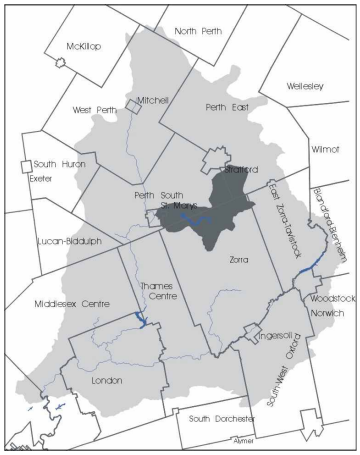
APPENDIX A

UTRCA Sample Report Card

Trout Creek

UPPER THAMES RIVER CONSERVATION AUTHORITY

Trout Creek
2001 Watershed Report Card

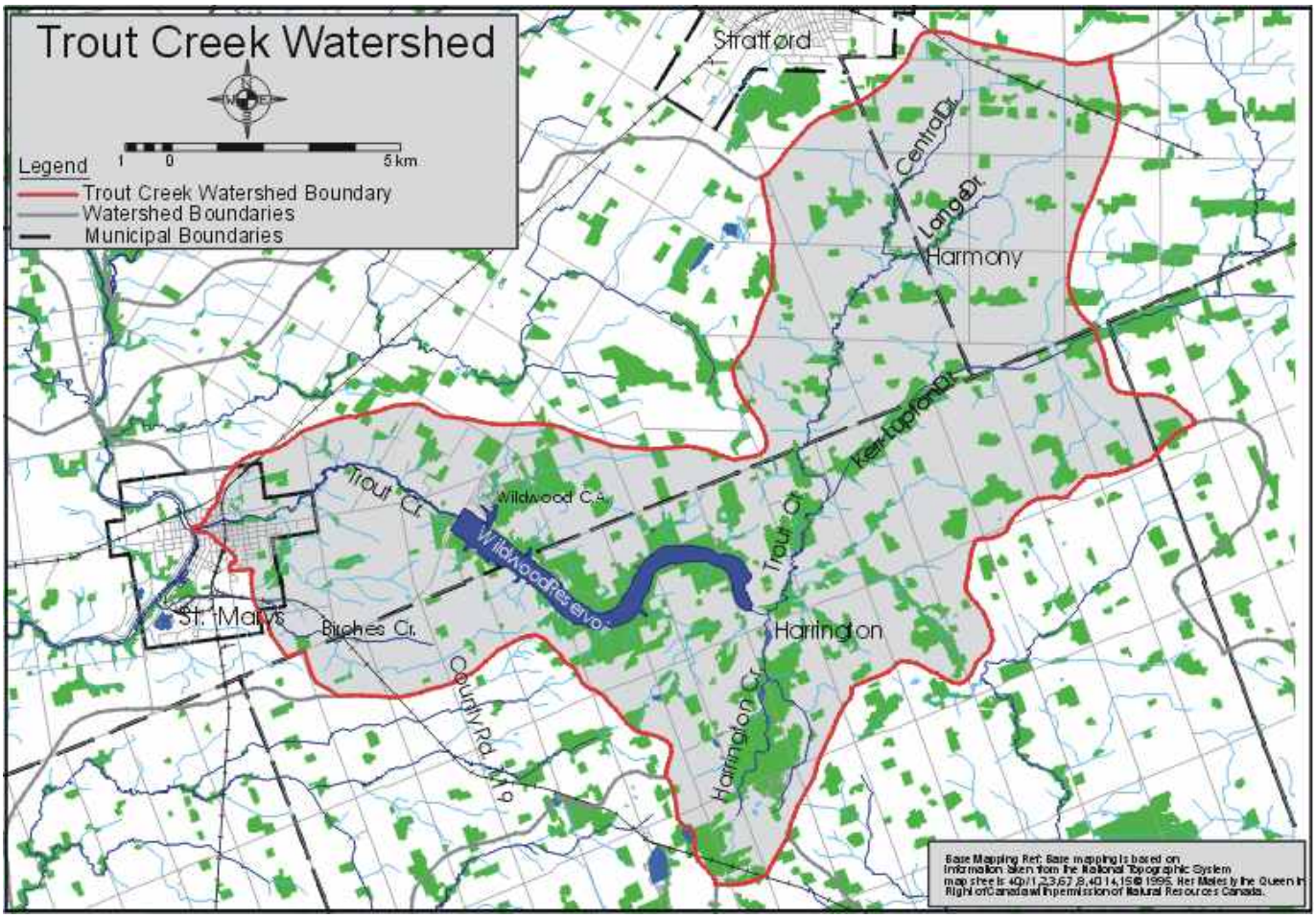


This watershed report card outlines the general state of the forest, surface water and groundwater resources in the Trout Creek watershed as of 2001.

The grades give a quick picture of the health of the natural resources. The tables and text inside provide additional details.

This is one of a series of standardized watershed report cards produced by Ontario conservation authorities every five years to track changes over time.

Grades	
Forest Conditions	**C**
Surface Water Quality	**C**
Groundwater Quality	**N/A**



Grade C

Forest Conditions

Indicators	Trout Creek Results		Upper Thames Watershed Averages		Indicator Description
Forest Cover	16%	C	12%	C	Forest cover is the percentage of the watershed that is forested. It is believed there should be 25-30% natural cover in southern Ontario's landscape to sustain our native plants and animals (Carolinian Canada, 2000).
Forest Interior	3.0%	D	1.8%	D	Forest interior refers to the protected core area found inside a woodlot that some bird species require to nest and breed successfully. The outer 100 m perimeter of a woodlot is considered 'edge' habitat and prone to high predation, sun and wind damage, and alien species invasion. While no ecological ideal has been established, 7-8% forest interior is believed to be a healthy amount.
Average	--	**C**	--	**C**	

Source: 1994 National Topographic Series (NTS) maps with information current as of 1990.

Overall, forest conditions score a C grade and the two indicators score grades of C and D (see table above). The amount of forest cover (16%) is higher than the average for the Upper Thames watershed (12%), but still considered too low for sustainability. The ideal for southern Ontario is 25-30% natural cover.

The amount of forest interior (3%) is also higher than the average for the Upper Thames watershed (1.8%), but still considered much too low. Most of the woodlots are not big enough to support sensitive species that need to live in large protected habitats. Over 80% of the forest cover is 'edge' habitat.

Local Actions Needed for Improvement:

- Protection of all woodlands and Locally Significant Wetlands at the municipal planning level is a very important and effective method of preserving forest health at the local level. This goal can be achieved through designations in Official Plans, enforcement of tree cutting by-laws and other appropriate planning measures.
- Woodlot owners can maintain and improve the health of their woodlots by preparing and following Woodlot Management Plans.
- Forest interior can be increased by "bulking up" small woodlots (making them larger and rounder) by planting native trees and shrubs around existing woodlots or allowing the edges to naturalize on their own (e.g. retire land near woodlot edges).
- Connections can be made between woodlots and other habitat types by planting hedgerows or windbreaks along fields, waterways and roads.
- The large wooded areas around Wildwood Conservation Area and Harrington Creek hold the greatest potential for wildlife habitat and so enhancement and restoration projects should be targeted here. Projects could include conifer plantation thinning to encourage hardwood regeneration (especially at Wildwood CA) and conducting wildlife inventories with landowner cooperation.
- Strategies should be put in place for the other significant woodlands and wetlands in the watershed (with landowner cooperation), to ensure the unique system of natural heritage features in this watershed is preserved.

