Teck Highland Valley Copper Partnership

Highmont Tailings Storage Facility
Operation, Maintenance & Surveillance Manual

November 2014

Teck

ACRONYMS AND ABBREVIATIONS

BC............................ British Columbia

CDA.......................... Canadian Dam Association

DFA .... Disaster Financial Assistance

EMBC .... Emergency Management British Columbia

EMS.......................... Environmental Management System

EOC.......................... Emergency Operations Centre

EPRP........................ Emergency Preparedness and Response Plan

ERP .... Emergency Response Plan

ERT .... Emergency Response Team

HVC.......................... Highland Valley Copper

ISO .... International Standards Organization

MAC.......................... Mining Association of Canada

MOE .... Ministry of Environment

MOTI......................... Ministry of Transportation and Infrastructure

OMS .... Operation, Maintenance and Surveillance

PECC........................ Provincial Emergency Coordination Centre

PMP.......................... Probable Maximum Precipitation

RCMP .... Royal Canadian Mounted Police

SRB .... Sulphate Reducing Bacteria

TNRD........................ Thompson Nicola Regional District

TSF........................... Tailings Storage Facility

7. TAILINGS STORAGE FACILITY SURVEILLANCE

7.1. Objective

The overall objectives of performing surveillance monitoring activities are to promptly identify unusual conditions or any departures from expected behaviours and to determine appropriate actions for response. Facility surveillance is recognised as a critical element in the safe and efficient operation of the Highmont TSF. In addition to regularly scheduled surveillance and maintenance, all personnel working at the Highmont TSF will integrate surveillance with their daily activities. Employees are expected to continually monitor all regular operations, environmental performance standards, overall TSF structural integrity indicators, and site safety elements. Surveillance parameters and schedules should be updated as required when conditions change or unusual conditions arise. All tailings and water management personnel are expected to report and act on any observed departures from expected behaviours. See Section 7.10 for proper reporting procedures.

7.2. Surveillance Parameters

Tailings storage facility failure may stem from several probable causes. Signs of hazards can often be identified through regular visual and instrumentation monitoring before potential hazards become problematic. Potential failure modes have been identified for the Highmont TSF and are listed with the probably triggers, visual effects, and instrumentation effects in Table 5. Tailings and water management personnel can identify the need for maintenance and repair by observing changes in the surface appearance of dam structures and surrounding areas, which may include cracking, bulging, sloughing, seeps, subsidence, depressions or sinking ground, rutting of crest and bench roads, displaced or abnormal vegetation, erosion, gullying, and the general conditions of spillways, raisers, walkways, and other structures that may present corrosion problems that affect their performance. Table 6 classifies the visual effects by type with expected and unexpected behaviours. Regular inspections to associate hydraulic structures should also be performed (e.g., drainage or return ditches that run adjacent to the berm toe). Conditions to be inspected on ditches include conditions of flow, water levels, ditch bank conditions, seeps, vegetation cover, undercutting of inflow pipelines, etc.

7.3. Potential Failure Modes for Assessment

Table 5 – Potential Failure Modes for Assessment

Failure Mode	Probable Triggers	Visual Effects	Instrumentation Effects
Failure or suspect impending failure of the tailings dams	Foundation failure, seepage, piping, seismic loading, overtopping.	Displacement of monuments cracks in embankment, cloudy seepage, and high seepage face on dam, rising pond levels.	Inclinometer movement, piezometric level increase, rising pond, increased drain flows.
Overtopping of the tailings dams	Precipitation, Reclaim pump failures.	Rise in pond level, overtopping, erosion due to water flow over the embankment	Rising Pond level, rising drain flows, increased piezometric levels.
Slumping, sliding, cracking or bulging of tailings dams	Foundation failure, piping, increase in pore pressure.	Sliding, deformities in the dam shell, seepage or wet zones on dam face, increased seepage, turbidity sediment transport in seepage flows	Broken casings, rise in piezometric or pond levels, increased flows.
Rapid increase or unexplained cloudy appearance of seepage through the tailings dams and/or their foundations	Piping, development of slip surfaces in foundation or embankment, hydraulic fracture of till core, seismic event.	Increase in seepage flows, sediment transport, turbidity in flows, sinkholes	Sudden change in piezometric levels or increased movement in inclinometers or survey monuments. Increased flows in drains.

Failure Mode	Probable Triggers	Visual Effects	Instrumentation Effects
Formation of sinkholes on the tailings beach or dams	Seismic event leading to Piping, Settlement or consolidation within tailings, release of gas from buried lacustrine organics.	Depressions on the beach or dam fill	None
Breakage of tailings pipelines, which may result in dam erosion and/or release of tailings slurry	Pressure build-up due to blockage in the delivery system, damaged or worn pipe, construction damage.	Washout, erosion of damfill	None
Large earthquakes	Natural event	Deformation and settlement of embankment	Elevated piezometric pressures, increased movement in inclinometers, sudden changes in drain flows, possible damage to instrumentation
Extreme flood	Unusual storm events	Rise in pond level, surface runoff, developing erosional gullies due to runoff, increased turbidity.	Rise in flows, and piezometric levels, potential damage to instruments
Severe storms	Natural event	Rise in pond level, surface runoff, rapidly developing erosional gullies due to runoff	Rise in flows and piezometric levels, potential increase in inclinometer movements, potential damage to instruments

Failure Mode	Probable Triggers	Visual Effects	Instrumentation Effects
Sabotages and other criminal activities	Terrorist or criminal activity, explosives or unauthorized access or use of equipment/machinery.	Damage to the embankment.	Possible damage to instrumentation

7.3.1. Classification of Visual Observations

Table 6 – Classification of Visual Observations

Type	Expected Behaviours	Unexpected Behaviours
Surface Cracking	No or limited increase in size with time. Expected in areas with loosely compacted side fill or limited confinement.	Rapid change in characteristics, extension over long lengths, deepening and widening of cracks. Development into Erosion and seepage pathways. Surface slumps and failures.
Surface Bulging	Accumulation over time from windblown sand or surface water runoff where till wrap not provided. Generally a surficial feature.	Sudden appearance or growth.
Surface Depressions	No or limited increase in size over time. Does not recur if infilled.	Deepening and widening of depression, appearance of cracks around edge, development of erosion and seepage pathways, downstream appearance of fines and seepage, can lead to sinkhole development
Sink Holes	No or limited increase in size over time.	Significant change in size or shape, growth and development of erosion and seepage pathways, downstream appearance of fines and seepage, appearance of actual holes or pipes at base of hole, development of multiple pathways.
Vegetation	Grass established to limit erosion	Shrubs and trees establishing on dam surfaces.

Type	Expected Behaviours	Unexpected Behaviours
Slope Erosion	Minor slumps or surface gullies at zones of construction water seepage, generally where slopes are steep and new seepage paths are established. These are typically limited in depth and cease regression once the water source is removed.	Severe or deep slumps, sloughs or erosional gullies rapidly regressing or evolving under surface or seepage flow.
Water Levels	Gradual increase with time, along previously established trends. Sudden increase in areas where construction (cyclone sand with water runoff) occurs.	Rapid increase or decrease in water level without introduction of construction water. Rise in piezometric levels remaining after construction ceased (after a suitable time lag).
Seepage Areas	Wet slopes, no soil movement, no cloudy seepage.	Seepage appearing in new areas, slumping or erosion at point of seepage, cloudy seepage.
Beach Slopes	Flat development of slopes typically 0.5% to 2%, with steeper slopes (5% to 10% below water).	Over steep slopes, slumps or slides into pond.

7.3.2. Surveillance Parameters for Instrumentation

Surveillance parameters for instrumentation are developed and maintained by the dam engineering consultants. In 2012, Klohn Crippen Berger reviewed piezometer and inclinometer data to ensure surveillance parameters were accurate. This review provided updated Alert levels for instrumentation and recommended responses to exceeded thresholds. The recommended Alert levels are reviewed annually during operation of the impoundment.

7.4. Surveillance Procedures

7.4.1. Visual Monitoring and Inspection

Routine Visual Monitoring

Successful surveillance procedures are dependent on routine visual monitoring by all HVC personnel and contractors that regularly perform work around the Highmont TSF. Routine visual monitoring allows staff to make ongoing observations relating to the conditions and performance of dams and associated facilities (e.g., pipelines, pump stations, seepage ponds, dam instrumentation) as well as pond/reservoir management operations (see Section 6), so that a hazardous condition or any changes to dam conditions or performance can be identified and addressed promptly. Training on how to perform routine visual monitoring is provided annually during the Tailings Management Workshop.

Typical observations to be made during visual monitoring and inspection include:

- pond level;
- evidence of dam structure deformation (e.g., slope bulging or crest settlement) or other unexpected behaviours (described in Section 7.2.2. above);
- evidence of seepage, overland runoff, or wave erosion (e.g., slope sloughing, loss of riprap protection, rutting at dam crest, soft dam toe conditions);
- seepage clarity and quantity (visual estimates) and signs of chemical precipitation;
- possible evidence of piping downstream of the dams;
- possible evidence subsidence or sink holes in tailings;
- other unusual conditions in the dam area.

