4.0 MATABITCHUAN RIVER WATER MANAGEMENT PLAN DESCRIPTION OF EXISTING WATER POWER AND CONTROL FACILITIES AND STRUCTURES

4.1 Introduction

The information contained herein provides a description of the Matabitchuan River watershed, the water power and control facilities located within, and the operating criteria for each, including voluntary constraints.

4.2 Rivers, Reservoirs and Hydroelectric Facilities

Watersheds are dynamic systems. Water levels and flows in natural systems can vary annually, seasonally or even daily due to meteorological events. Similarly, regulated systems can vary for the same reasons and have the added influence of operational events that may influence water levels and flows. Erosion and accretion of material are continuous components of the life-cycle as watersheds evolve over time and may be influenced by natural and man-induced events.

River flow is caused by the gradient (elevation difference) between the headwaters and the outlet to some downstream water body. Flow velocity is a function of the river gradient and channel geometry. Channel geometry can be influenced by the material forming the bed and banks of the river. By their very nature, the linearity of river systems means that they may cross terrain exhibiting a variety of geomorphic land use and other characteristics. Individually and collectively, these characteristics influence the channel geometry and the erosion susceptibility of the river bed and banks.

In comparison to unregulated lakes, reservoirs associated with hydroelectric generation facilities are very young with respect to geologic time. Waters impounded upstream of a dam impact on lands, which might not normally be located adjacent to an aquatic environment. Immediately after impounding, significant shoreline erosion may occur at many locations as the shoreline soils and slopes are re-shaped and altered. At other locations a significant inland retreat of the shoreline may occur, while at other locations deposition of soils may create off-shore bars or shallows. Over time, the rate of erosion often decreases as shoreline slopes move toward a state of stability and as the shoreline becomes more resistant to erosion.

Lakes often possess many significantly different shoreline conditions resulting from variations in shoreline geomorphology, exposure, vegetation cover and development. Erosion caused by wave action or by large storm events may vary significantly from location to location along a lake shoreline. Water level fluctuations may also influence the rate and nature of erosion occurring along a lake shoreline. Erosion occurring along reservoir shorelines may be more pronounced and may occur at an increased rate relative to erosion occurring in unregulated lakes (*Kallemeyn and Cole 1990*). It must be stressed, however, that because of the many factors affecting erosion, it is often difficult to determine if the erosion that is occurring at a particular location is solely the result of natural processes, is the direct result of regulated flow and water level regimes, or is the product of the interaction of natural and altered processes. It must also be stressed that because of the myriad of other impacts on surface runoff and erosion that may be occurring within a watershed, it may be very difficult to determine quantitatively whether there might have been more or less erosion occurring within a watershed had it remained in its natural state versus having being subjected to river flow regulation.

Erosion, accretion and movement of shoreline materials are a normal and natural phenomenon. Natural erosion forces include flowing water, flooding, wind-induced waves, groundwater seepage, freeze-thaw action, ice scour, surface run-off and wind. As waters flow into a reservoir, flow velocities generally decrease and suspended material will be deposited on the reservoir bed. After passing through the dam, because of the increased velocities and decreased suspended load, increased scour of the river banks and bed may occur immediately downstream of the dam. This material will ultimately be transported downstream and at some downstream location, because of reduced flow velocities, this material will be deposited to create shoreline and/or mid-channel bars or shallows. Such deposits may ultimately have an impact on the channel configuration and alignment, the nature of channel flows and upon the extent and location of river bank erosion. Fine soils, such as clays and silts transported in this manner, may also be deposited as flow velocities decrease both upstream and downstream of the dam. Such deposits may ultimately have a significant negative impact on fish spawning areas and other natural features of importance. In other situations dams may have a positive impact on the fishery by creating new spawning areas.

The regulation of water flow associated with hydroelectric generating facilities involves obtaining a balance between natural influences, valued ecosystem components, riverine ecosystem objectives and power system demands. In order to ensure optimal operation of hydroelectric generation facilities and associated structures, proper management of water flow is crucial. However, this cannot be done in isolation or with disregard to these other factors. Many of the factors controlling water flows within river systems are naturally occurring phenomena that require an ongoing interactive analysis. Rainfall and reservoir inflows are natural events that may vary significantly. The balancing of reservoir inflows and outflow is currently accomplished through gauge systems and through an evaluation of meteorological data across the watershed. When this occurs, reservoir inflows may exceed the regulating capacity of the hydroelectric generation facility, thereby causing the river to return to a state of natural flood conditions. Because of the high flows and velocities associated with such events, these natural floods can have a significant impact on shoreline and river bank erosion, even if the events are only of short duration. Consequently, even within what may be described as a “regulated river system”, natural forces may govern flow and impact significantly on the nature, location and extent of erosion on occasion. Because of the interaction of the many natural and man-made factors affecting the rate, location and extent of reservoir shoreline and downstream river bank erosion, it is often difficult to quantify the impact of the operations of the hydroelectric generating facilities on the overall erosion process.

