

T12.8 FRESH WATER AND RESOURCES

“As a resource, fresh water is a vital requirement for agriculture, industry, power generation, recreational activity, drinking and aesthetic enjoyment.” Fresh water also supports wildlife and ecosystems and is a major component of Nova Scotia’s landscapes. Possibly, it is because fresh water from Nova Scotia’s lakes, rivers, wetlands and groundwater reserves is so plentiful that it is taken for granted as a commodity. “As a result, some of our uses of water interfere with others.”¹

Numerous direct and indirect activities have altered the province’s aquatic ecosystems, and, although the changes are not always readily seen in the landscape, the effects are apparent in species diversity and in water-quality studies.

The Minister’s Task Force on Clean Water recommends developing a water-resource management

strategy for Nova Scotia to mitigate the effects of the conflicting interests related to freshwater use in the province. Such a strategy would necessitate an understanding of how aquatic systems function and how they respond to human influence.²

HISTORICAL CONTEXT

Before European Contact

The long tradition of water use in Nova Scotia dates back to early transportation routes. Practically everywhere that there are navigable rivers in the province they were used, combining canoeing and portage. The Mi’kmaq navigated inland waters that were probably originally used by Paleo-Indian cultures. An encampment dating to 5,000 years before the present was discovered at the southern end of

Kejimkujik Lake where the Mersey River leaves the lake (sub-Unit 412a). Archaeologists conjecture that the site was a seasonal eel-harvesting site used by people who had travelled up the Mersey from encampments along the coast.³ This part of the river is believed to have been used for eel fishing for 5,000 years.

Eel weirs tended to be sited where natural obstacles, such as ledges or debris, could be supplemented by boulders so that the stream current was formed into a “V” shape.



Plate T12.8.1: The water-powered grist mill at Balmoral Mills is built on falls on Balmoral Brook, a tributary of Waugh’s River, Colchester County (sub-Unit 521a). The mill, preserved by the Nova Scotia Museum, is one of the last examples of many built in Nova Scotia in the nineteenth century. Photo: R. Merrick

Sticks and other debris were added to force the eels into the centre of the V.

Early cultures and the Mi'kmaq usually located their camps near springs that supplied an abundant source of fresh water.

1600s and 1700s

Early European accounts of spring spawning runs on streams described the fish as being so abundant that “everything swarms with them.” This subsistence economy was soon supplanted by a commercial economy, which eventually resulted in the overfishing of certain species, such as salmon. By the late 1700s, colonists and Mi'kmaq were involved in commercial exploitation of rivers by trading their salmon catch with dealers along the coast. For Mi'kmaq as well as nonnative fishermen, success was determined by proximity to good fishing areas, the availability of various species and ecological constraints.

Inland waterways provided transportation routes for Europeans and Mi'kmaq involved in trade and later for military purposes. The river systems that flowed down to the coasts were the most obvious corridors connecting coastal settlements with the interior of the province. The initial impetus for moving inland was to get access to new timberlands as coastal forests were depleted. For example, in the late 1700s, there were several mills near the mouth of the Mersey River. Operations moved upstream as lumber grew scarce around Liverpool. There were no roads, so the river provided the main transportation routes for the lumbering operations. Settlements such as South Brookfield, Queens County, (Unit 433), were established along these transportation routes. By travelling inland up rivers, settlers discovered good farmland in the drumlin fields of southwest Nova Scotia (see T12.4).

Even after roads were established, some of the early settlers continued to use the rivers for transportation. Enterprising people used the waterways to advantage. For example, one settler in South Brookfield combined boatbuilding with agriculture and transported his goods to market down the Medway in boats he had built, which he then sold after unloading the produce.

The earliest documented canoe trip across the province occurred in 1686 from Annapolis Royal to Liverpool. Seven Frenchmen and two Mi'kmaq guides navigated the inland waterways and portage routes in six days.⁴ At about the same time, people were looking to link the two coasts of the province by road from Nictaux to Liverpool.

