9 Water Management Plan Amendments



9. Water Management Plan Amendments

Operation of the Bala Generating Station will require an amendment to the existing MRWMP. MNR has recently recommended a coordinated approach between the environmental screening process and water management planning to avoid duplication of effort (MNR, 2007), whereby some of the requirements of the WMP amendment requirements can be addressed in the Environmental Screening Report with an Amendment Request/Information Summary being submitted to MNR following completion of the Environmental Screening/Review Report. This coordinate the two processes. This section has been prepared in accordance with MNR's WMP Guidelines for Water Power (2002c).

The MNR, with recommendation from the MRWMP Standing Advisory Committee (SAC), will determine if the amendment is an administrative, minor or major one, following the MNR's final approval of the proposed operating plan. With incorporation of water management planning into the EA process, it is now possible to include the details of the amendment to the latter WMP in this document.

As per Section 17.2 of the MRWMP, the amendment request must contain the following information:

- a brief description of the proposed amendment
- the rationale for the proposed amendment and a discussion of its significance
- if new operations are proposed
 - a brief description of the proposed operation and a description of the previously approved operations in the WMP that will be changed by the proposed amendment (if any)
 - an outline of the applicable planning requirements for the proposed operations including public consultation, based on the planning requirements for similar operations in the WMP.

The public, agency and First Nation consultation requirements of the WMP process have been incorporated into the consultation undertaken as part of the EA process. The existing WMP SAC has been informed of the project and will review the information contained within this document and the subsequent stand-alone amendment document. The SAC will then make a recommendation regarding the proposed amendment to the WMP Steering Committee (SC).

9.1 Introduction and Zone of Influence

MNR states in their Water Management Planning Guidelines (MNR, 2002), that the goal of water management planning is to contribute to the environmental, social and economic well-being of the people of Ontario through the sustainable development of waterpower resources and to manage these resources in an ecologically sustainable way for the benefit of present and future generations.

MNR has outlined the following key principles to guide the water management planning process:

- strive to maximize the net environmental, social and economic benefits to society
- strive for riverine ecosystem sustainability through the management of water levels and flows
- use best available information in water management planning



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- conduct a thorough assessment of water management options
- use adaptive management to reduce areas of uncertainty, build on successes and make adjustments to limit adverse impacts
- act on study findings in a timely manner where an environmental, social or economic benefit may be realized without adversely affecting the waterpower industry's operating revenues
- undertake water management planning without prejudice to the rights of Aboriginal people and treaty rights
- public participation is required to ensure accountability and transparency in the planning process.

The zone of influence for the North Bala Dam project is defined as the Bala Bay area at the western end of Lake Muskoka and downstream through the Bala Reach in the Lower Muskoka watershed. The broader study area for the environmental screening included Lake Muskoka as well as the Moon and Musquash rivers downstream of the Bala dams, including the MNR Go Home Lake Dam and all downstream generating stations to Georgian Bay (Figure 1.1).

The key objective of this specific facility WMP is to manage water levels and flows associated with the proposed North Bala Hydro Project in such a manner as to maintain existing water levels and flows in Lake Muskoka and downstream in accordance with the approved MRWMP (Acres, 2006).

9.2 Physical and Biological Description of Riverine Ecosystem

See Section 2.1 of the Environmental Screening Report.

9.3 Socioeconomic Description Related to Riverine Ecosystem and Water Management

See Section 2.2 of the Environmental Screening Report.

9.4 Waterpower Facilities, Water Control Structures, and Current Water Management Strategies

The relevant existing regulated lake (Lake Muskoka), waterpower facilities and water control structures potentially affected by this project are described below, including current water management strategies as outlined in the approved MRWMP.

Lake Muskoka

Lake Muskoka is the largest lake within the Muskoka River watershed, with a surface area of 120 km² and average depth of 15.5 m. Its maximum depth is 67 m. Its shores have numerous seasonal and permanent residences as well as businesses mainly associated with tourism or recreation. There are over 1800 boathouses and 3700 docks along the 285.3-km long shoreline of Lake Muskoka (Acres, 2006). The water levels in Lake Muskoka are regulated under the MRWMP and controlled by the operations of the North and South Bala dams, both presently owned and operated by the MNR. The normal range of annual water level fluctuation is 1.15 m, between elevations 224.6 and 225.75 m above sea level. The proposed facility will operate in accordance with the existing WMP in relation to Lake Muskoka levels and flows into the downstream Bala reach of the Moon River.



