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B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
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File No. BR476B

RECEIVED

JAN 26 2016

TOWNSHIP OF NORTH HURON

January 21, 2016

Sharon Chambers
Chief Administrative Officer
Township of North Huron
274 Josephine St., Box 90
Wingham, ON N0G 2W0

Dear Sharon

RE: Howson Dam – Stability Analysis

We have received a copy of the January 21, 2016 letter to you, from the Ontario Ministry of Natural Resources and Forestry. Their letter provides background information about the Lakes and Rivers Improvement Act, (LRIA) and references a technical bulletin. Their letter concludes, *"If the proposed repairs exceed the definition of minor works outlined in the procedure and approval is required under the LRIA, a stability analysis would be required..."*

The drawing of proposed repairs, prepared by our office and dated March 30, 2015, certainly does not meet the definition of *minor works* and almost no sub-portion of the works would meet that criteria. So the proposed work or any sub-part would, in the opinion of the MNRF, require a stability analysis in order to obtain their approval. Their letter also suggests that they would require reports on the Intake Design Flood and the Hazard Potential Classification for the dam before issuing such approval.

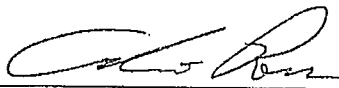
Of course, it must be assumed that the conclusions of the analyses would need to be favourable before they would approve the proposed work. The analyses could show the dam to have insufficient factors of safety, and it could be assumed that the Ministry would not approve the project unless it is shown to bring the factors of safety within Ministry criteria.

Another consideration is the bridge that spans the dam. We have seen examples, (County of Huron at Benmiller), where a bridge, integral with a dam, has been repaired and the MNRF has not been concerned. However, the removal of the bridge from the Howson Dam will remove gravity loads that will be significantly contributing to the stability of this dam. Whether or not the LRIA criteria cover this situation or not, it is our opinion that a stability analysis must prove that the factors of safety are adequate if the mass of the bridge is removed.

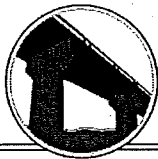
Please contact us if you have any questions.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per 
A. I. Ross, P. Eng.

AIR:dmd



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File No. BR476B

March 30, 2015

Pat Newson, Director of Recreation and Facilities
Township of North Huron
274 Josephine Street, Box 90
Wingham, ON N0G 2W0

Dear Pat

RE: Proposed Repairs to Howson Dam

Please find enclosed 5 copies of a revised plan of the proposed repairs for the Howson Dam. Please distribute the plan among members of your committee.

By way of this letter we wish to address some of the items discussed in our meeting of March 2, 2015. This report is in addition to the report dated February 2, 2015.

Flashboards and Operating Height

Our previous report and the preliminary drawings referred to an elevation of 309.28 m for the restoration of the concrete sill. This was suggested as the operating height. However, the committee provided photos from July 2006 that showed the flashboards in place. They may have even been used since that time. Members of your committee report that the flashboards have been located and measure 21 to 30 inches (530 to 762 mm) high. Water marks are reported to be visible on the piers at about 36 inches above the concrete sill which would confirm the height of 30 inch flash boards plus overflow.

Probably some flashboards were higher than others so that the overflow would be directed to particular bays, rather than have a thin overflow along the entire spillway. Observations of the committee were that many of the newer flashboards were 24 inches or 28 inches high.

As mentioned previously, no stability analysis has been completed and was not included in the scope of this report. Previously the report indicated that the operating level in recent decades was the concrete sill elevation of 309.28 m. However, your committee has provided proof that the summer operating level as recently as 2006 was as high as elevation 310.04, or about 30 inches above the concrete sill. For this reason, we have revised the design of the stop logs that are to be installed on the north side of pier #1. The lower logs are now detailed as 10"x10" timbers to resist the higher hydrostatic pressures caused by the flashboards to this level.

The details of the concrete wall that support the stop logs has been revised to show the re-facing, and not a new cutwater. A cutwater detail has been provided which could be used to help with the restoration of other piers.

No details have been provided for the flashboards and removable posts. These are assumed to be service items and not part of the main structure. The revised drawing makes reference to them and the operating water level resulting from the flashboards.