Extensive changes to freshwater habitats began in the eighteenth and nineteenth centuries, when

colonists dammed Nova Scotia's rivers and streams for water-powered gristmills and the sawmills of the burgeoning timber industry.

The Acadians operated water-powered sawmills in Nova Scotia in the 1600s, and settlers continued to use this method as lumbering operations expanded in the 1700s. Both the Roseway and the Jordan rivers in southwest Nova Scotia became sites for Loyalist sawmills. Financial incentives were offered by the government to encourage the construction of mills, resulting in forty-seven new sawmills between 1783 and 1787.⁵

1800s and 1900s

In the 1800s, hunters and fishers travelled waterways for recreation, using early settlers and Mi'kmaq as guides. Canoe routes continued to be the way to access hunting and fishing grounds into the twentieth century.⁶ The influx of sportsmen led eventually to the establishment of permanent hunting and fishing lodges along some of the main rivers.

Rivers continued to be used for the transportation of goods and lumber during the 1800s. During a small gold rush in southwest Nova Scotia in 1884, for example, the Medway system was used to transport men and goods to the Molega Mine (Unit 432). Log drives tended to occur in the spring, when the water was highest. The quantities of logs damaged stream-bank habitats and left extensive quantities of organic debris, which settled to the bottom of rivers, smothering organisms in bottom habitats. This also caused anoxic conditions in the sediments and, in extreme cases, could cause oxygen deficiencies to the ecosystem. Breaking down great amounts of organic material requires oxygen normally available to other biota.

Frozen waterways have always fostered recreational activities and resource industries. In the latter half of the nineteenth century, before the invention of refrigeration, the ice industry was important. The Halifax area had two ice companies in operation, at Williams Lake and Lake Micmac, supplying ice blocks to markets. The Dartmouth Lakes boasted some of the first hockey games in Canada in the eighteenth century, when British garrison teams adapted a form of skateless hockey played by the Mi'kmaq.

By the mid-1800s 1,400 sawmills were in operation in Nova Scotia. Water was the main choice of power generating for the mills (see Plate T12.8.1). Liverpool was an example of a settlement founded

on the prospect of natural resources, including the Mersey River. “Its river, down which large quantities of timber are floated with the spring freshets, and the fisheries ... are the main source of its wealth.”⁶

The sawmill operations often made watercourses inaccessible for spawning fish, which consequently suffered population declines. Although legislation requiring fish passes was enacted in 1786 in Nova Scotia, it was rarely implemented.⁷ As elsewhere in the province, salmon had once been plentiful in the Sackville River at the head of Bedford Basin, but in 1856 Captain Campbell Hardy wrote, “The Sackville River offers no sport to speak of now for the sawmills and their obstructive dams have quite cut off the fish from their spawning grounds.” Mill refuse contributed to water-quality changes in Nova Scotia, and this dumping practice continued on some rivers well into the 1930s.⁸

In the 1920s, pulp-and-paper companies built dams on the Mersey River, flooding the area and creating Lake Rossignol (sub-Unit 412a). Although fish ladders were built, very few fish would go up them. For local Mi’kmaq guides, this affected their best guiding businesses—salmon fishing and moose hunting. Erosion around Lake Rossignol has exposed many sites of archaeological significance, which may be seen when water levels are low.

In his 1873 account of the first settlers of Colchester County, Nova Scotia, Thomas Miller wrote:
*“The first settlers of Stewiacke had many difficulties to contend against. On September 8, 1792, there was the great freshet which carried away a large part of their wheat which was standing in stook in the field. Many of their houses stood on the interval and were in danger of being carried away. Many made rafts of boards from the floors of their homes and pushed off for higher land, while those who had canoes were busy saving the people first and afterwards the cattle and sheep. After this they very prudently built more of their houses on the uplands.”*⁹

