
MULTIPLE USE MANAGEMENT OF THE RIDEAU AND TRENT-SEVERN
WATERWAY RESERVOIR SYSTEM¹

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ABSTRACT: First a military system and a commercial transportation route, recreational boating is today the major use of the extensive Rideau and Trent-Severn Waterway systems. Since 1972, these canals have been managed by Parks Canada in the context of the Canada - Ontario - Rideau - Trent-Severn Agreement (C.O.R.T.S.). In fact, Parks Canada's responsibilities extend throughout adjacent reservoir lakes totalling over 150,000 hectares and integrate programs involving: the maintenance of navigation channels; water level control; development of support facilities for boater recreation but also for land based users; the physical maintenance of the control structures and locks; natural, cultural and historical resources conservation and interpretation; and enhancement of general recreational environment.

A variety of other federal, provincial and municipal agencies play a role in the management of these waterways. Water uses also include hydro-electric power generation, irrigation for agriculture, water supply for domestic or industrial purposes, and resource harvesting. Together, supported by research and monitoring, these multiple uses constitutes a practical example of managing a reservoir ecosystem.

RESUME: Originellement un système militaire et une voie de transport commercial, la navigation de plaisance est aujourd'hui devenue l'utilisation majeure des voies navigables Rideau et Trent-Severn. Depuis 1972, ces canaux sont administrés par

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Parcs Canada dans le cadre de l'Entente Canada - Ontario - Rideau - Trent-Severn (C.O.R.T.S.). De fait, les responsabilités de Parcs Canada couvrent un réseau de canaux, et de régulation et retenue des eaux s'étendant sur un territoire d'environ 150,000 ha. et comprennent l'intégration de programmes reliés à l'entretien des canaux, à la régulation et retenue des eaux, au fonctionnement et à l'entretien des structures, à l'aménagement de facilités récréatives complémentaires, à la protection et l'interprétation des ressources naturelles, historiques et culturelles, ainsi qu'à la mise en valeur du milieu pour des fins récréatives.

Plusieurs autres agences gouvernementales au niveau fédéral, provincial ou municipal participent à la gestion du réseau et à l'aménagement du territoire. L'utilisation de la ressource eau comprend aussi la production d'énergie hydro-électrique, l'irrigation, l'approvisionnement en eau pour des fins domestiques ou industrielles et l'extraction des ressources. L'intégration de ces utilisations multiples, appuyées par des programmes de recherche et de surveillance, constitue un exemple pratique de gestion et d'aménagement d'un écosystème de réservoirs.

INTRODUCTION

The Rideau Canal and Trent-Severn Waterway have been operated since 1972 by Parks Canada as heritage canals to encourage public understanding and enjoyment by protecting for all time their heritage resources and by operating them for recreational use (Parks Canada, 1979a).

The purpose of this paper is to briefly describe how Parks Canada in the context of the Canada-Ontario Rideau-Trent-Severn Agreement (C.O.R.T.S.) operates and manages a system of reservoir lakes covering over 150,000 ha. for a variety of uses. The integration of multiple uses constitutes a practical example of managing a reservoir ecosystem.

LOCATION AND DESCRIPTION

The Rideau and Trent-Severn waterways are located in Southeastern Ontario in the heart of Ontario's recreational land in proximity to Canada's two largest urban centers. The corridor passes through four watersheds: the Rideau, Cataraqui, Trent and Severn Rivers, which are in great part controlled by the Rideau Canal and Trent-Severn Waterway (Figure 1).

