

CASE
STUDY

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Economic Benefits Help Drive
Cleanup of Severn Sound

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On the southeastern edge of Lake Huron's Georgian Bay lies Severn Sound, a complex of bays and inlets covering approximately 50 square miles (130 square kilometers, Figure 1). Small- to medium-sized urban centers dot the Severn Sound area, with approximately one-third of its watershed devoted to agriculture.

In 1985, the International Joint Commission designated Severn Sound an Area of Concern (AOC) due to its degraded environment, primarily due to eutrophication and habitat loss. This designation triggered nearly 20 years of cleanup that was justified, in part, by the economic benefits projected to be realized from a healthy environment. As a result of these efforts, in 2003 Severn Sound became the second AOC to be delisted, and one of only seven of the 43 AOCs yet to achieve this status.

One key element in this success was an innovative partnership agreement between the federal and provincial governments and the 10 municipalities in the Severn Sound area. The partnership became the Severn Sound Environmental Association (SSEA), which is now

a Joint Municipal Services Board (as defined by Ontario Municipal Act, Section 202) representing the local municipalities (Sherman et al., in press). It continues to guide management decisions related to Severn Sound.

Severn Sound Cleanup

The Stage 1 Remedial Action Plan (RAP), describing environmental conditions and use impairments, was completed in 1989 (SSRAP,



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Figure 1. Map of municipalities in the Severn Sound watershed. Cedit: Severn Sound Environmental Association.

1989). The Stage 2 RAP outlining water use goals, objectives, and remedial actions necessary to restore impaired beneficial uses was completed in 1993 (SSRAP, 1993).

The RAP addressed environmental issues through actions in six areas: phosphorus control, habitat restoration and enhancement, pollution prevention, planning, environmental monitoring, and public education on environmental issues. Phosphorus was controlled by improving processes at sewage treatment plants, upgrading private sewage systems, eliminating sewage bypasses and combined sewer overflows, and reducing inputs from agricultural sources. Not only did the sewage treatment plant improvements reduce phosphorus loads to meet

RAP targets, but these improvements resulted in considerable cost savings to the municipalities.

Through a Sewage Treatment Optimization Project, the federal and provincial governments provided technical support and training for municipal operators in all eight treatment plants in the AOC watershed. In addition, the Ontario Ministry of the Environment and Climate Change contributed \$23 million to upgrade four of the eight sewage treatment plants.

The Severn Sound Urban Stormwater Strategy was developed by municipalities who passed enabling bylaws to govern new construction, stormwater retrofits, and sewer separation projects. To help reduce algal growth in Severn Sound, 3,000 private shoreline sewage systems

were inspected and improvements were made to 600. Tributary phosphorus loadings from agricultural sources were reduced through farm-level projects to manage manure runoff, treat direct milk house wastes, restrict livestock access to rivers, and improve crop practices.

Between 1990 and 2002, the Canadian federal Great Lakes Sustainability Fund provided \$3.4 million for restoring environmental quality in support of 22 projects in the Severn Sound AOC. This partnership arrangement realized more than \$4 million in direct partner funding and nearly \$2 million from in-kind contributions (Sherman, 2002).

Conservation agreements and wetland rehabilitation projects protected 1,015 acres (411 hectares) of wetlands and associated uplands. In tributary streams, 132 projects were completed, creating vegetative buffers and linking habitat nodes. In addition, townships and municipalities adopted natural heritage strategies.

Beginning in 1991, Trumpeter Swans were reintroduced to Wye Marsh, contributing to re-establishment of this species. Lead shot in the swan's habitat had limited their population. A lead shot ban in 1993 and use of an innovative technology to sink the pellets deep into sediment out of reach of the swans helped contribute to the goal of a sustainable population.



Tree planting as part of habitat restoration, 2016. Credit: Severn Sound Environmental Association.

In addition, upgraded infrastructure, local job creation, and cost-effective decisions assisted by RAP studies improved the area's economic vitality. Volunteer participation and positive media support helped gain community acceptance of the RAP principles of maintaining a healthy environment and ensuring economic and environmental sustainability, including their inclusion in municipal plans.

