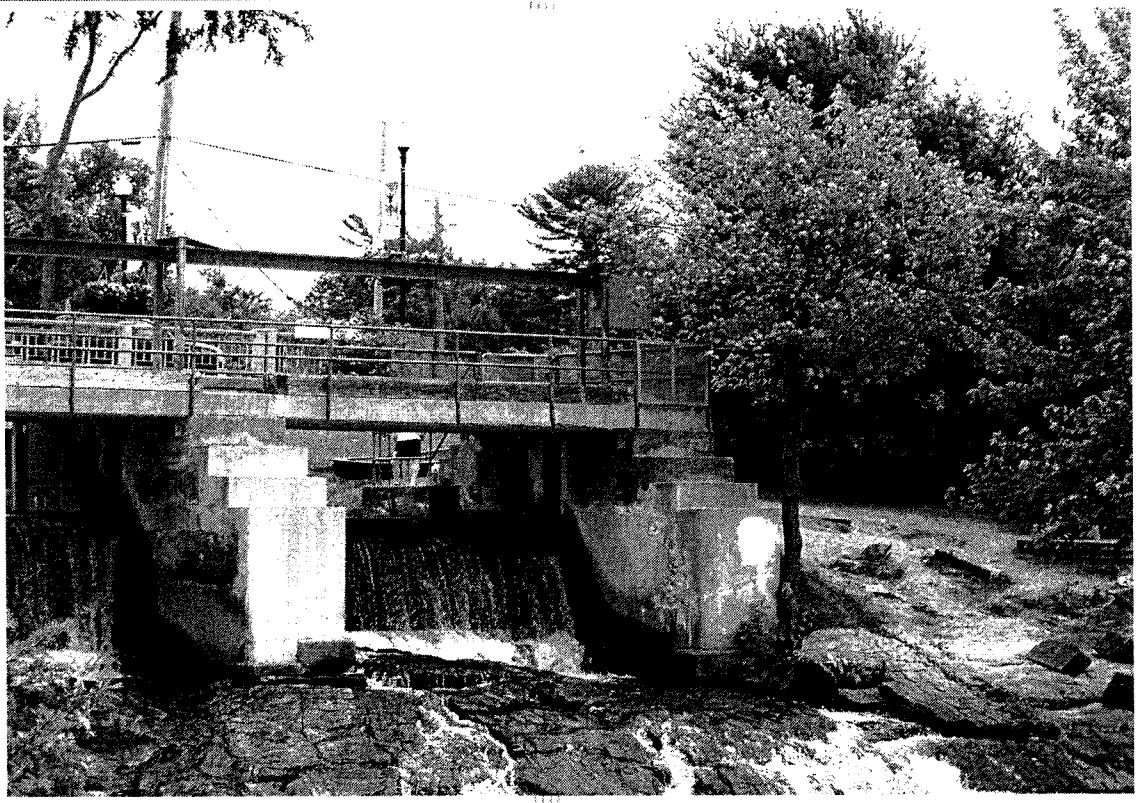
2012

Bala North GS – NWPP review



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Transport Canada / Transports Canada

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Contents

Results of final Addendum/File review

1 Complaints Received

1. Swimming
   - 1.1. off rail bridge (jumping) will not be able to continue
   - 1.2. Near town dock upstream – regatta
   - 1.3. Downstream of dam – water cascade area
   - 1.4. Safety re: kids jumping into tailrace area shallow water from GS.
2. Water velocities
   - 2.1. Manoeuvring in upstream and downstream town dock areas (high velocities)
3. Rescue plan for intake area
4. Portage areas
   - 4.1. Distances for portage (doubling)
   - 4.2. Removal of Historic Portage south edge of North Dam
   - 4.3. Removal or restriction of upstream historic portage area adjacent to Purk's Place on Provincial property
   - 4.4. Children carrying heavy packs and canoes across road, longer portages
5. Danger/loss of access to Purk's Place Marina and Boathouse/docks
6. TC Mandate (from complaint letter to MP from Save the Bala Falls.