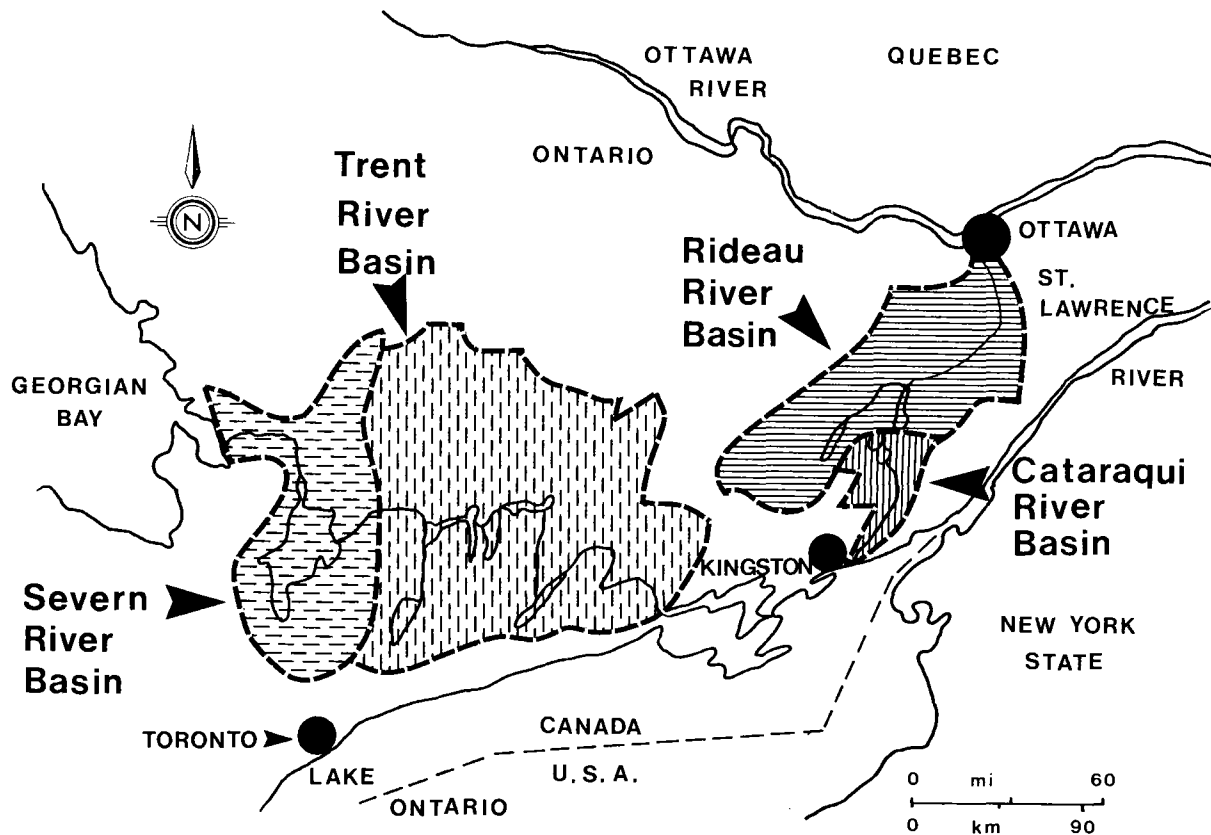


Figure 1. Eastern Ontario, showing watersheds controlled by the Trent-Severn Waterway and Rideau Canal.

The Rideau Canal links the Ottawa River to Lake Ontario through the Rideau and Cataraqui Rivers which combined, drain an area of about 4600 sq. km. The Rideau has an elevation of 122.4 m. at its highest point and drops to 40.5 m. at Ottawa and 73.4 m. at Kingston.

The Trent-Severn Waterway links Lake Ontario to Georgian Bay. Both the Trent and Severn watersheds are mainly controlled by the waterway. The elevation ranges from 256.3 m. at its highest point to 74.4 m. at Trenton and 176.2 m. at Port Severn, on Georgian Bay.

Both the Rideau Canal and Trent-Severn Waterway are located within the Great Lakes - St. Lawrence Forest Region (Rowe, 1972). The landscape is largely man modified by urban, agricultural and recreational uses. Pockets of natural forests and wetland habitats are scattered along the waterways (Hodges and Arbour, 1981).

