Klohn Crippen Berger

June 25, 2015

Teck Highland Valley Copper Partnership
P.O. Box 1500
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Chris Fleming
Superintendent, Tailings and Water Management

Dear Mr. Fleming:

HVC Tailings Dams - Highland Tailings Storage Facility and 24 Mile Lake
Response to MEM Memorandum- February 3, 2015

1 INTRODUCTION

The Independent Expert Panel[1] (Panel) appointed by Ministry of Energy and Mines, British Columbia (MEM) released their report on the Mount Polley tailings dam breach on January 30, 2015. Subsequent to the release of the Expert Panel report MEM issued a memorandum on February 3, 2015 (MEM memorandum), to all tailings dam owners in British Columbia to undertake a specific risk assessment of their tailing dams and report the results to MEM by June 30, 2015.

This report outlines KCB's assessment of conditions at the L-L Dam and H-H Dam of the Highland Tailings Storage Facility, as well as at 24 Mile Lake, relative to the specific aspects raised by the MEM memorandum, based on a review of available documents, to prepare a "summary of knowledge". This assessment has been sealed by a qualified professional engineer and complies with generally-accepted professional practice common to the local area.

The report format is based on the MEM wording and numbering system, as requested by MEM. MEM items are shown in blue italicized text; KCB's response is shown in normal black text.

We consider this assessment to represent the knowledge of the facility available to KCB at the time of writing. Operating, inactive and closed facilities are subject to physical and geochemical changes over time, including ongoing construction activities. It is essential that monitoring and assessment of the facilities continue through regular surveillance, dam safety inspections, dam safety reviews and other stewardship activities.

[1] Independent Expert Engineering Investigation and Review Panel, 2015. *Report on Mount Polley Tailings Storage Facility Breach*. January 30.

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Teck HVC has a very robust surveillance program as outlined in their operation, maintenance and surveillance manual involving regular inspections, daily surveillance, instrumentation monitoring, full time engineering staff on site, and a thorough reporting plan which includes dam safety inspections, annual performance reviews and annual construction summary reporting.

1.1 Assessment Scope

The MEM memorandum asked that an assessment be undertaken to determine if the dams may be at risk due to the following three conditions:

1. Undrained shear failure of silt and clay foundation;
2. Water balance adequacy; and
3. Filter adequacy.

KCB reviewed available historical information on foundation characterization, design, construction, and operations records for the L-L Dam and H-H Dam of the Highland Tailings Storage Facility (TSF), as well as at 24 Mile Lake downstream of the H-H Dam, to prepare responses for sub-items listed in the MEM memorandum. A summary of documents reviewed is included in the reference list. Responses to the above three items are provided in Section 3, following the numbering system used in the MEM memorandum. Documents supporting this letter will be maintained on-site by HVC.

Our review included review of test pit and borehole logs from the 1970s to present.

2 HIGHLAND TSF AND 24 MILE LAKE OVERVIEW

Highland TSF is shown on the attached Figures 1, 2and 3, and consists of two major dams, L-L Dam and H-H Dam which span the northwest and southeast sides of the Highland Valley divide, with 24 Mile Lake beyond H-H Dam to the south. The TSF is about 10 km long and contains about 1.4 billion tonnes of tailings. The consequence classification (CDA, 2007) of L-L Dam is Extreme and the H-H Dam is Very High.

L-L Dam

L-L Dam is a zoned earthfill dam comprised of a starter dam; downstream sand and gravel foundation blanket; granular foundation drains; impervious till core; one upstream cyclone sand berm and three downstream cycloned sand buttress berms (the South Buttress, Valley Buttress and North Buttress Berms). The dam is constructed of local borrow material, processed filter materials and cycloned sand. It is raised annually using the centerline method with a 15.24 m wide vertical impervious till core. The dam has the following configuration:

- Original ground El. 1100.3 m (at centreline, valley bottom);
- Minimum (end of 2014) crest elevation of 1257.6 m and a dam height of 157.3 m;
- Current (2015) length of 2.9 km; and

- Permitted ultimate crest of El. 1279 m and dam height of 178.7 m.