Lake Muskoka water levels are presently managed by the operations of the North and South Bala dams as prescribed in the approved MRWMP:

Target Operating Level Range:	224.9 to 225.6 m		
Normal Operating Zone Range:	224.6 to 225.75 m		
Absolute Range:	224.55 to 225.97 m		
Summer* Range (Typical):	225.28 to 225.65 m		
Winter Drawdown:	225.52 to 224.9 m		
Flood Allowance (lake/river):	225.75 to 225.97 m/368.1 m ³ /s (spring)/283.0 m ³ /s (summer)		
Maximum Daily Flow:	309.6 m ³ /s		
Minimum Daily Flow:	6 m ³ /s summer target (inclusive of 4 m ³ /s from Burgess Generating Station)		
Natural Environment Constraints:	• Above winter limit drawdown to protect lake trout spawning shoals		
	• Spring flows for walleye spawning at Moon Falls (see next page)		
Social Constraints:	• Above water level limits to protect extensive high value shoreline development with infrastructure ranging from 225.64 to 226.44 m		
	• Protect against spring ice damage to infrastructure.		
	• Protect navigation access at Port Carling locks.		
	Protect flooding of Marinas on Indian River		
Other:	Winter drawdown undertaken for downstream hydropower production		

*Summer period defined as June 1 to September 15.

The existing MNR-approved Lake Muskoka operating strategy is shown graphically in Figure 9.1.

North Bala Dam

The North Bala Dam is located on the brink of Bala Falls. The falls is a popular recreational site, particularly during summer when low flows allow people to walk or sit along the rocks of the falls. The area immediately abutting the falls to the north is fitted with benches for recreational sightseeing and picnicking. Interpretive plaques are placed on the northern shore of the falls. North Bala Dam





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and the neighbouring South Bala Dam control flows from Lake Muskoka downstream into the Bala Reach and Moon Chute of the Moon River (Figure 1.1).

The area adjacent to the North Bala Dam previously housed a small hydroelectric generating station (2.3 kV) built in 1924 by Bala Electric Company. It was purchased by the Hydro Electric Power Commission of Ontario in 1929 and supplied power to the Town of Bala until 1957. It was demolished in 1972. The intake, powerhouse and tailrace areas were in-filled, which is evident by the in-fill material that differs from the surrounding natural rock in the area.

South Bala Dam

The South Bala Dam is an eight stop-log bay concrete dam located approximately 150 m south of the North Bala Dam and is the same height (4 m) as the North Dam. It is approximately 24 m in length. Together, the Bala Dams control the upstream Lake Muskoka water levels, the Muskoka River up to Bracebridge Falls and the Indian River to the Port Carling Dam.

Burgess Dam and Burgess Generating Station

The Burgess Dam which is integrated with a small hydroelectric generating station (Burgess Generating Station) is located at the most northerly outlet from Lake Muskoka, a narrow channel approximately 300 m north of the North Bala Dam (Figure 1.1). This generating station is owned by Algonquin Power. The allocated maximum flow to the Burgess Generating Station is 4 m³/s and there is no spilling capacity. As a result, all flood flows passing from Lake Muskoka are routed through the North and South Bala Dams. Downstream of Bala, the river forks into the Moon and Musquash Rivers after approximately 5 km (Acres, 2006).