Hydroelectric generation developments impound water and may reduce downstream river bank erosion by moderating large spring freshet or storm event flows. Impounded water pooled against a natural reservoir shoreline slope may increase bank stability by adding a resisting force to the toe of the slope. Conversely, impounded water may generate wind-induced waves which may cause increased shoreline erosion of the toes of a slope leading to an over-steepening of the bank and ultimate failure. Historically, the rivers regulated by OPGI have generally experienced reduced peak flows during spring freshet through the use of the reservoirs and drawdown to mitigate upstream and downstream flooding.

Substantial seasonal fluctuations may be replaced by smaller daily or seasonal fluctuations in a regulated system, both upstream and downstream of the dam. These more frequent fluctuations of water levels and flows may result in increased reservoir shoreline and/or downstream river bank erosion due to the frequent wetting and de-watering of the bank, particularly at those locations where soil conditions are susceptible to this erosion process. Conversely, regulated lakes may experience reduced fluctuations at certain times of the year within a narrow operating zone instituted in response to fish spawning requirements, and to accommodate recreational and navigational needs.

In general, the construction and operation of hydroelectric generating facilities on a watercourse will alter to some degree, the natural processes of erosion and accretion. When a hydroelectric development or other change occurs on a waterway, there may be a period of readjustment when erosion and/or accretion may be more or less prevalent. It is important to acknowledge the potential impacts of both natural and human factors when assessing the nature, rate and extent of erosion and/or accretion occurring along a waterway. It is also important to acknowledge that the degree to which each of these factors contributes to the overall erosion process is very difficult to quantify. Historically, as a stake holder in the watershed, OPGI has acknowledged public concerns about erosion and has performed substantial erosion protection works in many watersheds throughout the province. By promoting a better public understanding of hydroelectric operations, it is anticipated to assist in developing a better public appreciation of the interaction between natural and regulated conditions and their respective impacts on the watershed.

4.3 Monitoring of Levels and Flows

OPGI Snow Courses:

Winter snow accumulation in Ontario plays a major role in determining the water levels and flow rates on river systems and lakes used by OPGI's Hydro electric generating stations. As such, OPGI regularly gathers snow accumulation data. Because this information is also of interest to some government ministries, e.g., Environment Canada, OPGI makes available snow data survey results on their website. Snow surveys are undertaken on the 1st and 15th of each month, March 1st through June 1st inclusive. Reports are posted following receipt of data for all courses. Snow depth and water content measurements are taken and a percent of normal water content is presented for each of the snow courses.

DCP (Data Collection Platform)

OPGI personnel require accurate and real-time elevation data from the storage reservoirs in order to calculate accurate inflows, discharges and rates-of-rise which are essential to the day-to-day operation of the storages and the "fuel" that they supply to the generating stations on the river system. DCP's or "data collection platforms" which provide this information can be installed in remote locations as they incorporate a self sustained solar power supply. The DCP's provide automatic near real-time data by transmitting coded digital water level data to one of two GOES (Geostationary Operational Environmental Satellite) in orbit over the earth. This information can then be accessed by OPGI personnel via the NESS (National Environmental Satellite Service) computer located in Suitland Maryland, where the processing and evaluation of the DCP information takes place.

Guide Curve and Fall/Winter Drawdown:

Storage reservoirs were created to provide a means of storing water during high inflow periods, to be used for power generation during low inflow periods. High inflows during the fall are stored and used over the course of the winter when natural inflows are at their lowest. At the end of the winter, when the storages have been drawn down, the reservoirs are replenished by the high spring flows.

Guide curves are derived from a compilation of historical data collected over the years to define a typical storage lake drawdown. However due to the inconsistencies in magnitude and timing of temperature and rainfall the actual drawdown of the storage will vary from the typical guide curve. An example of this would be in the event of a late and wet fall when the drawdown would be delayed until the downstream generators would no longer be spilling and the storage water could then be used more efficiently. A cold early winter would have the reverse affect in that the drawdown would be started early in December to meet the higher power demand.

The drawdown target elevations remain consistent in that the intent is to have the storage lakes drawn down prior to spring runoff. This would provide maximum storage capacity in order to provide flood mitigation downstream.

4.4 Operating Constraints

The water management plan identifies operational constraints as follows:

- Operating constraints – constraints developed due to the electrical, structural or legal requirements of the storage/generating facility. Each location has a normal operating range. Some have additional storage available for flood protection or energy reserve during critical periods. Operating constraints are limits such as absolute maximum and minimum reservoir levels, as well as fishery requirements that must not be violated.

- Citizenship constraints – voluntary constraints developed to benefit other users of the water are subject to watershed conditions. Examples are summer water levels to enhance recreational activities. A reasonable effort is made to fulfill the constraint.

- Environmental constraints – constraints developed to mitigate environmental concerns associated with the regulation of levels and flows.

Water level graphs are provided in this document. Operating ranges for all storage reservoirs and generating stations are shown. The median level (50% time exceedence) for a given time period, along with 25% of time and 75% of time exceedence bands are also included.

The median level corresponds to the expected average value. The operating bands are described in terms of probability as follows.