All personnel and contractors that regularly perform work around the Highmont TSF are expected to become familiar with the normal operating conditions as well as with potential unexpected behaviours associated with the dams, access roads, etc. Any unusual observations made at dam structures or associated facilities must be reported immediately by the observer to Protective Services, their supervisor, or the Superintendent Tailings and Water Management. This process is described in detail in Sections 7.4 through 7.7.

Dam Inspections

Routine dam inspection primarily involves regular and occasional walk-over of dams and associated facilities in order to make observations relevant to dam safety. Dam inspections are performed by experienced HVC personnel and engineering contractors that are familiar with the general arrangement, function, and normal operation conditions of the Highmont TSF as detailed in the following two tables.

Dam inspections are documented using the Dam Inspection Checklist (included in Appendix II) and supporting photographs.

Where varying with time conditions are suspected (e.g., increasing seepage or deformation of dam structure, progressive erosion, etc.), photographs must be taken from the same location to monitor the changes. Where necessary, the Superintendent Tailings and Water Management may review these observations with the dam engineering contractor.

Any unusual observations made at dam structures or associated facilities should be immediately reported to the observer's supervisor or Superintendent Tailings and Water Management.

All Dam inspection checklists (Appendix II) should be securely filed in the Tailings and Water Management library, and any unusual conditions should be reported verbally at the time of submission. A record of these inspections is sent to the engineering consultant performing the annual inspection.

Table 7 – Periodic Inspections by HVC Personnel

Responsible Person	Activity	Frequency	Structure
Dam Inspector	Perform visual inspection tour across the dams to evaluate the conditions and performance of dams and associated facilities (e.g., pipelines, pump stations, seepage ponds, dam instrumentation) so that any changes to dam conditions or performance, or a hazardous condition can be identified and promptly addressed. (Documented)	2x annually	Highmont Storage Dam and spillway
Dam Inspector	Visual surveillance tour across the dam to evaluate the conditions and performance of dams and associated facilities (e.g., pipelines, pump stations, seepage ponds, dam instrumentation) so that a hazardous condition or any changes to dam conditions or performance can be identified and promptly addressed. (Documented).	Weekly (weather permitting)	Highmont TSF and associated facilities
Tailings and Water Management Survey Crews	Dam movement monitoring	Annually	Storage dam
Tailings and Water Monitor	Perform visual inspection tour of the TSF components including seepage ponds and the booster station to evaluate conditions. Report abnormal conditions to the Senior Foreman, Mill Operations	Daily (road and weather conditions permitting)	Seepage ponds and components of the water collection and pumping system at Highmont TSF
All Employees Working on/around Highmont TSF	Make on-going observations relating to the conditions and performance of dams and associated facilities (e.g., pipelines, pump stations, seepage ponds, dam instrumentation) so that any changes to dam conditions or performance, or a hazardous condition	Ongoing	Highmont TSF and associated facilities

	can be identified and promptly addressed. (Not documented)		

Table 8 – Periodic Inspections by Engineering Consultants

Responsible Person	Activity	Frequency	Structure
Klohn Crippen Berger Engineers	Weir readings to monitor seepage	Monthly from June - October	Highmont TSF
Klohn Crippen Berger Engineers	Standpipe piezometer readings	Monthly from June - October	Highmont TSF
Klohn Crippen Berger Engineers	Inspection	Annually	Highmont TSF and associated facilities
External, Independent Dam Reviewer	Dam safety review	Every seven years	Highmont TSF and associated facilities

7.4.2. Instrumentation and Monitoring

Instrumentation and monitoring programs have been established at the Highmont TSF to evaluate geotechnical, hydrogeological, and water quality aspects of the tailings dams and impoundments. All functioning instrumentation must be monitored to meet the schedule recommended by Klohn Crippen Berger in their annual surveillance plan, to assist the design engineer(s), to confirm the satisfactory performance of the tailings dams, and to check design assumptions. Instrumentation shall be monitored by HVC, as required, during the period when no Klohn Crippen Berger field personnel are present. All Instrumentation data shall be reduced, plotted, and reviewed in the field to allow for immediate checks on erroneous readings and quick identifications of anomalous readings. The design engineer(s) shall be alerted to any anomalous readings so that both the instrumentation and the dam performance can be reviewed and appropriate actions taken promptly.

Existing working instrumentation at the dams shall be preserved and properly maintained to provide continuous data for assessing dam performance and confirming design assumptions. All contractors and mine personnel shall be advised of the existence and location of any instrumentation in advance of any work to be conducted in the general area of the dams.

On a monthly basis from June to October, Klohn Crippen Berger Ltd. field engineers at the Highland L-L Dam are assigned the responsibility to measure flows into and out of the seepage collection ponds, record the levels of the seepage collection ponds, record hours pumped at various seepage collection ponds and the main pond, take and record standpipe piezometer readings at certain ponds and at the main tailings impoundment. This information is recorded by Klohn Crippen Berger Ltd. and they include this data in their annual report.

The six movement monitoring monuments at the crest of the dam are surveyed once a year with Tailings and Water Management Survey Crews carrying out this assignment. Tailings and Water Management Surveyors also record water levels at the main tailings pond. This data is passed on to Klohn Crippen Berger Ltd. for their annual report for this facility.

The main tailings pond and the perimeter seepage ponds are visited twice a year; once in the spring and once in the fall by Klohn Crippen Berger Ltd. Hydrogeological staff and their reports are kept on file. In addition Klohn Crippen Berger Ltd. personnel also make an annual inspection visit to the site.

7.4.3. Collation and Analysis of Data

Collected instrumentation data and most recent as-built configurations are used in stability analyses to check the interim stability of the dams through the following year. The maximum allowable pond levels for the current dam crests are calculated so that the available flood storage at each facility can be tracked. Information pertaining to tailings impoundment fill is included in the Annual Review.

Initial Screening of Visual Inspection Observations and Field Data

HVC's Dam Inspectors perform initial screening of visual inspection data at the time of inspection and document findings using the *Dam Inspection Checklist* included in Appendix II. Photographs are taken during the inspection to support the screening process and are included with the checklist. All dam inspection checklists are to be stored securely in the Tailings and Water Management library.

Initial screening of instrument measurement data is performed by HVC Tailings and Water Management personnel and the engineering consultant.

Follow-up Screening of Visual Inspection Observations and Field Data

In the event of an unusual condition at the Highmont TSF, the Superintendent Tailings and Water Management should perform follow-up review of dam inspection records and photographs on file, and should consider contacting the engineering consultant to discuss findings and to review instrument readings. In the event that no unusual conditions are observed throughout the year, inspections and reviews will be performed by the engineering consultant during the annual dam safety inspection described in the following section.

7.4.4. Periodic Inspection and Review

Periodic Review of Inspections and Instrument Readings

Periodic inspection are completed by the engineering consultant and collected data is reviewed on regular basis. Detailed review and additional inspections are completed by the engineering consultant at the time of Annual Dam Safety Review described in the following section. Inspection and review may take place more frequently if unusual conditions are present at the Highmont TSF.

Periodic Inspection and Review of Total Facility Performance

Two formal inspections of the facility are carried out each year by Klohn Crippen Berger Ltd.: twice regarding the hydrogeological aspect and once regarding the geotechnical aspect. The annual report incorporates all observations and recommendations by the consultant.

Since 1991, HVC has engaged Klohn Crippen Berger (previously Klohn Leonoff) to carry out performance reviews and assessments studies in order to re-affirm that the Highmont Tailings Dam is in compliance with the most recent Provincial Government requirements as well as the recommendations of the CDA. The Consultant would be required to review the guidelines from time to time until decommissioning as a part of the annual review of the facility.

The following timeline summarizes reviews and studies concerning the Highmont TSF:

- 1994: stability review and spillway design of Highmont TSF by Klohn Crippen
- 1996: long-term stability assessment of Highmont TSF; classified all dams as "significant"
- 2003: reclassified Highmont TSF dams as "low" based on CDA Guidelines (1999) and BC Dam Safety Regulations (2000)

The following table summarizes the dam safety review information for the Highmont TSF.

Table 9 – Dam Safety Classification

Dam	Dam Classification (CDA, 2007)	Dam Safety Review Frequency (CDA, 2007)	Dam Safety Review Date last/next
Highmont North	High	Every 7 years	2013 / 2020
Highmont East	Significant	Every 10 years	2013 / 2023[1]
Highmont South	High	Every 7 years	2013 / 2020
Seepage Pond S1	Significant	Every 10 years	2013 / 2023
Seepage Pond S2	Significant	Every 10 years	2013 / 2023
Seepage Pond S3	High	Every 7 years	2013 / 2020
Seepage Pond S5	Significant	Every 10 years	2013 / 2023
Seepage Pond S8	Low	Not applicable[2]	Not applicable[2]

[1]A Dam safety review for the Highmont East Dam will most likely happen at the same time as the reviews for the North and South Dams, in 2020.

[2]A Dam Safety review is not required for low-consequence dams. However, the consequences of failure are reviewed periodically, since they may change with downstream development.

In 2014, HVC revised consequence classifications of the Highmont Tailings Dams according to the BC Dam safety Regulation 163/2011 and CDA guidelines, as recommended by AMEC in the Dam Safety Review (AMEC, 2014). The Highmont Dam was classified in three sections, North, East, and South, based on differing downstream effects. The Seepage Pond Dams were also formally classified.