H-H Dam

The H-H Dam forms the south-eastern limit of the TSF, and is a zoned earthfill dam constructed of local borrow materials, processed and pit-run filter materials and mine waste rock. It is raised annually using the centerline method with a 15.24 m wide vertical impervious till core. The dam has the following configuration:

- Original ground El. 1179.6 m (at centerline, valley bottom);
- Minimum (end of 2014) crest elevation of 1267.2 m and a dam height of 87.6 m; and
- Permitted ultimate crest of El. 1292.7 m and dam height of 113.1 m.

24 Mile Lake

24 Mile Lake, located at the downstream toe of H-H Dam between the dam and the Valley Pit, is a containment facility which receives emergency discharges of water and tailings from the H-H Pumphouse. 24 Mile Lake is a former natural lake surrounded by waste dumps which have been constructed during the life of the mine. The low point of the containment is the access road across the waste dumps at about El. 1220 m. The current depth of tailings is unknown, but the current water level appears, at least in part, to be above original ground level. The H-H Pumphouse is located at the downstream toe of the east abutment of H-H Dam and connects to 24 Mile Lake via an open channel. Discharge to 24 Mile Lake only occurs when there are upset conditions in the H-H Pumphouse. 24 Mile Lake is sometimes referred to as the H-H Pumphouse Emergency Tailings Pond.

There are ongoing investigations, monitoring and surveillance at the Highland TSF. There is ongoing monitoring and surveillance at 24 Mile Lake. Where ongoing activities relate to the MEM questions, we quote existing recommendations and tasks and their reference number.

3 RESPONSES TO MEM MEMORANDUM

3.1 Task 1 - Task 1 - Review of Foundation Conditions Risk of Undrained shear failure of silt and clay foundations

Lacustrine and glacio-lacustrine silt and clay layers within the foundations of the L-L Dam and H-H Dam have been identified and addressed in the design since the 1970's. There are also known glacio-lacustrine layers exposed at the Valley Pit near 24 Mile Lake.

Where these layers occur at 24 Mile Lake and H-H Dam, they are not a concern to stability because of the depth of these layers and deep confining overburden layers. At L-L Dam these layers are accounted for in the design and ongoing investigations. The discussion below further describes how the design accounts for these layers.

Based on the investigations, analyses, surveillance and inspections, including some that are ongoing, the L-L Dam, the H-H Dam, and 24 Mile Lake have a low risk of undrained shear failure of silt and clay foundations.

a. Including a determination with respect to whether or not similar foundation conditions exist below the dams on your site

L-L Dam

There are silt and clay layers beneath the L-L Dam. These units were identified during initial site planning and investigations for the starter dam in the 1970's. The following units are known:

- A surficial silt and clay lacustrine unit present mainly under the starter dam. The lacustrine unit was removed downstream of the starter dam, beneath the current Valley Buttress Berm (VBB) but is still present under the starter dam.
- There is a glacio-lacustrine clay layer beneath the Starter Dam and the Valley Buttress Berm at about 30 m depth (from about El. 1079 m to El. 1071 m). The unit appears to be discontinuous and this could reflect separate pockets of material rather than one continuous layer.
- There is a second glacio-lacustrine varved silt and clay layer at the VBB near original ground level at El. 1119 m. This was exposed during construction of the Valley Buttress Berm Extension (VBBE) in 2012 and 2013.
- There is a glacio-lacustrine layer at approximately 11 m to 20 m depth below the original ground surface (El. 1142 m to El. 1123 m) at the south side of the North Buttress Berm (NBB). This may be the same layer as noted near original ground near the VBB. It was encountered during drilling in 2010 for the North Buttress Berm Extension (NBBE).
- There are glacio-lacustrine layers within a deep, layered sequence of sand and gravel and glacial till in a buried valley beneath the north arm of the L-L Dam. The upper layer was encountered at 5.5 m to 13.5 m depth (El. 1255.3 m to 1256.5 m) below original ground and is about 1 m to 2.5 m thick. The lower layer was encountered at 18 m to 30 m depth (El. 1232.3 m to 1239.6 m) below original ground and is about 1 m to 4.5 m thick. The lateral extent of each layer is unknown.

The character and extent of the silt and clay layers have been documented in various design reports and investigation data reports. All of these layers are subject to ongoing surveillance, monitoring, drilling, laboratory testing and investigations.

