

VIII. RESEARCH AND MONITORING PLAN

A detailed plan for long term monitoring was designed and set out in Appendix I of the 1992 Stage 2 Report with a preamble in Chapter VIII. Monitoring was divided among compliance monitoring, effects monitoring, and surveillance monitoring.

The long term monitoring plan was revisited during the updating of the Stage 2 Report. Implementing agencies were surveyed to submit a list of the monitoring programs that their organization performed each year in Hamilton Harbour and its surrounding watershed. Basic information included: who is in the lead of the monitoring, where the monitoring takes place, what is being monitored, and how often monitoring takes place. Figures 73 - 78 contain the results of the survey.

A key step when developing a monitoring plan is establishing a clear definition of the purpose for all the monitoring. Monitoring is important in the RAP as the documentation of conditions over a long time period will assist in the delisting of Hamilton Harbour as an Area of Concern (AOC). The surveys were reviewed to see which delisting objectives or RAP recommendations each monitoring task related to and this information also appears in the figures.

The RAP Technical Team is addressing the need for research and monitoring information to be presented to others in the RAP on a regular basis by hosting an annual Hamilton Harbour Research and Monitoring Workshop. The RBG host a Project Paradise Field Season Review annually to present work accomplished in the Cootes Paradise Marsh and the Grindstone Creek Estuary areas. A third workshop could be added to the series on Harbour Watershed monitoring activities.

Continuing research and development is needed to parallel the routine monitoring laid out in this plan. This is important to enable the RAP to deal with new issues and problems as they arise, and to facilitate the regular review and interpretation of the monitoring data. Intensive research and monitoring will also be needed as the end of the implementation plan approaches to determine if Hamilton Harbour meets the delisting objectives.

Figure 73. Federal Government Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
Environment Canada (EC) – NWRI	Hamilton Harbour 4 Stations (50, 51, 52, 53)	Water quality • nutrients, major ions, physical measurements (including EBT profile surface to bottom, DO, pH, temp), organic contaminants (OCs/PCBs, PAHs, CBs), total metals	1 time/year (spring) annually	viii WQ – 1a
EC – NWRI	Hamilton Harbour 4 Stations (50, 51, 52, 53)	Water quality • nutrients, major ions, physical measurements (including EBT profile surface to bottom, DO, pH, temp), total mercury	1 time/year (end summer) annually	viii WQ – 1a
EC – NWRI	Hamilton Harbour 4 Stations (50, 51, 52, 53)	Suspended sediments • PCBs, dioxins and furans, pesticides, PAHs	Monthly from May to October	viii TSSR – 3
EC – NWRI	Hamilton Harbour Central Station (Station 52)	Water quality • phosphorus, oxygen, ammonia, nitrate, nitrite, chlorophyll, Secchi transparency, temperature profiles, zooplankton, phytoplankton, algal toxins, zebra mussel veligers, coliforms, E.Coli	Weekly from May to October At 23 more stations several times per year in intense research years	viii xiii WQ – 1a WQ – 1e
EC - CWS	Hamilton Harbour	Colonial Waterbirds Count • size and reproductive success of breeding populations	Annual – Biennial Basis	iii RM – 1
EC – CWS	Hamilton Harbour	Herring Gull Egg Contaminants Monitoring Program	Annual	v FW – 6 RM – 2
EC – CWS	Cootes Paradise	Snapping Turtles • contaminant levels in eggs • deformity rates in hatchling turtles	Biennial (next 2002)	v FW – 6 RM – 2

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Who	Where	What	How Often	Delisting Objectives + RAP Recs
Fisheries and Oceans Canada (DFO)	Hamilton Harbour 40 sites (100 m transects along the shore at 1.5 m depth)	Fish Community Assessment <ul style="list-style-type: none"> Fish populations Submerged Aquatic Vegetation Survey <ul style="list-style-type: none"> % cover of aquatic plants species composition follow-up monitoring of aquatic plant control sites in marina basins 	3 times/year (spring, summer, fall) every third year (next 2002)	iii xiv FW – 11 RM – 1
DFO	Hamilton Harbour	Contaminant Trend Monitoring Study of the Harbour Fish Community <ul style="list-style-type: none"> several trophic levels, whole fish analysis 	Periodic (start 2002)	i FW – 6
DFO	Hamilton Harbour	Fish Tumour Survey	Every 10 Years (next 2006)	iv FW – 6