Bala Reach, Ragged Rapids and Moon Dam - OPG

The Bala Reach operating strategy, which is implemented through operation of the Moon Dam and Ragged Rapids Generating Station, is as follows, based on the approved MRWMP:

Normal Operating Zone:	219.0 to 219.3 m summer	
	219.2 to 219.5 m spring, fall and winter	
Summer* Range (Typical):	219.0 to 219.3 m	
Winter Drawdown:	None	
Flood Allowance:	None. However, the facility has limited discharge capacity and cannot control river levels beyond the specified High Flow trigger. Levels may exceed the upper extent of the Normal Operating Zone (NOZ) at this time.	
Maximum Daily Flow:	88.9 m³/s	
High Flow Trigger:	85 m ³ /s (at Bala dams) (when high water level may be exceeded)	
Minimum Daily Flow:	None	





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Low Flow Trigger:	3 m ³ /s (when low water limit may be exceeded)
Natural Environment Constraints:	Flows for walleye spawning at Moon Falls (April 15 to June 1) of 14 m ³ /s target when flows >20 m ³ /s; when flows are <20 m ³ /s, target flows are 8 to 10 m ³ /s in the Moon River and 4 to 6 m ³ /s in the Musquash River.
	Summer flow in the Moon River of approximately 1 m³/s via leakage through Moon Dam.
Social Constraints:	High water levels in Bala Reach may affect septic beds and inundate docks and cottage crawl spaces. Low water levels in Bala Reach may restrict access to docks and properties.
Other:	Moon Chutes, located at the downstream end of Bala Reach, restricts outflow from Bala Reach at flows in excess of 85 m ³ /s resulting in progressively higher levels as flows continue to increase.
	Flows and levels in Bala Reach are managed jointly by MNR and OPG. Optimum flow withdrawal for waterpower generation at Musquash stations (Ragged Rapids and Big Eddy) is 85 m ³ /s.

*Summer period defined as June 1 to September 15.

The Bala Reach operating strategy is shown graphically in Figure 9.2.

Moon Dam

This is a water control structure located on the Moon River approximately 6 km downstream of the North Bala Dam. The Moon River eventually empties into Georgian Bay. The Moon Dam is owned and operated by OPG in coordination with operations at Ragged Rapids Generating Station.

Ragged Rapids Dam and Generating Station

The Ragged Rapids Dam is associated with the OPG-owned Ragged Rapids hydroelectric generating station and is located on the Muskoka (Musquash) River approximately 6 km downstream of the North Bala Dam (Figure 1.1).

Big Eddy Dam and Generating Station

The Big Eddy Dam is associated with the OPG-owned Big Eddy hydroelectric generating station and is located on the Muskoka (Musquash) River approximately 13 km downstream of the North Bala Dam (7 km downstream of Ragged Rapids) (Figure 1.1).

Go Home Lake Control Dam

Go Home Lake receives the flow from the upstream section of the Musquash River and empties into the downstream section which flows into Georgian Bay (Figure 1.1). The Go Home Lake Control





Dam is owned and operated by MNR to control outflows from Go Home Lake into the lower Musquash River.

Go Home Lake Filter Dam

The Go Home Lake Filter Dam is located on the west side of Go Home Lake at the Go Home Chute (Figure 1.1). Its function is to maintain lake levels and is not operated, but is intentionally designed to pass leakage.

9.5 Issues, Resource Values and Interests

See Section 4 of the Environmental Screening Report.

9.6 Baseline Data Collection Program

See Sections 4.2 and 4.3 of the Environmental Screening Report.

9.7 Option Development and Preferred Option

Several alternative layouts for the proposed North Bala Small Hydro Project were considered as outlined in Section 1.5 and Appendix A2 of the Environmental Screening Report. The reasons for rejection of five of these alternatives are also provided in Section 1.5. The preferred scheme is shown on the drawing for Alternative 2D (Appendix A2).

The options considered for managing water levels and flows for the proposed North Bala Generating Station were as follows:

- A daily peaking regime with the facility generating at maximum capacity and passing maximum capacity flows of between 96 m³/s (rated capacity) to 100 m³/s (maximum capacity) during peak times. Any inflows to Lake Muskoka which were not required for maintaining or restoring lake water levels to the target level would be passed during the off-peak period.
- A two-tiered plan for operation of the North Bala Generating Station using the existing Bala Reach trigger flow of 85 m³/s as a cap for peak period flow releases from all Lake Muskoka water control facilities, i.e., North Bala and Burgess Generating Stations, South Bala Dam and North Bala Dam when inflows to Lake Muskoka are less than 85 m³/s.
- A run-of-river regime with the facility generating power according to the inflows and corresponding water levels in Lake Muskoka. The facility would pass up to 100 m³/s through the turbines during flood conditions, but would generate at lower capacity or in some cases not at all during lower flow periods.

