magnitude more than agricultural areas and almost three orders more than open space/parks/forest). Based on the modelling exercise, of the total urban load, 66% is estimated to be from stormwater and 34% from combined sewer overflows (CSOs). However, agricultural and rural sources are still predicted to contribute 66% of the total load in surface water in the AOC. This is influenced in large part by the extent of this land-use (64% of total area).

It is unknown to what extent these sources impact on individual beaches. Within the Welland watershed, Binbrook Conservation beach is exposed to sources within the reservoir catchment, but not downstream. Most of these sources are agricultural/rural in nature. Chippawa Creek Conservation Area is not directly connected to the Welland River and therefore would not be exposed to upstream or downstream (since the Welland flows both ways) sources. Although the Welland River confluence is upstream of the Queens Royal and Ball Street beaches on the Niagara River and would contribute to the bacterial load somewhat, it contributes only a very small proportion of the total flow of the river. What can be assumed from the mass-balance modelling exercise above is that agricultural/rural sources are impacting the Binbrook

Conservation beach. It is less clear whether urban sources within the AOC may also be impacting beaches in the vicinity of Niagara-on-the-Lake, and to what extent New York-based Niagara River sources, or contributions from Lake Erie may be impacting these beaches as well. An important monitoring/assessment recommendation, as outlined in section 5.0, is to investigate sources and conditions affecting *E. coli* levels at Binbrook Conservation beach, and (although a lower priority) at Bowen Road, Queens Royal and Ball Street beaches.

3.0 Current Status of the Impairment

The impairment is assessed for beaches in the Welland watershed (table 3) and for beaches of the Niagara River (table 4) based on evidence presented in section 2.0 of this document. The impairment assessment is split this way since beaches on the Niagara River and the river itself are likely minimally affected by anthropogenic activity in the Ontario portion of the AOC and are also subject to sources outside of it, while beaches of the Welland watershed upstream of the Chippawa Power Canal are subject to the impacts of such activity within specific areas. Overall, this BUI is listed as impaired due to the frequency and duration of beach postings, and their likely association with anthropogenic activity, at Binbrook Conservation beach.

Table 3: Evaluation of impairment status for the Welland River watershed

Question	Result	Comments
Existence of public beaches in AOC?	Yes	Public beaches are at Binbrook Reservoir and Chippawa Creek Conservation Area.
Evidence of chronic beach postings?	Yes	Frequency and duration of postings in the last decade at Binbrook Conservation beach have been infrequent with the exception of 1999 and the most recent years of 2003-2005. The latter years have shown a substantial and consistent increase in postings/exceedances, suggesting the need for additional investigation of sources.
Association of the above with anthropogenic sources?	Likely	Simple mass-balance modelling carried out as part of the Niagara Water Quality Protection Strategy estimated substantial loads of *E. coli* from agriculture (65% of total) and urban storm runoff-related sources (31%-stormwater and CSO outfalls). Agricultural and rural sources are most likely associated to some extent with beach postings at Binbrook Conservation beach.
Overall Impairment Assessment Result	**Impaired**	

Table 4: Evaluation of impairment status for the Niagara River portion of the AOC

Question	Result	Comments
Existence of public beaches in AOC?	Yes	There are currently two public beaches along the Niagara River- Queens Royal and Ball Street beaches. Four beaches (Bowen Road, Princess Street, Dufferin Islands, and King's Royal Park) have been closed by the Niagara Parks Commission since the Stage 2 report was published due to reasons other than water pollution.
Evidence of chronic beach postings?	No	Overall, there has been a low frequency and duration of postings since 2001, with single years with a greater frequency of postings for both Niagara River beaches (2003 for Queens Royal and 2004 for Ball Street). Exceedances of the PWQO are typically not severe.
Association of the above with anthropogenic sources?	Insufficient Evidence to Assess	It is unknown to what extent local sources influence *E. coli* levels in the Niagara River, given the volume of flow.
Overall Impairment Assessment Result	**Not Impaired**	

4.0 Review of and Recommendations for Delisting Criteria

4.1 Existing Stage 2 Delisting Criterion

The existing delisting criteria for this BUI are as follows:

(Proposed International Delisting Criteria for the Niagara River AOC)