H-H Dam

Layers of silt or clay were identified in several drill holes at El. 1110 m, El. 1150 m, and El. 1067 m (KCB 2010). The deeper silt and clay layer is about 10 m thick. These layers are part of a dense interglacial unit and have been described as a dense strong foundation unit (Bechtel 1972a; KL 1988). Some of the layers are too deep (up to 111 m below original ground) to be potential slip surfaces. Some of these layers are described as layered, hard and dense.

Pockets of surficial soft organic silt and lacustrine deposits were found underneath and near the footprint of the H-H Dam foundation and were removed during the starter dam foundation preparation as reported in the construction report (Bechtel 1972b). Dam raise foundation preparation specifications required removal of topsoil down to competent foundation soils.

24 Mile Lake
The 24 Mile Lake is a natural lake impoundment surrounded by waste dumps, access roads and laydown areas that are about 1.6 km wide between 24 Mile Lake and Valley Pit. Although the fill slopes are not a typical dam structure and the foundation is expected to contain some clay layers, the configuration of the landforms, the large fills, and the 1.8 km distance from 24 Mile Lake to the rim of Valley Pit is such that there is no credible failure mechanism.

The geology and geomorphology from previous design, construction, and site investigation reports was reviewed. We noted no indications of weak lacustrine or glacio-lacustrine soils in the road or dump foundations. Waste dumps on either side of the valley are known to include high plasticity clay (AMEC 2012), and the regional overburden across the valley bottom that impounds the 24 Mile Lake likely includes silt/clay layers. Prior to development of the area, the Big Divide Lake was located between the 24 Mile Lake and the Valley Pit. It was infilled as part of site development and it would be reasonable to assume silts or clays are present. Finally, glacio-lacustrine clay layers have been encountered during the excavation of the Valley Pit, approximately 1.8 km downstream of 24 Mile Lake.

b. Whether or not sufficient site investigation (drill holes, etc.) has been completed to have confidence in this determination

L-L Dam
Sufficient site investigation has been completed to establish the presence of the lacustrine and glacio-lacustrine units. Additional investigations are ongoing. There have been about 243 drill holes and 122 test pits carried out at L-L Dam. There are ongoing investigations, testing and monitoring of these layers to further confirm the extent and the material properties. Several site investigations programs have been completed involving drill holes, test pits, instruments, cone penetration testing, and geophysical investigations along with laboratory testing and in-situ testing. The main investigation programs include the original site investigations in the 1970s, 1988, and the 2010/2011 design update investigations. There have been ongoing evaluations or instrumentation installations involving additional drilling since 2011.

H-H Dam
Sufficient site investigations have been done to have confidence in the determination of clay/silt layers at depth. Our review included 73 drill holes (through foundation) and 95 test pits.

24 Mile Lake
Other than the drilling near the toe of H-H Dam, there is no drilling information to indicate the presence or absence of glacio-lacustrine layers at or near the 24 Mile Lake. Geological interpretations have been based on drilling at the Valley Pit, drilling at the H-H Dam, and regional geology

information. There is limited information on the material placed in 1.6 km wide waste rock dumps crossing the valley bottom and confining 24 Mile Lake; however it is understood the material includes waste rock and material from pre-stripping activities which may include high plasticity clay (AMEC 2012).

c. If present, whether or not the dam design properly accounts for these materials

L-L Dam

The historic and current dam designs, operating procedures, monitoring, surveillance, and assessments (Bechtel 1971; Bechtel 1977b; Burke and Smucha 1979; KCB 2010) account for the presence of these materials.

The glacio-lacustrine and clay layers are accounted for in the design by the Valley Buttress Berm (VBB), the North Buttress Berm (NBB) and the Valley Buttress Berm Extension, (VBBE).

Since the L-L Dam is raised annually there is the possibility of excess pore pressure (undrained conditions) developing in the lacustrine and glacio-lacustrine due to loading from the dam fill. It may also be possible to develop excess pore pressures under seismic loading. Construction loading is considered annually as part of construction staging. Seismically induced excess pore pressures were considered in the dam design (KCB 2010)

The lacustrine unit under the starter dam deformed in shear during construction of the starter dam in 1976 and 1977, and had to be buttressed by the VBB to arrest this movement. For construction after 1978, the lacustrine unit was removed from the footprint downstream of the starter dam and the VBB was raised to provide additional downstream support. As anticipated, the rate of shear of the lacustrine unit has slowed (as monitored by inclinometers) over the 37 years since original construction and the shear zone is limited to the footprint of the original starter dam and is currently monitored by inclinometers. There are multiple piezometers and inclinometers to monitor this area.