OPG and MNR both expressed concern about the proposed unrestricted peaking and two-tiered operation regimes and the resulting downstream water level and flow fluctuations in Bala Reach, the head pond of Big Eddy Generating Station, and Go Home Lake. More specifically, MNR was concerned that any daily peaking operation would result in larger water level fluctuations in Go Home Lake and Bala Reach than the residents at these two locations had come to know and expect, as well as increase operational demands at Go Home Lake Dam (MNR). OPG was concerned that the release of peak flows above the natural inflow rate and above the Bala Reach high flow trigger of 85 m³/s would cause them to incur higher spill loss or reduced generation at the Ragged Rapids plant downstream.



In consideration of these concerns, the run-of-river operation described above was chosen as the preferred option.

9.8 Environmental Effects of Preferred Option

Prior to confirming the preferred water management strategy for the proposed North Bala Generating Station as described in Section 9.9, the environmental effects of construction and operation were assessed and the results are provided in Sections 5 and 6 of the environmental screening report.

9.9 Operating Plan for the North Bala Generating Station

The proposed North Bala Small Hydro Project facility will operate within the existing approved Lake Muskoka operating plan as is presently outlined in the MRWMP. This means that the plant will be operated to maintain its headwater (Lake Muskoka) at the TOLs in the MRWMP, with the NOZ being adopted as the plant compliance levels. An operational band around the TOL is proposed, which for the purposes of the plan will be referred to as the Best Management Zone (BMZ) band. The BMZ zone will be entirely within the NOZ which presently exists in the MRWMP. Figure 9.3 depicts the operating plan with proposed BMZ band. Between January 1 and May 1, there will be no BMZ around the TOL. Lake Muskoka will be drawn down to a level of 224.90 on or before March 25 in order to provide adequate storage for the spring freshet. MNR may instruct SREL to achieve the drawdown level by a date earlier than March 25 and/or lower the lake further in order to prepare for the freshet and associated flood mitigation. This decision by MNR will depend on snow pack conditions, water content and other flood forecasting indicators and objectives.

From May 1 to May 31, a BMZ of up to 5 cm below the TOL will be applied for flood risk reduction. From June 1 to July 31, a ± 2 cm BMZ around the TOL (i.e., up to 2 cm above or 2 cm below the TOL) will be applied. From August 1 to September 15, the BMZ will be from 4 cm above the TOL to 2 cm below the TOL. From September 16 to October 15, the BMZ will extend to 5 cm above the TOL. The descending slope of this band will merge with the TOL on or around October 20. MNR may instruct SREL to alter the timing and duration of the fall drawdown based on the progress of the lake trout spawning period. From on or about October 20 to December 31, a BMZ band up to 6 cm below the TOL will apply.

The WMP for Lake Muskoka and Bala Reach requires a minimum daily average flow of 6 m³/s to be passed through the three Lake Muskoka control facilities (Burgess Generating Station, North Bala Dam, and South Bala Dam). Generally 4 m³/s is allocated to the Burgess Generating Station for power generation and, a minimum daily average flow of 2 m³/s is assumed to pass through the North Bala and South Bala dams, split equally between the two structures. For the purposes of improving fish habitat, maintenance of water quality, and channel aesthetics in the South Channel during the low flow periods of summer, the flow passage through the South Dam may be increased to 2 m³/s. Flow through the Bala dams is assumed to occur either via leakage or through log manipulation.

Flows in excess of the minimum turbine flow of 14 m^3 /s will pass through the plant up to a maximum unit flow of 100 m^3 /s. Due to the considerable storage provided by Lake Muskoka, it is anticipated that there will be some amount of generation every day.