HISTORICAL REVIEW

The construction of the Rideau Canal (1826-1832) and the Trent-Severn Waterway (1835-1918) was originally for a military and commercial system to ensure a safe transportation route with a minimum of reliance on the Great Lakes which are shared by the United States and to facilitate the flow of trade along the waterways of Eastern Ontario. From 1832 to 1856, under British Ordnance, the Rideau Canal was managed as a military system. Subsequent to this period and under different jurisdictions, the canals remained an important commercial trading route for more than 80 years. As a transportation system, they played a key role in the development of South-Eastern Ontario. From 1936 to 1972, the canals were under the jurisdiction of the federal Ministry of Transport.

With the advent of more efficient alternative transportation methods and the expansion of leisure time, recreational boating became the predominant use. The canals have also acquired historic and aesthetic value as examples of early engineering technology in Canada and as scenic corridors. In recognition of these changes in role the responsibility for both the Rideau Canal and Trent-Severn Waterway was transferred to Parks Canada in 1972.

MULTIPLE USES

The management responsibilities of Parks Canada emphasize not only pleasure navigation and associated activities but also include water level control, the protection and interpretation of the natural and cultural heritage values and the enhancement of the general recreational environment.

A variety of other federal, provincial and municipal agencies such as the provincial Ministries of Natural Resources, Environment, Housing, Industry and Tourism, the National Capital Commission and other branches of the federal Department of Environment, Conservation Authorities, Ontario Hydro and municipalities play a role in the management of the Rideau and Trent-Severn corridor in participation with private groups and individuals.

An agreement was signed, in 1975, between the federal government and the provincial government for guiding development and land use along the Rideau-Trent-Severn corridor. The goal of C.O.R.T.S. is "to develop a distinctive environmental corridor wherein a wide variety of recreational opportunities are available to users in a safe, pleasant and interesting environment and where optimum recreation use is achieved" (C.O.R.T.S., 1977a).

A series of objectives and land use guidelines (C.O.R.T.S., 1977a) and a policy statement (C.O.R.T.S., 1980) also provide a broad framework for the management of the Corridor.

It is within the context of these objectives and guidelines and of its own policy that Parks Canada manages these waterways for multiple use.

Navigation

Apart from water flow control and storage activities which are discussed separately, the main operation and maintenance activities include lock, dam and other structural repairs or reconstruction, dredging to maintain advertised grade depth or for shoreline stabilization, and aquatic weed control.

A complicated network of canals, improved lake and river channels, locks, flow control structures and bridges are maintained to ensure safe, pleasant recreational navigation (Table 1). Combined expenditure levels for both canals

averaged approximately 7.2 million annually over the past 6 years.

Table 1

Distances and Structures on the Navigation Channel, Rideau and Trent-Severn Waterways (From Parks Canada, 1977)

	Trent-Severn	Rideau
Total distance (km)	387	201
Length of canal channel	53	19
Length of improved lake and river channels	334	182
Number of dams (along the navigation channel only)	52	24
Number of locks	43	46
Number of lift locks	2	-
Number of marine railways	1	-
Number of swing bridges	22	16
Number of fixed bridges	43	28
Number of railway bridges	15	6

The maintenance of the advertised grade depth requires periodic dredging of the navigation channels. The assessment of potential impacts and development of appropriate mitigating measures is now an integral part of the project design to conform with Parks Canada policy (1979a) and the Federal Environmental Assessment and Review Process (1978).

Parks Canada's responsibility in a continuing programme of weed control is restricted to the navigation channels and key areas adjacent to lock stations but involvement includes participation in solving this problem throughout the corridor. Parks Canada sits on a committee chaired by Inland Waters Directorate, Department of Environment which co-operates with

the Ontario Ministries of Natural Resources and Environment on aquatic weed research and experimental programmes.

Water Level (Flow) Control

The waterways are part of a major system which provides water regulation primarily for navigation but also for flood control, recreation, conservation and hydro-electric power generation.

The flexibility in water level regulation is described in Figure 2 (Sigvaldason, Bennet, 1978) which shows the permissible variation and an example rule curve for a representative reservoir over 1 year, which is the procedure utilized on the Rideau Canal. The key period of each year is the period between February 1st to May 15th when the operating philosophy of the reservoir system shifts from water level regulation to water flow control in order to bring the reservoirs up to early summer levels with as few side effects as possible especially downstream flood damage. The many physical control structures shown in Table 1 are manipulated according to procedures combining basin runoff forecasts and releases from storage according to reservoir volume and expected fill rates.