6.1. TC to stick to mandate of navigation and not swimming or scuba diving
6.2. Purk's docks – consider impacts to less experienced users
6.3. Extend flow simulations to docks – downstream private and town dock.

2 Flow Regime

1 Rated capacity of GS – 96 cms
2 Leakage required at Bala North – 1 cms
3 Leakage required at South Dam – 1 cms
4 Spring flow through North Dam for spawning shoals – 9.5 cms
5 Burgess Dam/GS flow – 4 cms
6 Post spring flows for fish incubation, North Dam – 2 cms
7 Timing of flows
7.1 November to March (outside of navigation season) – 99 cms North Bala – excess through South Bala
7.2 April to May (early nav season) – 107 cms
7.3 June to October (main navigation season) – 99.5 cms
8 Cycling of flows – mid July to mid August period (heavy navigation season, heavy swimming)
8.1 Occur at less than 26 cms outflow total
8.2 21 cms through North Bala GS
8.3 4 cms Burgess
8.4 Leakage of 1 cms
8.5 Result in probable 2 cm fluctuation in upstream water levels.

3 Identification of Areas of Concern for TC with Option 1A (current proposal)

1. Flow regime and impact on navigation upstream and downstream (during all parts of navigation season)
   1.1. Change in direction of flow
   1.2. Change in velocity of flow
   1.3. Change in timing of flows
2. Purk's Place access and riparian rights of access
3. Flow Cycling impacts
4. Navigation Safety zones up and downstream (standards and guidelines for areas and booms and navigation markings)
5. Impacts of fish habitat improvements/Mitigation
6. EA and CEAA review and conclusions
7. Aboriginal Consultations – impacts and conclusions
8. Temporary measures due to construction (blasting, cofferdams, excavation, flow, water levels)
9. Safety and rescue
10. Portage – continuing navigation past structures
11. Ramping rates during cycling operations
12. 'Synchronous condenser' type operation during non operational periods of cycling
13. Remote operations

Analysis

4 Portage

1. There has been great concern expressed for the impacts to what is widely consider as a Historic Portage (take out upstream beside Purk's Place, across the road and down the bank adjacent to the North Falls (south side).
2. Inspection during the summer of 2011 showed evidence of use of this area (refer to file photo showing kayakers using downstream location as described above). This area is currently steeply sloped with no improvements such as stairs or other accessories to facilitate portage. The banks have had vegetation worn down by persons, weather or other natural actions and the ground consists of rocks and loose sand and soils as evident in the photo.
3. TC's opinion is that there are a number of take out and put in possible locations for continued portage around the dam and proposed GS structures; including,
   - 3.1. Take out adjacent to upstream town dock (grassed area and gentle slopes), up a path along the intake area on the north side, across the road (Hwy 169), through the grassed park or utilizing the town roads to the downstream town dock to put in.
     - 3.1.1. These areas are public property, already used for persons picnic, walking scenic enjoyment and are gently sloped with not obvious tripping hazards or other significant hazards (except for the crossing of hwy 169 which is a common concern or all portage options).
     - 3.1.2. The path leading from the upstream town dock to the highway is separated from the intake area by rocks, brush and other natural plants. It is expected that these natural separations will provide acceptable safety measures for persons utilizing the area for portage. Note that the area is currently open to public and widely used as an access to the town dock and the shoreline in the town dock area.
     - 3.1.3. This is considered as the primary portage for the reconfigured GS proposal
   - 3.2. With the current proposal (Option 1A) it is expected that a small public land access is likely to continue to exist adjacent to Purk's Place that may be used for upstream portage. (approx. 5 m wide area between Purk's docks and the south end of the proposed MNR approved safety Boom location)
   - 3.3. Alternatively (and currently accessible), is the Diver's Point location upstream between North and South dams. This area is public land and is grassed with small banks. This area is used by scuba divers for access to the upstream water areas for training and recreational diving.
   - 3.4. Alternative downstream locations include the above described primary location of the Town dock as well as possible use of public lands (Municipal) south of the proposed GS Option 1A – this is proposed to be declared a Heritage location by the Town and is locally known as part of Portage Landing. Currently this land is steeply sloped and rocky.
4. Discussions with MNR support TC's finding and determinations relative to alternative locations and continued ability for portage around the dams and the proposed GS.
   - 4.1. MNR has means in the Public Lands Act (section 65(4)) to protect Historic portage sites from blockage – primarily for areas with a single viable portage site. In this case it is considered that there are a number of reasonable portage locations so the

protection afforded in the PLA is not likely to be exercised (refer to letter MNR/Save the Bala Falls, of August 23, 2012 on file for details)