Normally for periods not including the walleye spawning period, inflows to Lake Muskoka in excess of 106 m³/s (plant rated flow plus mandated Burgess Generating Station and dam aesthetic flows) will be passed using the South Dam, with the North Dam being operated only if the South Dam's spilling capacity is exceeded. Lake Muskoka levels will thereby be maintained within the NOZ. When inflows are below 106 m³/s, correspondingly lower flows will be passed through the plant. During





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the spawning period (typically late April to early May), adequate flows will be passed over the North Bala Dam to allow continued use of existing spawning areas downstream of the North Bala Falls rapids. The flow and the exact timing of its release will be determined through dialogue with the DFO and MNR.

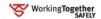
As is the case presently, flows to Burgess Generating Station will be limited under instructions from MNR when there is insufficient water to allow for its operation (typically when both dams are closed and water levels are falling below the NOZ. As flows from Lake Muskoka increase, it is proposed that the flows be sequentially allocated to Burgess Generating Station (up to 4 m³/s), then to the North Bala Hydro facility, up to its maximum capacity of 100 m³/s. This assumes the remaining 3 m³/s will be passing via leakage or through log manipulations at the North (1 m³/s) and South (2 m³/s) Bala Dams. With additional flows above the 106 m³/s, the further sequential allocation will be to the South Dam, then the North Dam. Under declining flows, the priorities would be reversed.

The existing Lake Muskoka operating strategy in the approved MRWMP will be adopted by the proposed facility. It is currently implemented through operation of the Bala North and South Dams. The new hydroelectric facility will be included in the implementation of the operating strategy.

The seasonal changes in the TOLs for Lake Muskoka as required by the approved MRWMP are summarized in Table 9.1. The plant will adopt the existing TOL as its operating TOL, with a BMZ band, complying with the water level direction changes as described in the MRWMP.

Component	Operating Characteristics	MRWMP Values	Seasonal Period	North Bala GS Operating Plan
Spring Water Level (freshet to	Upper NOZ (m) Lower NOZ (m) TOL (m)	225.75 224.6 – 225.28 225.6 – 225.48	Jan 1 to Apr 31	No BMZ during this time period (TOL to be adhered to)
May 30)	Peak Date TOL Change WL* Direction	May 1 0.12 Down	May 1 to May 31	BMZ band = TOL -5 cm BMZ band width = 5 cm
Summer Water Level (June 1 to	Upper NOZ (m) Lower NOZ (m) TOL (m)	225.75 - 225.52 225.28 225.48 - 225.35	Jun 1 to Jul 31	$BMZ band = TOL \pm 2 cm$ BMZ band width = 4 cm
Sept 15)	TOL Change WL Direction	0.13 Down	Aug 1 to Sep 15	BMZ band = TOL+4 cm /-2 cm BMZ band width = 6 cm
Fall Water Level (Sept 16 to	Upper NOZ (m) Lower NOZ (m)	225.52 - 225.61 225.28 - 225.12	Sept 16 – Oct 15	BMZ band = +5 cm BMZ band width = 5 cm
Nov 30)	TOL (m) TOL Change (m) WL Direction	225.35 – 225.25 0.1 Down, then natural rise to 225.52 by Dec 1	Oct 20 to Dec 31	BMZ band = -6 cm BMZ band width = 6 cm
Winter Water Level (Dec 1 to March 15)	Upper NOZ (m) Lower NOZ (m) TOL (m) TOL Change (m) WL Direction	225.61 – 225.1 225.12 – 224.6 225.52 – 224.9 0.62 Down	Jan 1 to Mar 15	No BMZ during this time period (TOL to be adhered to)
*Water Level				

 Table 9.1
 North Bala Generating Station – Lake Muskoka – Seasonal TOLs





Bala Reach

Bala Reach water levels are presently managed by flow releases at the North and South Bala Dams in coordination with discharges at OPG-owned Ragged Rapids Generating Station and Moon Dam. OPG's operations at these dams are normally directed by the compliance limits for water levels within Bala Reach. The operating plan for these OPG facilities is presented in Section 9.4. The North Bala Hydro facility will be required to pass flows which do not inhibit OPG's ability to remain in compliance at Bala Reach, while at the same time having no negative impact on OPG's generation. This can be achieved only through coordination with OPG. It is therefore proposed that as part of operations there be an agreed method of effective communication between the operators of the North Bala Generating Station and OPG Ragged Rapids Generating Station.