Probable Costs

The February 2 report provided some unit and lump sum costs. We understand that the committee may wish to break the project into components for the sake of budgets. At the meeting of March 2, it was discussed that the re-facing and restoration of the upstream concrete sill is probably of the highest priority. The total project cost of the sill restoration and re-facing may look like this:

1. Mobilize and site access	\$ 12,000
2. Dewatering, environmental controls	\$ 7,000
3. Excavate and backfill for re-face to frost depth 160 m ³ @ \$20	\$ 3,200
4. New concrete face and crest 36 m ³ @ \$3,500	\$126,000
5. New stop logs	\$ 2,800
6. Contingency allowance	\$ 10,000
Subtotal construction	\$161,000
Design and contract administration	\$ 24,000
Total probable cost	\$185,000 + HST

Secondary repairs would include patch-repair restoration of concrete surfaces of the piers and aprons of each of the four bays of the spillway. This would be limited to the lowest 2 m of the vertical surfaces of the piers. The restoration would not apply to any of the bridge components except the lower portions of the pier or abutments. Detailed soundings have not been measured. It has been assumed that about 40% of the apron area requires repair and about 50% of the lowest 2 m of the piers and abutments require repairs. Based on this, a typical repair of one spillway bay may look like this:

1. Concrete patch repairs 9.5 m ³ @ \$5,000	\$47,500
2. Steel dowels to concrete 56 @ \$18	\$ 1,000
3. Restoration of upstream cutwater of one pier	\$ 7,000
4. Contingency allowance	\$ 4,000
Subtotal construction	\$59,500
Design and contract administration	\$ 8,800
Total probable cost	\$68,300 + HST

Considering the needs of the four bays of the spillway and the restoration of the sill and stop logs, the probable cost of the entire project is about \$458,200 plus HST. This does not include materials or maintenance of the flashboards and removable posts, and it does not include repairs to the bridge structure above.

Service Life

The new concrete in the repairs should be expected to perform satisfactorily for 30 to 50 years. However, the old concrete beneath some patches or adjacent to patches will show some signs of deterioration within even a few years after the repair. The deteriorated areas may be left to accumulate for some years until there is enough volume to make a repair contract worthwhile. Probably a repair program should be anticipated about every 15 years. Such repair contracts are not likely to be as comprehensive as the one suggested here, but could be in the range of \$50,000 (2015 dollar value) each time. The timber stop logs may only have a service life of about 10 years, but this can be reviewed during annual operations.

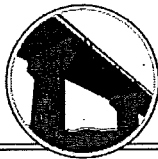
Please contact us if you have any questions.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per _____
A.I. Ross, P. Eng.

AIR:hv
Encl.



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File No. BR476B

February 2, 2015

Pat Newson, Director of Recreation and Facilities
Township of North Huron
274 Josephine Street, Box 90
Wingham, ON N0G 2W0

Dear Pat

RE: Proposed Repairs to Howson Dam

Please find enclosed 5 copies of a preliminary plan of the proposed repairs for the Howson Dam. Please have the plan reviewed by your committee and let us know if you require modifications.

By way of this letter we wish to outline some of the parameters and assumptions used in the design as well as suggest some unit costs that could be applied to the repairs.

No stability analysis of the dam was completed. The dam has performed satisfactorily for many decades. Most recently, it has functioned without the installation of flashboards to raise the water level. All features of this design of repairs assumes that the weir level of 309.28 m will be restored. Although the existing weir has degraded to values lower than this elevation in places, some areas of original concrete on the weir were found to be at that elevation. The design does not indicate any use of flashboards to raise the water level above this value and we cannot support an increase in the water level as the effects on the stability of the dam are unknown. The design is based on repairing to base conditions.

All of the repairs detailed on the drawing will either be neutral to stability or improve stability. For example, the new re-facing of the upstream side of the weir will add mass to this gravity dam, and add it to the side that would help to resist overturning.

No part of the design shown on this drawing represents a repair or restoration of the strength of the bridge overhead.

Stop Logs

The design shows replacement stop logs made from 8x8 dimension timbers. The lapped detail is optional. It is designed to slow (but not stop) leakage between logs. The lap detail also allows for sharing loads and deflections from one log to the next, assuming that the deeper log takes the greater pressure.

The 8x8 grade SPF2 has been chosen as being strong enough to resist water pressure to the weir elevation plus 0.5 m. This is to allow up to 0.5 m deep flow over the weir, and is not intended to suggest that flashboards could be used. The logs are assumed to be in good condition. Logs that show deterioration or excessive deflection should be replaced with good material.

The stop logs are shown without any lift bolts. It is assumed that the spillway at the north end of the dam is the control structure. These new stop logs beside pier #1 might be lifted out once the pond is drawn down and allow some additional seasonal flow through the opening. This may improve seasonal sediment transport from upstream of the dam.

A detail on the drawing shows a new cutwater construction for the concrete wall between piers 1 and 2. The cutwater allows for a new concrete gain to hold the stop logs in place. Currently, the north end of the stop logs just rest against the end of the wall by pressure.

Concrete Repairs

The areas of deteriorated concrete are very large on this structure. Repairs could be phased by priority if budget values do not allow for one comprehensive repair. Identification of all areas needing repair are beyond the scope of this design.