The Government of Canada and its partners completed all remedial actions by 2002. The Stage 3 RAP was completed in 2003, where environmental monitoring confirmed achievement of delisting criteria established for Severn Sound (Sherman, 2002). Official delisting of Severn Sound as an AOC occurred in 2003.

The SSEA facilitated the delisting of Severn Sound. The association played a key role in

the sewage treatment plant upgrades, farm pollution control projects, stormwater treatment studies, tree planting, shoreline restoration and ecosystem monitoring, and public outreach on environmental issues. Of particular note was how SSEA helped provide community-based, cost-effective, environmental management for the Severn Sound area, which helped sustain momentum and achieve delisting. Delisting



Trumpeter swans on Hogg Bay of Severn Sound, Ontario. Credit: Severn Sound Environmental Association.

would not have been possible without the concerted effort of the Severn Sound RAP Implementation Office, SSEA, and the Severn Sound community, especially the municipalities and the farming community (Sherman et al., in press). Following delisting, creative local partnership agreements and financing were arranged to continue long-term implementation and to meet emerging environmental and sustainability challenges.

Economic Benefits

Economic benefits assessments played an important role in making the case for implementing remedial actions and documenting return on investment. Economic assessments of the Severn Sound RAP (Keir Consultants, 1991; Zegarac et al., 1994; Tejani and Muir, 2004) outlined the estimated costs and the benefits of completing the remedial actions using phosphorus and sediment control as a basis for comparison. Keir Consultants (1991) provided a community profile and cost-benefit analysis of remedial actions early on in the Severn Sound RAP process and concluded that “the Severn Sound area will need to employ a variety of coordinated remedial actions to achieve and maintain the desired water quality and at the



Penetang Bay, Severn Sound, Ontario. Credit: Severn Sound Environmental Association.

same time they will need to employ a mixture of funding mechanisms that will generate the necessary monies for capital improvements and operational expenses. An attractive, safe, useable water body is one of the main assets that communities surrounding Severn Sound will require in order to continue to attract recreational growth and strengthened economic base.”

Zegarac et al., (1994) provided estimates of costs and benefits of remedial actions in the context of overall municipal spending, showing the value of remedial actions in terms of phosphorus removed. Their analysis also showed the benefits of ongoing maintenance of environmental controls.

Tejani and Muir (2004) evaluated the cost and benefit of restoration projects over the RAP period of 1991-2002. They sorted, quantified, and monetized achievements of restoration activities based on a cost-saving approach. Other environmental benefits were evaluated based on a benefit transfer technique – namely for the value of wetlands and carbon stored per metric ton. Due to restrictions of time and data availability, the Tejani and Muir (2004) study covered only those aspects that could be readily evaluated. Therefore, these authors cautioned that their estimated values are by no means exhaustive nor definitive. Moreover, monetary benefits of environmental amenities are not realized only once the project is implemented, but they continue to produce benefits (i.e., goods and services) every year. The monetary benefits presented in the Tejani and Muir (2004) study cover a 12-year period of 1991-2002.

Table 1 presents a summary of the results from the Tejani and Muir (2004) study. The total monetary value of the Severn Sound RAP restoration projects implemented between 1991 and 2002 was estimated at \$35.3 million. The total implementation costs of restoration projects during the same time period was estimated at \$2.16 million. Every dollar spent by the end of 2002 would generate \$16.34 in benefits, reflecting cost effectiveness of these RAP restoration

projects (Tejani and Muir, 2004). It should be noted that these benefits assessments were based on a 10-year life span, meaning that the economic benefits were only estimated for 10 years (SSRAP 1993).