Inspections Following Unusual Events

HVC performs event-driven inspections as needed following unusual events. The following table summarizes the inspection actions to be performed following significant events.

Table 10 – Unusual Events Requiring Follow-up Inspections

Event	Inspection Requirements
Large earthquakes	Carry out a detailed walkover of all Dam structures, including crests, downstream and upstream (visible) slopes and dam toes, and all spillways, looking for signs of cracks, bulging, settlement and/or other deformations. Look for and note any changes in seepage, particularly with respect to the rate of seepage flows at dam slopes and seepage clarity. Read all piezometers. Inspect downstream toes of dams for sand boils and dam slopes for sinkholes. Inspect ponds upstream of the dams looking for 'whirlpools'. Inspect all pump stations and pipelines, and (active and decommissioned) decant structures at the main dam. Discuss findings with the dam engineer.

Event	Inspection Requirements
Rapid snowmelt and/or heavy rainstorms	Inspect the (visible) slopes and the crests of dams looking for areas of concentrated runoff and erosion. Inspect permanent spillways for damage and repair as necessary Make note of saturated ground/soft ground conditions at dam slopes and toes. Examine dam slopes for indications of localized slumping/instability. Inspect all pump stations and pipelines Check the water levels in all ponds/reservoirs against the critical levels, and keep checking these levels until the pond/reservoir inflows subside. Discuss findings with Klohn Crippen Berger engineers. Check piezometric levels at dam sites if instructed by Klohn Crippen Berger engineers Open the spillway gate during potential flood events to prevent overtopping of structure If necessary, adjust the runoff management and/or treatment schedule as advised by Klohn Crippen Berger engineers
Unusually high winds	Check the condition of erosion protection on the upstream slopes of the dams. Check suspended solids in the upper and lower cells.
Extreme snow pack	Check the water levels in all ponds/reservoirs against the critical levels, and keep checking these levels until the spring freshet is over. Contact Senior Civil Engineer to evaluate the situation in terms of possible snowmelt scenarios. Make predictions as to the expected storage capacity available in ponds/reservoirs If deemed necessary, mobilize pumping and mobile treatment equipment to the site.

Event	Inspection Requirements
Significant, relatively rapid erosion (any cause) of dam slope or 'sudden' seepage break at dam slope or downstream of dam in form of continuous seepage or boils	Initiate Emergency Response Plan (see Section 8: Emergency Preparedness and Response Plan)
Deformation at dam crest, slope or toe area, including development of a 'wet spot'	Initiate Emergency Response Plan (see Section 8: Emergency Preparedness and Response Plan)
Pond level close to, or approaching a critical level	Notify Superintendent Tailings and Water Management Consider initiating Emergency Response Plan (see Section 8: Emergency Preparedness and Response Plan)
Significant change in a piezometric level	Check the past reading paying special attention to seasonal water level changes Check the measurement again Contact the Superintendent Tailings and Water Management
Necessity to store more than typical amount of water in a pond/reservoir (any reason)	Record all current pond/reservoir levels Contact the Superintendent Tailings and Water Management
Other events/observations	Notify Superintendent Tailings and Water Management

Periodic Inspection and Review of Continuing Validity of Facility Design and Performance Criteria, Including for Surveillance

Surveillance parameters and procedures are reviewed annually as part of OMS manual review, and updates are made as required to ensure that dam safety performance surveillance criteria is consistent with TSF design.

7.5. Conditions or Events that Indicated Existing or Potential Emergency

This section covers only those emergency situations that could potentially pose a threat to the structural integrity of the tailings dams or result in the release of tailings materials and/or supernatant pond water into the surrounding environment. In the event of an emergency, prompt action shall be taken to avoid delays, which could have serious consequences. Responsible persons and agencies listed in Section 8.3.3 shall be informed and contingency plans put into effect.

Emergency situations may include, but are not limited to the following:

- Failure or suspected impending failure of the tailings dams
- Overtopping of the tailings dams
- Slumping, sliding, cracking, or bulging of tailings dams
- Rapid increase or unexplained cloudy appearance of seepage through the tailings dams and/or their foundations
- Formation of sinkholes on the tailings beach or dams
- Large earthquakes
- Extreme flooding
- Severe storms
- Sabotages and other criminal activities

Particular attention shall be given to inspecting and, where necessary, repairing the Highmont TSF following unusual or extreme events. All unusual events shall be reported to Protective Services or supervisory personnel. In an unlikely event that high seepage flows occur downstream of the tailings dams, and particularly if seepage water is carrying soil particles from the dams or their foundations (an early indication of a potential piping problem), it shall be reported immediately to the Superintendent Tailings and Water Management and the Klohn Crippen Berger Engineering Consultant.

In the event of an emergency or unusual situation, the engineering consultant, if on site, or HVC personnel will monitor all instrumentation in the affected area during and/or immediately following the event. This information shall be forwarded to the design engineer(s) immediately so that the situation can be assessed and any required remedial actions taken promptly.

7.5.1. Identifying an Existing or Potential Emergency

Existing or potential emergency conditions may be visually identified through routine surveillance activities described in detail in Section 7 of this OMS Manual, through TSF surveillance, or by monitoring instrumentation at the dams.

7.6. Assessing the Severity and Magnitude of an Existing or Potential Emergency

7.6.1. Assessing Unusual Conditions or Dam-related Emergencies

In the event of an unusual condition that could result in a dam-related emergency or crisis, the Superintendent Tailings and Water Management or his designate should refer to Table 11 to assist with the determination of the situation's severity. This table was developed based on dam safety guidance from numerous sources including MAC and CDA. Ultimately, the severity determination should be based on the circumstances unique to the potential emergency situation, rather than on this table alone (see Section 7.7 for further detail on how Alert Levels are assigned for any situation). The piezometer and inclinometer threshold levels should be reviewed if they are available for the affected dam and discussed with the dam consultant immediately if instrument readings are beyond specified values.

Table 11 – Alert Level Rankings for Unusual Conditions and Emergencies at Highland Valley Copper Tailings or Water Storage Facilities

Event or Observation	Situation	Alert Level
Rising Water Levels, Freshet, and Overtopping	Impoundment water level is rising and approaching specified depth below embankment crest (minimum freeboard elevation)	1
	Impoundment water level above specified depth to embankment crest or freeboard (e.g., 1 meter)	2
	Water is flowing over the dam	3
	Water is flowing over an abutment or saddleback rim of impoundment	3
Extreme Precipitation Event	Threat of flash flood condition from excessive rain or rapid snow melt	1
	Threat of avalanche into pool	1
	Threat of land slide into pool	1
	Observed ground saturation near or on dam embankment	1
Extreme Precipitation Event (contd.)	Water starting to flow through emergency spillway	1
	Localized slumping or instability on dam face	1
	Impoundment water level is rising (see 'Rising Water Levels and Overtopping' section above)	*
Extreme Wind Event	Deposition of material on dam faces	1
	Erosion visible on face the dam	1
Extreme Snowpack	See 'Rising Water Levels and Overtopping' section above	*
Spillway Erosion or Blockage	Minor erosion / turbidity apparent in emergency spillway flow	N/A
	Emergency spillway flowing with bottom erosion with active headcut advancing toward control section	N/A
	Emergency spillway blocked by significant debris or landslide material with impoundment level approaching minimum freeboard elevation	N/A
	Emergency spillway flowing with erosion at control section	N/A
Seepage	Change in vegetation growth indicating increased embankment saturation	1

Event or Observation	Situation	Alert Level
	New seepage areas or increased discharge from internal drain outlet within or near dam	1
Seepage	New seepage areas or internal drain discharge with cloudy flow (increasing turbidity) and increasing flow rate	2
	Seepage at greater than a specified flow rate or causing erosion (excessive turbidity or sediment) of the dam or foundation	3
Delivery Pipe Failure	Leaking outlet causing minor dam surface erosion and/or release of tailings slurry	1
	Leaking outlet causing down cutting in dam surface erosion and/or release of tailings slurry	2
Delivery Pipe Failure Contd.	Breakage of outlet possible causing significant to catastrophic dam surface erosion and/or release of tailings slurry	3
Sinkholes	Sinkhole with non-structural impacts	1
	Observation of new sinkhole in impoundment area or on embankment	1
	Rapidly enlarging sinkhole	2
Embankment and Abutment Cracking	New cracks in the embankment or abutments at greater than specified width	1
	New cracks in the embankment with associated seepage	2
	New cracks in the abutment with seepage and increasing flow rate	3
Embankment Movement	Observed movement/slippage or bulging of embankment toe, slope, or crest	1
	Observed movement/slippage or bulging of embankment toe, slope, or crest where there is a direct threat to the structural integrity of the dam	2
Embankment Movement (contd.)	Sudden or rapidly proceeding slides at embankment slope	3
	Sudden or rapidly proceeding subsidence at embankment crest	3
Animal Evidence	Damage to monitoring instruments from animals	1
	Animal burrows present on dam face or abutment	1
Instrumentation	Measurement instrument readings beyond specified values	1
Control	Failure of outlet/inlet controls with no impacts to the functioning of the dam	1
	Failure of outlet/inlet controls that has resulted in seepage flow	2

