

BRODIE
CONSULTING

MEMORANDUM

DATE: July 9, 2010

TO: Kaori Torigai, PM, YG

FROM: John Brodie, P. Eng.

SUBJECT: Intermediate Dam Rip Rap
DRAFT PENDING FURTHER FIELD ASSESSMENT

Background

In order to reduce the risks associated with site water management, it has been decided that the Intermediate pond is to be operated at a level which is lower than historic levels. The current target is 1043 +/- m elevation. See Figure 1. We may be only able to approach but not meet this target in 2010 due to limits on the maximum drawdown rate to ensure stability of the upstream slope of the dam.

The historic lower limit for operation of the pond was based upon not exposing the interval on the up-stream face of the dam which does not have rip rap, and it was anticipated that lowering the pond water level in 2010 would expose this interval. The top of this interval has recently been found to be at 1045.5 +/- m elevation. This is different from what is indicated in the available records (see Figure 2). However, BGC 2009 Annual Geotechnical Evaluation and Instrumentation Review page 18 notes:

“Deformation and sloughing of the rip rap was noted in 2006 and repairs were recommended. Repairs to the rip rap were undertaken in 2007. The repaired area appears to be performing satisfactorily.”

At this time we are unable to locate any as-built information concerning the location and scope of those repairs. The existing rip rap surface is very steep and loose, which suggests that the 2007 repair consisted of placing a layer of new rip rap over the dam face to blanket the interval without rip rap. This was done down to the limit which could be reached with the available equipment.

Figure 1, attached, shows the historic water level trends since 2005 with key elevations annotated. Figure 2 shows the Int. Dam in cross-section with similar annotation.

Options for addressing the rip rap issue on the Int. Dam.

1. Place additional rip rap to cover the 0.3 m (implied) of unprotected dam face. This could involve either:
 - Remove existing rip rap, remove exposed sand & gravel, and replace the full height with rip rap. This would be a significant earthworks project.
 - Place additional rip rap to extend the existing protection. This would likely be quite inefficient as the steep and loose nature of the slope would result in much of the new rip rap rolling off the face into the pond.
2. Place no additional rip rap and do one or more of:
 - Monitor if wave or ice action is damaging the dam and take corrective action as needed.
 - If erosion is occurring, it is probable that it will result in downward creep of the upper rip rap into the erodible area, thus precluding the need to place additional rip rap. Depending upon how these processes evolve, it may be appropriate to push some of the loose rip rap downward into any eroding areas.
 - Maintain the pond such that the winter water level does not rise to the elevation of the exposed sand & gravel during the winter to the extent practical.
 - This presumes that ice plucking is the most severe erosion mechanism.
 - The pond water level rose 1.3 m between Nov 1 and May 1 in 2009 winter and 0.8 m in 2008. The smaller pond area would tend to increase the winter rise, which would be slightly reduced (10%) by winter operation of the new ETA pumping system.
3. Accelerate modification of the dam (8 m raise and new rip rap) and tailings surface raise to approx 1049.4 m) (Ref. KC-B, 2008) to be compatible with the ultimate closure plan for the dam. This concept was preliminary and some optimization work may still be outstanding.

Discussion and Recommendation

Due to remaining uncertainties, Option 3 is not recommended at this time.

Option 1 seems like an excessive amount of work to address a small (0.5 m) gap in the rip rap at point which is well below the crest of the dam and would be a deficiency only until the closure plan is implemented. The extent of the gap in the rip rap must be confirmed. Assuming actual conditions/dimensions on the dam are found to be as described herein, then Option 1 seems less preferable than Option 2.