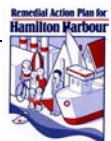


Figure 74. Provincial Government Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
Ontario Ministry of the Environment (OMOE)	Hamilton Harbour Index Station (Station 258)	Water quality • nutrient status, major ions, metals, physical parameters	3 times/ year (spring, summer, fall) every third year	viii
		Sediment quality • nutrient status, metals, PCB/OCs, PAHs, physical parameters	1 time/year (late summer) every third year	viii
		Suspended sediment • nutrient status, metals, PCB/OCs, PAHs, physical parameters	1 time/year (seasonal accumulation) every third year	viii
		Benthic invertebrate community • taxonomy and enumeration	1 time/year (late summer) every third year	vi
OMOE	Hamilton Harbour 4 stations	Sediment screening assessment Sediment quality • nutrient status, metals, PCB/OCs, PAHs, physical parameters Benthic invertebrate community • taxonomy and enumeration	1 time/year (late summer) every third year	vi
OMOE	MISA Industrial Dischargers e.g., Dofasco, Stelco	MISA regulated parameters at frequencies specified in the appropriate schedules in the Regulation (e.g. daily, weekly, monthly, annual)	OMOE receives quarterly reports of monitoring data and forthwith reports of non-compliance/spills	viii
OMOE	Municipal Wastewater Treatment Plants 4 WWTPs	Certificate of Approval requirements • e.g., BOD, SS, TP	OMOE receives quarterly reports of monitoring data and forthwith reports of non-compliance/spills	viii
OMOE	Hamilton Harbour	Sport fish sampling program for the Guide to Eating Ontario Sport Fish	Annual sampling Biennial report release	i RM – 2

Figure 75. Municipal Government Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
City of Hamilton	Wastewater Treatment Plants Woodward King Street Main Street	Final Effluent Discharge (phosphorus, ammonia, suspended solids, BOD, nitrates, nitrites, TKN, alkalinity, flow)	Woodward – 5 days/week King + Main – 1 day/week	viii WQ – 1b
City of Hamilton	Storm Sewer Outfalls Over 80 locations that discharge directly or indirectly to the Harbour	Visually monitored. Some locations have spill retention booms that are cleaned as required.	Every 2 weeks	viii WQ – 1b
City of Hamilton	Industrial/ Commercial Sewer Sampling	Inspection and in-sewer sampling done to ensure compliance with the Sewer Use By-law.	Varies	TSSR – 3
City of Hamilton	Closed Landfills West Hamilton Dundas Upper Ottawa Brampton St <i>[under review]</i> Rennie St <i>[under review]</i>	Exact analysis profile of groundwater and surface water varies per site, but may include: general chemistry, major ions, nutrient/organic indicators, metals, phenols, volatile organic compounds, PCBs	2 times/year	TSSR – 3
City of Hamilton	Public Beach Areas 5 sites/area Bayfront Park Pier 4 Park	E. Coli Levels	1 time/week until posting, then more frequently	x WQ – 1a WQ – 1c RM – 3
Regional Municipality of Halton	Wastewater Treatment Plant Skyway	Final Effluent Discharge (phosphorus, ammonia, total suspended solids, E. Coli)	4 times/month [E. Coli only seasonally]	viii WQ – 1b
Regional Municipality of Halton	Closed Landfills Bayview	Groundwater monitors, leachate collector system, surface water stations, gas monitoring	GW – 2 times/year Others – 1 time/year	TSSR – 3
Regional Municipality of Halton	Closed Landfills Old Burlington	Groundwater monitors, leachate collector system, surface water stations, gas monitoring	GW + GM – 1 time/year LCS + SWS – 4 times/year	TSSR – 3

Figure 76. Conservation Authorities Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
Conservation Halton	Grindstone Creek 2 Stations	Water quality <ul style="list-style-type: none"> solids (suspended, total, dissolved), pH, conductivity, total alkalinity, hardness, DO, temp, turbidity, ammonia, ammonium, nitrite, nitrate, phosphate, total phosphorus, TKN, E. Coli, metals 	Monthly from March to October (Maximum 8 samples/year)	viii WQ – 1a RM – 4
Hamilton Conservation Authority (HCA)	Spencer Creek Watershed 4 – 8 stations	Water quality <ul style="list-style-type: none"> bacteria, nitrites, nitrates, TKN, phosphorus, ammonia, suspended solids, temperature, pH, alkalinity, DO 	4+ times per summer – baseflow and storm events	viii FW – 4 RM – 4
HCA	Spencer Creek Watershed 15 – 20 stations	Benthic invertebrates (BioMAP), temperature, pH, alkalinity, DO	1 time/year	FW – 4 RM – 4
HCA	Spencer Creek Watershed 3 – 20 stations	Fish species and numbers, temperature, pH, alkalinity, DO	1 time/year	FW – 4 RM – 4
Hamilton – Halton Watershed Stewardship Program	Hamilton Harbour Watershed 50 + stations	Tree planting success, survival rates, species composition	Each site 1, 3, 5, 10 year cycle	EPI – 6 RM – 4