- *90% of the wet weather (peak) flow and all dry weather flow in combined sewer system is treated to WPCP levels, on an annual basis.*
- *Use most stringent swimming water objectives for phosphorous, sediments, turbidity, and drinking water objectives for toxic chemicals (as there are no recreational objectives for toxic chemicals) of the jurisdictions involved.*

(For the Niagara River (Ontario) AOC)

- *Ensure safe swimming: faecal coliforms less than 100 counts/100 mL; control sources of phosphorous with the goal of 30 ug/L in the Welland River and tributaries; secchi disk visibility greater than 1.2 m; water quality meets drinking water objectives for toxic chemicals.*

There are several shortcomings in these criteria, as follows:

- The Province of Ontario PWQO for Fecal Coliforms is no longer used, and has been replaced with the PWQO for *E. coli* of 100 colony-forming units (CFU) per 100 ml.
- There are many areas in the Great Lake which are not AOCs where the PWQO is not met 100% of the time. This is most likely due in part to natural quantities of bacteria such as from wildlife and other dispersed sources, which are temporarily elevated following rain events but which are not indicative of a chronic bacterial contamination problem.

- Currently, there are no toxic chemicals in the AOC, in water or sediments, which are elevated above levels for safe swimming, including dermal contact with sediments, in areas accessible for swimming.
- Excess phosphorus and associated ecosystem response (i.e., cultural eutrophication) are dealt with in the BUI "Eutrophication and Other Undesirable Algae".

It is recommended, however, that the criterion related to CSOs be maintained, since there are many CSOs within the AOC which discharge to waters which drain indirectly or directly to the Niagara River. The criterion is based on MOE's F-5-5 Guideline for CSOs, and including its implementation as a delisting criterion will serve to strengthen the case for action on CSOs by municipal and regional governments.

4.2 Recommendations and Rationale for New Delisting Criteria

The Committee recognized there was no strong science basis for deciding what would constitute an "acceptable" number of *E. coli* sample exceedances over a recreational season. While this should be a low number, what is "acceptable" is subjective, and may vary across AOCs. The Committee considered that the value used by the internationally-accepted Blue Flag beach certification program (< 20% of the geometric means of water samples) provided some basis to better define "acceptable" for delisting of this BUI. The recommended criterion is as follows:

Public beaches meet the following conditions:

i) Prominent sources of fecal pollution that could contaminate beach or recreational waters are known;
ii) Less than 20% of the geometric means of water samples collected over the swimming season exceed the Provincial Water Quality Objectives (100 E. coli / 100ml);
iii) Any severe exceedance of Provincial Water Quality Objectives is rare and predictably associated with local events such as significant rainfall events.

Evaluation of whether the above criterion has been attained will require a number of years of consecutive sample results based on a regular (i.e., weekly or biweekly) water sampling program that collects 5 samples per site per sampling event and from which geometric mean *E. coli* concentrations are calculated. Interpretation should allow for occasionally poor performance in a given year when based on climatic conditions such as abnormally hot or wet summers. Such allowances should be made on a site-specific basis.

4.3 Assessment of the Performance of Beaches Relative to Recommended Delisting Criteria

Figure 7 shows the annual percentages that the PWQO has been exceeded at individual AOC beaches for the period 2003 to 2005, relative to the delisting criterion proposed above. Results show that the criterion is consistently not met for Binbrook Reservoir beach, is inconsistently met (two out of three years for 2003-05) for Queens Royal and Ball Street beaches, and is consistently met across this three year period for Chippawa Conservation beach.