It has now been 25 years since the Stage 2 RAP (SSRAP 1993) phosphorus control targets were beginning to be addressed. Some of the remedial actions taken in the 1990s have outlived their original life-span. The targets for phosphorus control are still being met as new expansion and upgrades of sewage plants have been brought on line. For example, upgrading the Victoria Harbour Sewage Treatment Plant was completed in 2017, resulting in improved effluent quality and plant reliability, increased capacity, and non-toxic effluent in terms of reduced effluent ammonia and elimination of chlorine. This upgrade was funded by wastewater rates and development charges. The municipality upgraded its plant and will eventually increase its wastewater capacity by 50 percent, resulting in continued achievement of the Severn Sound RAP phosphorus loading target, while funding this upgrade locally. This allowed them to continue to use an existing outfall into Sturgeon Bay and avoided the cost of building a new outfall. In the case of the agricultural sector, the original cost-benefit analyses (Zegarac et al., 1994; Tijani and Muir, 2004) are still valid, showing minimal

costs to farmers that result in optimized yields and costs, while reducing erosion and runoff and improving stream quality. An analysis of sediment loss from two Severn Sound watersheds showed that the significant riparian habitat restoration projects of the early 1990s are still providing benefits in terms of significant reductions in sediment loss from the streams (and phosphorus) entering Severn Sound (Stang, 2011).

Concluding Thoughts

Severn Sound is one of only seven AOCs to be delisted since 1985. Effective collaboration and cooperation among all stakeholders were essential to achieve delisting (Sherman et al., in press). Economic benefits assessments were an important part of making the case for implementing remedial actions, documenting return on investment, and securing commitments from responsible organizations for implementation.

SSEA has proven to be an effective partnership among federal, provincial, and municipal governments, and other organizations, to ensure local ownership and acceptance; sustain long-term restoration efforts; and facilitate transition to sustainability. Bob Whittam of the Wye Marsh Wildlife Center, who was selected as public involvement facilitator and was well respected in the community, had this to say at the acceptance of the Stage 3 RAP:

Our overall effort and success is excellent, and the RAP team should be commended. However, there is still life after delisting and we should proceed as if we were approved and passed, but forever on probation, lest we become complacent.

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RESTORATION ACTIVITY	MINIMUM BENEFITS	MAXIMUM BENEFITS	AVERAGE BENEFITS (2002)	TOTAL COSTS*
Wastewater treatment cost savings	\$9,246,059	\$47,477,968	\$32,985,043	\$2,086,807
Septic tank upgrades	\$307,898	\$1,581,036	\$1,098,416	\$400,721
Riparian buffer strip phosphorus savings	\$2,071,191	\$10,635,444	\$7,388,913	\$493,296
Cattle restricted access fencing	\$155,224	\$797,068	\$553,758	
Milkhouse wastewater management	\$972,380	\$4,993,116	\$3,468,939	\$39,339
Eavestrough stormwater diversion	\$324,767	\$1,667,659	\$1,158,596	\$31,141
Manure storage tank construction	\$5,022,709	\$25,791,313	\$17,918,365	\$356,505
Soil conservation (tillage)	\$391,890	\$2,012,333	\$1,398,057	\$765,804
Other cost savings of riparian buffer strips	\$16,067	\$66,891	\$41,479	
Riparian buffer strip sediment savings	\$8,871	\$40,688	\$24,780	
Streambank maintenance	\$2,194	\$3,354	\$2,774	
Flood control	\$5,001	\$22,848	\$13,925	
On-site cost savings of conservation tillage	\$151,498	\$852,225	\$501,862	
Carbon storage	\$432,173	\$467,806	\$449,989	
Wetlands	\$1,320,394	\$1,320,394	\$1,320,394	\$71,883
Total	\$11,166,190	\$50,185,284	\$35,298,767	\$2,158,690

Table 1. Estimated total cost savings and monetary benefits generated by implementation of the Severn Sound RAP, compared to costs of the rehabilitation projects, 1991-2002 (Tejani and Muir, 2004).

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Cover photo of natural shoreline of Severn Sound courtesy of Severn Sound Environmental Association.

All monetary amounts are in Canadian dollars.

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The Severn Sound case study is part of a larger project to evaluate achievements and lessons learned from 32 years of efforts to clean up Great Lakes AOCs. Case studies will be used to help sustain support for cleaning up AOCs and to inspire and motivate others to restore other degraded aquatic ecosystems.

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