- 2 out of 4 years, the level can be expected to be between the 25% and 75% of time exceedence band

- 1 out of 4 years, the level can be expected to be above the 25% of time exceedence band

- 1 out of 4 years, the level can be expected to be below the 75% of time exceedence band

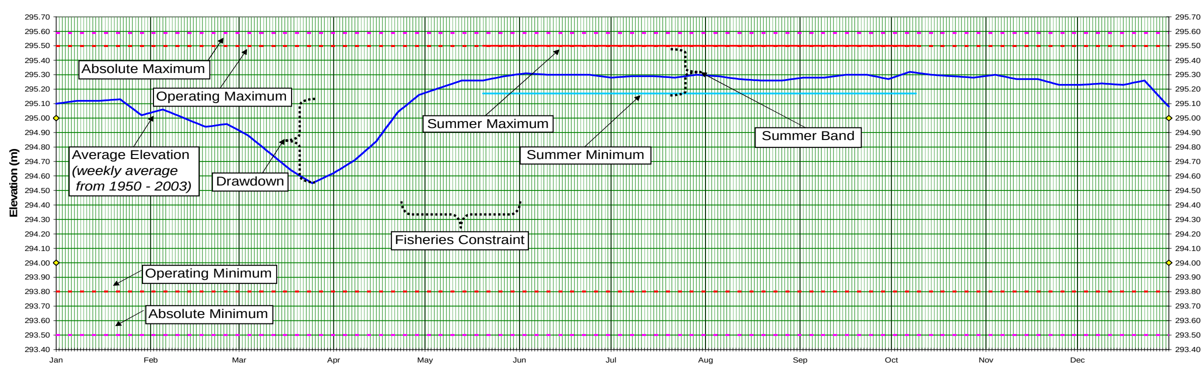

Fig 4.1: Typical Operating Curve
(Coutersy of OPGI)

4.5 Description of Matabitchuan River Watershed

The Matabitchuan River has its headwaters on the heights of land between Hudson Bay and the St. Lawrence River, 296.5 meters above sea level. The length of the river is approximately 70 kilometers with a drainage area of about 933 km^2. The headwaters extend to Rib Lake to the North East of Temagami and takes in other major tributaries such as Net, Cassels, Rabbit and Fourbass lakes, before emptying into Lake Temiskaming.

OPGI owns and operates the lone generating station on this river system as well as the control dam preceding it, while MNR owns and operates two control dams at the head of the river system. The first facilities on this river system were constructed in 1910 by the Mines Power Company and subsequent facilities were constructed to satisfy needs of local industry.

The flowchart that follows shows the flow sequence of the Matabitchuan River watershed:

MATABITCHUAN RIVER WATERSHED

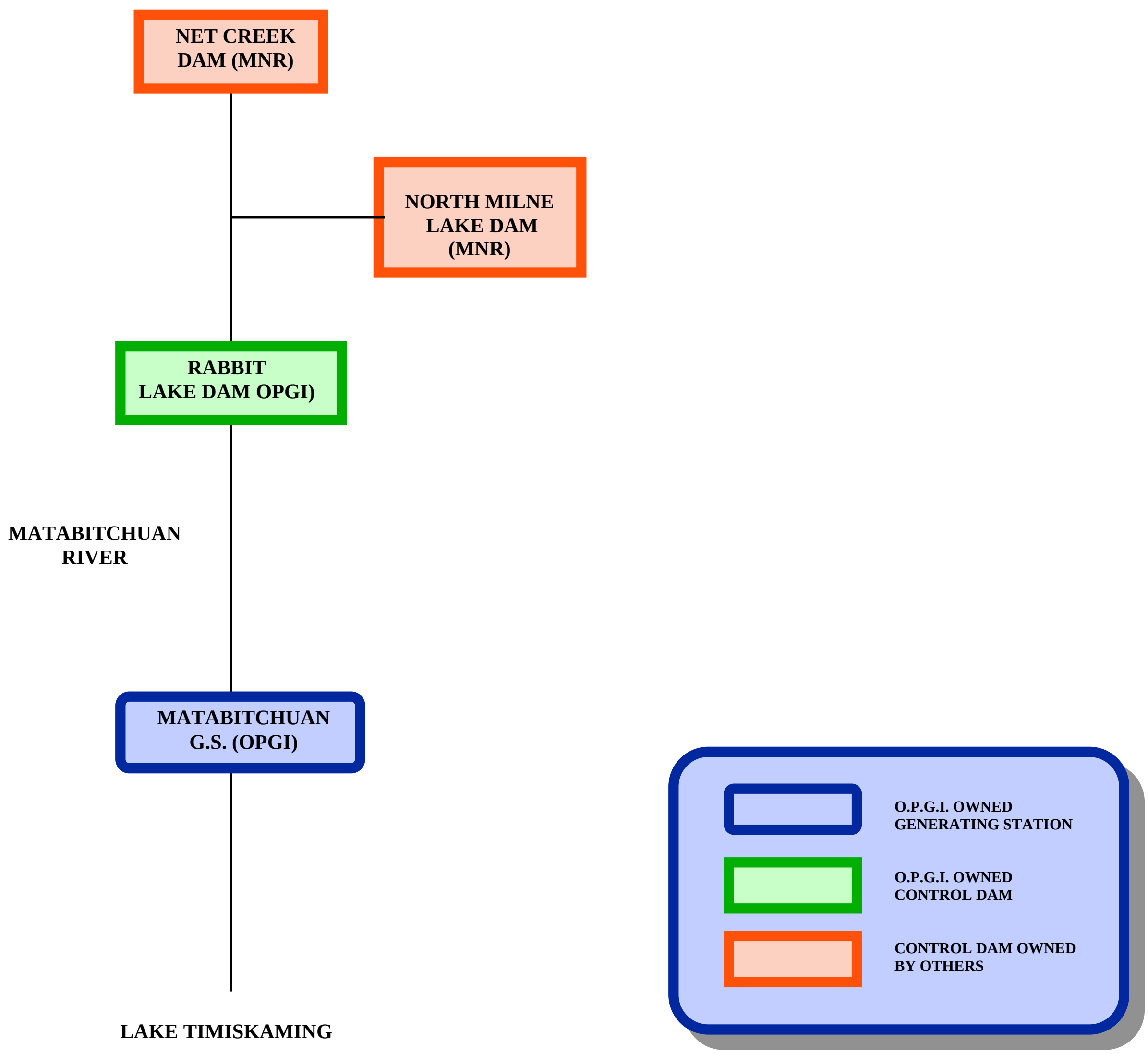

Figure 4.2: Flowchart of Matabitchuan River Watershed
(Courtesy of OPGI)

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4.6 Facility Description - Table of Contents:

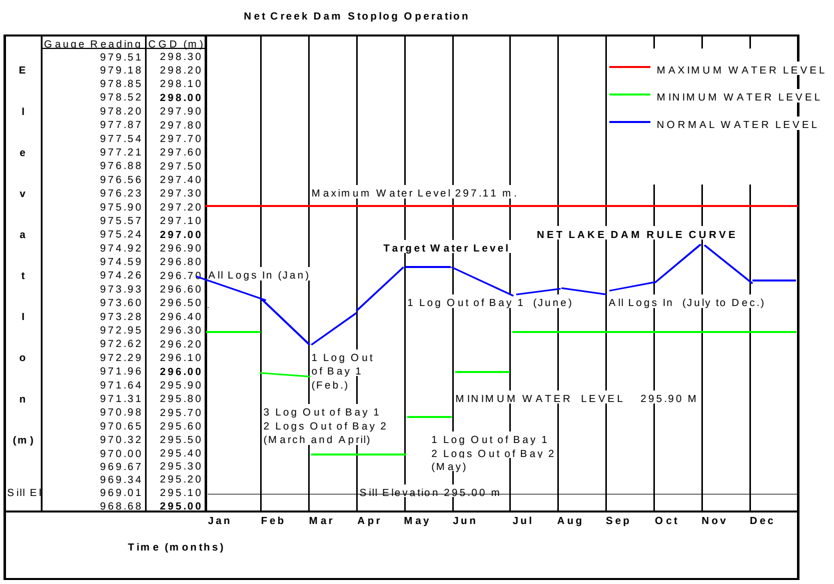
4.6.1 Net Creek Dam

The Net Creek dam, located at the outlet of Net Lake, was originally a rock filled timber dam built by the Temagami Timber Co. in the 1920's to ensure adequate water levels for a lumber mill at the town of Goward, upstream of the dam. The dam fell into disrepair and was replaced by the MNR with the current concrete structure in 1974. This dam is currently owned and operated by the MNR. This dam controls Net Lake flow into Cassels Lake on the Matabitchuan River system. The water level is maintained at the normal level of 296.16 m for the summer period for recreational and navigational purposes. During winter, the water level is pulled to the low level to prepare for the additional volumes of the spring freshet.

Figure 4.4: Map of Net Creek Control Dam
(Courtesy of MNR)

Figure 4.5: Photo of Net Creek Dam
(Courtesy of MNR)

Net Creek Dam



Note:

1 A typical stoplog is 0.3 m (12 inches) high.
2 Dates are approximate.
3 Communicate operations to lake residents.
4 Extra log(s) removal may be required to pass the spring flood
5 If water level reaches the maximum allowable level, removing stop logs to pull the level down
6 Dam has 2 bays

Created Jan 2001

Figure 4.6: Net Creek Dam Historical Operating Graph
(Courtesy of MNR)

4.6.2 <u>North Milne Lake Dam</u>

North Milne Lake dam was originally a rock filled timber crib dam built some time prior to 1955. The Department of Public Works replaced the deteriorating timber crib dam with a concrete structure in 1958 and it is presently owned and operated by the MNR. It controls North Milne Lake flow into Rabbit Creek, 8 km above Rabbit Lake. The log sluice is set at 310.25 m to provide an adequate water level for recreational and navigational purposes. The MNR has completed an EA to convert the dam into a non-operational weir, to maintain the existing operating regime.