Grade D

Surface Water Quality

Indicators	Trout Creek Results		Upper Thames Watershed Average		Indicator Description
Benthic Score (FBI)	6.81	D	5.66	B	Benthic organisms are the aquatic invertebrates that live in stream sediments and are a good indicator of water quality and stream health. The Family Biotic Index (FBI) scores each species according to its pollution tolerance.
Phosphorus (mg/l)	0.06	B	0.08	B	Provincial Objective = 0.03. Phosphorus is found in such products as soaps, detergents, fertilizers and pesticides, and contributes to excess algae and low oxygen in streams and lakes.
Bacteria (# E. coli per 100 ml)	256	C	304	C	Recreational Swimming Guideline = 100. *E. coli* bacteria are found in human and animal waste and their presence in water indicates fecal contamination. *E. coli* bacteria are a strong indicator for the potential to have other disease-causing organisms in the water.
Average	**---**	**C**	**---**	**B**	

Source: *Benthic scores represent a two year average of data collected from 1998-1999. Phosphorus and bacteria data represent a 10 year average of data collected from 1990-1999.*

Water quality in the Trout Creek watershed ranks a D with the three indicators ranging from B to D (see table above). Poor benthic scores are largely influenced by the effects of dams (Wildwood and St. Marys) in the lower portion of the watershed. These dams modify water flow and water temperature creating negative impacts on aquatic life.

Upstream of Wildwood Reservoir, stream conditions are variable with some healthy coldwater streams (e.g. Harrington Creek, Young's Drain, and a mid-section of Trout Creek) along with poorer channelized watercourses. In the summer, several of these streams contribute significantly to baseflow in Trout Creek which provides approximately 75% of the summer baseflow in the North Thames River below St. Marys.

Fecal coliform bacteria levels in are fairly low but show an increasing trend from the 1970's to present day indicating contamination from human/animal waste. Current information on fish habitat and populations, and stream characteristics (cold versus warm water, permanent versus intermittent flow) is lacking for the north part of this watershed in Perth County.

Local Actions Needed For Improvement:

- Continue to monitor conditions and develop solutions to the impacts of Wildwood Dam on downstream water quality. Implement practices to improve oxygen levels downstream of the dam to protect fish populations.
- Conduct further study on fish habitat and stream characteristics in the north part of this watershed.
- Plant buffers (grasses or trees) along creeks, rivers and open drains to filter runoff and provide shade. Target rehabilitation of the coldwater streams.
- Implement protection of identified groundwater infiltration zones and continue with groundwater research and monitoring (*Oxford County Groundwater Study*, 2000; *Perth County Groundwater Study*, 2001).
- Encourage the decommissioning of abandoned wells according to Ministry of the Environment standards.
- Target soil erosion measures to areas of high erodibility, (16% of the land within this watershed is classified as highly erodible compared to Upper Thames River watershed average of 9%).
- Assess the purpose of the 12 dams to determine if any should be removed or modified to improve river health.
- Encourage environmentally sustainable practices on golf courses (e.g. Audubon Cooperative Sanctuary Program).
- Encourage drain maintenance and design procedures that protect water quality (e.g. careful timing of work, proper use of silt traps, maintaining existing vegetation where possible, use of natural channel design).

... continued

- The following actions should be targeted within St. Marys:
  - upgrade sewer systems where risk of contamination is greatest (e.g. combined sanitary/storm sewers), extend sanitary sewers to urban properties on septic systems, and repair or replace faulty existing septic systems;
  - develop a strategy for retrofitting existing stormwater facilities on Birches Creek; implement stormwater management plans for all new urban developments; implement projects to reduce stormwater runoff (e.g. through infiltration ponds, pavement alternatives, etc);
  - encourage river clean-up/stream stewardship projects to improve stream habitat; and educate urban residents regarding urban Best Management Practices such as reduction and proper use of pesticides and fertilizers, proper household hazardous waste disposal.

- The following actions should be targeted within rural areas:
  - encourage landowners to repair or replace faulty septic systems;
  - encourage agricultural Best Management Practices in the areas of manure storage and spreading, soil conservation practices, fertilizer and pesticide storage and application, fuel storage, milkhouse washwater disposal, and cattle access restriction; and
  - promote the completion of Environmental Farm Plans and Nutrient Management Plans.

Grade N/A

Groundwater Quality

	Shallow Depth Aquifer		Intermediate Depth Aquifer		Deep or Bedrock Aquifer		Indicator Description
Bacteria (# E. coli per 100 ml)							The presence of E. coli indicates contamination from human or animal fecal waste. Some strains of E. coli are toxic to humans.
Nitrate-N + Nitrite-N (mg/L)							The presence of nitrates indicates contamination from fertilizers, manure and/or pesticides. High levels may lead to Blue Baby Syndrome.
Chloride, Sodium (mg/L)							The presence of chloride may indicate contamination from road salt.
Average							

Source: Not currently available. In the future, bacteria data will be synthesized from MOH data on private wells. Nitrates and chloride data taken from the Provincial Groundwater Monitoring Network; the table would include well number and location.

Watershed Projects (1995-2001)

- *Plantation Thinning at Wildwood CA* -- 10 of 30 ha completed. Every 3rd row of pines is removed to encourage the native hardwoods to move in.
- *Tree Planting* – The UTRCA helps farmers and rural landowners plant approximately 1500 trees per year in this watershed through the UTRC's Private Landowner Tree Planting Program. Trees are planted as windbreaks or in blocks.
- *Experimental Tree Plots* – The UTRCA planted 1 ha of plugs and bare root stock to test survival at the Wildwood CA.
- *Naturalization of Harrington Mill Site* – UTRCA planted wildflowers and trees.
- *Clean Water Projects* – 5 projects completed by farmers in this subwatershed in 2001
- *Perth County Groundwater Study* – commenced in 2000.
- *Provincial Groundwater Monitoring Network* – well installed just west of Wildwood Lake.
- *Well Improvement Projects* – 4 wells capped/improved through the MOE's Program.

Tree Planting

Buffer Strip

Watershed Features

Municipalities	Zorra (77 sq. km), Perth South (53 sq. km), Perth East (26 sq. km), Town of St. Marys (4 sq. km), East Zorra-Tavistock (<1 sq. km)
Watercourses	Trout Creek (tributary of North Thames River), Harrington Creek, Kerr Lupton Drain, Young's Drain, Raper Drain, Central Drain, Lange Drain, Birches Drain/Creek
Area	153 sq. km (4.4% of Upper Thames River watershed)
Land Use	78% agriculture, 17% wooded, 3% urban, 2% water (GIS derived using OMAFRA Landuse Systems, 1983)
Soil Type	43% silt loam, 33% clay loam, 10% sandy loam, 7% bottom land, 4% organic, 3% loam, 2% not mapped (urban) (GIS derived using county soil maps)
Soil Erosion/Delivery	16% of the watershed is classified as highly erodible, meaning lands that contribute over 7 tonnes/ha of soil to a watercourse per year. The average for the Upper Thames River watershed is 9%. (GIS derved using 1991 Geomatics data)
Physiography	54% undrumlinized till plain, 16% spillway, 14% drumlinized till plain, 7% till moraine, 6% eskers, 1% clay plain, 1% water (Chapman and Putnam, 1984)
Stream Flow	1.9 cubic metres/second is the mean annual flow upstream of St. Marys. Trout Creek contributes approximately 5% of the flow in the Thames downstream of London. Trout Creek also contributes approximately 75% of summer flow in the North Thames below St. Marys. (Environment Canada, 1998)
Groundwater	Shallow overburden aquifers (<18 m) are concentrated along the upper branches of Trout Creek. The remaining area is supplied primarily by the deeper bedrock aquifer. (MOE 1981)
Fishery Resources	A total of 33 fish species has been recorded. Wildwood Reservoir provides sportfishing opportunities for bass, pike and panfish. As well, there are several coldwater tributaries, four of which support Brook Trout populations.
Dams	12 dams are documented in this watershed including the Harrington Conservation Area Dam and the Wildwood Conservation Area Dam. The other dams are privately owned. The St. Marys Weir backs water up in the downstream section of Trout Creek. (UTRCA, 1991)
Sewage Treatment	There are no sewage treatment plants discharging to Trout Creek. Most St. Marys homes in this watershed are serviced by the St. Marys Sewage Treatment Plant. Rural residences in the watershed are serviced by private septic systems.
Woodlot Size	45% of the woodlots are very small (<4 ha), 18% are small (4-10 ha), 16% are mid-sized (10-30 ha), 5% are large (30-40 ha) and 16% are very large (>40 ha). (GIS derived using 1997 NTS maps)
Riparian Forest	34% of the riparian zone (20 metres on either side of all watercourses) is forested. The average for the Upper Thames watershed is 24%. (GIS derived using 1997 NTS maps)
Rare Species	Fish – Northern Brook Lamprey, Silver Shiner (ROM/UTRCA and NHIC, 2000)
Wetlands	*Provincially Significant* – Brooksdale Forest, Trout Creek Swamp, Wildwood Lake Wetland, Wetland ZO34Bd, Wetland ZO34cbc, Wetland ZO34cfg *Locally Significant* – none
Significant Natural Areas	Fairview Woods, Happy Hills, Harmony Woods, Lost Concession,Shagbark Hickory Woods, Trout Creek Floodplain, Trout Creek Valley (MOE, 1981)
ANSIs	*Earth Science ANSIs* — Harmony Cut, St. Marys Cement Company South Quarry, Wildwood Silts (MNR and UTRCA 1996, County ESA reports)