Stability analyses including sensitivity analysis have been conducted which include the presence of the glacio-lacustrine layers, the assessment of drained and undrained conditions, and the sensitivity (peak to remoulded strength ratio) of the material. A conservative assumption of a continuous layer of glacio-lacustrine clay has been used, although ongoing drilling investigations may conclude that this layer is not continuous. These analyses indicate the dam is stable and meets design factor of safety (FoS) for peak and residual drained strengths, and for peak undrained strengths. The residual undrained strength state indicates a FoS meets the design criteria.

H-H Dam

The most recent dam design and annual review stability accounts for two layers of “foundation silt” at elevations 1110 m and 1150 m (KCB 2010), but does not consider a deeper silt and clay layer at EL. 1067 m.

Additional stability analyses were performed to assess the H-H Dam stability under undrained conditions for the deep silt and clay layer using strength parameters obtained from the L-L Dam 2014

investigation. This analysis indicates this clay layer is well below a credible critical slip surface (FoS > 3.0).

The H-H Dam is regularly inspected and inclinometers are monitored monthly; there is currently no indication of foundation instability. The dam design and operating procedures are adequate considering the presence of the silt and clay layers.

24 Mile Lake
There is potential that clayey materials from pre-stripping activities have been incorporated into the waste dumps on either side and across the bottom of the valley impounding 24 Mile Lake, however, the geometry of the valley is such that there is no credible failure mechanism related to instability of the landforms impounding 24 Mile Lake. AMEC (2012) assessed the potential for a failure of the Valley Pit wall to progress backwards to 24 Mile Lake and found this mode of failure "kinematically inadmissible". No dam design is in place but no design is necessary for the current configuration of the 24 Mile Lake.

d. If any gaps have been identified, a plan and schedule for additional sub-surface investigation

L-L Dam
The following gaps have been identified, with a plan to address:

- Defining the extent and material properties of the various glacio-lacustrine layers has been ongoing since 1977 as part of the design, construction and monitoring of the Highland TSF. As per KCB recommendation DSI-LL-06 (KCB 2014b, and recommendations in our 2010 design update report (KCB2010) additional drilling and lab testing is underway for the foundations of in the VBB, NBB and North Abutment.
- Update stability analyses as new strength data are acquired.
- It is also necessary to understand the stresses, deformations, and generation of pore pressures in the glacio-lacustrine layers under the loading from current and predicted construction stages. This should be accomplished using a stress-deformation model (such as Settle 3D, or similar) based on updated definitions of material extents and characteristics (from #1, above) and a review of inclinometer performance data (DSI recommendation #DSI-LL-08 (KCB 2014b)).

H-H Dam
The following gap has been identified:

- The deep foundation silt and clay layers are not well characterized; however, these do not represent potential critical slip surfaces even assuming conservative properties and undrained conditions. Nevertheless, a deep inclinometer installation would confirm the stratigraphy and provide monitoring to confirm the design assumptions. Additional characterization of strength, index, and piezometric levels of the deep foundation silt/clay layers is ongoing as part of DSI recommendation # DSI-HH-02 (KCB 2014b).

24 Mile Lake

No gaps have been identified related to the foundation conditions of the landforms impounding the 24 Mile Lake.

3.2 Task 2 - Water Balance Adequacy

The Highland TSF water balance is being managed to maintain appropriate storage capacity for flood inflows while maintaining adequate freeboard. There is low risk to the Highland TSF from water balance issues.

24 Mile Lake has significant capacity for flood inflows and therefore is at low risk from water balance issues.

a. Including the total volume of surplus mine site water (if any) stored in the tailings storage facility

L-L Dam and H-H Dam

The Highland TSF Pond is located about 8 km west of the H-H Dam, near the L-L Dam. The volume of free water behind the L-L Dam as of June 2015 was approximately 26 Mm^3 (based on Teck survey results) with a pond elevation of 1245.2 m giving a freeboard (measured from the pond level to the minimum dam crest) of 12.4 m. There is currently no spillway so the TSF is designed to store the PMF design flood plus the operating pond. The maximum normal operating pond volume (used in design) has been adopted as 50 Mm^3, almost double the current volume. The maximum pond elevation, pond water volume, and freeboard for the past five years are:

Year	Pond Elevation	Volume[(1)] (Mm^3)	Min. Dam Crest El.[(2)]	Freeboard[(3)]
2014	1244.5 m	28.6	1257.6 m	13.1 m
2013	1243.5 m	32.0	1255.1 m	11.6 m
2012	1242.0 m	31.0	1253.0 m	11.0 m
2011	1240.6 m	34.4	1252.6 m	12.0 m
2010	1238.4 m	28.6	1245.9 m	7.5 m

Note:
(1) Pond volumes are estimated based on survey provided by Teck.
(2) Minimum dam crest from 2014 DSI and annual reviews (KCB 2011c, 2012, 2013i, 2014b).
(3) Pond level to minimum dam crest elevation.

24 Mile Lake

The volume of free water in 24 Mile Lake as of May 22, 2015 was estimated to be 520,000 m^3 with a pond elevation of 1195.8 m giving a freeboard to the minimum elevation of the surrounding rock and access road fill of 24.2 m. The maximum historical pond elevation, volume and freeboard for the past five years are:

Year	Pond Elevation	Volume[(1)]	Freeboard[(2)]
2014	1198.1 m	1,270,000 m^3	21.9 m
2013	1196.7 m	750,000 m^3	23.3 m
2012	1194.9 m	350,000 m^3	25.1 m
2011	1195.4 m	440,000 m^3	24.6 m
2010	Pond elevation was not surveyed		

Note:
(1) Pond volumes are estimated based on a stage-storage curve provided by Teck (May 26, 2015).
(2) Pond level to the estimated minimum elevation of surrounding access road fill El. 1220.0 m (KCB 2014b).

b. The volume of surplus mine water that has been added to the facility over each of the past five years

L-L Dam and H-H Dam
Mine water is delivered to the Highland Pond with the tailings stream and reclaim is pumped back to the mill. Inflows include: tailings water, precipitation, runoff, inflows from Woods Creek, pumpback water from Surface Water Reclaim Pond and 24 Mile Lake. Outflows include: reclaim, water lost to tailings pore water (entrainment), deep seepage, seepage that reports to the Surface Water Reclaim Pond and 24 Mile Lake, evaporation, and evapotranspiration. The volume of outflows and inflows is managed to control the operating pond size resulting in a neutral water balance since 2010.

24 Mile Lake
Mine water is delivered to 24 Mile Lake when tailings are periodically deposited there. Inflows include: tailings water, precipitation, runoff, seepage from Highland TSF. Outflows include: pumpback water to Highland TSF via the H-H Pumphouse, seepage, evaporation, and evapotranspiration. The volume of outflows has been less than the volume of inflows resulting in a net increase since 2010.

c. Any plans that are in place or that are under development to release surplus mine water to the environment

L-L Dam and H-H Dam:
There are no plans to release water from the TSF to the environment.

24 Mile Lake
There are no plans in place to release water from 24 Mile Lake to the environment.

d. Recommended beach width(s), and the ability of the mine to maintain these widths

L-L Dam
The upstream minimum beach design width is 186 m including the 126 m cycloned sand upstream berm and a minimum 60 m tailings beach beyond the sand berm. Teck has the ability to build beach quickly using cycloned sand if beach widths become less than designed. The current approximate beach width (270 m to 700 m) exceeds the minimum requirement.

H-H Dam
The current beach width is approximately 8 km. The design does not specify a minimum width, as the pond is maintained at the L-L Dam side of the impoundment. Since the H-H Dam crest elevation is typically 10 m to 12 m higher than the L-L Dam crest elevation there is no risk of overtopping of the H-H Dam given the current configuration.

24 Mile Lake
There is no minimum beach width specified and a beach is not required.

e. The ability of the TSF embankments to undergo deformation without the release of water (i.e. the adequacy of the recommended beach width

L-L Dam
The most recent analyses predicted a deformation of 0.4 m (KCB 2010) from seismic loading. Currently there is about 12.4 m of freeboard.

H-H Dam
The H-H Dam has about 22 m of freeboard above the water pond, and 8 km of beach width. As such, release of water due to deformation of the embankment is not a credible failure mode.