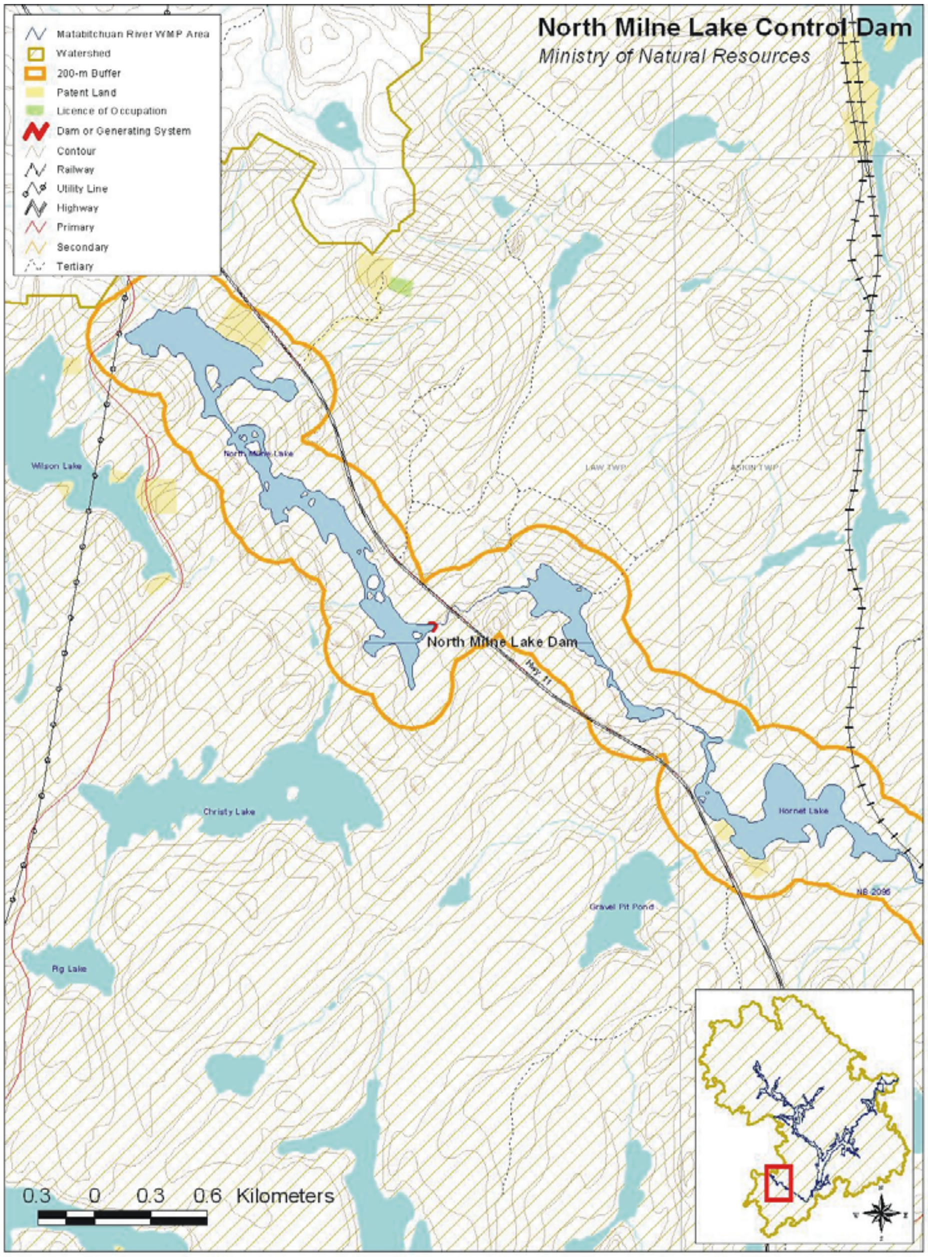


Figure 4.7: Map of North Milne Lake Control Dam
(Courtesy of MNR)

Figure 4.8: Photo of North Milne Lake Dam
(Courtesy of MNR)

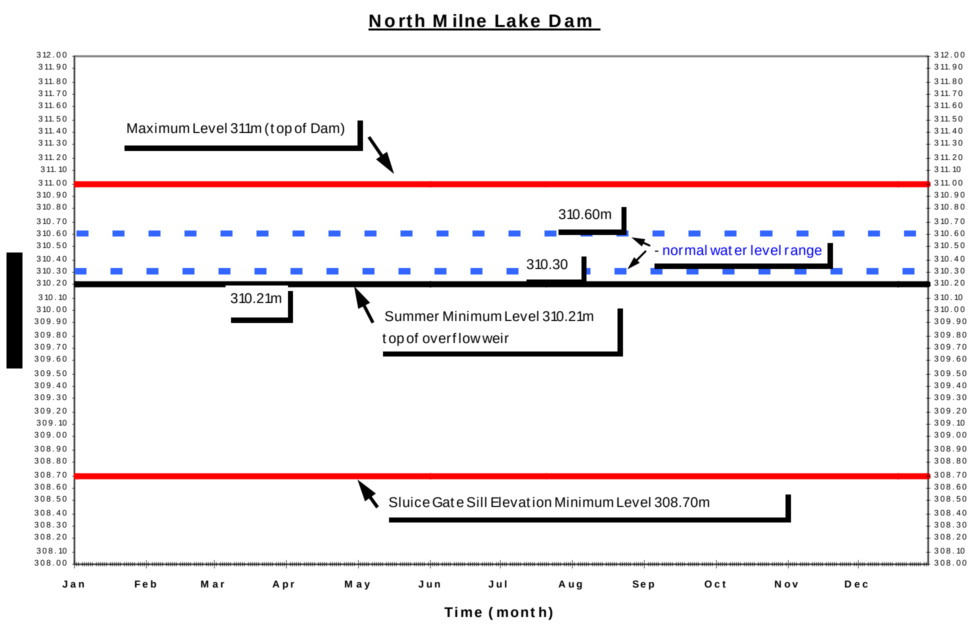


Figure 4.9: North Milne Lake Dam Historical Operating Graph
(Courtesy of MNR)