Event or Observation	Situation	Alert Level
	Failure of outlet/inlet controls that has resulted uncontrolled water release	3
Earthquake	Measurable earthquake felt or recorded within specified distance of dam	1
	Measurable earthquake with observed structural damage to facility and or dam controls	2
	Measurable earthquake resulting damage to outlet/inlet controls, dam or appurtenances that has resulted in uncontrolled water release	3
Security Threat	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam or appurtenances	3
Vandalism	Vandalism to dam with no leaking evident	1
	Vandalism to outlet/inlet controls, dam or appurtenances with no impacts to the functioning of the dam	1
	Vandalism to measurement instrumentation	1
Vandalism	Vandalism to dam resulting in leak (see 'Delivery Pipe Failure' section above)	*
	Vandalism with damage to outlet/inlet controls, dam or appurtenances that has resulted in seepage flow	2
	Vandalism with damage to outlet/inlet controls, dam or appurtenances that has resulted in uncontrolled water release	3
Other Situations	Any unusual event or condition on or around the dam with potential to harm the dam	1
	Any unusual event or condition that has caused visible damage to the dam and requires mitigation efforts to restore structural integrity of the dam	2
	Any unusual event or condition that has resulted in, or will likely result in, an uncontrolled release of water or tailings from the impoundment	3
*See other section(s) specified for a more detailed description of circumstances		

7.7. Communication of Unusual Events

It is the responsibility of all HVC personnel and contractors working on or around the Highmont TSF to immediately communicate any unusual conditions to their supervisor and Protective Services.

The person who discovers a situation that may threaten the structural integrity of a dam, such as excess seepage or surface depressions, will advise their supervisor and Protective Services immediately. Protective Services will notify the Superintendent Tailings and Water Management (or their alternate) in accordance with the Emergency Reporting Procedure included in section 8.3 of this OMS Manual.

7.8. Alert Level Determination, Emergency Response Plan Activation, and Initial Response

This section outlines procedures for assessing the severity and magnitude of an existing or potential emergency, and designates the person(s) responsible for identifying and evaluating the emergency and activating the emergency response. This section is intended for use internally by HVC's Tailings and Water Management and Safety and Loss Control departments.

The Superintendent Tailings and Water Management will assess the situation and make an alert level determination. If the situation is determined to be *Level 1 – Unusual Condition*, the situation will be closely monitored. In the event of a *Level 2 – Emergency* determination, preventive or remedial actions may be possible to restore the condition of the dam, and a mandatory evacuation may be ordered at the discretion of the Superintendent. If a *Level 3 – Crisis* has been declared, a mandatory evacuation of the area will be ordered and the ERP will be activated by the Superintendent Tailings and Water Management and this individual will act as Evacuation Coordinator.

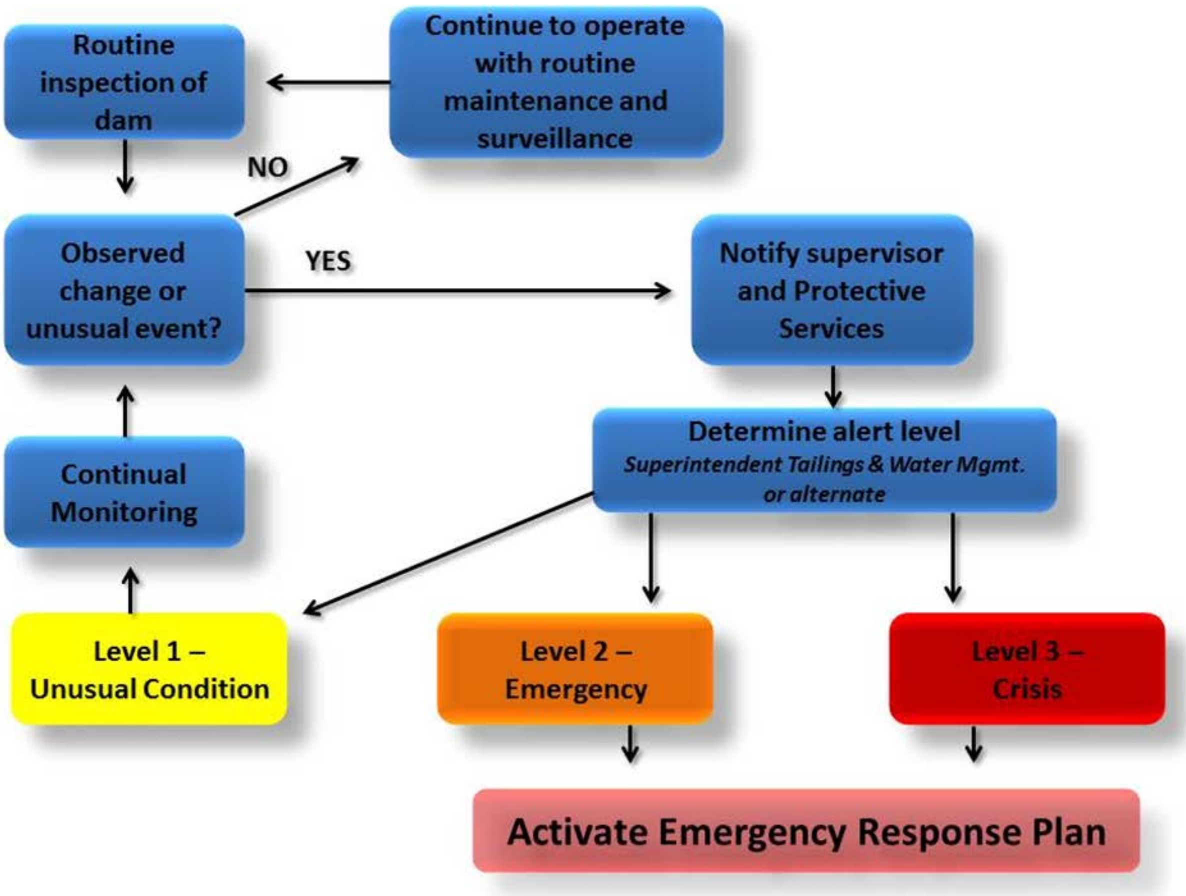


Figure 3 – Alert Level Determination and ERP Activation

Level 1 – Unusual Condition (Slowly Developing)

A **Level 1** categorization is defined as an event or observed change at the dam that is not normal, but has not yet threatened the operation or structural integrity of the dam. The primary objective when an unusual condition occurs is to increase monitoring activities. This situation has potential to harm the integrity of the dam if it is not mitigated. The Superintendent Tailings and Water Management (or their alternate) should be contacted to investigate the situation and recommend actions to be taken.

The condition of the dam should be closely monitored to detect any development of a potential or imminent dam failure situation. The situation should be escalated to Level 2 - Emergency, if it is determined by the person in command that the conditions may possibly develop into a worse situation that may require emergency actions. Communication of the unusual condition should remain internal to HVC.

Examples of Events or Observations Commonly Assigned Alert Level 1

- Threat of flash flood conditions from excessive rain or rapid snow melt
- Erosion visible on face the dam
- New cracks in the embankment or abutments at greater than specified width

Level 2 – Emergency, Potential Dam Failure Situation (Rapidly Developing)

A **Level 2** categorization is defined as a situation that may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. The primary objectives in an emergency are to save the dam, evaluate the need to evacuate HVC personnel and contractors around the dam, and notify local external agencies of the situation. The Emergency Response Team (ERT) and others specified in the emergency reporting procedure should be notified of this emergency situation. The Superintendent Tailings and Water Management (or their alternate) and the engineering contractor should take remedial actions if possible, closely monitor the condition of the dam, and periodically report the status to the ERT Incident Commander.

Local emergency response agencies should be ready to initiate evacuations of the public or road closures if flooding occurs. Pre-evacuation notices may be issued at this time. The situation should be escalated to Level 3 - Crisis if it is determined by the person in command that there is a total loss of control and a dam break or serious downstream flooding is imminent.

Examples of Events or Observations Commonly Assigned Alert Level 2

- New seepage areas or internal drain discharge with cloudy flow (increasing turbidity) and increasing flow rate
- Measurable earthquake with observed structural damage to facility and or dam controls
- Verified bomb threat that, if carried out, could result in damage to the dam

Level 3 – Crisis, Dam Failure Appears Imminent or is in Progress (Urgent)

The **Level 3** categorization is an extremely urgent situation when a dam failure is occurring or is about to occur and cannot be prevented. The primary objective in a crisis is to save lives. Flash flooding will occur downstream of the dam. Local emergency response agencies should close roads and begin evacuations of the public at risk. The ERT should ensure that all personnel in and around the dam have evacuated.

Examples of Events or Observations Commonly Assigned Alert Level 3

- Vandalism with damage to outlet/inlet controls, dam, or appurtenances that has resulted in uncontrolled water release
- Sudden or rapidly proceeding slides at embankment slope
- Breakage of outlet or tailings pipelines possible causing significant to catastrophic dam surface erosion and/or release of tailings slurry

7.9. Designations of the Person(s) Responsible for Identifying and Evaluating the Emergency and Activating the Emergency Response Plan

Only the Superintendent Tailings and Water Management or their designated alternate have the authority to activate the ERP and initiate appropriate response. If the Superintendent Tailings and Water Management or their designate cannot be reached during a potential or actual emergency or crisis, the General Manager has the authority to activate the ERP.