FRESH WATER AND RESOURCES TODAY

Watershed Management

The province is traversed by a multitude of watercourses of all sizes that provide drainage to the sea. In Nova Scotia, forty-four primary watershed-drainage areas (see T8.1.2) have been identified for management and monitoring. Land use in watershed areas can greatly affect the water quality of municipal drinking water. In most cases, municipalities

drawing water have little control over the watershed lands that are often located in another municipality, and as a result water contamination may occur because of land-use activities incompatible with the production of safe drinking water. The clearing of land for agriculture, mining, forestry and highway construction affects Nova Scotia’s freshwater environments. Impacts can be minimized by following established ecological guidelines or leaving uncut greenbelts by watercourses (see T12.9, T12.10). Eutrophication can occur from agricultural runoff, domestic sewage, siltation and other human activities. Degradation can also occur through the destruction of wetlands because of infilling, reclamation as farmland and as such other activities, developing subdivisions for homes and cottages.

Floodplains

Floodplains have tended to be popular places to build because the land is flat and the soil deep. Developments, such as housing projects, have often been built without considering the potential flood levels of most floodplains. Construction activities, in many cases, have decreased the capacity of the floodplain land to retain water and, therefore, have intensified the effects of flooding and drought. By ignoring the natural function of the floodplain (see T8.2), developers are at risk from the inevitable periodic floodings that have caused considerable property damage in the past. To avoid flooding, developers have often built up the land with fill, to raise the level of the property. This reduces the area available to contain flood water and can lead to increased upstream and downstream flood damage. The Little Sackville River floodplain¹⁰ and the Truro floodplain¹¹ (adjacent to the Salmon and North rivers) are just two of the areas where serious flooding has taken place.

In 1978, the federal and provincial governments entered into an agreement aimed at reducing potential flood damage by discouraging unwise use of flood-prone land. The agreements provide for the identification, mapping and study of serious-flood-risk areas throughout the province. This flood-risk mapping program has proven to be valuable for municipal land-use policies as well as in the review of major projects that were scheduled to be constructed through floodplains, e.g., the North River Bridge, TransCanada Highway.¹²

A flood-risk area is defined as land that is subject to severe flooding on the average once in 100 years (i.e., there is a one per cent chance of the land being flooded in any given year to a particular elevation—the 100-year elevation). A smaller area, designated



Plate T12.8.2: A watercolour of the Sackville River floodplain in 1817 by John Elliott Woolford. The view from Sackville shows the floodplain area prior to development. This area now contains the Bedford Place mall. Historical plate: N.S. Museum, Museum Services Division.

as the floodway, is the part of the floodplain subject to more frequent flooding. In this zone, flooding occurs on average once every twenty years (i.e., there is a five per cent chance of flooding in a given year to a particular elevation—the twenty-year elevation. The designated floodway fringe lies between the floodway and the outer limit of the flood-risk area. Within this fringe area, any new building or alteration of an existing building requires appropriate flood-proofing measures if it is to receive federal or provincial assistance.

Damming

Rivers in Nova Scotia have been dammed to convert the energy potential of water into electrical power at thirty-two power sites around the province. The drawdown and flooding associated with large-scale dam construction can alter both terrestrial and aquatic ecosystems, including changes in habitat for plants and animals that require fast-flowing water and changes in water quality. Reservoir water levels are usually maintained at the optimum required for hydroelectric production and do not always coincide with the requirements of fish migration or waterfowl breeding. Flooded forests near sites often die; however, they then provide nesting sites for heron colonies, which favour the standing dead-

wood and stumps. Dams can affect spawning and fish migration patterns (see T12.11).

Wetlands

Until recently, the ecological role of wetlands has been poorly studied. As an intermediate between freshwater and terrestrial habitats, wetlands were often infilled to create more “useful” land. This infilling interrupts surface and subsurface flow of water and can seriously affect the water-table level during dry periods. There are several programs in Nova Scotia that focus on the construction and protection of wetlands as wildlife habitat and as retention and filtration ponds. These artificially created systems are part of the more than 33,000 inventoried wetlands in the province (see T8.3).