4.6.3 Rabbit Lake Dam

The Rabbit Lake dam was originally a timber crib structure built by the Mines Power Limited Company at the outlet of Rabbit Lake in 1910. It was rebuilt in 1927 by the Northern Ontario Light and Power Company, and replaced again by Ontario Hydro with a concrete structure in 1957. It is currently owned and operated by OPGI. This dam controls Rabbit Lake flow into the Matabitchuan River, which flows into Fourbass Lake. The water level maintained between 291.40 m and 291.88 m from Victoria Day to Thanksgiving Day weekend for recreational and navigational purposes. By agreement with the MNR, the elevation is to be maintained above 290.63 m until January 15th to protect the Lake Trout spawn. Elevations between 292.18 m and 292.34 m are used for flood mitigation only with MNR approval. It has a normal operating range of 286.0 to 292.18 m.

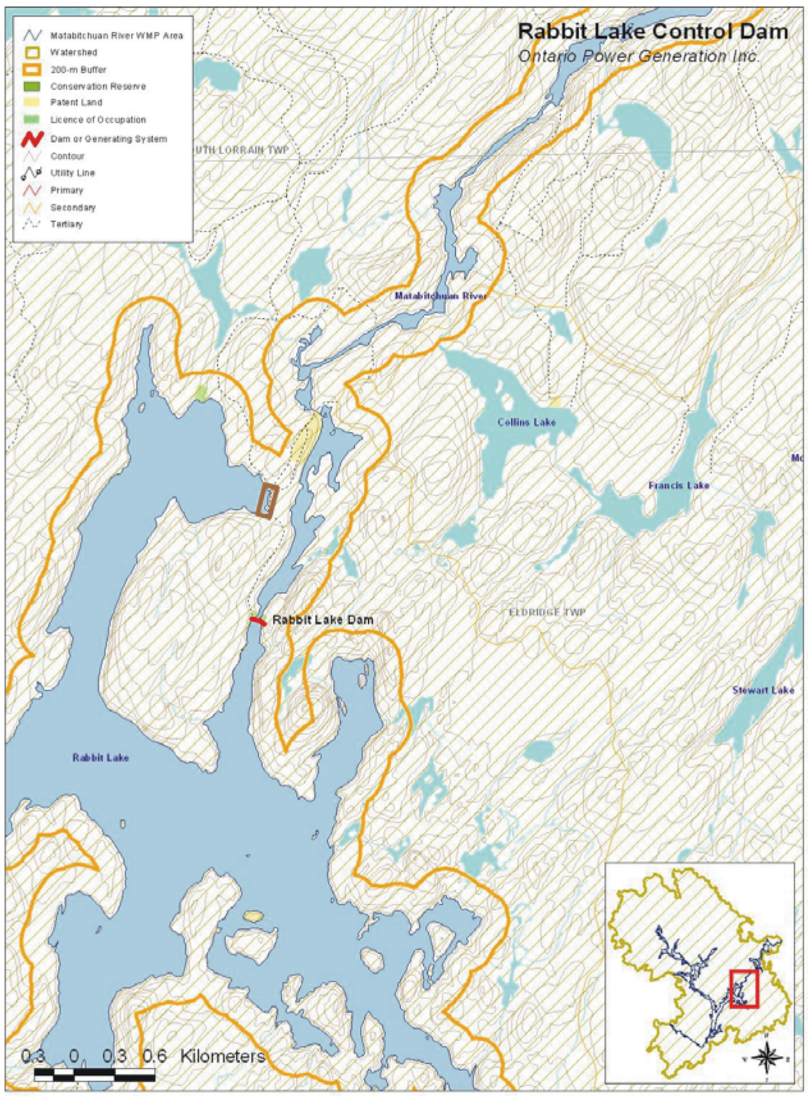


Figure 4.10: Map of Rabbit Lake Control Dam
(Courtesy of MNR)

Figure 4.11: Photo of Rabbit Lake Dam
(Courtesy of OPGI)

Rabbit Lake Forebay Level Constraints:

	Elevation (m)	Range (m)	Duration	Comments
Normal Operating Range	286.00-291.88	5.88	Always	OPGI Constraint
Flood Allowance	291.88-292.34	0.46	Always	OPGI Constraint
Energy Emergency	None			
Absolute Range	286.00-292.34	6.34	Always	Legal Constraint

1. Ideally, the summer operating range should be 291.40 - 291.88 m during the period of May 15th – October 15th.

2. By agreement with the MNR, to protect Lake Trout spawning, the elevation should not drop below 290.63 m before January 15th of each year.

3. The Rabbit Lake Dam is operated under License of Occupation No. 7447 and Water Power Lease Agreement No. 27.

Rabbit Dam Lake Flow Constraints:

None. Flows will be fluctuated in attempts to fulfill the elevation constraints as stated above.