References: For a complete listing of references, see the full report: *The Upper Thames River Watershed Report Card* (UTRCA, 2001).

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The Thames, A Canadian Heritage River

APPENDIX B

RVCA Sample Report Card

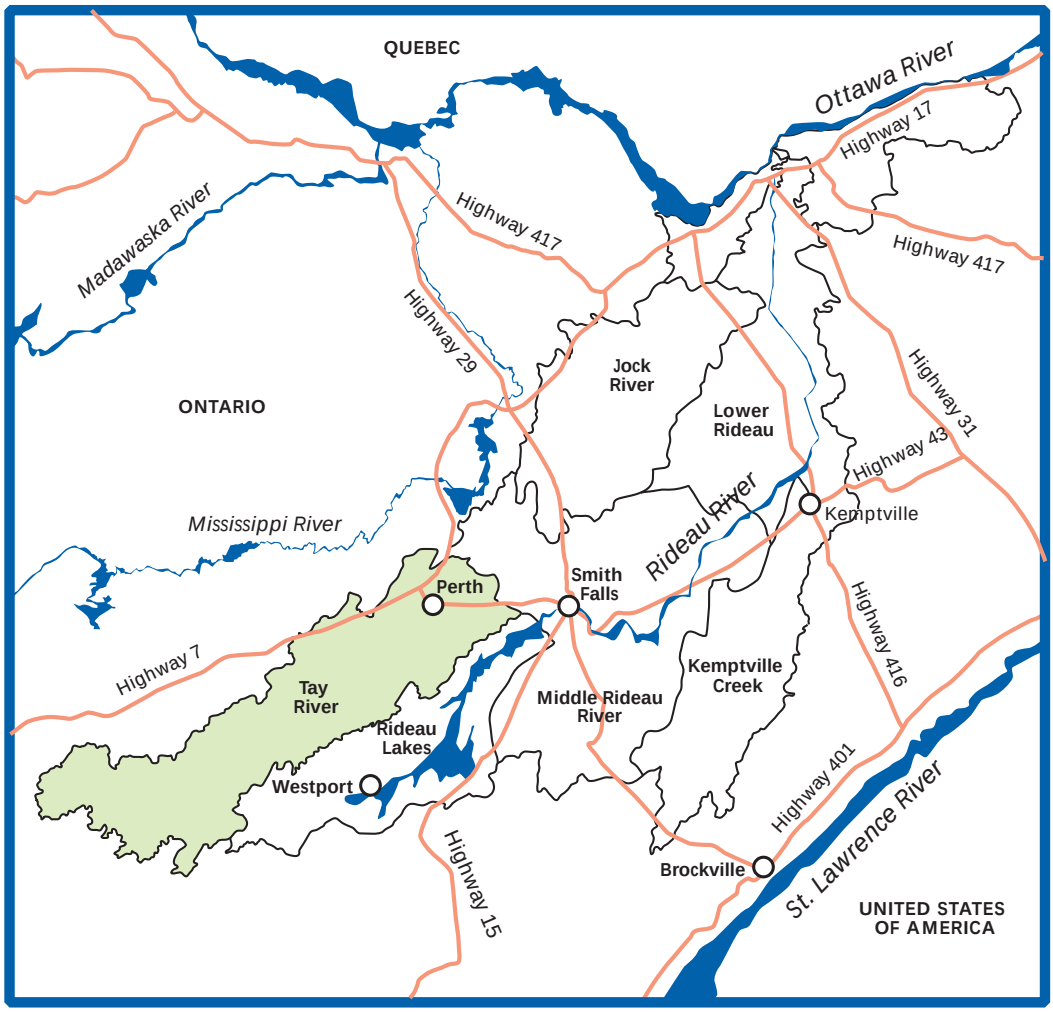
Tay River

Tay River

2002 Watershed Report Card

This Watershed Report Card outlines the state of the forest, surface water and groundwater resources in the Tay River subwatershed as of 2002. Watershed report cards for other basins within the Rideau River watershed will soon be available.This is one of a series of standardized watershed report cards produced by conservation authorities across Ontario allowing comparisons with other regions. Report Cards will be produced every five years to track changes over time

Grades	
Forest Conditions	A
Surface Water Quality	A
Groundwater Quality	A



RIDEAU VALLEY CONSERVATION AUTHORITY

Forest Conditions

Grade: A

Indicators	Tay River Subwatershed		Rideau River Watershed Average		Indicator Description
Forest Cover	53%	A	43%	A	Forest cover is the percentage of the watershed that is forested. It is believed there should be at least 25-30% natural cover to sustain native plants and animals.
Forest Interior	15%	A	16%	A	Forest interior refers to the protected area inside a woodlot that some species require to survive. The outer 100 metre petrimeter is 'edge' habitat and prone to stresses from predators, alien species and the elements.
Average Grade		A	A		

Source: Tay River data derived from Ontario Basic Mapping Series maps published in 1991.

Overall, forest conditions in the Tay River watershed score a grade of A. With over 53% of the valley forested, the Tay River watershed is well above what is considered necessary (25 - 30% (Carolinian Canada, 2000)) to sustain healthy populations of plants and animals. Forest interior is very good, indicating that the forested areas are of sufficient size to support sensitive species that need to live in large protected habitats. The downside is that the forest is located mainly in the upper two thirds of the watershed. In the lower part of the watershed, most of the wooded area is field or riparian edge with some woodland but few large enough to provide very much high quality habitat although some good linkages exist. No attempt has been made to date to specifically quantify the change over time of forest cover in the watershed. However, land use has been relatively stable with some development occurring but probably a similar amount of land being actively, through planting, and passively, through abandonment, returned to forest.