7.10. Documentation

Highmont TSF documents and records collected as part of the surveillance of the facility are to be retained in accordance with the documentation procedures described in the *Highland Valley*

Copper Tailings Management System Manual. The types of documents that should be retained are summarized below. Surveillance reporting forms may include information on:

- Tailings pond level survey pick up – twice a year
- Survey of monuments on crest of dam – once a year
- Water quality at intervals required under Permit PE376
- Pumping hours at seepage ponds – once a month
- Seepage to and from seepage Ponds S1, S2, S3, S5, and S8; once a month between June and October
- Piezometer reading – once a month between June and October

7.11. Reporting

Surveillance information for the Highmont TSF is communicated internally through personal interaction between various levels of the organization (department and/or crew meetings), through information posted in hardcopy format on bulletin boards, through this OMS Manual, and electronically via *SiteLine*. Communications with all contractors involved in tailings management is conducted weekly during tailings dam construction meetings. Staff, hourly employees, and contractors are encouraged to communicate openly with HVC management about surveillance observations that may require attention. Procedures for initiating emergency response alerts for instrumentation are described in the following section of this manual, *Emergency Preparedness and Response Plan*.

8. EMERGENCY PREPAREDNESS AND RESPONSE PLAN

8.1. Purpose and Introduction

This Emergency Preparedness and Response Plan (EPRP) serves to establish a clear emergency response structure specific to the Highmont Tailings Storage Facility (TSF) and applies to the following dams:

- Highmont Tailings Dam North
- Highmont Tailings Dam South
- Highmont Tailings Dam East
- S1 Seepage Dam
- S2 Seepage Dam
- S3 Seepage Dam
- S5 Seepage Dam
- S8 Seepage Dam

In planning for emergencies that could cause significant harm to people, property, or the environment, Highland Valley Copper (HVC) has developed a list of potential emergency situations and works cooperatively to ensure adequate response capabilities in case of an incident. However, effective emergency preparedness relies not only on facility preparedness, but also on the ability of local authorities to respond quickly to any urgent situation. As such, local authorities may wish to use this EPRP to inform their own EPRPs for major floods or dam breaches.

In the event this facility experiences a flood emergency, designated site staff are trained to activate the **Emergency Response Plan (ERP)** as outlined in Section 7.8 *Alert Level Determination, Emergency Response Plan Activation and Initial Response*. The ERP (Section 8.4) is considered a sub-section of the EPRP. Section 8.5.4 *Additional Information* includes the EPRP-specific distribution list. Section 7 *Surveillance* lists and classifies site-specific warning signs with reference to potential tailings and water management facility failure modes or emergencies—from both structural failure(s) and failure(s) due to environmental impacts.

Notification procedures are outlined as well as presented in Figure 6 to ensure appropriate and effective lines of communication in the event of an emergency. EPRP training, testing, and updating guidelines are also included to ensure uniformity across the organization.

8.1.1. Authority

This EPRP is issued for the Highmont TSF by the owner and operator Teck Highland Valley Copper. It has been prepared in accordance with guidelines established by Provincial and Federal agencies, the Mining Association of Canada (MAC), and the Canadian Dam Association (CDA). The on-site person directly responsible for the safety of all dams owned and operated by HVC is the Superintendent Tailings and Water Management. If the Superintendent Tailings and Water Management is unavailable or cannot be reached, their designated alternate (included below) should be contacted.

Table 12 -- Authority Information

Name	Position	Work	Home	Cell
Chris Fleming	Superintendent Tailings and Water Management	250.523.3315	[redacted]	[redacted]
Ross Billy (Primary alternate)	Senior Supervisor Tailings	250.523.3502	[redacted]	[redacted]
Ian Haskell (Secondary alternate)	Field Supervisor	250.523.3735	[redacted]	[redacted]

8.2. Emergency Preparedness

8.2.1. General

Site: Teck Highland Valley Copper

Facility: Highland Tailings Storage Facility

Location: Logan Lake, Kamloops Mining Division, British Columbia

Latitude 50º 28’ N

Longitude 121º 2’ W

Status: Operating

8.2.2. Ownership

Teck Resources, Ltd owns 97.5% of HVC, and Highmont Mining Company (excluding Teck Resources) owns the remaining 2.5%. Teck acquired majority interest in HVC when it purchased BHP Billiton’s share of HVC, and in 2009, Teck Cominco Ltd. changed its name to Teck Resources Ltd.

HVC’s office and contact information are as follows:

Teck Highland Valley Copper Partnership

P.O. Box 1500

Logan Lake, B.C. Canada V0K 1W0

t: 250.523.2443

f: 250.253.3242

8.2.3. Project Location and Description

The Highmont TSF is located on the south side of Highland Valley approximately 10 km (6.2 miles) east of the Highland Mill and is situated on a high bench at approximate elevation of 1480 m (4856 ft.). The access roads to the Highmont TSF are shown on Drawing 114-800-150 (see Appendix III).

The Highmont TSF is easily accessible from Highway 97C, connecting Kamloops with Logan Lake and Ashcroft located in the Highland Valley as shown on Drawing 114-800-150 (see Appendix III). The access roads to the Highmont TSF are gravel roads, one runs through the HVC mine maintenance complex and the other turns south just east of the entrance road to the HVC Mill complex. British Columbia Ministry of Transportation and Highways maintains the paved highway 97C year round. The gravel mine roads are regularly maintained by HVC and provide satisfactory all-weather vehicular access to the facility.

See Figure 4 for the general location of HVC relative to nearby communities and Figure 5 for key facilities and landmarks onsite.

Detailed descriptions of TSF layout and operation are included in Section 4, Tailings Storage Facility Description, and Section 5, Tailings Storage Facility Operation.