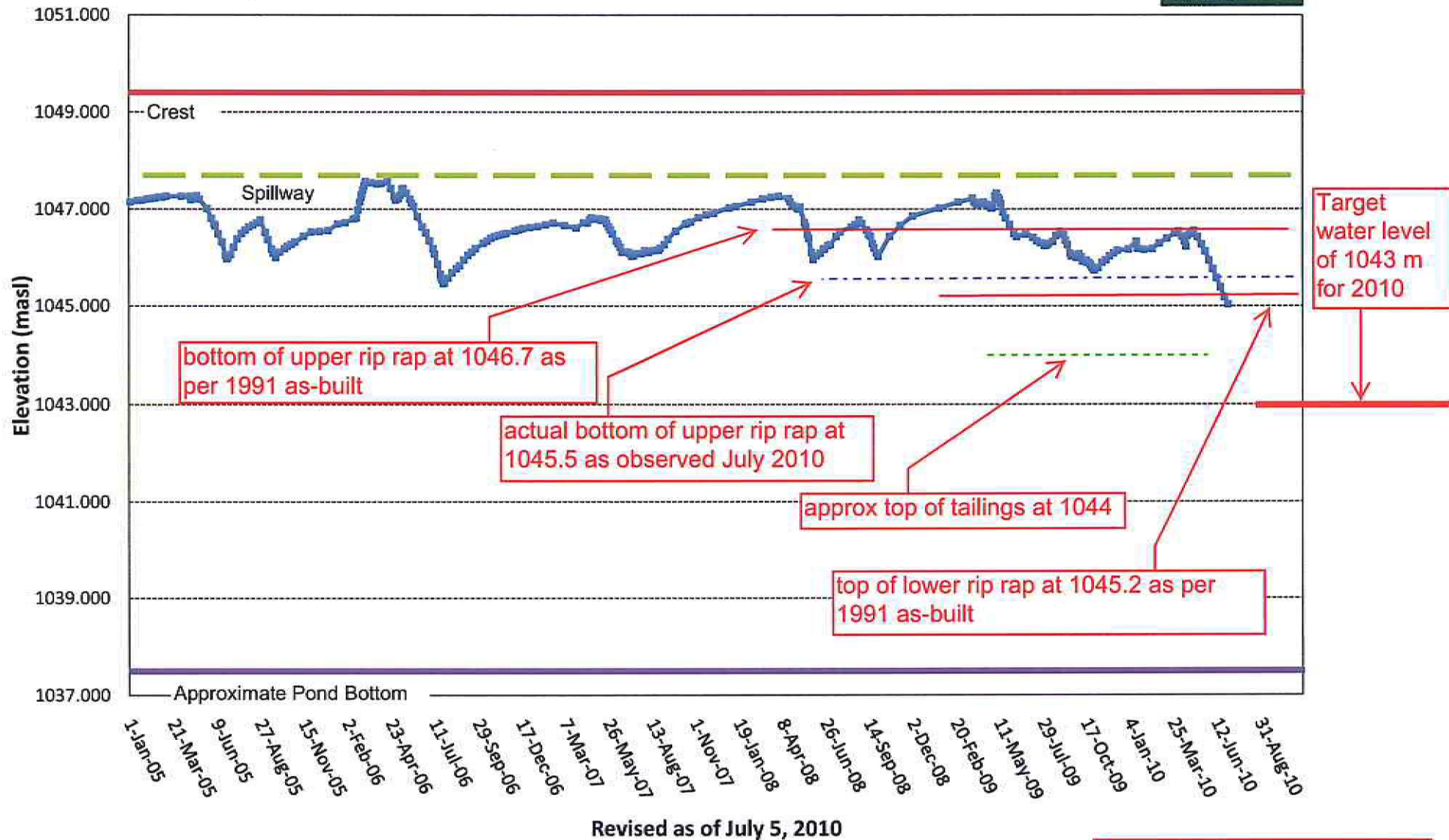
Option 2, by default appears to be the best option, although it should be noted that this is a departure from best management practice for a dam. It is only acceptable if:

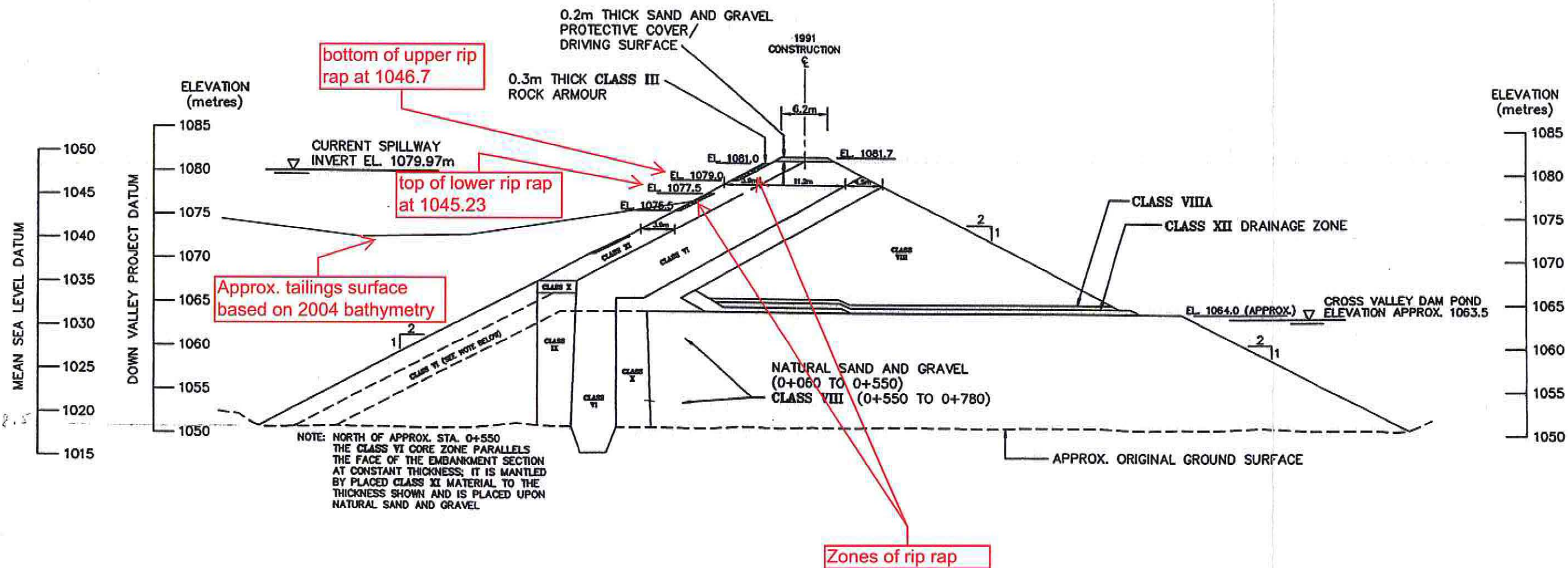
- monitoring of the face of the dam is carried out as described, and,
- water level control is carried out to the extent practical, and,
- the situation is temporary (implementation of closure measures will be conducted), and,
- return to Option 1 is taken if monitoring indicates that the integrity of the dam is at risk.

References

Klohn-Crippen Berger, Intermediate Dam Spillway PMF Flood Handling, April 2008, Figure 3.5

Intermediate Pond Water Elevations





- NOTES :
1. Embankment geometry and internal zoning as shown in Golder Associates Drawing 912-2402-3, Int. Dam Raising & C.V. Dam Toe Drain, Cross Section and Detailed Plan, Rev. 1, Aug. 8, 1991.
 2. All elevations are referenced to Down Valley Project Datum. Subtract 32.3m from elevations shown to convert to mean sea level (NAD27) datum.
 3. Refer to Golder Associates as built reports for detailed descriptions of material classes. General descriptions as follows :

| | |
|--------------|--|
| CLASS VI | Dam Core (glacial till) |
| CLASS VII | Upstream Shell (silty sand and gravel) |
| CLASS VIII | Downstream Shell (sand and gravel) |
| CLASS VIII A | Drainage Filter (sand and gravel) |
| CLASS IX | Upstream Filter (silty sand) |
| CLASS X | Downstream Filter (sand and gravel) |
| CLASS XI | Tailings Sand (fine to medium sand) |
| CLASS XII | Drainage Zone (gravel) |

Figure 2
Int. Dam Rip Rap Assessment
BCL July 2010

0 5 10 15 20 25 metres
SCALE
1:500

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN REPORT DATED

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KLOHN CRIPPEN

PROJECT
ROSE CREEK TAILINGS IMPOUNDMENT
SEISMIC STABILITY ASSESSMENT

TITLE
INTERMEDIATE DAM
TYPICAL SECTION

PROJECT No.
M09237A01

FIG. No.
2.5