5 Navigation Impacts upstream of proposed GS

1. Navigation Safety zones up and downstream (standards and guidelines for areas and booms and navigation markings)
   1.1. TC has a number of tools and conventions to review and determine reasonable safety zones in the upstream areas above dams. Primarily there are 3 methods in use – 1. Observation and geographical features of the waterway, 2. The AECOM report – *"Guidance Document for Water Control Structures"*, which provides three methods for rough calculation and approximation of the safety (or exclusion) zones, 3. Using surface water velocity analysis and comparing against known acceptable velocity ranges for small boat use.
   1.2. All methods were considered in the review of this proposal with the most accurate being considered the determining method(s).
      1.2.1. In this case the 3 AECOM report methods were calculated and produced the following results:
         1.2.1.1. PONR – 16 m
         1.2.1.2. Drawdown – 27 m
         1.2.1.3. Spillway – 45 m
      1.2.2. Observation and Geographical approximations would dictate that the safety zone should include the entire intake channel from dam and proposed intake to a location upstream above the CP Rail Bridge. This approximation would severely impact Purk's Place Marina and Boathouse and could deny riparian access rights flowing from the property ownership/lease. If practical and reasonable for navigation a safety zone below or adjacent to the Purk's Place would be a preferred location.
      1.2.3. Swift River Energies Ltd had Hatch Consultants perform in situ water flow testing, computer modelling and production of charts showing surface water velocities under the expected varying flows for this proposal. These were analysed and considered against known velocities acceptable for the operation of small boats.
      1.2.4. The results were (for the current Option 1A):
         1.2.4.1. Q=117 (this is equal to a Q2 return period)
            1.2.4.1.1. Town Dock – 0.7 to 0.9 m/s
            1.2.4.1.2. Purks Place – 0.6 to 0.7 m/s
            1.2.4.1.3. Downstream tailrace – 1.7 m/s
         1.2.4.2. Q=21 (July to August cycling flows)
            1.2.4.2.1. Town Dock – 0.1 m/s
            1.2.4.2.2. Purk's Place – 0.1 to 0.2 m/s
         1.2.4.3. Q=105 (Full capacity and spawning – early spring April/May)
            1.2.4.3.1. Town Dock – 0.5 to 0.9 m/s
            1.2.4.3.2. Purk's Place – 0.5 to 0.9 m/s
            1.2.4.3.3. Downstream tailrace – 1.6 m/s
         1.2.4.4. Q=98 (Late Spring, early summer and incubation flows)
            1.2.4.4.1. Town Dock – 0.6 to 1.0 m/s
            1.2.4.4.2. Purk's Place – 0.6 to 0.7 m/s
            1.2.4.4.3. Downstream tailrace – 1.6 m/s