Actions Needed for Improvement

- **Identify species and communities in terrestrial environments to determine composition, signifiicance and potential;**
- **Protect all woodlands at the municipal planning level;**
- **Enhance, where appropriate, by reforesting marginal lands, 'bulking-up' woodlots to make them larger and rounder and planting hedgerows or windbreaks along fields, roads and waterways to increase the linkages**

Surface Water Quality

Grade: A

Indicators	Tay River Subwatershed		Rideau River Watershed Average		Indicator Description
Benthic (Family Biotic Index)	4.285	A	4.566	A	Benthic organisms are the aquatic invertebrates that live in stream sediments and are a good indicator of water quality and stream health. The Family Biotic Index scores each species according to its pollution tolerance.
Phos-phorus (mg/L)	0.024	A	0.038	B	Phosphorus is found in such products as soaps, detergents, fertilizers and pesticides and contributes to excess algae and low oxygen in streams and lakes.
Bacteria (# E. coli/ 100 ml)	18.2	B	12.2	B	E. coli bacteria are found in human and animal waste (manure) and their presence in water indicates fecal contamination. E. coli bacteria are a strong indicator for the potential to have other disease-causing organisms in the water.
Average Grade		A-	B+		

Source: Tay River and Rideau River watershed data: Benthic scores represent a four year average of data collected from 1999-2002 bythe RVCA. Phosphorus and bacteria data represent a five year average of data collected from 1998-2002 by the conservation authority through the PWQMN and authority baseline program.

The Tay River watershed gets an A- with respect to overall water quality. The benthic score indicates Tay waters are of good quality with some organic pollution supporting a population of both pollution intolerant and tolerant species. Of the sites sampled on the Tay River, most have a very good to excellent Family Biotic Index rating. The two poorer scoring sites are located downstream of the Bolingbroke Dam and the Pike Lake Dam. These dams modify water flow, which influence water temperature and oxygen levels, thus potentially causing negative impacts on the aquatic life downstream of these structures.

The concentrations of bacteria and total phosphorus are generally very low. The Provincial Water Quality Objective for bacteria for recreational use of water is 100 counts per 100 millimitre sample. This was met or exceeded in only 10% of the sample set. Two extreme counts of 1,000 and 11,000, did occur on the same day in two minor streams but were likely as a result of lack of dilution and warming of the relatively small volume of water during low flows in August.

Also of note are the relatively high total Kjeldahl nitrogen concentrations throughout the Tay watershed. 38% of sample concentrations were above the guideline threshold of 0.5 mg/L and the remainder were only slightly below. This indicates that a high background concentration of nitrogen exists in the watershed. Although there appear to be no significant impacts, care has to be taken to limit inputs to avoid disturbing the balance.

Actions Needed for Improvement

- **Consider investigative surface and groundwater monitoring to determine sources and types of impairment (e.g. septic systems, sewage treatment plant, agricultural lands, stormwater outfalls)**
- **Undertake septic system surveys to determine contribution to condition of surface and ground waters;**
- **Continue, and expand where possible, baseline water quality monitoring program;**
- **Continue macroinvertebrate monitoring of watershed streams to complement baseline chemistry program.**

Groundwater Quality

Grade: A

Parameters	Shallow Bedrock Aquifer		Intermediate Bedrock Aquifer		Indicator
Bacteria	4	B	4	B	The presence of E. coli indicates contamination from human or animal fecal waste. Some strains of E. coli are toxic to humans.
N as Nitrate + Nitrite (mg/L)	5	A	5	A	The presence of nitrates indicates contamination from fertilizers, manure, and pesticides. High levels may lead to Blue Baby Syndrome.
Chloride or Sodium (mg/L)	5	A	5	A	The presence of chloride may indicate contamination from road salt.
Average	A		A		

Source: Data are taken from planning applications circa 1989 that may not be representative of the current conditions.

Based on the MOE data, there are 5 levels of aquifers. Groundwater can be encountered at different levels and is usually dependent on quantity of water found at a particular depth at the time of drilling. Due to this variability generalization is difficult and results from only the top levels of aquifers are presented in the table above.

As the table shows, there were no major concerns regarding the groundwater quality at the time of the studies and in the limited study area. Some bacterial contamination was found but it was not an aquifer wide issue as the analysis from other stations did not show any bacterial presence. Given the limited available information, it is not possible to indicate a trend.

Regional groundwater studies, one of which has been recently completed and another of which is presently in process, along with data from the Ministry of Environment Provincial Groundwater Monitoring Network will provide more detailed information about the whole watershed for future reports

Actions Needed for Improvement

- **Analysis from the deeper aquifer should also be conducted;**
- **Educate people on protecting the well water quality;**
- **Adopt a routine baseline groundwater monitoring program to be able to better characterize the groundwater regime;**

Additional Information on Tay River Watershed

Subwatershed	- area: 805 sq. km (20% of the Rideau River watershed) - flow length: 101 km - average slope: 0.0027 metres/metre
Land use	- 53% forested, 21% agriculture, 10% rivers/lakes, 11% wetland, 6% wooded, 5% urban, 1% successional.
Physiography	- about 66% of Tay watershed is rough topography with precambrian rock overlain generally with thin moraine till material but with numerous areas of exposed rock ; remaining 33% is clay and limestone plain overlain generally with thin layers of till material but with deeper soil areas such as that of the clay plain area between Perth and Christie Lake which is where the majority of agricultural activity occurs in the watershed.
Surface Water	- area of lakes: 8375 hectares (45 lakes - Bobs Lake, 3147 ha, is a reservoir for Rideau Canal) - number functioning control structures in system: 9 - data is insufficient to estimate a mean annual flow with stations having been discontinued or relocated and operated seasonally.
Fishery Resources	- 44 species of fish recorded in the subwatershed
Sewage Treatment	- Town of Perth STP discharges to Tay River about 5 km above confluence with Big Rideau Lake
Significant species	- provincially: black tern, black crowned night heron, least bittern, stiff gentian - regionally: American widgeon, lesser scaup, ring-necked duck, green winged teal, pickerel frog, sedge, skunk cabbage, dewdrops, northern downy violet,, small beggars ticks, black bear
ANSIs	- Blueberry Marsh, Tay Marsh, Maberly Bog, Christie Lake wetland
Stressors	- urban expansion around Town of Perth; - increased development of lake and river shoreline properties and conversion of seasonal recreational properties to permanent residential use; - industrial development; - increased transportation demands (water and roadways in all seasons); - erratic climatic conditions causing varied surface flow and groundwater recharge

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APPENDIX C

A CASE STUDY SUMMARY

OF STATE OF

THE WATERSHED REPORTING

A Case Study Summary of State of the Watershed Reporting

The following document was prepared as background information for a series of workshops as part of the Watershed Reporting Pilot Project. Report Author: Karen Maaskant, Upper Thames River Conservation Authority, London, Ontario, April 2002

Public demand for understandable, integrated environmental information is growing. Past practices of reporting either complex chemical concentrations or much more simplified 'motherhood' statements are no longer seen as adequate. The public more clearly understands the direct relationship between environmental health and human health and is demanding integrated environmental information that clearly describes local risks.

Watershed based reporting of environmental information through the use of indicators has evolved as an effective way of satisfying this public demand for understandable environmental information. Several examples of this style of reporting exist across North America. In particular, Ontario's Conservation Authorities have led the move to watershed reporting and they are now attempting to develop minimum reporting standards that would provide consistency and allow comparison of environmental quality across watersheds.

This report includes two sections. The first addresses the need for environmental information by presenting an overview of recent environmental issues as context for the discussion. The second presents a range of watershed reporting case studies from across Canada and the United States with special emphasis on Ontario's Conservation Authorities. For the purpose of discussion, 'Watershed Reporting' has been divided into several distinct components to allow comparisons among the case studies.

The Need for Environmental Information

Many recent events and initiatives in Ontario have pointed to the need for high quality, understandable environmental information.

Walkerton's tainted water tragedy during the summer of 2000 brought to light the value and vulnerability of our water resources. The resulting public inquiry has highlighted the importance of communicating reliable environmental information to key water management decision-makers and the public. The tragedy also generated incredible public awareness regarding groundwater quality, water treatment and risks to human health. Most people in Ontario are now far more knowledgeable about water quality and are requesting information from water management agencies to allow them to better understand the water cycle and to better assess their own health risks. In many cases, water management agencies have had to scramble to meet the public demand for information.