Water control on the Trent-Severn is generally done to modify the natural annual cycle of rising and falling water levels. Abnormally wet or very extended dry conditions can cause the system to exceed the preferred limits of level and flow in the whole watershed in spite of the controls. Generally, however, excesses or shortages in small parts of the watersheds can be offset and accommodated by upstream or downstream flow changes. The major consideration is to store sufficient springtime meltwater in the lakes to enable the maintenance of adequate navigation draught throughout the lakes forming the canal route. A second priority is that overall recreational pursuits be protected by the minimum necessary releases of stored water and third priority includes hydro-electric power generation which is generally given more value during non-navigational and non-recreational times of the year. Minimization of flood damage and wildlife disturbance is given prime attention at the localized situations and times when they are critical.

Some 18 permanent hydro power plants are located along the Trent-Severn Waterway with a maximum installed capacity totaling about 61,000 kw. Throughout the summer, a very limited

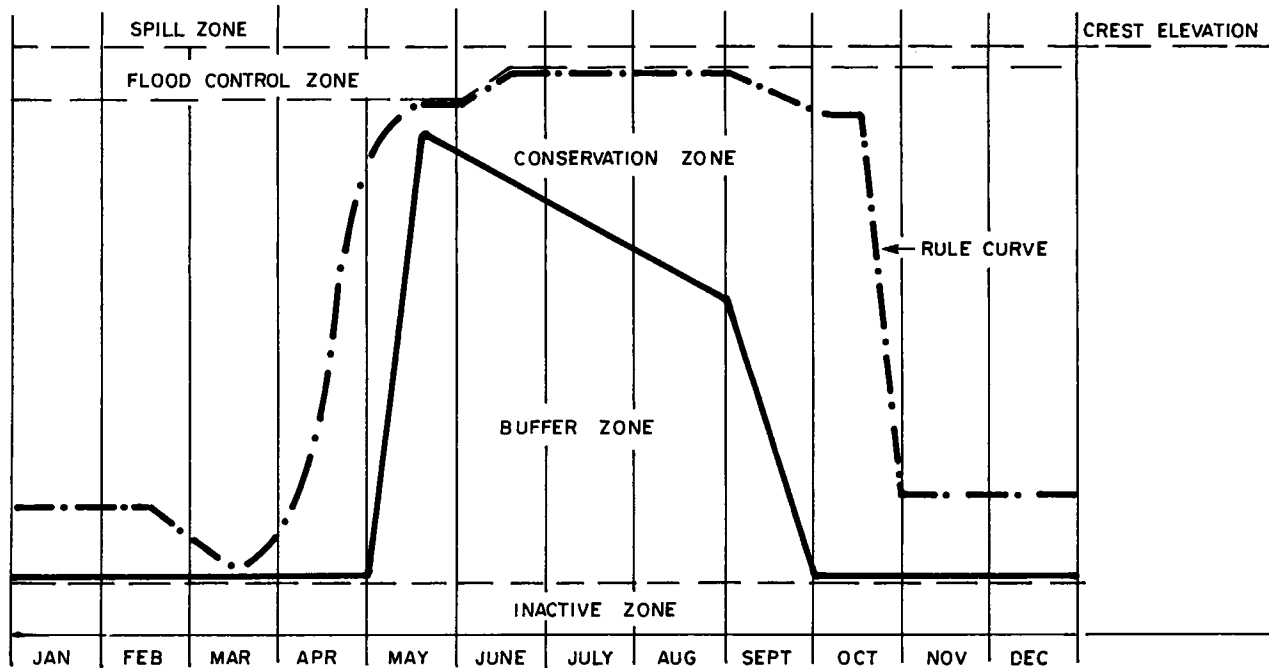


Figure 2 . Variation of zones and rule curve for a typical reservoir through an annual cycle . (from Sigvaldason , Bennett , 1978) .

flow coming from the reservoirs is available for power generation. During this period of low flow along the system, Parks Canada allows the power companies to pass most of the water through their turbines but the water level must be maintained within the navigation limits. In addition to these 18 larger permanent plants, an experimental turbine and generator have been installed by Ontario Hydro at Wasdell's Falls on the Severn River. Testing of this 130 kw. station is underway to determine the feasibility of this type of installation in areas not served by the utility grid. It is designed to syphon its intake flow over a pre-existing dam or embankment thus eliminating many environmental concerns.