2. TC reviewed an application by MNR for a proposed relocation of their safety boom and considered only the AECOM methods plus the observation/geographical method in 2009. The relocated boom location was proposed and approved at a distance upstream of the North Bala dam of 60 m North end and 50 m south end of an angled boom as measured from the centre pier of the dam. (Boom is angled from North to south to provide self rescue and directional guidance to the MNR property along the south edge of the intake waterway. This configuration is recommended by TC rather than a perpendicular configuration.)
   2.1. The proposed location was determined by using the Q=117 flow of a 2 year return period as is recommended in the AECOM guide. This distance provides a slightly greater safety zone from that calculated for the revised GS Option 1A proposal by Swift River – range from 16 m to 45 m.
   2.2. The approved location was designed to accommodate both the long term portage take out/put in location and to protect the riparian rights of access for the Purk's Place Marina and Boathouse and the ability to install docks fronting that property – so that the existing business would be able to continue.
3. [redacted] The flow and surface water velocities modelling show that areas upstream of the CP Rail Bridge should not be impacted by the proposal, as velocities under all conditions during the regatta (mid/late summer) are very low.
4. Acceptable surface water velocity for easy and safe small vessel manoeuvrability varies and conclusive evidence is unavailable; however, figures describing reasonable ranges of velocities have been found in a number of publications including:
   4.1. Transport Canada's Sea Kayaking Guide (TC-1003045) – 0.98 to 1.54 m/s
      4.1.1. Page 11 of the guide refers to **"Currents between 1 to 4 knots are then regarded as average, while currents above 4 knots are significant"** – converting knots to m/s using normal mathematical measures results in ranges of 0.98 to 1.54 m/s
      4.1.2. Page 12 of the same publication lists wind speed of up to 7.84 m/s as light and 9.8 m/s as moderate. For small vessels of shallow draft (canoes, small recreational fishing boats and medium recreational family vessels) it is well understood that wind has a greater affect than current on their manoeuvrability due to the shallow draft and greater freeboard.
   4.2. The AECOM guideline refers to a surface water velocity of 0.5 m/s as speed at which a single inexperienced canoeist is able to paddle in for an extended time (1 to 6 hours). It is reasonable to conclude, based on this, that in short term close manoeuvring situations that same canoeist would be able to paddle in higher surface water velocities.
   4.3. The Australian hydro power company 'Hydro Tasmania' produces an employee safety manual that lists guidelines for wading in stationary or flowing water when undertaking gauging in streams. It gives a max. water velocity for wading of 1.8 m/s in shallow waters of 1 m deep.
   4.4. It has been described to us that published reports, by Hyra (1978) and Merril and O'Laughlin (1993), provide a large range of surface water velocities that small vessels may operate in (from 0.0 m/s to 2.74 m/s). For inexperienced paddlers and small boaters we try to target the low end of the spectrum in the 0.5 m/s range.
5. During cycling of the water flow in the mid summer period (July/August) there is an anticipated possible increase of up to 2 cm of water level increase in the upstream

Muskoka Lake due to a small storage of water. A 2 cm increase in water levels is incremental and is not expected to have any impact to navigation.

6. During cycling operations the hydro generator will stop and start (Addendum page 48, section 6.2.1.3 describes this operation). The generator is planned to start only once in each 24 hours and the flow will be ramped up over a duration of up to 1 minute. This slower increase is expected to reduce fish impingement – but for TC the slower ramp rate will also decrease any impacts to small boats close to the tailrace area or the upstream safety boomed area.

6 Navigation impacts downstream

1. The surface water velocities expected in the tailrace and downstream of the proposed GS will be altered in direction and concentrated in a narrow area of the Moon River.
2. Existing conditions during spring produced flow velocities in two directions extending from the North dam – a high velocity downstream along the North shoreline above 1.30 m/s and a second stream exceeding 1.7 m/s across the bay into the south shore. This resulted in a circular current pattern in the bay and turbulence in the downstream Town Dock area.
3. Post construction of the GS the flow is expected to be aligned more along the main channel of the Moon River (centreline) and reduced to 1.6 m/s or less. It is expected that the high velocity shoreline flow will no longer be a factor and that with the flow aligned more along the centerline of the river the south shore impacts will be significantly reduced.
4. Manoeuvring a small vessel is more predictable and made easier in currents without changing directions. With lower velocity along the shore manoeuvring at the town dock is expected to be acceptable (velocities in the 0.5 m/s and lower range) post GS.
5. The overall combined flow of the river is not expected to or is not allowed to change – the existing Muskoka River Water Management Plan (MRWMP) is to be adhered to (with a small allowance for cycling flow at low summer flow levels). While there is expected to be an impact on the direction, concentration and velocity of the water, the volume of water exiting into the downstream Moon River will not change.
6. Fish Habitat compensation is planned to be constructed in the tailrace area, and in the near shore areas around the North and South Dam tailraces. Impacts from these boulders and broken rock or gravel is not expected to significantly impact navigation as the enhancements are in shallow areas close to shore.
7. It is anticipated that a safety boom will be installed in the immediate area of the GS tailrace – to provide the delineation of the high water velocity area exiting the GS and prevent casual entrance into the tailrace by small boats. The safety boom location is not designed or necessary to provide self rescue, but in this case is only to delineate the "dangerous water area" and provide the visual and physical barrier of the boom (as is the case of all safety booms).
8. The tail race boom location is based on observation, geographic restraints and surface water velocities and is to be chosen to exclude the least amount of water from navigation.
9. During cycling operations the hydro generator will stop and start (Addendum page 48, section 6.2.1.3 describes this operation). The generator is planned to start only once in each 24 hours and the flow will be ramped up over a duration of up to 1 minute. This slower increase is expected to reduce fish impingement – but for TC the slower ramp rate will also decrease any impacts to small boats close to the tailrace area or the upstream safety boomed area.