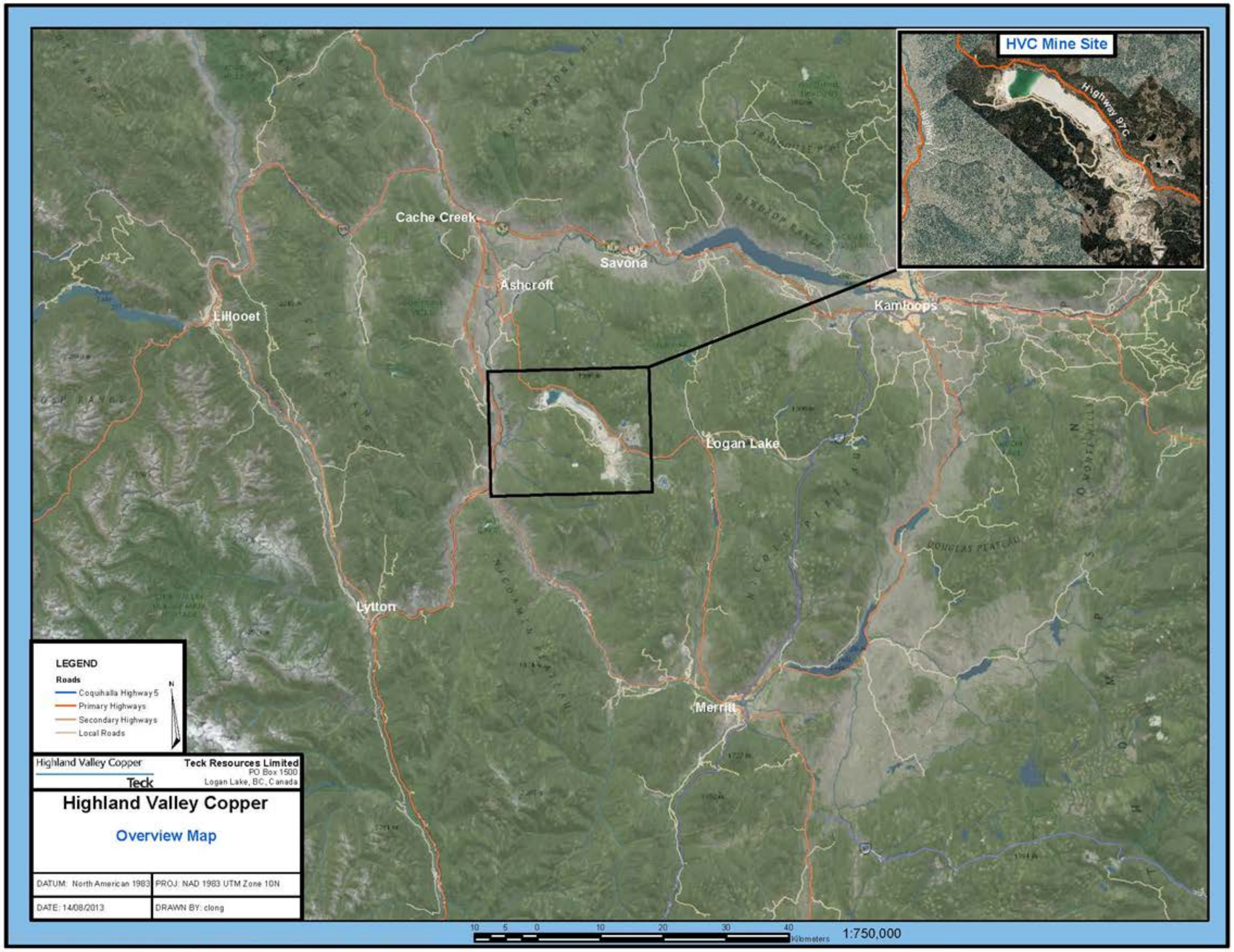


Figure 4 – HVC Mine Site Location and Access

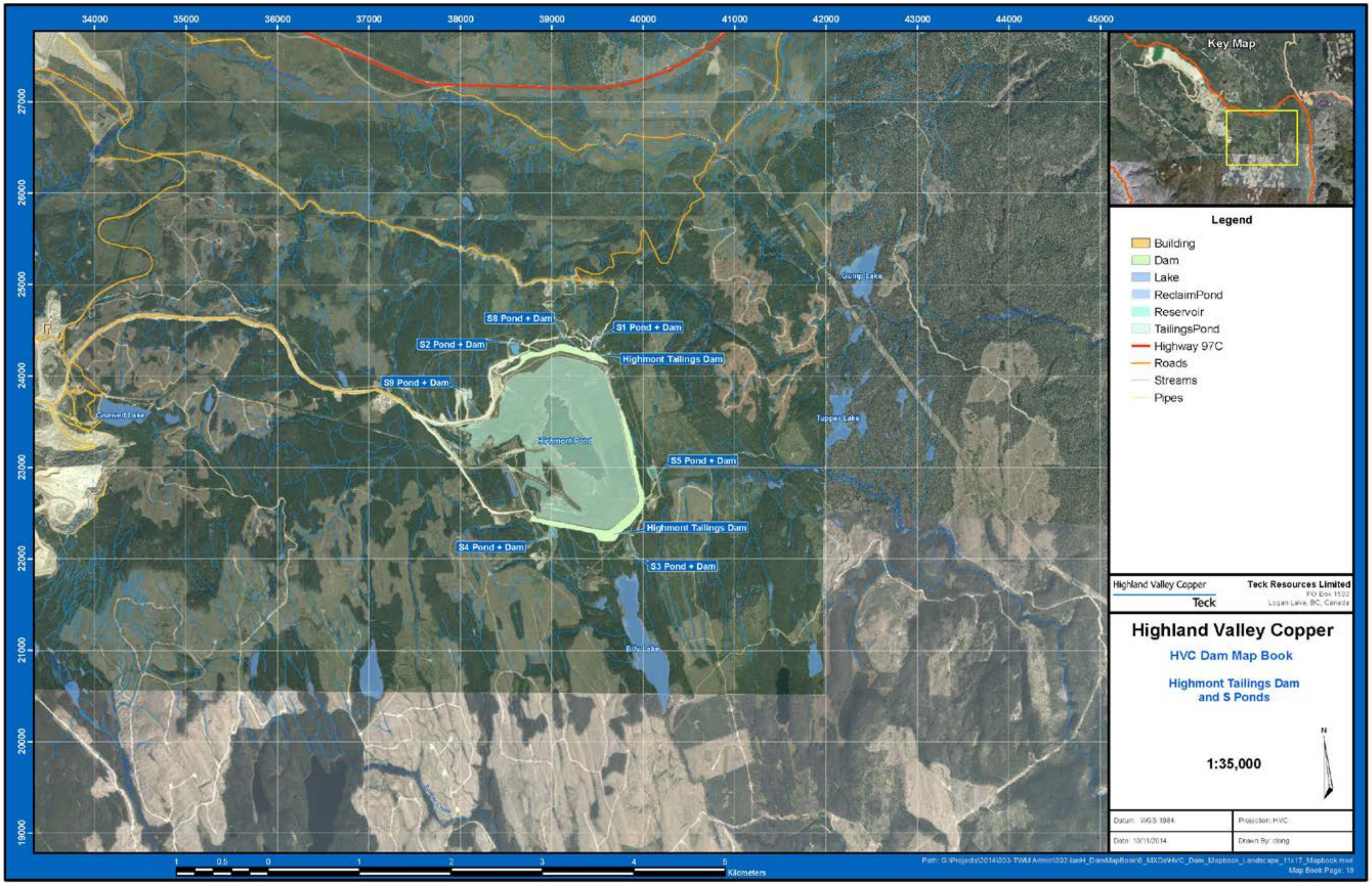


Figure 5 – Highmont Tailings Dam and Seepage Ponds

8.2.4. Effects of Inundation

Potential effects of inundation are described below for the Highmont TSF dams included in this EPRP. AMEC released a dam break study in September, 2014 (AMEC 2014) for the Highmont TSF north, south, and east dams. Incremental downstream effects due to the dam break of each of the three Highmont TSF dams were identified for both Sunny-day and Rainy-day (flood induced) failure types.

Potential effects of both Sunny-day and Rainy-day failures have been summarized below for the Highmont TSF dams. Supporting tables and figures are provided in Appendix IV. The Canadian Dam Association Dam Safety Guidelines (CDA 2007) define Sunny-day and Rainy-day failures as follows:

- **Sunny-day failure:** This is a sudden dam failure that occurs during normal operations. It may be caused by internal erosion, piping, mis-operation leading to overtopping or another event.
- **Rainy-day (Flood induced) failure:** This is a dam failure resulting from a natural flood of a magnitude that is greater than what the dam can safely pass.

Uncertainties

Inundation studies, dam break studies, tailings runout studies, and descriptions of potential effects of inundation are based on hypothetical scenarios. All dams described below are in safe and stable condition. Requirements to describe potential effects of inundation for each dam do not reflect on the structural integrity or safety of the dams and situations that would result in a dam failure are considered extremely unlikely. Assumptions and industry-standard modelling techniques used for inundation and dam break studies are considered conservative.

8.2.5. Highmont Tailings Dam North

The potential effects of inundation for Sunny Day and Rainy Day failure modes are discussed below, and were adapted from the inundation study conducted by AMEC in 2014 (AMEC 2014 b). Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *High.*

Refer to Appendix IV for select tables and/or figures included in this study that could be useful in the unlikely event of a dam safety emergency at this facility.

Sunny-day Failure

Water mixed with tailings would be running into Witches Brook. The flood wave would travel further to Mamit Lake. The incremental effects from the Sunny-day failure are higher than the flood failure. If failure of the North Dam causes the failure of the S1, S2, or S8 seepage pond dykes, there would be spillage of water containing molybdenum, copper, and sulphate into Witches Brook adding more potential threat to the drinking water supply. Witches Brook contamination, in a Sunny-day failure, may extend to Mamit Lake. In addition, the following infrastructure could be damaged: gravel roads used for logging, Highmont Booster Pumphouse building (which could result in interruption to the water supply apparently to Gnawed Lake from the booster pump house and the Highmont diversion pipeline), and various electrical cables around the site that could cause power interruptions and associated risks. An incremental risk of loss of life may exist at the road crossings in a Sunny-day failure.

A Sunny-day failure would result in the release of approximately 0.5 Mm^3 of combined water and tailings. If North Dam failed, without the failure of the seepage pond, there would be a loss of marginal habitat. If seepage pond dykes failed as well, significant loss of marginal habitat or deterioration of important fish (rainbow - trout) habitat is expected.

Tailings runout may affect approximately 150 m downstream of the North Dam breach. Highland Valley Copper's drinking water supply would be affected. Restoration or compensation in kind is highly possible if the dam failed with or without the seepage pond dyke.

Peak Wave Travel Time

For the Sunny-day failure mode, the peak wave travel time from the dam to the confluence with Witches Brook is approximately 15 minutes. The flood wave would reach the confluence of the Guichon Creek after approximately 9.75 hours to from the dam breach. At Mamit Lake inlet, the maximum water level would occur after 23.0 hours from the dam breach. The increased durations for the flood wave for the Sunny-day condition are due to the slower speed of the flood wave as compared with the flood condition due to a smaller volume of water being discharged from the facility.

Table 6.1 (from AMEC, 2014b): Peak Wave Travel Time for the North Dam Break

River Station	Channel Length (m)	Station (m)	Time to Reach Max. Water Level since the Start of the Breach (hr)	Peak Wave Travel Time from the Dam (hr)	Time to Reach Max. Water Level since the Start of the Breach (hr)	Peak Wave Travel Time from the Dam (hr)
			Flood		Sunny Day	
D/S of North Dam	148	23910	4.0	0.0	1.0	0.0
	141	22000	4.3	0.3	1.3	0.3
Witches Brook	117	12300	6.5	2.5	9.8	8.8
Ghichon Creek	114	6600	7.5	3.5	15.0	14.0
Mamit Lake	111	0	9.0	5.0	23.0	22.0

Maximum Velocity

In case of the Sunny-day failure, the velocities downstream of the North Dam and Witches Brook would range between 0.6 m/s and 3.2 m/s. The velocities at the reaches from Witches Brook to Mamit Lake are lower than 0.9 m/s. The velocities downstream of the North Dam and Witches Brook would range between 1.2 m/s and 5.4 m/s. The velocities at the reaches from Witches Brook to Mamit Lake would range between 0.4 m/s and 2.0 m/s.