24 Mile Lake
The 24 Mile Lake is impounded by natural landforms and associated roads and waste dumps. The landforms impounding the lowest boundary of the lake are in excess of 1 km wide and have capacity to undergo deformation without the release of water. Currently there is over 20 m of freeboard at 24 Mile Lake.

f. Provisions and contingencies that are in place to account for wet years

L-L Dam and H-H Dam:
The crest of the L-L Dam is maintained a minimum of 2 m above the design Probable Maximum Flood (PMF) pond level, based on a 50 Mm^3 normal operating pond level, plus the 49.6 Mm^3 PMF inflow. In practice, the normal operating pond is significantly smaller than 50 Mm^3 creating even more available storage capacity. The dam crest is raised annually to maintain freeboard and precipitation into the impoundment is consumed as make-up water to the concentrator. This provides adequate storage for wet years.

A freeboard is maintained at H-H Dam of minimum 2 m above the tailings surface to dam crest level. The current freeboard above the tailings surface is 3.5 m. The dam crest (El. 1267.4 m) is approximately 22 m above the current pond level (El. 1245.6 as of June 12, 2015).

24 Mile Lake
24 Mile Lake has the capacity to store approximately 6 times the PMF at typical normal water levels. The water level is maintained in 24 Mile Lake by either pumping to the H-H Pumphouse, or pumping to the Highland Mill.

g. If any gaps have been identified, a plan and schedule for addressing these issues

No gaps have been identified concerning water balance adequacy at the Highland TSF or the 24 Mile Lake.

3.3 Task 3 - Filter Adequacy

The L-L Dam has adequate filters in place and there is a low risk of failure due to internal erosion (piping) under current operational conditions. The filter design is based on (KCB 2010) and as-built condition is verified by construction quality control and quality assurance testing.

The H-H Dam has a zone with inadequate filters but as there is an 8 km long beach and therefore a low gradient there is low risk of internal erosion under current operational conditions.

The 24 Mile Lake does not have a discernible dam structure and therefore no filters. However, piping is not considered a credible failure mechanism for the 24 Mile Lake due to the long distance to the open face of the Valley Pit, the irregular topography and stratigraphy between the lake and the pit and the low gradient over the 1.8 km distance to Valley Pit.

a. Including the beach width and filter specifications necessary to prevent potential piping

L-L Dam
The current minimum beach width is over 186 m (including the compacted cyclone sand zone) which satisfies the design requirements.

The filter gradations have been checked against the US Army Corps 2004 filter design criteria and are appropriate and adequate to prevent piping.

H-H Dam
Part of the H-H Dam downstream dam fill was not designed with filter compatible zones next to the core, from El. 1193.6 m to El. 1255.4 m. The downstream fill zone adjacent to the core was a variable sand and gravel rockfill, without a specified gradation.

Since 2010, above El. 1255.4 m a downstream filter zone next to the core has been constructed.

The 8 km distance from the pond to the H-H Dam severely limits the potential for piping across the H-H Dam core.

24 Mile Lake
There are no filters and no beach (designed or actual) for the 24 Mile Lake. However, piping is not considered a credible failure mechanism for the 24 Mile Lake due to the relatively low pond level, the anticipated naturally occurring silt in the lake bottom, and the anticipated low hydraulic gradient between the 24 Mile Lake and the Valley Pit (a distance of more than 1.8 km).

b. Whether or not the filter has been constructed in accordance with the design

L-L Dam
The construction records, including QA/QC testing by full-time KCB staff, indicate that the filters have been constructed in accordance with the design.

Further, based on the qualitative and quantitative observations conducted regularly during construction, the core and filters are performing as required by the design. Observations that validate this conclusion include:

- Water levels in the downstream shell, monitored by piezometers, and remains low.
- Seepage is measured at several monitoring points, including flow and visual observations. Sedimentation has not been observed in seepage collected from the dam drains;

- Construction QA/QC testing for compliance to specifications is routinely carried out during construction and are documented in annual Construction Summary Reports.

H-H Dam
Although the dam fills have been constructed in accordance with the design there is a zone of fill downstream of the core where no filter compatible materials were specified (from El. 1193.6 m to El. 1255.4 m). The construction records indicate that from El. 1193.6 m to El. 1216.7 m, a poorly graded silty sand and gravel was used for downstream structural fill. While it is possible this material may meet filter criteria, there are no gradation results available. From El. 1216.7 to El. 1255.4 m, the downstream fill zone was well graded waste rock. This material is not considered filter compatible with the core material but again there are no gradation results available.