Predictions are based upon the water equivalent of the snowpack from regular tests at predetermined locations, daily precipitation levels from local weather stations, the measured changes in flow or levels of each reservoir and over 30 years of historical data. To reflect the changing hydrological conditions of late winter, spring freshet and post freshet, three variations of the forecasting procedure are used (Acres, 1973, a, b, 1977; Sigvaldason, *et al.*, 1975). To successfully integrate all of the user concerns stemming from water level (flow) control Parks Canada initiates regular meetings of affected agencies and local governments, makes this issue an important part of its visitors (and user) awareness activities and on the Trent-Severn a monthly water level bulletin is distributed to help foster this essential communication.

Recreation

Figure 1 shows the Rideau and Trent-Severn Waterways reservoir systems are accessible to the residents of Canada's two biggest cities. Both waterways are in important summer cottage areas and are a major tourist attraction in Ontario where tourism is a leading industry. Practically, diverse viable four season recreation depends as much upon provincial and private sector initiatives as it does the attractiveness of the waterways. C.O.R.T.S. Implementation Guidelines (1981) help break down these and other responsibilities according to the various organizations involved.

Parks Canada participates in numerous recreational activities ranging from maintaining with the National Capital Commission the world's longest skating rink on the Rideau Canal in downtown Ottawa to organizing major festivities such as the 150th Anniversary of the Rideau Canal. Table 2 giving

vessels and lockages indicates the number of total visitors which have used the reservoir systems in recent years. It is also important to remember that at each lock there is a landscaped lockstation with day-use facilities and road access whose capabilities for recreation are being upgraded through preparation of site plans by Parks Canada. Already the ratio of water based to land visitors on the Trent-Severn is about 1.0 to 1.3 and this ratio is expected to increase in the future. Over two million visitors were estimated to have used the Trent-Severn Waterway alone in 1980.

Table 2

Number of Lockages and Vessels, Rideau and Trent-Severn Waterways, 1976 - 1980 (From Parks Canada, 1981)

	Rideau		Trent-Severn	
	Vessels	Lockages	Vessels	Lockages
1976	57750	42186	185148	112533
1977	62674	42319	184131	108713
1978	66075	43000	198836	110054
1979	77381	43002	231325	68926
1980	71310	45075	214541	116102

Natural Heritage Preservation

The protection of natural resources is a main consideration in planning for and maintaining the Rideau Trent-Severn corridor.

The federal Environmental Assessment and Review Process and the Ontario Environmental Assessment Act require the evaluation of possible impacts of proposed actions involving federal or provincial crown lands or funds. Results of this evaluation must be considered in the decision-making process.

Wetlands and shore habitats constitute a major natural, aesthetic, scientific and educational value along the system.

Sparling (1979), the Canadian Wildlife Service (Hodges, 1981) identified many large wetlands along the reservoir system of significance in Southern and Eastern Ontario. There are also many strand and pocket wetlands which while not identified as significant, make as a whole a vital contribution to the character of the waterways and to the general viability of the wetland ecosystems. The need to protect and, as required, manage these wetlands has been agreed by both the provincial and federal governments. It has been stressed in various Parks Canada and C.O.R.T.S. documents. C.O.R.T.S. (1980) specifically recommends that important wetlands and other habitats be protected. Because of the variety of land ownership and separation of responsibilities for management, multi-agency cooperation is critical for the protection of wetlands. Parks Canada's goal is the establishment of a comprehensive programme for the protection and management of wetlands.