Water Supply

Forty-eight of the fifty-six surface water supplies and nineteen of the twenty-five groundwater supplies contributing to municipal water systems have significant, identifiable water-quality problems. Some contaminants occur naturally; these include iron and manganese, which add colour and affect the taste, and hydrogen sulphide, which gives an unpleasant smell. Arsenic pollution of groundwater has been associated with abandoned gold mines at

several locations. Other natural contaminants are radon, various salts, compounds from organic decomposition and silt entering waterways in excessive amounts as a result of such activities as forestry, land clearing and construction. Other contaminants resulting from human activity include acid precipitation, sewage, industrial effluent, dry-cleaning fluids, road salt, oil, pest-control products and agricultural runoff. Hog manure now produced in the Annapolis Valley is equivalent to the sewage discharge of a city of 250 000 people.

The Nova Scotia Department of Municipal Affairs has prepared a list by county that shows the type of water supply used by each municipality (i.e., surface water and/or groundwater).

Groundwater

Groundwater constitutes only six per cent of the total volume of fresh water used throughout the province; however, it is still important to many residents. This is particularly evident in Cumberland County and in the Annapolis Valley, where groundwater is the primary source of municipal water supplies.

The greatest human use of fresh water is for various household needs. Approximately half of the domestic water used in the province is drawn from lakes and streams that are part of our surface-water resource. Approximately fifty per cent of the population use wells that tap the groundwater resource. The average household uses 150 to 250 gallons of water per day, of which only four per cent is consumed by drinking and cooking.¹³

The primary aquifers in the province are found in sand and gravel deposits (the Annapolis and Margaree valleys) and in sandstone and gypsum areas, mainly in Colchester and Cumberland Counties and in parts of Cape Breton. In these areas, which have relatively little surface water, wells are the primary source of domestic-water supply.

Overpumping of the groundwater resource can reduce well yields and lower water levels. In coastal areas, there have been incidents of saltwater intrusions into groundwater supplies from overpumping by fish plants. Interference with water wells can also decrease the natural groundwater discharge to rivers and streams during drought periods, affecting water supplies, wildlife and recreational and other uses.

The waters of Spa Springs, Annapolis County, (District 610), were reputed to possess healing prop-

erties, which attracted many visitors to that area in the eighteenth century. Today, the community is renowned for its bottled mineral water. The major dissolved mineral in the groundwater is gypsum, which is attributed to the gypsum lenses found in the late Triassic silt stones and shales of the Blomidon Formation.

Recently, groundwater has been used for geothermal-energy production in Nova Scotia. The groundwater in hard-rock districts will rise approximately 1°C for every 30 m depth. Carboniferous bedrock has a higher geothermal gradient potential, a phenomenon exhibited by the water temperatures in the abandoned coal mines in the Carboniferous lowlands (Region 500). In Springhill (Unit 581), there are five water-filled seams, the deepest of which extends at a 32° angle for approximately 4 km. The water circulates rapidly, with temperatures reaching up to 21°C. The geothermal industry at Springhill has prompted other studies on the potential of using the heated groundwater in abandoned mine sites.^{14, 15, 16}

Acidification of Fresh Water

Much of Nova Scotia's surface water is naturally mildly acidic; however, increased acidity levels resulting from human activities have been a source of concern in the province.

Runoff from quarries, highway construction and urban development displaying low-pH levels is generally referred to as acid drainage. Acid drainage is caused by the chemical and biological oxidation of sulphur-rich minerals. Construction activities contribute to acidified waters in southern Nova Scotia, because the blasting exposes pyritic slate bedrock of the Halifax Formation to the atmosphere, leaching aluminum, heavy metals and acid in water runoff to streams and lakes. The Halifax Formation is found throughout the southern mainland, extending from Yarmouth to Canso. With such widespread occurrence, mineralized slates are difficult to avoid. In fact, many towns and villages and a whole network of highways are situated on top of these rocks.