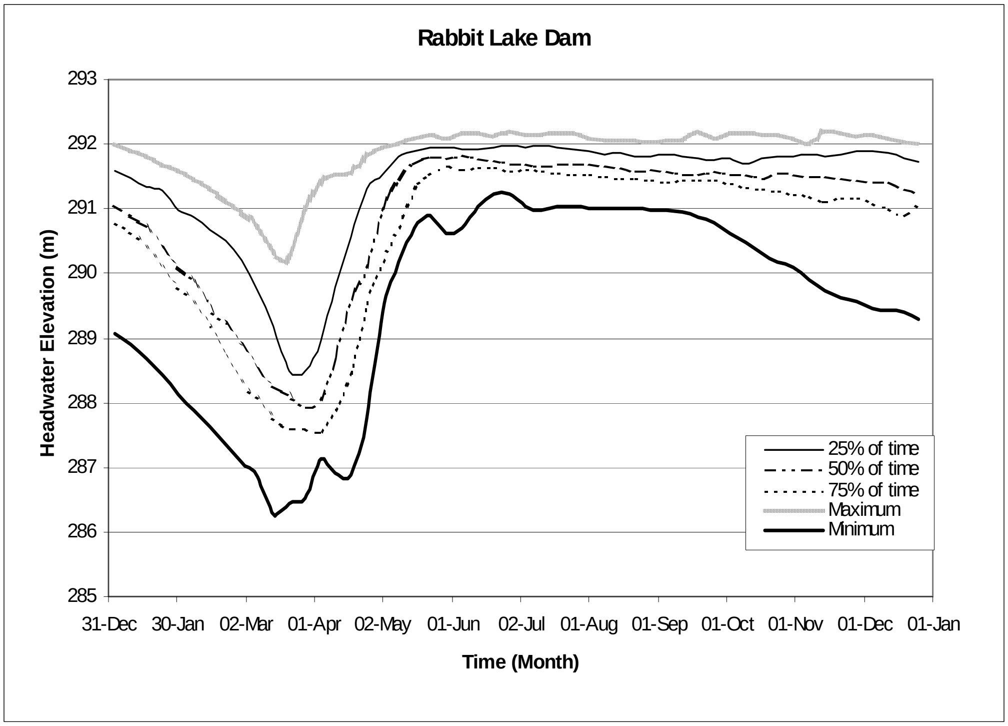


Figure 4.12: Rabbit Lake Dam Historical Operating Graph
(Courtesy of OPGI)

4.6.4 Matabitchuan Generating Station

This power dam was constructed in 1910 and was originally owned by the Mines Power Company and the British Canadian Power Company. Ontario Hydro acquired this generating station from Northern Ontario Power Company in 1944. It is currently owned and operated by OPGI. This facility has an operating head of 93 m, which is second only to Eugenia generating station in the Province of Ontario. The water level is maintained between 275.0 m and 275.33 m from Victoria Day to Thanksgiving Day weekend for recreational and navigational purposes. The elevation of Fourbass Lake is maintained above 274.6 m during the walleye spawning period, mid April to mid June, to allow the walleye to access Cooper Creek. A "spill log" is installed by April 15th to ensure that adequate water is available for fish spawning below the spillway. The "spill log" is removed at the end of June. The requirement for the "spill log" was developed during the EA for redevelopment of the Fourbass Lake Dam in 1995.