7 Swimming and other non- navigation issues

1. Swimming was observed in the North Bala downstream area (tailrace of existing Dam) and swimming jumping off the CP Rail Bridge (see photos).
2. The NWPP mandate does not include consideration or mitigation of swimming related issues and concerns; however, it is well known that accessing Rail Bridges for swimming or jumping off is a relatively dangerous practice and is considered to be trespassing. Rail police may charge persons participating in these activities.
   2.1. Many areas under and around the rail bridge in Bala are shallow (north end of bridge around pier).
   2.2. Under the current Option 1A proposal the required navigation safety boom is downstream of the CP Rail Bridge – so people jumping into the water from the rail bridge would not be jumping directly into the protected area of water above the dam and proposed intake.
3. Swimming and wading takes place in the tailrace of the North Bala dam and losing that access is a concern to residents of the Bala area.
   3.1. Swimming in the vicinity of dams is not an activity that is considered safe (refer to *Canadian Red Cross Trend Reports 191-2008 Module 1 Overview*, page 36 **"Don't Underestimate Current"** paragraphs which state 'Swimmers and boaters should be trained to avoid approaching anywhere close to even small dams, including areas above and below').
   3.2. During a summer inspection of the site the majority of the access to the tailrace of the dam was done from the North shore – the municipal park area, and across that rocky shoreline.
   3.3. In the recent past there have been deaths of swimmers recorded at this location (newspaper reports and MNR communications). The impacts of swimming and wading at this location may be reduced as only minimum leakage flows of 1 cms will be maintained through the dam for scenic purposes. In addition – the realigned outflow of the Bala GS may also reduce the near shore circulating currents.

Conclusions

8 Portage

1. The revised option 1A GS will impact the downstream side portage trail adjacent to the North falls; however, there are reasonable alternatives to this trail including the primary portage through the Municipal public lands/park to the North of the falls and utilizing the downstream public park and dock as a put in/take out location.
2. In addition, the public will still be able to utilize the Diver's Point or the MNR lands immediately adjacent to the Purk's Place Marina and Boathouse (approx. 5 m wide access area) as part of the portage.
3. Downstream it is quite likely that a new access trail/path may naturally result over time on the municipal lands south of the proposed GS as it is the shortest distance from upstream to downstream. The slope is similar to the existing path. This is not the TC recommended portage – but persons using the area may through use create a path.

9. Swimming

1. Swimming is not in the mandate of TC – NWP Programs review; however, the current swimming from the CP Rail Bridge and the North Dam tailrace – while not encouraged or supported, may experience no or very few restrictions resulting from the proposed GS.

10 Regatta

1. It is unlikely that the regatta will be impacted at all from this proposal as the timing of the regatta occurs during the GS cycling flow periods resulting in minimal surface water velocity and the regatta location is away from the intake area (out from the upstream Town Dock). For comparison purposes only - some published information shows that 'lazy river' swimming pools flow at 0.45 to 0.89 m/s and 'endless current' pools range to 2.5 m/s velocities. In the area far upstream of the proposed intake the flow is expected to be at background levels - less than 0.1 m/s.