Drought conditions in Ontario during 1998-1999 and 2001 also highlighted the need for better environmental information. The complete absence of any provincial groundwater monitoring network and the existing inadequate surface water monitoring system resulted in harsh public criticism of the state of water management in Ontario. Consideration of bulk water exports from the Great Lakes and the perception of an expanding bottled water industry during the drought served to further fuel the public's interest in meaningful water quantity information. The province has had to respond by designing a new Provincial Groundwater Monitoring Network and by modifying the existing surface water monitoring system to better understand low water conditions. Data storage, access and analysis systems are also being modified to ensure there is meaningful water quantity information for water managers and the public.

The debate surrounding intensification of the livestock industry in Ontario has generated further public demand for environmental information. Concerns for surface water and groundwater quality as well as impacts on local private wells have led to continuous requests from affected neighbours, municipalities and proponents regarding pre-existing ambient conditions and predictions. Again, the public is demanding integrated, understandable environmental information so that they can better understand their own health risks.

A development moratorium for the Oak Ridges Moraine region north of Toronto during 2001 was prompted in part by a lack of specific information about and understanding of the role the moraine plays in supporting surface water and groundwater quantity and quality. Public pressure for clear environmental information was partly responsible for the moratorium. Water management agencies, including Conservation Authorities, worked to assemble, integrate and communicate information regarding the importance of the moraine to water resources. A unique and specific land use plan was strongly endorsed by the public to protect the features of the moraine. Again, understandable environmental information was a prerequisite for a meaningful and supported outcome to be developed.

Recent government initiatives have also recognized the importance of the reporting of environmental information. The Water Resources Information Project (WRIP) was initiated in January 2000 to make improvements to the state of water information in Ontario. Provincial ministries with water management responsibilities and Conservation Ontario are participating in the project. The WRIP, which identifies the need for a Provincial Water Strategy, includes recommendations specific to watershed monitoring and reporting by conservation authorities. These recommendations include:

- convert data to information for clients
- develop consistent and seamless state-of-the-watershed reporting for clients - be capable of providing a regional picture
  (Conservation Ontario Report, March 2001)

The project has also facilitated improvements to key data sets including private well logs and the Ministry of the Environment's Permit to Take Water Database. Improving the consistency of and access to data is seen as a necessary step toward improved reporting. This project is on-going.

The recently released report, *Managing the Environment: A Review of Best Practices* (Executive Resource Group, 2001), is a comprehensive review of environmental management practices in many jurisdictions. The intent of the report is to describe 'best environmental practices' as a guide to improved environmental management in Ontario. A number of recommendations for monitoring and reporting are offered, including the following:

- commit to a renewed monitoring program and the development of indicators and bio-monitoring approaches
- commit to the early integration of existing environmental databases and as a first step bring data and information together on a watershed basis
- make information available in a format that is easy to understand and use by the specialized and general public

The Draft 2001 Canada-Ontario Agreement (COA) also addresses the need for accurate information made available to governments, organizations, and basin residents in the Great Lakes Basin ecosystem. The following two goals are identified for the next five years: 1. Coordinated and efficient federal/provincial scientific monitoring, and 2. An information management system for tracking environmental change and progress (Canada-Ontario Agreement, 2002).

Collectively, these recent events and government responses point to the importance of reporting environmental information to decision-makers and the public. The following case studies demonstrate current efforts to implement this reporting on a watershed basis.

State of the Watershed Reporting

The following section will present a number of case studies for watershed based reporting from the United States and Canada. This review will pay particular attention to the work of Ontario's Conservation Authorities.

United States

The United States Environmental Protection Agency (U.S. EPA) has developed an extensive web-based system called "Surf Your Watershed." This system allows access to information on each of 2111 watersheds in 48 states. The information is reported as a popular summary for each watershed and is accessible through the EPA web site (www.epa.gov/surf). A key part of this information is the Index of Watershed Indicators (IWI) developed by U.S. EPA and its partners and first released in 1997. Fifteen indicators are used to assess water resource health by way of a numerical score and descriptive ranking (e.g. better water quality *versus* serious water quality problems)

The 15 indicators include condition indicators that show existing water quality, and vulnerability indicators that indicate pollution and other pressures that may cause future problems.

Condition indicators:

- waters meeting State/Tribal uses established for EPA
- fish and wildlife consumption advisories
- source water quality indicators - drinking water systems

- contaminated sediments
- ambient water quality data - four toxic pollutants
- ambient water quality data - four conventional pollutants
- wetland loss index

Vulnerability indicators:

- aquatic wetland species at risk
- pollutant loads discharged above permitted discharge limits - toxic pollutants
- pollutant loads discharged above permitted discharge limits - conventional pollutants
- urban runoff potential
- index of agricultural runoff potential
- population change
- hydrologic modification - dams
- estuarine pollution susceptibility index

Currently this system focuses on indicators of water resources. Work is being done to address overall watershed health by adding indicators such as biological integrity, terrestrial condition, groundwater and air quality.

Through programs such as "Surf Your Watershed" many watersheds in the U.S. have information on watershed indicators being collected and made available to decision-makers and the general public. Two specific examples are the Saginaw River and the Tennessee Valley.

The Tennessee Valley Authority (TVA) has identified three fundamental criteria in developing indicators for watershed reporting: 1) ensure accurate monitoring of watershed conditions, 2) report the things that are meaningful to the public, 3) effectively communicate progress and the need for improvement. The TVA has developed a series of 'report cards' in the form of watershed brochures to report on the ecological health of lakes and watersheds. The information is presented with a river-user's perspective as a focus. The five indicators used are chlorophyll, oxygen, fish, bottom life, and sediment. Ratings for ecological health indicators are presented in the form of colour-coded maps of each watershed (TVA, 2000).

The Saginaw River and Bay were designated as one of 42 Areas of Concern (AOC) in the Great Lakes by the International Joint Commission's Water Quality Board in 1978. The series of indicators recently developed for this region are specific measures that reflect the goal of "delisting" the Saginaw River/Bay as an AOC. Partners in the watershed developed indicators in five categories that were previously cited as impaired: bacteria, sediment contamination, fisheries, wildlife, and bay ecosystem. There are 18 indicators (targeted restored conditions) in total. Examples include:

- No more than three swimming beach closures per year lasting no more than two days each on Saginaw Bay.
- The level of contaminants in Saginaw River/Bay sediments no longer imposes additional costs due to requirements for the removal, confinement, and remediation of dredge spoils.
- Samples of mayfly nymphs collected in open waters of Saginaw Bay exceed 30/m^2 for two consecutive years, based upon established sampling methods.
  (Saginaw County Planning Department, 2000)

Canada

Canada and the United States, the two Parties to the Great Lakes Water Quality Agreement, issue a State of the Great Lakes report biennially. These reports have been developed through scientific information gathered through a biennial State of the Lakes Ecosystem Conference (SOLEC). The focus of these conferences has been the development of 80 Great Lakes ecosystem health indicators that should allow Canada and the United States to report on progress in a comparable and standard format (State of the Great Lakes, 2001). Currently 33 of the 80 indicators are used for reporting based on data availability. Individual indicator reports are prepared by subject experts at a frequency suitable for each indicator. The information is outlined in a popular summary accessible through the Great Lakes indicators web site (www.epa.gov/glindicators).