Assessment of Highway 97C Crossings

Witches Brook downstream of Highmont North Dam crosses Highway 97C at two different locations. The crossing locations are identified as Section 115 and Section 117 in the HEC-RAS model developed by AMEC.

In a Sunny-day North Dam failure, the resulting peak flow at Section 117 and Section115 is estimated to be approximately 10 m3/s. The resulting peak flow is less than the estimated capacity of the culverts and may not add incremental risk to the crossings.

Rainy-day (Flood induced) failure:

Water mixed with tailings would be running into Witches Brook. The flood wave would travel further to Mamit Lake. The incremental effects from the Sunny-day failure are higher than the Rainy-day failure. If failure of the North Dam causes the failure of the S1, S2 or S8 seepage pond dykes, there would be spillage of water containing molybdenum, copper, and sulphate into Witches Brook adding more potential threat to the drinking water supply.

Peak Wave Travel Time

For the Rainy-day failure mode, the peak wave travel time from the dam to the confluence with Witches Brook is approximately 15 minutes. The flood wave would reach the confluence of the Guichon Creek after approximately 6.5 hours to from the dam breach. At Mamit Lake inlet, the maximum water level would occur after 9.0 hours from the dam breach.

Table 6.8 from the 2014 AMEC dam break study is included in the Sunny-day failure section above.

Maximum Velocity

In case of the Rainy-day failure, the velocities downstream of the North Dam and Witches Brook would range between 1.2 m/s and 5.4 m/s. The velocities at the reaches from Witches Brook to Mamit Lake would range between 0.4 m/s and 2.0 m/s.

Assessment of Highway 97C Crossings

Witches Brook downstream of Highmont North Dam crosses Highway 97C at two different locations. The crossing locations are identified as Section 115 and Section 117 in the HEC-RAS model developed by AMEC.

In the case of 1 in 200 year dam failure, the incremental flow is expected to be more than 10 m^3/s. The flow would be doubled at Section 117 and would increase by approximately 30 percent at Section 115. Floods higher that the 1 in 200 up to the PMF could result in the failure of the culverts with or without the North Dam failure.

8.2.6. Highmont Tailings Dam South

The South Dam of the Highmont impoundment faces Billy Lake and potential inundation effects include run out to Seepage Pond S3 and water quality impacts to Billy Lake. The potential effects of inundation for Sunny-day and Rainy–day failure modes are discussed below, and were adapted from the inundation study conducted by AMEC in 2014. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *High.*

Refer to Appendix IV for select tables and/or figures included in this study that could be useful in the unlikely event of a dam safety emergency at this facility.

Sunny-day Failure

Water and tailings could flow to Billy Lake that is about 500 m away, even without a failure of the S3 Seepage Pond dyke. There would be spillage of water and tailings containing molybdenum, copper, and sulphate into Billy Lake. Also, power poles and gravel roads could be damaged. Water and tailings may travel further to Mamit Lake via Dupuis Creek.

A Sunny-day failure would result in the release of approximately 0.5 Mm^3 of combined water and tailings. Additional impacts could include significant loss or deterioration of important fish (rainbow) habitat in Billy Lake with or without failure of the seepage pond due to the spillage of water and tailings containing molybdenum, copper, and sulphate into Billy Lake. Tailings runout may affect approximately 150 m downstream of the South Dam breach. Restoration or compensation in kind is highly possible.

Peak Wave Travel Time

River Station	Channel Length (m)	Station (m)	Time to Reach Max. Water Level since the Start of the Breach (hr)	Peak Wave Travel Time from the Dam (hr)	Time to Reach Max. Water Level since the Start of the Breach (hr)	Peak Wave Travel Time from the Dam (hr)
			Failure Mode			
D/S of South Dam	800	9650	4.0	0.0	1.0	0.0
Billy Lake	600	8800	4.3	0.3	2.0	1.0
Dupuis Creek (South Reach)	300	2200	5.0	1.0	3.3	2.3
Dupuis Creek D/S	100	0	5.3	1.3	3.8	2.8

Rainy-day Failure

Water and tailings could flow to Billy Lake that is about 500 m away, even without a failure of the S3 Seepage Pond dyke. There would be spillage of water and tailings containing molybdenum, copper, and sulphate into Billy Lake. Also, power poles and gravel roads could be damaged. Water and tailings may travel further to Mamit Lake via Dupuis Creek.

Additional impacts could include significant loss or deterioration of important fish (rainbow) habitat in Billy Lake with or without failure of the seepage pond due to the spillage of water and tailings containing molybdenum, copper, and sulphate into Billy Lake. Tailings runout may affect approximately 150 m downstream of the South Dam breach. Restoration or compensation in kind is highly possible.

8.2.7. Highmont Tailings Dam East

The potential effects of inundation for Sunny-day and Rainy-day failure modes are discussed below, and were adapted from the inundation study conducted by AMEC in 2014. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *Significant.*

Refer to Appendix IV for select tables and/or figures included in this study that could be useful in the unlikely event of a dam safety emergency at this facility.

Sunny-day Failure

Water mixed with tailings would be running into Dupuis Creek. The flood wave would travel further to Mamit Lake. The incremental effects from the Sunny-day failure are higher than the Rainy-day failure. If S5 Seepage Pond dykes fail, there would be spillage of water containing molybdenum, copper, and sulphate into Dupuis Creek. Dupuis Creek contamination, in a

Sunny-day failure, may extend to Mamit Lake. Poles, right of ways, and gravel roads would also be damaged.

A Sunny-day failure would result in the release of approximately 0.5 Mm^3 of combined water and tailings. If East Dam failed, without the failure of the seepage pond, there would be a loss of marginal habitat. If the dykes in Seepage Pond S5 fail as well, there would be more losses or deterioration of important fish (rainbow - trout) habitat in Dupuis Creek, which could also affect Mamit Lake.

Tailings runout may affect approximately 150 m downstream of the East Dam breach. Restoration or compensation in kind is highly possible if the dam failed with or without the seepage pond dyke.

Rainy-day (Flood induced) failure:

Water mixed with tailings would be running into Dupuis Creek. The flood wave would travel further to Mamit Lake. The incremental effects from the flood failure are lower than the Sunny-day failure. If S5 Seepage Pond dykes fail, there would be spillage of water containing molybdenum, copper, and sulphate into Dupuis Creek. Dupuis Creek contamination, in a Sunny-day failure, may extend to Mamit Lake. Poles, right of ways and gravel roads would also be damaged.

Tailings runout may affect approximately 150 m downstream of the East Dam breach. Restoration or compensation in kind is highly possible if the dam failed with or without the seepage pond dyke.

8.2.8. S1 Seepage Pond

S1 Seepage Pond collects seepage at the toe of the Highmont Tailings Dam North. Failure of this dam could cause an environmental spill to Witches Brook. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *Significant.*

8.2.9. S2 Seepage Dam

S2 Seepage Pond collects seepage at the toe of the Highmont Tailings Dam North. Failure of this dam could cause an environmental spill to Witches Brook. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *Significant.*

8.2.10. S3 Seepage Dam

S3 Seepage pond collects seepage at the toe of the Highmont Tailings Dam South Failure of this dam could cause an environmental spill into Billy Lake. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *High.*

8.2.11. S5 Seepage Dam

S5 Seepage Pond collects seepage at the toe of the Highmont Tailings Dam East. Failure of this dam could cause an environmental spill to Dupuis Creek. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *Significant.*