Other filter zones, including the fill zones in the H-H starter dam, and the core to sand filter zone above El. 1255.4 m were checked against USACE 2004 requirements for permeability and stability (internal stability and soil retention) and satisfy stability criteria with some minor inconsistencies regarding permeability criteria.

Although there are likely some incompatible filter zones, between the core and the downstream fill material, these incompatibilities do not pose a current concern to the dam's integrity given that the pond is maintained at the 8 km long tailings beach. The lack of a nearby pond, and availability of water limits the rate and potential for piping.

No signs of piping have been observed at the H-H Dam during routine weekly inspection.

24 Mile Lake
This question is not applicable to 24 Mile Lake.

c. If any gaps have been identified, a plan and schedule for addressing these issues.

L-L Dam and 24 Mile Lake
No gaps in filter design or adequacy were identified.

H-H Dam:
The following gaps have been identified:

- There is limited piezometric information upstream and downstream of the H-H Dam core.
- It has been recommended in DSI recommendation #DSI-HH-02 (KCB 2014b) that additional instruments are installed in the tailings beach and downstream shell in order to estimate and monitor the gradient across the core, and alert levels should be updated to include a threshold gradient across the core.
- There is limited information on the extent and gradation of fill materials next to the core between El. 1193.6 m and El. 1255.4 m. Drilling and sampling could be of limited benefit and is not recommended at this time. Drilling and sampling will be reconsidered if the additional piezometers discussed above provide information that is inconclusive with regard to the gradient across the dam.

4 SUMMARY OF GAPS AND SCHEDULE TO ADDRESS

L-L Dam

1. Defining the extent and material properties of the various glacio-lacustrine layers has been ongoing since 1977 as part of the design, construction and monitoring of the Highland TSF. As per KCB recommendation DSI-LL-06 (KCB 2014b), and recommendations in our 2010 design update report (KCB, 2010) additional drilling and lab testing is underway for the foundations of in the VBB, NBB and North Abutment. A drilling program is planned for 2015. This is an ongoing task that spans multiple construction seasons; a progress update will be provided in the 2015 Dam Safety Inspection report.
2. Update stability analyses as new strength data are acquired. This is an ongoing task that is updated annually. This task will be reported in the 2015 Annual Performance Review report.
3. It is also necessary to understand the stresses, deformations, and generation of pore pressures in the glacio-lacustrine layers under the loading from current and predicted construction stages. This should be accomplished using a stress-deformation model (such as Settle 2D, or similar) based on updated definitions of material extents and characteristics (from #1, above) and a review of inclinometer performance data (DSI recommendation #DSI-LL-08 (2014b)). This work will be initiated following the planned 2015 drilling program with progress update given in the 2015 DSI and to be completed by end of 2016.

H-H Dam

1. The deep foundation silt and clay layers are not well characterized; however, these do not represent potential critical slip surfaces even assuming conservative properties and undrained conditions. Nevertheless, a deep inclinometer installation would confirm the stratigraphy and provide monitoring to confirm the design assumptions. This will be installed in 2016. Additional characterization of strength, index, and piezometric levels of the deep foundation silt/clay layers is ongoing as part of DSI recommendation # DSI-HH-02 (KCB 2014b). This is an ongoing commitment spanning multiple construction seasons and a progress report will be provided in the 2015 DSI.
2. There is limited piezometric information upstream and downstream of the H-H Dam core. It has been recommended in DSI recommendation #DSI-HH-02 (KCB 2014b) that additional instruments are installed in the tailings beach and downstream shell in order to estimate and monitor the gradient across the core, and alert levels should be updated to include a threshold gradient across the core. This is an ongoing commitment spanning multiple construction seasons and a progress report will be provided in the 2015 DSI.

24 Mile Lake

No gaps have been identified.