The Bala Reach operating strategy presented in Section 9.4 will be adopted by the proposed facility, which will operate in a run-of-river mode.

9.10 Compliance Considerations

The NOZ for Lake Muskoka, as identified in the existing MRWMP will become the legal operating range (compliance zone) for the proposed North Bala Generating Station. SREL will be out of compliance if they operate outside the NOZ, with the exception during extreme high and low water events as described in Section 13.3 of the MRWMP, and summarized below.

A *Low Water Indicator* would occur when the North Bala Generating Station and the North and South Bala Dams have been operated to provide the minimum flow of 6 m³/s (i.e., both the dams and powerhouse have been shut down) and the water level of Lake Muskoka falls below the NOZ. If this situation occurs, SREL would not be out of compliance with the MRWMP. MNR reserves the right to instruct SREL to reduce Bala flows to the minimum when Lake Muskoka levels fall toward the lower portion of the NOZ. This would involve first shutting down the North Bala Generating Station, followed by shutting down Burgess Generating Station and placing all stop logs in the North and South Bala Dams.

The *High Water Indicator* takes into consideration the recognized downstream flood constraints with the Bala Reach, allowing SREL to maintain the level of Lake Muskoka above the NOZ under certain high flow circumstances. For example, as Lake Muskoka levels or rate of rise begin to significantly increase above the BMZ and toward the upper portion of the NOZ, efforts will be made to prevent flows into the Bala Reach from surpassing 200 m³/s, (which corresponds to bank full flows and the point where high water concerns commence), while addressing Lake Muskoka level objectives. If Lake Muskoka levels are expected to rise above the NOZ due to high inflow conditions, the discharge into the Bala Reach can be increased to 280 m³/s.

Under watershed-wide flood conditions, flow discharge into the Bala Reach may surpass 280 m³/s in order to equitably balance the negative effects of flooding in Lake Muskoka and the Bala Reach/Moon River.

As per the Compliance Monitoring and Reporting Section of the MRWMP, SREL will be required to submit an Event Report whenever Lake Muskoka water levels rise above, or fall below the NOZ. Under the High Water Indicator and Low Water Indicator situations described above, SREL would not be out of compliance with the MRWMP.



9.11 Effectiveness Monitoring Program

A post-construction environmental monitoring program is outlined in Section 10 of the environmental screening report to assess the impacts of the project and the effectiveness of mitigation proposed. In addition, consultations will be ongoing with OPG to ensure that their downstream generating station operations are not adversely affected by the new North Bala generating facility. Consultation will also be ongoing with MNR to ensure that their downstream Go Home Lake Dam operations are not adversely affected by the Bala Generating Station or OPG facilities.

9.12 Compliance Monitoring and Reporting Program

It is understood that the North Bala Generating Station will be subject to the same general compliance and reporting requirements as described for other water power operators in the approved MRWMP (Acres, 2006) including the following:

- one instantaneous discharge (flow) reading per hour, on top of the hour
- one instantaneous Lake Muskoka water level reading per hour, on top of the hour.

For total instantaneous discharge readings, this would be a combination of gauged/measured flows from the North Bala Generating Station and calculated discharge from the North and South Bala Dams.

For the purposes of compliance monitoring, Lake Muskoka water level will be monitored from the main body of the lake (not within Bala Bay immediately upstream of Bala). SREL will be required to record Lake Muskoka water level data on a daily basis, determined to be the average of the 24 hourly values. Hourly flow data will be recorded separately for the North Bala Generating Station, Bala North Dam and Bala South Dam, in addition to the total Bala discharge. This information will be reported annually by January 31 as required for other small water power operators in the MRWMP.

An out of operating range situation will require the submission of an Event Report as described in the MRWMP (Section 13).

9.13 Provisions for Plan Reviews, Amendments and Plan Renewals

Since this WMP will form an amendment to the approved MRWMP, it will be subject to the same plan term (i.e., expiry March 31, 2016). It will also be subject to the conditions for plan amendments, reviews and renewals as specified in the MRWMP.

9.14 Public and First Nation Consultation

Public and First Nation consultation for the proposed North Bala Small Hydro Project and WMP is included in Section 3 of the environmental screening report.