The detail of the new cutwater to contain the north ends of the stop logs could be used as a typical detail to reconstruct or repair any of the pier cutwaters. Currently, the cutwater of pier #3 is in very poor condition and the same detail could be used there.

Details are provided for concrete surface patch repairs. These could be used in any location on the structure. In general, it is not necessary to remove poor concrete deeper than 225 mm. If the concrete is still poor below this depth, it is assumed that the new reinforced concrete acts as an armoured encasement. Steel dowels will still be required to be drilled and grouted to provide a physical bond between old and new concrete. Surface preparation is also important by sand-blasting or pressure washing, and cement slurry brushing, where possible.

Note that it is not acceptable to build-out or re-face the sides of the piers or abutments as that would reduce the hydraulic area of the spillway. Concrete repairs must be flush with existing surfaces. The ends of the piers or the wings of the abutments could be overlaid with new concrete without restricting the flow.

Probable Costs

The cost of the project is related to the extent of the repairs. The following construction costs could be expected, based on recent similar works.

• Mobilization, demobilization, site access	\$12,000
• Dewatering, environmental controls	\$ 7,000
• Excavation and backfill same material	\$ 20 per m ³
• New concrete in weir wall face, cutwater of stop log gain	\$ 3,500 per m ³
• Concrete removal and replacement	\$ 5,000 per m ³
• Drill and grout dowels	\$ 18 each
• Supply, cut, place stop logs	\$ 2,000

Approvals

It is our understanding that the work is to repair existing infrastructure without changing the size, purpose or capacity, and so there should be no requirement for an environmental assessment.

Based on the nature of the work and the proximity to the river, it is expected that you will require work permits or approvals from the Maitland Valley Conservation Authority, Fisheries and Oceans Canada, and the Ontario Ministry of Natural Resources. The plans contained may be used as attachments in the applications for approval. The agencies may wish to see an engineer's seal on the drawings and this can be provided once your review is complete and any mutually-agreed edits are made.

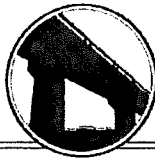
Please contact us if you have any questions.

Yours very truly

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Per _____
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AIR:es
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File No. BR476

VIA EMAIL ONLY

August 18, 2014

Kelly Church
Township of North Huron
274 Josephine Street, Box 90
Wingham, ON N0G 2W0

Dear Sir:

Re: Improvements to Howson Dam

The Howson Dam and the bridge that it supports is suffering from weathering effects on the concrete structures. The south spans of the bridge are no longer safe for traffic and the piers and crest of the dam are in obvious decay.

It is understood that the Township and local citizens would like to work towards maintaining the weir crests of the south segments of dam, to prevent their degradation. To allow deterioration further would result in reduction of water levels in the upstream pond.

The Township and a volunteer committee are proposing to have the weir maintained by constructing a wall on the upstream face of the dam. BMROSS is able to provide engineering services to design the new wall to integrate into the old structure and improve the durability for many more years. The work would be done by Andrew Ross, P.Eng. (Member, Canadian Dam Association). Of our 12 engineers, Andrew has the most experience with dams in southwestern Ontario.

It is proposed that the new wall would act as a re-facing of the upstream face of the concrete weir for only the south series of spans. The north span, which was built in the 1970's would not be involved in the work. Site surveys would be made to establish existing elevations of the weir and determine what the probable elevation of concrete was before deterioration.

The wall re-facing would be designed to go below frost grade (1.2 m deep). Some removal and replacement of deteriorated concrete would be required at the weir to interlock the old with the new structures.

This proposal for engineering services includes a design meeting with the Township and volunteers, site survey and modelling, design and drawings suitable for construction, specifications included as notes on the drawing. At this time, no budget is set to prepare a contract or tender package.

BMROSS prefers to work on a per diem basis as with other work for North Huron. We suggest the following budgets be used to include the work described above:

Site survey and modelling:	\$3,270 + HST
Design and drawing	\$5,140 + HST

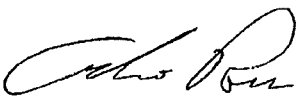
The project will require the approval of the Ontario Ministry of Natural Resources and the Maitland Valley Conservation Authority. We understand that some of the volunteers and staff will look after discussions and applications to these agencies. The MNR may request further studies such as a stability analysis or a dam-break analysis or hazard classification. These studies are not included in the budgets shown above, nor are attendance at meetings with these agencies. However, BMROSS can assist, if required, at normal rates.

BMROSS is well suited to design the wall as described. If the Township wishes to consider raising the weir elevation or restoring a stop-log system as was once used here, we would require further study, (by us or others), to prove the stability of the dam to hold water pressure which it has not seen for some decades.

Please consider this proposal and we would be pleased to discuss any aspect of it with you.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per 
A.I. Ross, P. Eng.

AIR:hv