Permission must be obtained by individuals or groups to dredge or place fill along the waterways. Each application to dredge or fill is reviewed by various governmental agencies concerned with the possible effects of the proposal as well as with respect to the use of Parks Canada lands or lands covered by water administered by Parks Canada. The applicant is also required to comply with specific conditions specified by Parks Canada if permission is granted.

Fish sanctuaries and other Environmentally Sensitive Areas have been and are currently being identified by the Ontario Ministry of Natural Resources. The maintenance of furbearer habitats, fish spawning beds, wetlands and shore habitats are among the most important ecological considerations in determining water levels (flows) regulation standards.

The protection and management of natural habitats and features is supported by basic inventories, resource management studies and monitoring programmes which ensure the identification of important features, the kinds and extent of adverse man-induced impacts and the management strategies for their preservation. Land acquisition by Parks Canada or other environmental agencies is also an important tool in protecting significant natural features. Information and interpretation programmes are developed to convey an understanding and appreciation by the public of the natural heritage values of the waterways (Parks Canada, 1979b).

Historic and Cultural Heritage

Canal construction, operation and maintenance has been and still is a major factor influencing the development and economy of towns and villages along the reservoir system. The buildings and lock structures are part of the expectations of the users and atmosphere of the system and many warrant preservation in their own right. The preservation of the historic and cultural heritage, is confirmed in Parks Canada policy (1979a).

Effective consideration of the historical character or archaeological value and then protection of cultural resources in an operational context has several important ramifications. Foremost are that special maintenance must be undertaken for historical structures; site design or reconstruction must keep historical context and materials in mind; upgrading the water control technology or provision of expanded services must be accommodated within the limitations of existing structures and the presence of these resources must be interpreted to the user public.

Table 3 shows the type and numbers of significant historical structures and potential archaeological sites along the navigation route. More detailed reports are published as part of the Manuscript Report Series of Parks Canada. These reports (e.g. De Lottinville, 1979; Beahen, 1978; Richardson, 1978) form the basis of both restoration projects and interpretive programs along the waterways.

Table 3

Type and Number of Historic Structures owned by Parks Canada, Rideau and Trent-Severn Waterway (From Parks Canada 1979b, 1980b)

Type	Rideau	Trent-Severn
Locks (some multiple)	50	29
Dams and weirs	40	35
Bridges	29	14
Houses	25	16
Other structures	25	17
Important archaeological sites	14	36

Natural Resource Use

Appropriate use and harvesting of the natural heritage resources along the reservoir system overlaps to a certain extent with other uses. Dredge and fill control has been mentioned under Natural Heritage Preservation and supply of water for hydro-electric power generations has been touched upon under Water Level Control.

Supply of water for domestic and industrial uses is an important use of water to the many towns and municipalities along the corridors. Irrigation and drainage are other water uses on the system and are mainly concentrated in the Holland Marsh area at the south end of Lake Simcoe. About 8000 acres have been drained of which 6500 is enclosed by dykes and the area is an important source of vegetable produce. About half of the drained area is also irrigated.

Since the British North America Act in 1867, the Province of Ontario has had the responsibility for natural resources management. Thus while sport fishing is enhanced by manipulation of water level controls the establishment of sanctuaries or sensitive sites and setting of catch limits are directed by the province according to the results of fisheries research programs. In the cases of muskrat trapping, waterfowl hunting or wild rice harvesting, for instance, Parks Canada acts much like any private landowner in that it must give permission to the provincial Ministry of Natural Resources to licence harvesters. Parks Canada may then set conditions or limits which it feels are necessary to sustain the resource in consultation with the biologists employed by the province. This capability is essential if Parks Canada's primary objectives are to be met.

CONCLUSION

The integration and balance of these multiple uses under the umbrella of C.O.R.T.S. is supported by research and monitoring and ensured via planning, management, operation and maintenance of the waterways. Communication and cooperation between government agencies at different levels and the participation of private individuals and groups is vital in achieving this balance. The integration of a variety of uses on the Rideau-Trent-Severn corridor constitutes a practical example of multiple use management of a reservoir ecosystem.

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