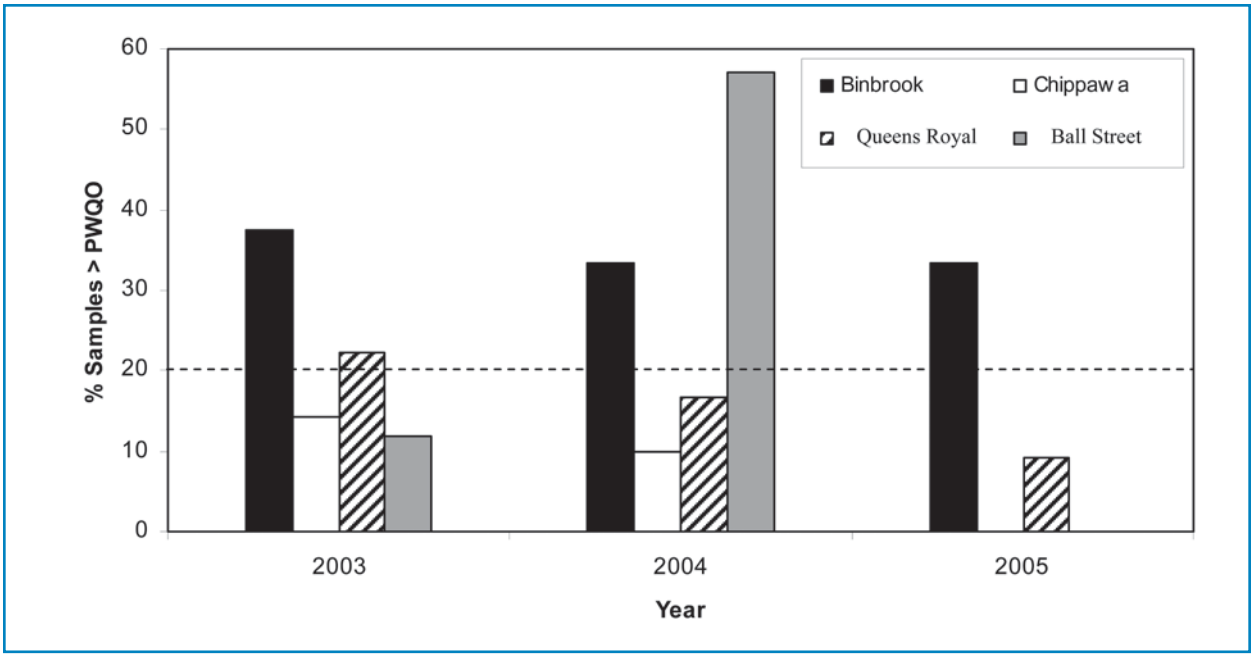


Figure 7: Performance of individual beaches within the Niagara River (Ontario) AOC between 2003 to 2005 for meeting an annual maximum of 20% or fewer geometric mean *E. coli* results exceeding the PWQO.

5.0 Recommendations for Monitoring and Assessment

To facilitate the collection of data consistent with delisting criteria, the following changes/additions to monitoring programs are proposed:

- Annual reporting of beach postings, with a breakdown of beach monitoring results and frequency of postings related to PWQO exceedances for beaches in the Ontario and international (i.e., Niagara River) portions of the AOC.
- Increased sampling frequency (i.e., greater than weekly) at public beaches to reduce unnecessarily long periods that beaches may be posted.
- Identification of patterns in elevated *E. coli* levels at Binbrook Conservation beach in relation to environmental factors such as rainfall, and investigation of sources which may be affecting these patterns.

6.0 References

Chen, K. 2004. Recreational Water Quality in the Niagara River (Ontario) Area of Concern - A Status Report. Unpublished Environment Canada report. 63 pp.+ appendices.

Regional Municipality of Niagara (NR). 2003. Niagara Water Quality Protection Strategy - Technical Report Phase 2. Regional Municipality of Niagara and partners. October, 2004

Our Plaque on the Niagara River

In June 1997 in a small park opposite Service Road 30 on the Niagara River Parkway just south of Chippawa, a plaque describing the community's efforts to restore the Niagara River (Ontario) Area of Concern was unveiled at a special ceremony. Attendees included local politicians, councillors, agency representatives and citizens involved in the then public advisory committee.

The Niagara River Remedial Action Plan plaque was funded by Environment Canada, and it was installed with permission and cooperation from the Niagara Parks Commission. The plaque recognized the concern and commitment towards cleaning up and restoring this section of the Great Lakes ecosystem for present and future generations. It also celebrated a milestone in the development of the Niagara River (Ontario) Remedial Action Plan when the goals and recommendations for cleanup were articulated in the Stage 2 report.

The English text on the plaque reads:

"Niagara's beauty has been an inspiration for today's environmental movement. Early conservationists such as George Catlin and Frederick Olmstead, who invented the concept of national parks, came to view its wonders. Nurtured by such visions and encouraged by the leadership of Colonel Casimir Gzowski, The Niagara Parks Commission established the first provincial park in Ontario in 1885.

The Remedial Action Plan (RAP) today unites concerned citizens committed to restoring Niagara's ecosystem for present and future generations."

Canada & Ontario **Date: 1997**