In 1994, Environment Canada established the Ecological Monitoring and Assessment Network (EMAN), which links groups involved in ecological monitoring in Canada in order to better detect, describe, and report ecosystem changes (Vaughan et al., 2001). EMAN has focused on developing a standardized set of ecosystem indicators that will address many current environmental issues such as endocrine disrupters, habitat fragmentation, and groundwater contamination (Environment Canada, 2000a). Twenty-two indicators were selected from a total of

1770 monitoring variables. The indicators selected (Core Monitoring Variables) include: water quality (dissolved oxygen and water clarity), stream flow, lake level, air quality/lichen indicators, soil temperature, snow/ice phenology, lake sediment, species richness (amphibians, mammals), species diversity (birds, plants, frogs, salamanders, aquatic invertebrates/benthos), community biomass/benthos, fish index of biotic integrity, land cover change, plant phenology, community productivity (phytoplankton, plants), soil health (earthworm species), tree health (crown and bole condition).

EMAN is working to standardize monitoring protocol to allow for comparisons at various scales. For example, developing a standard protocol for aquatic invertebrate monitoring was addressed at a workshop (spring 2001) attended by conservation authorities, Ontario Ministry of Natural Resources (MNR), Ontario Ministry of the Environment (MOE), and others. The development of standardized monitoring programs and indicators is a key step toward standardized reporting.

Province-wide Reporting

Most of the provinces are involved to some degree in state of the environment reporting on a province-wide scale. As an example, the Province of British Columbia (BC) has a very comprehensive approach to reporting. Every two years, information on 15 key indicators is updated showing trends and targets in a full report and popular summary (BC Ministry of Environment, 2000). In addition, the BC State of the Environment Reporting Office is developing regional reports based on watersheds. One example is the Georgia Basin Environmental Indicators report, which provides an excellent popular summary of the seven indicators for the watershed: groundwater, surface water quality, domestic waste, protected areas, species at risk, air quality/inhalable particulates (wlapwww.gov.bc.ca/soerpt/gbindicators/index.html).

Municipalities

An increasing number of municipalities are using environmental reporting as an important component of their environmental management systems. The following are two examples. The City of Calgary's *State of the Environment Report (1998)* focuses on indicators that measure the impacts and contributions of the Corporation of The City of Calgary. The report summarizes local environmental trends for selected indicators in the categories of air, water, land and waste management. The information summarized in the 75-page report is targetted primarily to City Council and Administration for future policy development, and local citizens to a lesser degree. The report is to be updated every three years.

In 1994, the municipality of Hamilton-Wentworth began a very comprehensive approach to indicator development involving McMaster University, the International Council for Local Environmental Initiatives (ICLEI), and a large degree of community input. Thirty-two indicators in 14 categories (e.g. water resources, health and well-being, agriculture) were chosen based on relevance to the public in fulfilling targets of the municipality's Vision 2020 (City of Hamilton, 2001). Like many municipal SOE approaches, the indicators cover economic, social/health, and environmental factors. A report card format uses happy (or sad) faces to interpret the direction of an indicator in relation to the target (Sustainability Indicators, 1998). A full report includes more detailed information including specific actions for citizens, business, and government to bring indicators towards target levels.

There are a number of programs on both a national and international scale that help communities in developing indicators. Redefining Progress (www.rprogress.org) documents community indicator programs, mainly at the municipal level, in Ontario, nationally and internationally. In Canada, the International Institute for Sustainable Development (www.iisd.ca) is an information source for sustainable community indicators.

Other municipal organizations are also involved with environmental reporting. For example, the Middlesex-London Health Unit addresses environmental issues related to health through its State of the Environment Reports. Each of their reports focuses on one issue and provide an in-depth review of the topic. Examples of issues reported include polychlorinated biphenyls (PCBs), air quality, and drinking water (Middlesex-London Health Unit, 2000).

Conservation Authorities

Many individual conservation authorities (CAs) are in the early stages of producing state of the watershed reports using indicators. A wide range of information and reporting methods is being used. The following section presents a sample of CA state of the watershed reports.

Ausable-Bayfield Conservation Authority

In 1995, the Ausable-Bayfield Conservation Authority (ABCA) completed a state of the watershed reporting project that provided information for their Watershed Management Strategy (ABCA, 1995). The information focuses on ecological features and stresses. Ecological parameters include: soils, agricultural capability, early vegetation communities, current forests, land use, aquatic habitat, protected areas, physiography, and topography. Stress indicators include: water related stresses (bacteria, phosphorus, sediment, drainage, recharge/discharge areas), soil related stresses (water erosion, wind erosion, soil compaction) and natural area stresses (loss of function related to interior forest, linkages, riparian cover, wooded areas). Indicators within each area were weighted and combined to give a rating (high, moderate, or low) for relative significance in the context of the ABCA area. Information is summarized for 36 subwatersheds. A *Watershed Management Strategy* report was developed that includes a two-page summary of each subwatershed (ABCA, 1995). The ABCA is currently developing a monitoring program and watershed report card format that will work as a system of updating and furthering the watershed management strategy.

Conservation Halton

Conservation Halton has undertaken state of the watershed reporting to monitor the progress made in addressing the actions of their strategic plan. Resource categories for reporting include: provide a natural legacy, manage natural resources, improve water quality and regulate stream flows, provide parks for education and recreation, and provide financial stability. The following eight indicators are evaluated: water quality, forest health, creek flows, development, wetland habitat, natural corridors, wildlife, support and enjoyment. A letter grade (A+ to C-) is used to assess actions taken by the CA, and a directional arrow shows the watershed health trend related to each action. The scale for reporting is the entire Halton region watershed. A four-page 'Watershed Report Card' will be updated every three to five years in conjunction with a review of their strategic plan (Conservation Halton, 2001).

Credit Valley Conservation

Credit Valley Conservation (CVC) is developing state of the watershed reporting to assess the environmental health of watersheds using indicators. The resource categories for reporting include water (currently) and terrestrial (starting in 2002). The indicators currently include hydrogeology, fluvial geomorphology, water chemistry, benthic macroinvertebrates, and fisheries. Parameters within each indicator are assessed to give an overall ranking for the indicator (eg. excellent, good, fair, or poor) for each of 20 subwatersheds. The CVC is producing a "State of the Credit" report due in spring 2002. The status of the indicators is outlined in *Credit Valley Conservation Integrated Watershed Monitoring Program 2000 Summary Report (*CVC, June 2001).

Essex Region Conservation Authority

The Essex Region Conservation Authority (ERCA) has recently completed a watershed health report focussing on the water quality of 20 subwatersheds. The indicators used include: chemical, biological (benthic invertebrates, *E.coli*), and physical (bank erosion, riparian vegetation). Parameters for each indicator are assessed to give an overall rating for water quality (good, fair, poor, very poor) and represented as colour-coded fish on watershed map. A brochure titled *Water Quality Report Card for the Essex Region, 2002* is targeted to the general public (ERCA, 2002). ERCA is planning a biannual publication that may expand beyond water quality information.

Maitland Valley Conservation Authority

The Maitland Valley Conservation Authority (MVCA) was one of the first CAs to develop a state of the watershed reporting system using indicators. The indicators include land use, recharge, terrestrial, sensitive land, channel network, and aquatic indices. Each index (indicator) is determined from a series of parameters that are given a ranking and ordinal and combined to give a score for each index and the entire sub-basin. A full report was completed in 1994 as well as a three-page technical summary for each sub-basin (MVCA, 1994). There are no immediate plans for an update. Recently the Maitland Watershed Partnership Strategy was developed to prioritize watershed management actions.

Nottawasaga Valley Conservation Authority

The Nottawasaga Valley Conservation Authority (NVCA) is developing a watershed health monitoring and reporting system that provides capacity for adaptive management. Indicators focus on the category of stream health and include biological assessment, water chemistry sampling, and temperature surveys. Data for indicators are compared with known reference sites and integrated to give a stream health status (below potential, unimpaired, impaired, unclassified). The stream health status for stream reaches is colour-coded on a map of the watershed.