Figure 77. Royal Botanical Gardens Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
Royal Botanical Gardens (RBG)	Cootes Paradise Fishway 1 station	Water data <ul style="list-style-type: none"> water level, temp, flow direction, speed, DO Individual captured fish data <ul style="list-style-type: none"> date, species, length, weight, age, selective PIT tagging 	Daily since 1997 from early March to October	iii viii FW – 10 FW – 11 RM – 1
RBG	Cootes Paradise (CP) and Grindstone Creek (GC) 13 stations	Water quality <ul style="list-style-type: none"> Secchi, DO, SP, TP, NO₂, NO₃, NH₄, TKN, pH, TSS, VSS, Chl a, temp, water level 	Biweekly from May to October since 1977	viii WQ – 1a
RBG	CP and G C 33 transects	Fish community characteristics <ul style="list-style-type: none"> kg/transect, native species YOY, carp, carp YOY, %exotics, % piscivore, general health 	3 times/year (spring/summer/fall) annually since 1994	iii FW – 11 RM – 1
RBG	CP and G C 11 transects and a variety of plotless samples	Aquatic macrophytes <ul style="list-style-type: none"> species composition, aerial coverage, photo records, transect densities, GPS georeferenced & mapped 	3 times/year (spring/summer/fall) annually since 1994	xiv FW – 9 RM – 1
RBG	CP and G C	Sediment accumulation	Annual since 1998	WQ – 1a
RBG	CP and G C 10 stations	Wildlife community with emphasis on waterbirds, amphibians, turtles (population dynamics)	Annual since 1994 Waterfowl totals 1998 only	iii RM – 1
RBG	CP and G C, Lower Spencer and Ancaster Creeks 10 sections	Fish spawning	Annual since 1999 (staffing levels permitting)	iii FW – 11 RM – 1
RBG	Chedoke Creek 1 station	Fish community, water quality, sediment accumulation	Annual since 1998	iii viii WQ – 1a FW – 4 RM – 4

Who	Where	What	How Often	Delisting Objectives + RAP Recs
RBG	Grindstone Creek floodplain marshes	Fish + aquatic macrophyte community, limited water quality parameters (eg. DO, temp)	Annual since 1996	iii viii xiv FW – 4 RM – 4
RBG	Long Pond 1 station	Water quality, water level	2 times/week from March to October since 2000	viii FW – 4 RM – 4
RBG	Long Pond	Fish Populations, Aquatic Plants	Annually since 1999	iii
RBG	All RBG Properties	General Surveys <ul style="list-style-type: none"> terrestrial birds (augmented w/ banding and nesting box studies), butterflies/other insects, benthic invertebrates, terrestrial mammals, aquatic mammals (esp. muskrat, beaver), terrestrial plants 	Periodic, ongoing surveys (staffing levels permitting) augmented with incidental sightings since 1977	iii vi xiv
RBG	All RBG Properties	Monitoring and control of Nuisance Species <ul style="list-style-type: none"> Canada geese, mute swan, cormorants, raccoons, deer, squirrels, woodchuck, feral cats, dogs, etc. 	Periodic, ongoing surveys (staffing levels permitting) augmented with incidental sightings since 1981	FW – 5

Figure 78. Industrial Monitoring Plan

Who	Where	What	How Often	Delisting Objectives + RAP Recs
Dofasco	MISA Monitoring 10 sites (4 process effluent, 1 merged effluent, 5 cooling water)	MISA parameters <ul style="list-style-type: none"> flow, total cyanide, ammonia + ammonium, pH, total suspended solids, total lead, total zinc, phenolics, benzene, benzo(a)pyrene, naphthalene, oil and grease, acute lethality testing in rainbow trout and daphnia magna, chronic toxicity testing 	Requirements vary from 3 times/day, daily, weekly, monthly, quarterly and semi annual sampling	viii WQ – 1b TSSR – 3
Dofasco	Additional Monitoring 10 MISA sites 2 non-regulatory sites (Ottawa St Sewer, Baywater Intake)	Intake + Discharges to Hamilton Harbour <ul style="list-style-type: none"> MISA parameters, total organic carbon, dissolved organic carbon, conductivity, iron, chromium, TKN, total phosphorus, chlorides, fluorides 	Varies from 3 times/day – semi annual sampling Most MISA parameters sampled more than regulated requirements	viii xii WQ – 1b TSSR – 3
Stelco – Hilton Works	MISA Monitoring 7 effluent sites representing all the direct water discharges to Hamilton Harbour (3 process effluents, 1 merged effluent, 3 cooling water effluents)	MISA Parameters <ul style="list-style-type: none"> flow, total cyanide, ammonia + ammonium, pH, total suspended solids, total chromium, total lead, total zinc, phenolics, benzene, benzo(a)pyrene, naphthalene, oil and grease, acute lethality testing for rainbow trout and daphnia magna, chronic toxicity testing for fathead minnow growth inhibition and <u>Ceriodaphnia dubia</u> reproductive inhibition 	Requirements vary from 3 times/day, daily, weekly, monthly, quarterly and semi annual sampling	viii WQ – 1b TSSR – 3
Stelco – Hilton Works	Additional Monitoring 7 MISA effluent sites 1 non-regulatory site (Baywater Intake)	Parameters Monitored <ul style="list-style-type: none"> MISA parameters, total iron, total phosphorus 	All additional monitoring performed weekly	viii xii WQ – 1b TSSR – 3