5 CLOSING

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Teck Highland Valley Copper Partnership (Teck) for the specific application to the Highland TSF and 24 Mile Lake MEM Response. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. The review is based on available information at the time of writing. In this report, Klohn Crippen Berger has endeavoured to comply with generally-accepted professional practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

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AS/DW/NS:cd

Attachments: Figure 1 – Location Map for Tailings Dams and Water Retention Dams
Figure 2 – Highland TSF – L-L Dam
Figure 3 - Highland TSF – H-H Dam

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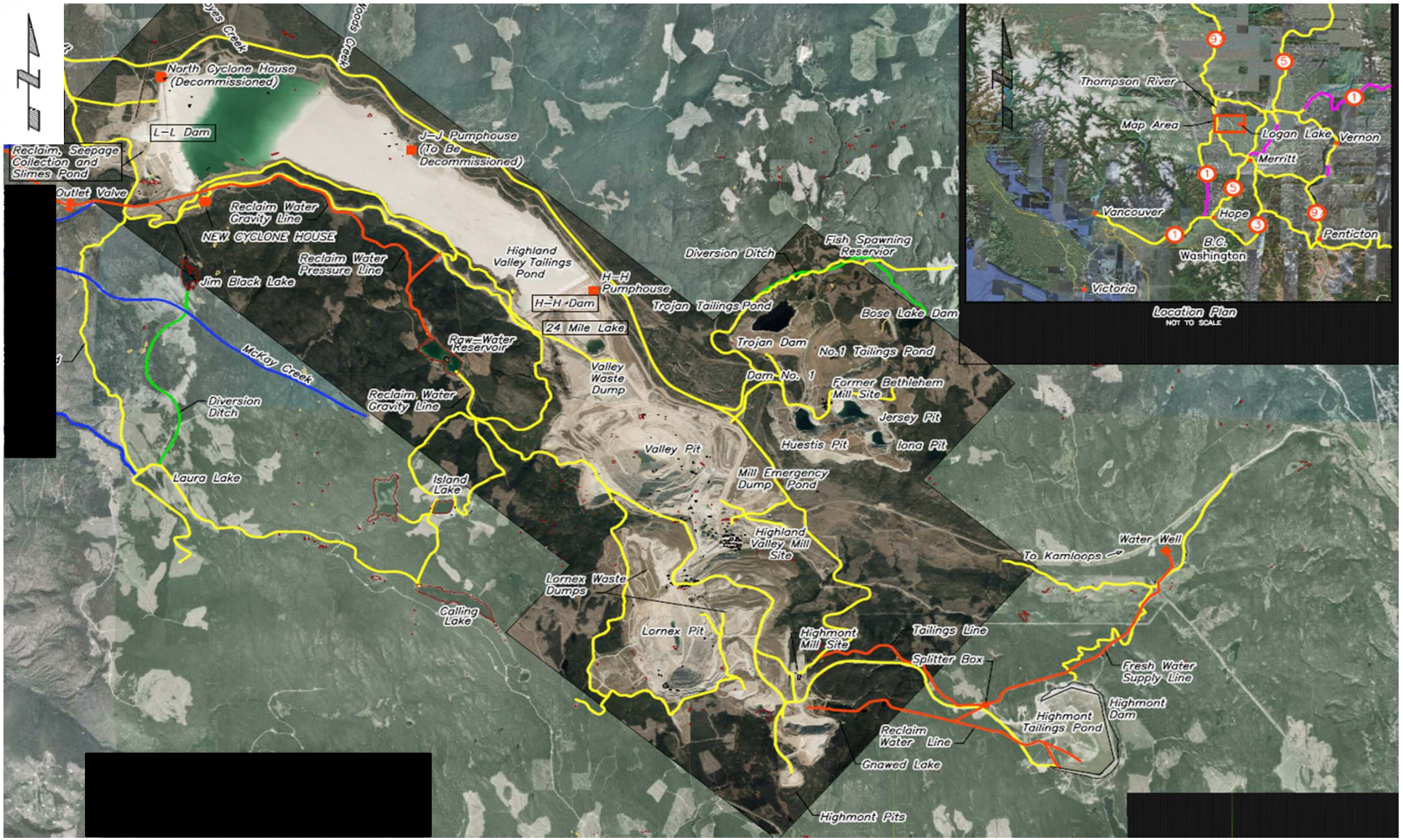
FIGURES



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PROJECT: HVC TAILINGS DAMS
RESPONSE TO MEM MEMORANDUM

TITLE: LOCATION MAP FOR TAILINGS DAMS AND WATER RETENTION DAMS

PROJECT No. M02341A87

No. 1

Date & Time: 25/06/2015 12:17

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PROJECT
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TITLE
HIGHLAND TSF
L-L DAM

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2

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RESPONSE TO MEM MEMORANDUM

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H-H DAM

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