11 Purk's Place Marina and Boathouse

1. With the revised proposal – Option 1A, the riparian impacts to Purk's Place from the proposed GS are negligible to nil as the upstream safety area and boom location is not expected to change from that previously approved by TC for the existing conditions.
2. The modelled surface water velocities appear to fall within an acceptable range for small vessels.

12 Remote Operations

1. It is quite common across Canada and in other countries that dams are remotely operated. The Canadian Dam Association has produced a guideline and technical bulletin that addresses the potential impacts of remote operation. It will be a recommendation to Swift River to obtain, review and operate their facility in a fashion similar to that recommended by the CDA guidelines. Impacts to navigation from remote operation of this facility are expected to be minimal due to the ramping of cycling flows, the primary run-of-the-river operation of the facility, the small size of the overall facility and low water volume available in the system.

13 Navigation

1. Surface water velocities in the upstream Town Dock area and Purk's Place area – based on reported range of acceptable velocities of 0.5 to 1.54 m/s are acceptable under all flow conditions expected resulting from the proposed GS – during the navigation season they range from 0.5 to 1.0 m/s at the upper end (the higher surface velocities are located in the shallow areas around the CP Rail bridge piers and the south edge of Diver's Point dissipating as the water depth increases). The maximum is well under the maximum reported and in fact are normally expected to be in the lower ranges during the busy part of the navigation season (June to Sept.) in the range of 0.1 to 0.7 m/s.
2. The revised location for the upstream safety boom – as approved for the MNR on July 4, 2011, is acceptable for the current proposed GS by Swift River - based on all calculations and expected flows and surface water velocities. The location and configuration also is expected to provide for self rescue, if required, by directing persons to the safety of

public lands on the south side of the intake channel. The location also protects the riparian access rights of and ability for the Purk's Place Marina and Boathouse to continue uninterrupted business.

2.1. Safety booms are expected to provide delineation of the "dangerous water" areas around dams, provide a visible and physical barrier to help prevent boats accessing the areas and to provide for "self rescue" in the event of a mishap – by angling the boom to a safe landing area. The proposed and approved MNR safety boom is expected to accomplish all three objectives.

2.2. The objectives described above are promoted by Transport Canada - Navigable Waters Protection Program and are also promoted in the Canadian Dam Association (CDA) *"Public Safety around Dams"* guidelines and technical bulletins. (available from the CDA on their web site)

3. Ramping of the start up of the generator during cycling operations rather than instant on start up are expected to reduce any negative impacts to small boat navigation in the immediate area of the tailrace – preventing a surge of water exiting the GS.
4. We have been advised that this facility will not be run in "Synchronous Condenser" mode at any time during the operation of this facility.

Outstanding Issues or Reviews

14 Fish Habitat Compensation

1. Additional detail from Swift River along with NWP Officer review of the downstream GS tailrace is required during the application and approval stage of the project.
   1.1. Information re: depth of water over the proposed boulders, location of compensation relative to the downstream tailrace boom and depth of water above the natural bottom is required to assess the impacts to navigation resulting from the proposed compensation.
   1.2. With the limited information available in the Addendum it is not expected that there would be significant impacts to navigation
2. Fish Habitat compensation in the remaining Moon River locations are not expected to have any significant impacts to navigation and may be approved during the review and approval stage of the application.

15 Post Construction Monitoring

1. TC – NWP Program will require, as part of the conditions of any approval for the GS, a follow up report - complete with figures, providing details of normal full flow and surface water velocities as measured in situ and modelled in the upstream intake for the area of the final approved safety boom location, showing the area of Purk's Place docking and the area of the upstream Town Dock.
   1.1. In situ surface water velocities in the area of the downstream Town Dock taken during normal full operation of the GS are to be included in the follow up report.
   1.2. This report will be required no later than the end of the first year of operation of the GS. The report is to show charts and flow details in a similar format to that

contained in Addendum Annex E so that the NWP Program may directly compare the predicted surface water velocities to that actually produced and experienced in operation.

1.3. The report is also to contain any known or reputed navigation impacts to the Town Dock, Purk's Place and the safety boom

1.4. The figures, as detailed above, are to have the approximate outlines of the two town docks shown in addition to the shorelines as per the current figures.