Freshwater acidity is also an issue in southwestern Nova Scotia, where the nature of the bedrock and shallow overburden contribute little to the buffering capacity for runoff (see T8.2). Slowly decomposing

One of the most cited examples of the effect of acid drainage resulted from construction activity at the Halifax International Airport. Runway and taxiway construction, excavations of slate for buildings and the stockpiling of slate material set off a chain reaction that initiated and promoted the generation of acid drainage. The production of acid related to these activities was determined to be responsible for major fish kills, the closure of a fish hatchery, the disruption of water supplies and the lowering of water quality in lakes and streams. In addition, a variety of heavy metals were found in drainage water.

organic materials, such as peat moss, can also create acid conditions in lakes.

Wildlife in aquatic ecosystems is especially sensitive to acidic deposition. As water in rivers and lakes becomes more acidic, the eggs of aquatic organisms are less likely to hatch and mature, while fish in all stages of their life cycle are vulnerable. The species that are most sensitive to acidity, including many species of fish, insects, crustaceans and molluscs, are eventually eliminated. The impoverished aquatic ecosystem that follows may be unable to supply the nutritional needs of waterfowl at breeding time; for example, calcium is required for the formation of eggshells, and protein demands are high for growing chicks. Increased acidity also causes aluminum, cadmium, lead and other potentially toxic metals to be more soluble and to be “mobilized” into the water. Methylmercury in fish from acidic lakes may reach concentrations that can interfere with reproduction in mink, loons and other predators. Cadmium is taken up by vascular plants and then accumulates in the livers and kidneys of herbivores, such as Moose, at levels that pose a risk to human consumers.

Salmon populations have declined in Nova Scotia because acidified waters have caused the loss of one-third of Nova Scotia’s available salmon habitat since 1950.¹⁷ This environmental stress has extirpated salmon in thirteen Nova Scotia rivers. Even if acid deposition could be stopped and the habitat allowed to purge itself, short-term natural recovery of these salmon stocks is no longer possible. Given their sensitivities to acidic waters, salmon are now designated as environmental-indicator species whose population numbers are used to monitor the state of

Nova Scotia’s freshwater ecosystems. In order to preserve native salmon stocks genetically suited to individual Nova Scotia rivers, the provincial government has instituted a conservation program to protect a particular salmon stock for genetic-salvage purposes. Each winter, a portion of the frozen East River near Chester is limed, to counteract the effect of the spring melt whereby ice and snow discharge their accumulated water, creating a surge in river acidification detrimental to spawning salmon in the critical stages of their life cycle. This has led to a dramatic increase in juvenile salmon in a 500-m² area of the river.

On a more optimistic note, reduction of emissions has been shown to lead to a gradual recovery of lake ecosystems. In 1992, an Environment Canada study concluded that seventeen lakes in southwestern Nova Scotia had shown significant improvement. During the eight-year study, sulphate deposits had declined in six Nova Scotia lakes and alkalinity rose in thirteen lakes, which is another indicator of declining acid-precipitation deposits.

Recreation

Swimming, boating and canoeing are popular freshwater-recreation activities. Cottage development along the edges of lakes is also popular and can cause problems in the ecosystem if waste-disposal regulations are not adhered to.



Associated Topics

T2.3 Granite in Nova Scotia, T2.4 The Carboniferous Basin, T6.4 Estuaries, T8.1 Freshwater Hydrology, T8.2 Freshwater Environments, T8.3 Freshwater Wetlands, T12.3 Geology and Resources, T12.9 Soil and Resources, T12.11 Animals and Resources