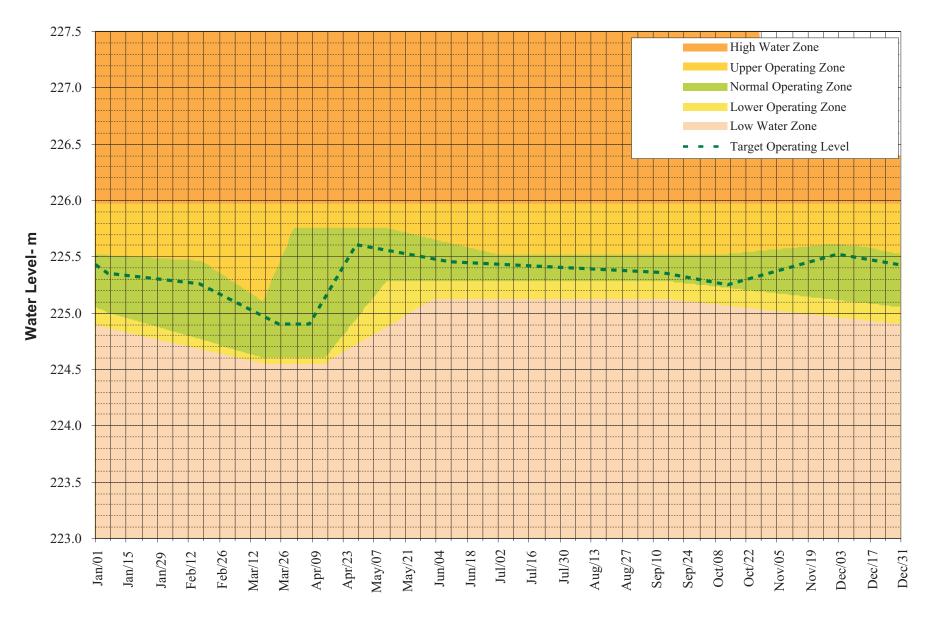
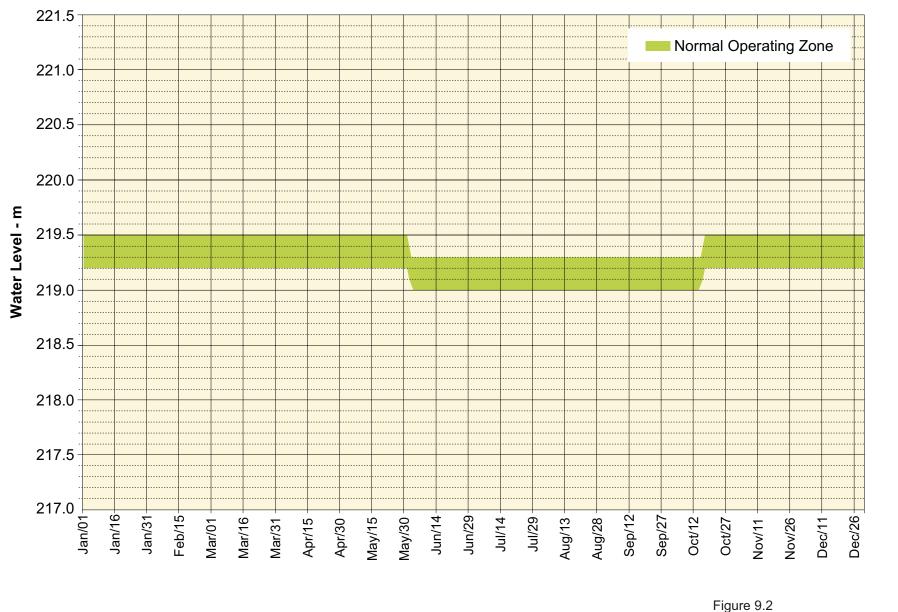


Figure 9.1 Swift River Energy Ltd. North Bala Small Hydro Project Existing Lake Muskoka Operating Plan







Swift River Energy Ltd. North Bala Small Hydro Project Existing and Proposed Bala Reach, Ragged Rapids and Moon Dam Operating Plan