An annual Watershed Health Report (eight page summary report) is produced to update information on the 24 sub-watersheds (NVCA, 2000). Current reports address surveillance monitoring (state of stream health). Performance evaluation (effectiveness of Authority actions) will be added to the reporting process in order to work towards an adaptive management approach. Watershed health information will also be expanded to include land issues.

Otonabee Region Conservation Authority

The Otonabee Region Conservation Authority (ORCA) has developed an SOE report for each of their eight municipalities. The information focuses on water quality (chemical, physical, biological). Indicators include: phosphorus, nitrogen, temperature, pH, total dissolved solids, total suspended solids, turbidity, conductivity, *E. coli*, and benthic invertebrates. Data are presented in the form of a descriptive paragraph for each separate parameter. Information for each municipality is summarized in a brochure titled 'Watershed Health Report' (ORCA, 2001). Reports will be updated annually. ORCA continues to work on developing indicators with the federal Ecological Monitoring and Assessment Network.

Rideau Valley Conservation Authority

The Rideau Valley Conservation Authority (RVCA) has developed a state of the watershed reporting system to monitor environmental change, assess management efforts, provide information to the public, and provide a tool for policy formulation and decision-making. The resource categories for reporting include: water quality indicators, biological indicators, and stress indicators. The following indicators are used: total phosphorus, nitrite/nitrate, dissolved oxygen, algae, heavy metals, *E. coli*, species diversity, species at risk, aquatic plants, harvest of aquatic plants, zebra mussels, fish, contamination of fish tissue, human population, urban development, municipal wastewater treatment, boat traffic, water removals, water level regulation, and agricultural activities. Data for each parameter are summarized with a graph and explanation of trends. The scale used for reporting is the entire Rideau River watershed. A full report, *The Rideau River State of the River Report*, was completed in November 2001 and there are plans for an update every three to five years (RVCA, 2001).

Toronto and Region Conservation Authority

Toronto and Region Conservation Authority (TRCA) has several state of the watershed reporting initiatives underway. The earliest of these is a report to assess progress on targets developed through the strategy for the Don Watershed. The resource categories for reporting include: the river, habitats and wildlife, people, protected natural areas, regeneration projects, and stewardship. The 18 indicators used are flow pattern, water quality-human use, water quality-aquatic habitats, stormwater management, woodlands, wetlands, meadows, riparian habitat, frogs, fish, public understanding and support, classroom education, responsible use and enjoyment, protected natural areas, regeneration projects, personal stewardship, business and institutional stewardship, and municipal stewardship. Directional arrows are used to show trends for each indicator for the entire Don River watershed. For each indicator there are targets to be achieved by 2003, 2010, and 2030. A watershed report card (40-page report) for the Don River was first completed in 1997, updated in 2000, and will continue every three years (Don Watershed Regeneration Council, 1997). The TRCA has nine major watersheds with watershed report cards developed for two (the Don and Humber Rivers).

Upper Thames River Conservation Authority

The Upper Thames River Conservation Authority (UTRCA) has recently completed a first set of watershed report cards to report on the environmental health of watersheds using indicators. The indicators, which fall in the resource categories of forest conditions and surface water quality, include: forest cover, forest density, forest interior, benthic score, phosphorus, bacteria, and conductivity. For each of 28 subwatersheds, indicator data were weighted and combined to give a single score for forest conditions and surface water quality. Results were then reported as letter grades (A to F) for forest conditions and water quality. A full report was developed including a four-page 'watershed report card' for each subwatershed (UTRCA, 2001). Reports are also posted on the UTRCA web site (www.thamesriver.on.ca) Future reports will be completed every five years.

Discussion

State of the watershed reporting includes several distinct components. For the purpose of this discussion, the following components will be used as a framework to allow comparison among the different case studies:

- Purpose: What is the general purpose of the report?
- Resource Categories: What elements of the environment are the focus for reporting?
- Indicators: What indicators are used?
- Scale: What spatial scale is used?
- Audience: Who is the intended audience?
- Frequency: How often will the reports be repeated?
- Format: What reporting format is used?

Purpose

Regardless of scale, most current efforts in state of the watershed reporting have the goal of providing information in a format that is useful and understandable to decision-makers and the general public. Most state of the watershed reports by conservation authorities have focussed solely on reporting indicators of environmental health using monitoring data. Some efforts also incorporate an assessment of agency performance. For example, watershed reporting for Conservation Halton is a self-grading exercise assessing the progress of their strategic plan. Nottawasaga Valley CA is incorporating both aspects: an assessment of stream health data, and an evaluation of Authority actions (performance measures).

Resource Categories

Table 1 summarizes the 'resource categories' used in state of the watershed reporting by a range of CAs and other agencies. Land, water, and air categories address measures of the health of these resources. Stressors refer to activities that put pressure on the resource (eg. agricultural activities, urban development). Organization's performance includes measures that evaluate the effectiveness of the agency's activities. As summarized in the table, water is the most common category of information reported.

Table 1: Resource Categories

Agency	water	land	air	stressors	organization's performance	total # of indicators
Ausable-Bayfield CA	X	X		X		22
Nottawasaga Valley CA	X					3
Ottonabee Region CA	X					10
Conservation Halton	X	X		X	X	8
Credit Valley CA	X	in 2002				5
Toronto and Region CA	X	X		X	X	18
Maitland Valley CA	X	X		X		6
Rideau Valley CA	X	X		X		20
Essex Region CA	X					5
Upper Thames River CA	X	X				7
U.S. EPA Surf Your Watershed	X			X		15
Tennessee VA	X					5
Saginaw River	X			X		18
SOLEC, State of Great Lakes	X	X	X	X		33 of 80
EMAN	X	X	X			22
Province of B.C.	X	X	X	X		15
Georgia Basin, B.C.	X	X	X			7
City of Calgary	X	X	X	X	X	18
City of Hamilton	X	X	X	X	X	32

Indicators

Table 2 summarizes a range of indicators used in the state of the watershed case studies by CAs and other agencies.

There is a large range in the number and types of indicators used by CAs in state of the watershed reporting. A number of case examples are outlined below.

The Maitland Valley Conservation Authority (MVCA) was one of the first authorities to develop an extensive watershed reporting system using indicators. In 1994 MVCA completed a detailed assessment of 41 sub-basins using six indices (indicators) developed from 29 parameters. Parameters were assigned a ranking and ordinal and an overall score was developed for each indicator. On a smaller scale is the reporting by the Crowe Valley Conservation Authority. The CVCA, with very limited resources for monitoring and reporting, has put priority on one indicator (lake levels) that is meaningful to the local public. In most situations indicators are limited by the availability of information. Many reports list potential indicators that are important but have no current information.

Table 2: Indicators

Indicator	Agencies using the indicator for SOE reporting
Water...	
chemistry	NVCA, UTRCA, CVC, MVCA, RVCA, ORCA, ERCA, ABCA, U.S. EPA, Saginaw, Tennessee, SOLEC, EMAN, Georgia Basin, Calgary, Hamilton
bacteria	ABCA, ERCA, ORCA, RVCA, TRCA, UTRCA, Saginaw, SOLEC, Georgia Basin, Calgary, Hamilton
benthic invertebrates	ERCA, ORCA, RVCA, MVCA, TRCA, CVC, UTRCA, NVCA, Saginaw, Tennessee, EMAN
fish	RVCA, TRCA, CVC, Saginaw, Tennessee, SOLEC, EMAN, BC
toxic pollutants	RVCA, USEPA, Saginaw, SOLEC, Prov.BC, Georgia Basin, Calgary
sediment	ABCA, USEPA, Tennessee, Saginaw, EMAN, Georgia Basin
groundwater	MVCA, CVC, Prov.BC, Georgia Basin, Calgary
Land...	
forest	ABCA, MVCA, TRCA, CH, UTRCA, EMAN, BC
riparian	ABCA, ERCA, TRCA, BC
wildlife	CH, U.S. EPA, Saginaw, SOLEC, EMAN, BC
species at risk	RVCA, BC, Georgia Basin
natural areas/protected	ABCA, MVCA, TRCA, CH, SOLEC, Prov.BC, Georgia B., Calgary, Hamilton
Air...	
air quality/particulates	SOLEC, EMAN, BC, Georgia Basin, Calgary, Hamilton
Stressors...	
agriculture	ABCA, RVCA, MVCA, U.S. EPA, SOLEC
urban development	ABCA, RVCA, MVCA, CH, SOLEC, Calgary, Hamilton
waste management	RVCA, BC, Georgia Basin, Calgary, Hamilton
Organization...	
stewardship	TRCA, CH
recreation	RVCA, TRCA, CH
other programs	RVCA, TRCA, CH

The criteria for initial consideration of indicators is fairly consistent among CA efforts, particularly with regard to selecting indicators that reflect issues of concern. The Rideau Valley Conservation Authority used the following criteria:

- is the indicator relevant and understandable?
- is it comparable?
- is the indicator at an appropriate scale?
- is it responsive to change?