2. A single copy of the first Construction Monitoring Plan and drawings produced as detailed in the *"Letter of Intent for Works or Undertakings Affecting Fish Habitat – North Bala Generating Station"* addendum annex D section 4.1, is to be provided to the NWP Program for review when available.

16 Details of the Required Safety Booms

1. There are newly released guidelines and technical bulletins that detail safety booms, their construction and installation available from the Canadian Dam Association ("Public Safety Around Dams").
   1.1. It is recommended for the upstream and downstream safety booms that the current recommendations in the technical bulletin "Booms and Buoys" be followed for this installation.
   1.2. In addition to the safety boom (yellow in colour) standard hazard buoys are recommended to be installed integral to the boom.
   1.3. The Hazard buoys are detailed in the Canadian Aids to Navigation system guidebook (TP- 968) available online from the Canadian Coast Guard.
   1.4. These buoys provide a recognized warning to boaters of the hazard ahead.
2. Details of the booms are required as part of the application and approval under the NWPA.

17 Temporary Measures and Construction Activities

1. Dewatering Berms
   1.1. Detailed plans and specifications required during the application and approval stage.
   1.2. Water flow and velocity changes expected in the upstream intake area during the use of the dewatering berms.
      1.2.1. High velocity water flow should not exceed the designed flows and velocities expected during operation of the GS facility – during the navigation season.
      1.2.2. If during the navigation season flows and velocities exceed that designed, temporary measures (booms, buoys signage etc. may be required to prevent danger to approaching boaters.
2. Methodology plans
   2.1. Construction timing
   2.2. Use of barges (section 2.1.4 of addendum)
      2.2.1. Barge is to be marked in accordance with the Collision Regulations.
   2.3. Blasting and safety measures related to small vessels.
   2.4. Temporary bridge or ford crossing of navigable waters (intake canal or downstream tailrace area).
3. Removals of Temporary measures

3.1. Timing
3.2. Methodology
3.3. Temporary silt curtains
3.3.1. Planned use, type, markings, duration, location details.
3.4. Disposal of materials (in water or on land)
3.4.1. Note that in water disposal of rock, earth, gravel or other material that is likely to sink is prohibited unless it is undertaken in waters greater than 20 fathoms (120 feet) or is separately approved by the Governor in Council through a Proclamation of exemption. (refer to section 21, 22 and 23 of the NWPA for details).

4. Navigation safety markings for temporary measures will be determined during final review by the NWP Officer for the:
4.1. Upstream temporary crossing (table 5.1)
4.2. Upstream dewatering berm
4.3. Downstream dewatering berm
4.4. Expected timing of construction

5. Final operation/ramping proposals as part of approved project.
5.1. Ramping plan/timing and rate
5.2. Agreement re: Friday night and Sunday night water levels in Go Home Lake. (refer to addendum section 2.2 for details)

18 Permanent Public Safety Measures

1. Possible Portage Marking
1.1. If requested or allowed by the Municipality or Town of Bala, standard white Portage signs are to be placed at both the upstream Town Dock area (South end) and at the downstream Town Dock for the information of paddlers.
1.2. In addition to the take out/put in locations an intermediate sign(s) may be placed along the preferred pathway to guide paddlers.
2. Throw Rings
2.1. Details and locations proposed for throw rings in the intake and tailrace areas of the proposed GS are to be supplied to the Program as part of the overall application for approval.
3. Fencing
3.1. Fencing may be required along the preferred portage route (North side intake from town dock to hwy 169)
3.2. If fencing is required by the Municipality or the MNR details of the proposed fencing are to be provided as part of the application for approval under the NWPA.
4. Warning/Danger Signage at Intake and Tailrace
4.1. Details of proposed signage to advise or warn the public of the dangerous areas in and around the proposed GS are to be designed in accordance with the CDA publication "Public Safety Around Dams and technical bulletins unless otherwise required by the MNR Lakes and Rivers Improvement Act.
4.2. Details are to be provided as part of the application under the NWPA.