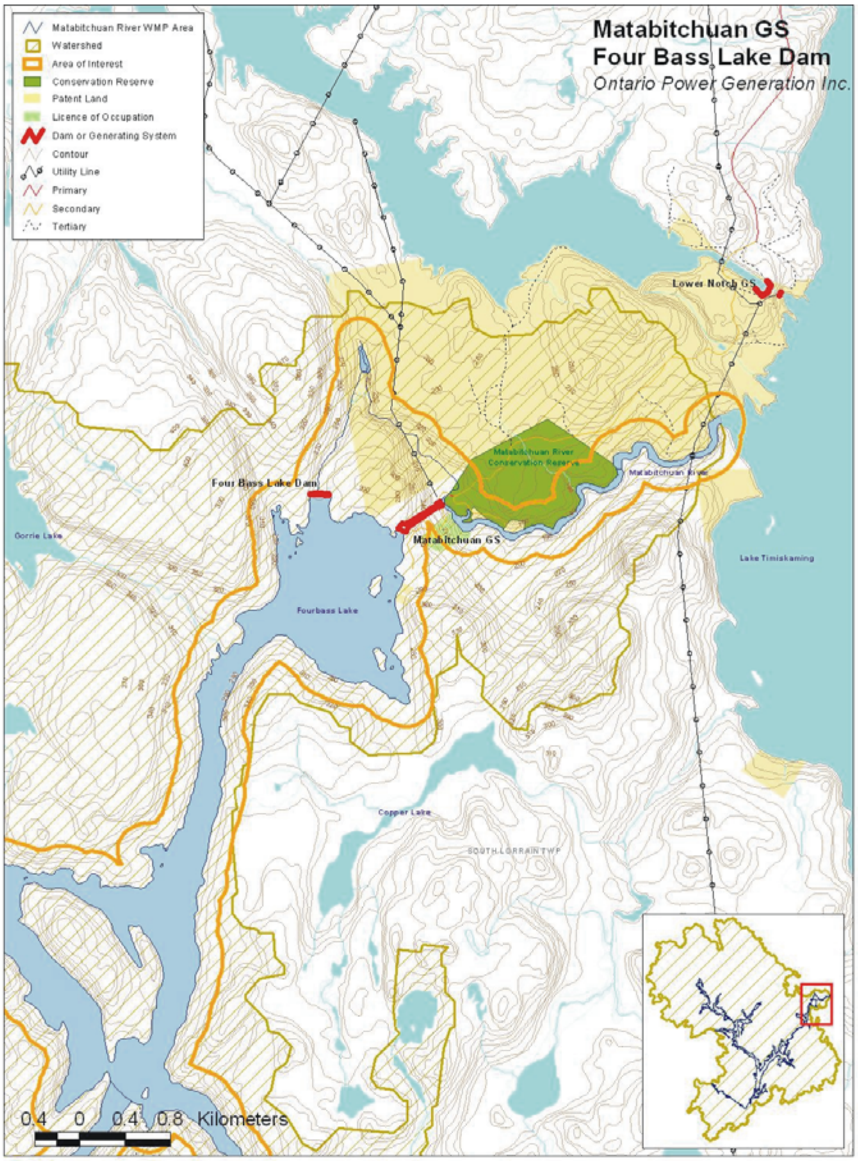


Figure 4.13: Map of Matabitchuan GS and Fourbass Lake Dam (Courtesy of MNR)

Figure 4.14: Photo of Matabitchuan GS
(Courtesy of OPGI)

Matabitchuan GS Forebay Level Constraints:

	Elevation (m)	Range (m)	Duration	Comments
Normal Operating Range	273.20-275.33	2.13	Always	OPGI Constraint
Flood Allowance	none			
Energy Emergency	none			
Absolute Range	273.20-275.33	2.13	Always	Legal Constraint

1. During the walleye spawning (usually mid-April to mid-June), the MNR requests that the forebay be kept above 274.60 m.

2. Matabitchuan discharge is dictated by Rabbit Lake outflows during the summer, fall, and winter up to January 15th, after which the plant is run at full load until freshet is over.

3. Matabitchuan GS is operated under License of Occupation No. 7459.

Matabitchuan GS Flow Constraints:

None. Flows will be fluctuated in attempts to fulfill the elevation constraints as stated above.

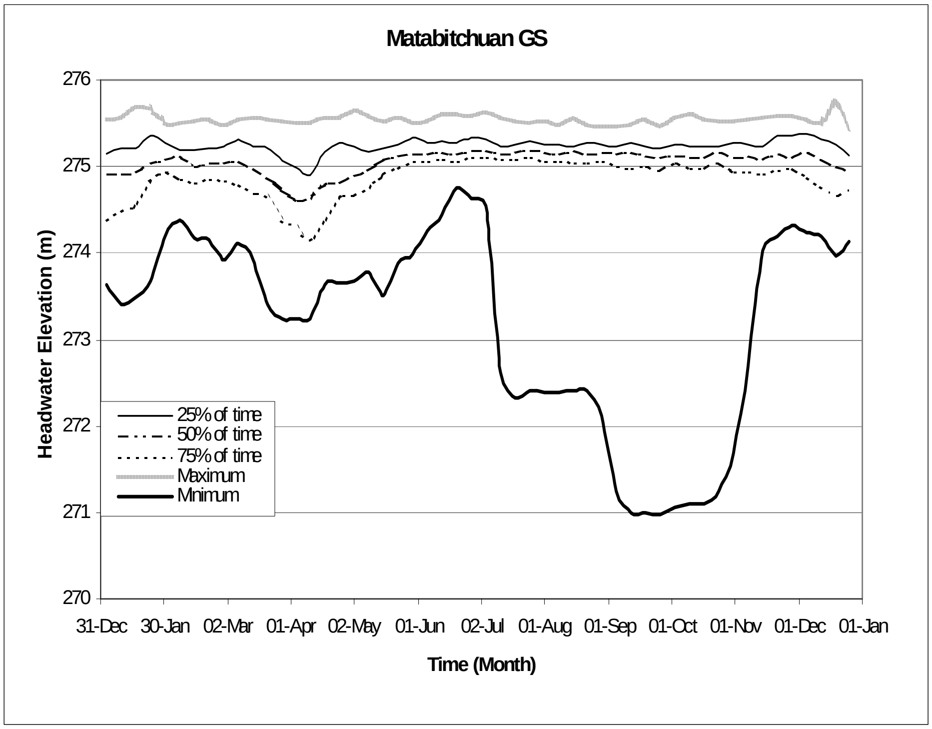


Figure 4.15: Matabitchuan GS Historical Operating Graph
(Courtesy of OPGI)

4.6.5 Lake Timiskaming Water Levels

The Ottawa River Regulation Planning Board and PWGSC control Lake Timiskaming water levels. The lower limit is 175.26 m and the upper limit 179.56 m. There are navigation lower limits from May 15th to Oct 15th of 178.65 m. Walleye spawning in this reach of the river is known to occur one to two weeks later than other areas of the watershed. Erosion has historically been an issue because of the fine sandy soil structure for the lower section of the river.