- are time-series data available?
- is long-term monitoring feasible?
  (RVCA, 2001)

There is a large variation among CAs in the methods used for converting data to information. In many cases raw data are simply summarized for each parameter and reported separately. Others have developed methods to integrate several separate data sources and monitoring locations into one index or indicator for the whole subwatershed.

Credit Valley Conservation has developed an Integrated Monitoring Program (IMP) that focuses on a number of monitoring parameters that act as indicators to detect environmental change. Each indicator includes interpreted data from a range of parameters that are assessed to give an overall ranking. For example, data for chlorides, total phosphorus, nitrate, *E. coli*, aluminum, and copper are each compared to a relevant standard (eg. Provincial Water Quality Objectives) and subsequent ratings are combined to give the indicator (water chemistry) an overall ranking of excellent, good, fair or poor.

The Upper Thames River Conservation Authority developed formulae for converting forest and water quality parameters into a letter grade for 'forest conditions' and 'surface water quality'. For example, three equally-weighted forest indicators (% forest cover, %forest density, %forest interior) are graded on a scale based on local and provincial conditions, and an overall letter grade is calculated.

Nottawasaga Valley Conservation Authority has developed a system where data for indicators are compared with known reference sites and assessed to give a stream health status (below potential, unimpaired, impaired, unclassified). The stream health status for stream reaches is colour-coded on a map of the watershed. The NVCA is also working towards refining a watershed health monitoring and reporting system that will allow for an adaptive management approach. This involves including both surveillance measures (how healthy is the watershed?) and performance measures (how effective are CA watershed management actions?). Developing performance measures that are meaningful, reproducible and quantifiable is proving to be the most difficult part of the process (Jones, C., 2002).

Many state of the watershed reporting efforts include setting targets for each indicator as an important component of measuring progress. These targets are often linked to goals of a strategic plan such as the City of Hamilton's Vision 2020 effort. Watershed report cards for Toronto's Don and Humber Rivers include specific targets for each indicator to be achieved by 2003, 2010, and 2030.

Scale

Table 3 outlines the scale at which various organizations are reporting environmental information.

Table 3: Scale

Agency	entire watershed	subwatershed	municipality/other	number
Ausable-Bayfield CA		X		36
Nottawasaga Valley CA		X		24
Ottonabee Region CA			X	8
Conservation Halton	X			1
Credit Valley CA		X		20
Toronto and Region CA		X		9
Maitland Valley CA		X		41
Rideau Valley CA	X			1
Essex Region CA		X		20
Upper Thames River CA		X		28
U.S. EPA Surf Your Watershed		X		>2111
Saginaw River	X			1
Province of BC		X		64
Georgia Basin, BC	X			1
City of Calgary			X	1
City of Hamilton			X	1

As summarized in the table, most agencies are using the subwatershed scale for reporting. The *Managing the Environment Report* (Executive Resource Group, 2001) supports this approach, stating that in environmental management there should be a move towards a place-based approach with boundaries that make environmental sense and facilitate a cross-media, cumulative approach (such as watershed management). The above table shows a range in the numbers of subwatersheds, but there is a lack of information in reports on the rationale used for choosing the size of subwatersheds (eg. stream order).

While most CAs are working towards sub-watershed scale reporting, some (eg. Conservation Halton) are reporting on the entire watershed. Others are choosing scales for specific partnerships such as the Otonabee Region Conservation Authority which reports information by municipality.

Format

Table 4 outlines the format used for SOE reporting by the various case studies. A 'full report' describes a comprehensive written report complete with monitoring and reporting methods, rationale and complete references. 'Popular summary' suggests a more concise, easier to read summary of findings not exceeding more than four to five pages. The popular summary would typically be more graphical and formatted for broader public distribution.

Table 4: Format

Agency	full report	popular summary	on web-site
Ausable-Bayfield CA	X*		
Nottawasaga Valley CA		X*	X
Ottonabee Region CA		X	
Conservation Halton		X	
Credit Valley CA	X	X	X
Toronto and Region CA	X		X
Maitland Valley CA	X*		
Rideau Valley CA	X		
Essex Region CA		X	X
Upper Thames River CA	X	X*	X
U.S. EPA Surf Your Watershed		X*	X
SOLEC		X	X
Saginaw River	X		X
Tennessee Valley		X	
Province of BC	X	X*	X
Georgia Basin, BC		X	X
City of Calgary	X		X
City of Hamilton	X	X	X

*report by individual subwatershed

The format for watershed reporting is quite varied among conservation authorities. A number of CAs have developed an individual brochure for each subwatershed. The Upper Thames River CA has done this in the form of individual subwatershed report cards. The St. Clair Region CA has developed a state of the watershed report in a poster format ('Get to Know Your Watershed'). Others, such as the Rideau Valley CA, provide information in a full report. Some CAs are using their web sites to post watershed reports for public use.

Web-based reporting, such as the U.S. EPA's "Surf Your Watershed," is becoming a vital means for public access to information. The *Managing the Environment Report* (Executive Resource Group, 2001) recommends the creation of an Access Ontario web site focussed on monitoring and reporting information that is easy to understand and use by the specialized and general public.

The Grand River Conservation Authority has a very progressive web-based 'Real-time River Data' system that gives current readings of information from continuous environmental monitoring stations. Data include river levels, water quality parameters, rainfall, and air temperature. Monthly summary reports are also posted.

The City of Hamilton has taken a very community-focussed approach to developing indicators as well as reporting information. Every year a Sustainable Community day is held to provide updates on indicator trends and progress towards the targets of the municipality's Vision 2020.

Frequency

With many CAs just beginning to produce SOE reports, most have not determined an exact time-frame for providing updated versions. Conservation Halton plans to update their watershed report cards every five years in conjunction with a review of their strategic plan. Toronto's Don Watershed Report Card is updated every three years. Further discussion is required to identify appropriate reporting frequencies.

Other Issues/Comments

A number of issues have emerged in this review of environmental reporting:

1. In discussions with CA staff across the province, there is a great deal of interest in developing baseline standards for monitoring programs, indicators, and to some extent reporting formats that will produce consistency in information across CA boundaries.

2. There is a need to address the scope of a baseline state of the watershed reporting system for CAs. Developing watershed health indicators is relatively straight forward. Developing indicators of performance for Authority-wide programs may be more difficult.

3. Some aspects of state of the watershed reporting need to remain specific to individual CAs to address local priorities. These may include:
   - specific indicators to address local issues (eg. lake levels)
   - setting targets for indicators based on local strategic planning efforts

4. There is a need to use a consistent approach in converting data to information for state of the watershed reporting.

5. CAs should ultimately work towards a seamless web-based system of baseline state of the watershed reporting for watersheds across the province.