Associated Habitats

H3.1–H3.6 Fresh Water, H4.1–H4.4 Fresh Water Wetlands

References

- 1 Eaton, P.B., L.P. Hilderbrand and A.A. d'Entremont (1986) *Environmental Quality in the Atlantic Region 1985*. Environment Canada, Environmental Protection Service, Atlantic Region, Dartmouth.
- 2 Nova Scotia. Minister's Task Force on Clean Water (1991) *Clean Water for Nova Scotia: New Directions for Water Resource Management. Final Report and Recommendations*. Dept. of the Environment, Halifax.
- 3 Ferguson, R. (1986) *Archaeological Sites in Kejimikujik National Park*. Parks Canada, Atlantic Region, Halifax.
- 4 Morris, W.E. (1935) "Account of the voyage of Monsieur de Meulles to Acadie 1685-1686." Translated by William Englis Morris. In *Acadiansis Nova 1598-1779*. 2 vols. Bernard Quaritch, London.
- 5 Robertson, B. (1986) *Sawpower: Making Lumber in the Sawmills of Nova Scotia*. Nimbus and the Nova Scotia Museum, Halifax.
- 6 Paine, A.B. (1908) *The Tent Dwellers*. The Outing Publishing Co., ed. by New York. Reprint, Cranberrie Publications, Nova Scotia, 1982.
- 7 Dunfield, R.W. (1985) *The Atlantic Salmon in the History of North America*. Fisheries and Oceans Canada, Halifax.
- 8 Johnson, R. (1986) *Forests of Nova Scotia*. Nova Scotia Dept. of Lands and Forests, Halifax.
- 9 Miller, T. (1989) "Historical and genealogical record of the first settlers of Colchester County, down to the present time." In *Flooding in Nova Scotia, An Overview: 1759-1986*. Environment Canada, Conservation and Protection Branch, Moncton.
- 10 Canada-Nova Scotia Flood Damage Reduction Program, Nolan Davis and Associates Ltd., Cumming-Cockburn and Associates Ltd. and Nova Scotia Dept. of the Environment (1987) *Hydrotechnical Study of the Little Sackville River Floodplain*. Cumming-Cockburn and Associates Ltd., Willowdale, Ont.
- 11 Canada-Nova Scotia Flood Damage Reduction Program and Nova Scotia Dept. of the Environment (1988) *Hydrotechnical Study of the Truro and Area Floodplain*. Nova Scotia Dept. of the Environment, Halifax.
- 12 Cameron, A. (1992) *Flood Damage Reduction Program. Nova Scotia—Status Report*. National Workshop on the Flood Reduction—Continuance Phase. Environment Canada and the Canadian Water Resources Association, Dartmouth.
- 13 Nova Scotia. Minister's Task Force on Clean Water (1991) *Clean Water for Nova Scotia: New Directions for Water Resource Management*. Nova Scotia Dept. of the Environment: Halifax.
- 14 Hennigar, T. et al. (1992) *Hydrogeological and Groundwater Interests in the Annapolis-Cornwallis Valley: Atlantic Geoscience Centre Field Excursion C-4 Guidebook*. Geological Association of Canada.
- 15 Ross, R. (1992) *Report on Geothermal Wells*. Report to Town of Springhill Geothermal Committee and Nova Scotia Dept. of Natural Resources.
- 16 MacFarlane, D.S., and I.R. Fleming (1988) *The Use of Low Grade Geothermal Energy from Abandoned Coal Mines in the Springhill Coal Field, Nova Scotia*. Jacques Whitford and Associates Ltd.: Halifax.
- 17 Watt, W.D. (1989) "The impact of habitat damage on Atlantic Salmon (*Salmo salar*) Catches." In *Proceedings of the National Workshop on Effects of Habitat Alteration on Salmonid Stocks*. Fisheries and Oceans, Ottawa. (*Can. Spec. Pub. Fish. Aquat. Sci.* 105).
- 18 Clair, T., G. Howell and G. Devarenes (1992) *Chemistry Trends in Atlantic Canada Lakes*. Environment Canada, Conservation Branch: Moncton.

Additional Reading

- Environment Canada (1984) *Land Use in the Atlantic Region*. Recreation and Tourism, Ottawa.
- Melanson, R. and F. Payne (1988) *Wetlands Habitat Management through Nutrient Enrichment*. Nova Scotia Dept. of Lands and Forests: Kentville. (*Occ. Pap.* No. 1).
- Nova Scotia Dept. of the Environment (1992) *Designing Water Strategies for Water Supply Watershed Management in Nova Scotia*. Province of Nova Scotia: Halifax.
- Payne, F. (1993) *Beaver and Ducks Unlimited Impoundments of the Pugwash River with Recommendations for Management*. Report on file with Wildlife Division, N.S. Dept. of Natural Resources, Kentville.