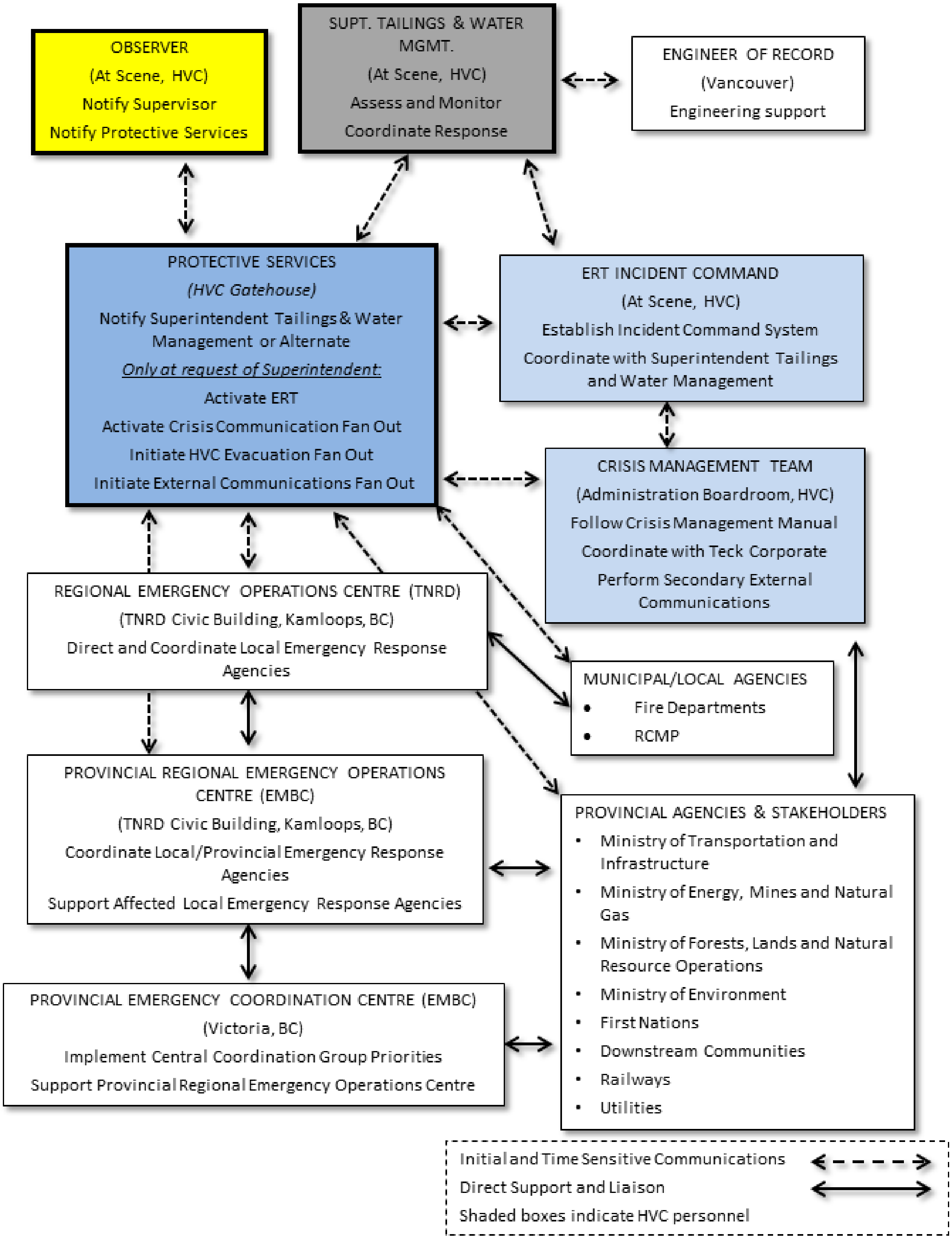
8.2.12. S8 Seepage Dam

This pond collects seepage at the toe of the Highmont Tailings Dam North. Failure of this dam could cause an environmental spill to Witches Brook. Consequence classification based on BC Dam safety Regulation 163/2011 and CDA guidelines: *Low.*

8.3. Overview of Emergency Response Structure

Emergency situations may include, but are not limited to the following:

- Failure or suspected impending failure of the tailings dams
- Overtopping of the tailings dams
- Slumping, sliding, cracking, or bulging of tailings dams
- Rapid increase or unexplained cloudy appearance of seepage through the tailings dams and/or their foundations
- Formation of sinkholes on the tailings beach or dams
- Large earthquakes
- Extreme flooding
- Severe storms
- Sabotages and other criminal activities



This diagram has been prepared for illustrative purposes only. Refer directly to the Emergency Reporting Procedure (call out) for a complete list of parties to be contacted in the unlikely event of an emergency.

Figure 6 -- Incident Command Organizational Response Matrix

In the event HVC experiences a flood emergency at the Highmont TSF, the Superintendent Tailings and Water Management (or their alternate) and the General Manager are trained to activate the on-site ERP. Activation of the ERP initiates a standard Incident Command system that will be facilitated by HVC's designated Emergency Response Team (ERT) Incident Commander and Safety and Loss Control Department as part of the site-wide crisis management program. The ERT Incident Commander will work closely with the Superintendent Tailings and Water Management or their alternate to assess the situation and will initiate the HVC Crisis Communication Fan-out system, if necessary. Internal resources relevant to the overall emergency response structure that have responsibilities to assist in the event of an emergency include:

- Safety and Loss Control Department
- Protective Services
- Superintendent Tailings and Water Management
- ERT Incident Commander
- Crisis Management Team

External agencies to be contacted in accordance with the Crisis Communication Fan-out and that may assist in the event of an emergency include:

- Emergency Management British Columbia (EMBC)
- Thompson Nicola Regional District (TNRD)
- Royal Canadian Mounted Police (RCMP)
- Ministry of Transportation and Infrastructure (MOTI)
- Ministry of Environment (MOE)
- Ministry of Energy, Mines and Natural Gas Regional Manager, Exploration & Mining Health – (BC Mine Emergency Management Plan)

Safety and Loss Control Department

The Safety and Loss Control Department is responsible overall for maintaining the Crisis Management Program, which includes designating an equipped crisis room for use as the Crisis Command Centre. This department is also responsible for managing equipment, materials, and personnel required for emergency preparedness and response.

Protective Services (Security)

Protective Services plays a central role in emergency preparedness and response for HVC's tailings and water management facilities. If Protective Services are notified of any unusual or emergency situations at the Highland TSF, they are responsible for immediately notifying the Superintendent Tailings and Water Management or their alternate. If an emergency or crisis is declared by the Superintendent Tailings and Water Management or their alternate, mandatory evacuations will be ordered, and Protective Services will initiate the following:

1. HVC Crisis Communication Fan-out
2. HVC Evacuation Fan-out
3. Emergency Reporting Procedure for HVC's Tailings and Water Storage Facilities

Protective Services will serve as the overall communication hub internally with HVC response personnel and externally with emergency response agencies, as illustrated on Figure 6 above.

Superintendent Tailings and Water Management (Evacuation Coordinator)

The Superintendent Tailings and Water Management is responsible overall for the development, testing, and maintenance of the EPRP and for directing emergency preparedness and response training (including tests/drills of the EPRP) for HVC's tailings and water storage facilities. Upon notification of any unusual or emergency situations at the TSF, the Superintendent Tailings and Water Management should immediately assess and make an alert level determination. If a decision is made to activate the ERP, this individual will act as Evacuation Coordinator.

Duties as Evacuation Coordinator

- Coordinates the evacuation, reports to the assembly area (or designates others to do so) and coordinates the head count numbers provided by the supervisors.
- Conducts an assessment of the emergency and initiates the appropriate action, including the posting of guards to prevent re-entry to the area.

After the ERT Incident Commander declares a stand down of emergency personnel and advises that the area is safe for re-entry, the Evacuation Coordinator accepts responsibility for the area and directs the resumption of normal work activity.

Emergency Response Team (ERT) Incident Commander

Responsibilities for the ERT Incident Commander are defined in HVC Policy 4.08, *Emergency Response Team Organization and Response Procedure*. In the event of an emergency or crisis at a tailings or water storage facility, the ERT Incident Commander will coordinate with the Superintendent Tailings and Water Management to assess the overall situation and determine the appropriate response actions for the ERT. The ERT Incident Commander will guide the ERT and lead communication efforts while the Superintendent Tailings and Water Management will direct preventive and remedial actions at the dam.

Crisis Management Team

Responsibilities for the Crisis Management Team are defined in HVC Policy 4.01, *Crisis Management and Emergency Response Procedure* under "Responsibilities of the Crisis Communication Superintendent." In addition to Policy 4.01, responsibilities for Crisis Management Team members are described in the *HVC Crisis Management Manual* that is distributed to each member.

Emergency Management British Columbia - Provincial Regional Emergency Operations Centre

Emergency Management British Columbia (EMBC) Central Region headquarters located in Kamloops is notified when a call is made to EMBC's 24-hour emergency number. A Provincial Regional Emergency Operations Centre will be activated to support emergency response activities occurring at the Thompson Nicola Regional District (TNRD) Regional Emergency Operations Centre (summarized below). It will be activated to coordinate provincially-led response measures and to ensure that key agencies and organizations with capability to assist are being mobilized. Staffing will be provided by EMBC Central Region personnel and affiliates.

Emergency Management British Columbia – Provincial Emergency Coordination Centre

Emergency Management BC’s Provincial Emergency Coordination Centre (PECC), located in Victoria, exists to facilitate and ensure all provincial parties affected by an emergency flood situation are notified in a timely manner. PECC receives strategic and policy direction from the Central Coordination Group and works in coordination with the Forests, Lands and Natural Resource Operations Water Management Branch Technical Specialists and MOTI Central Radio Room.

In addition to the activities listed in the All-Hazard Plan, activities of the PECC specific to flood events include:

- Distribute River Forecast Centre advisories to appropriate staff and stakeholders;
- Provide public flood safety information and distribute to media;
- Deploy sandbags, gabion baskets and regional resources from the provincial stockpile to local governments as requested;
- Coordinate the preparation of provincial flood response directives;
- Activate Temporary Emergency Assignment Management System roster based on flood needs;
- Coordinate with Aboriginal Affairs and Northern Development Canada regarding First Nations communities;
- Approve event eligibility for Disaster Financial Assistance (DFA) and administer the DFA Program for individuals, local authorities and businesses; and
- In a DFA event, deploy program staff to local communities to participate in information sessions and community meetings.

Thompson Nicola Regional District

As stated on the TNRD’s website, the agency would assist HVC in the event of a flood emergency in the following manner:

> *The TNRD Emergency Program does not take the place of the Emergency Management B.C. (EMBC), nor does it address emergencies that are normally handled at the scene by the appropriate first responding agencies such as police, fire, or ambulance. The TNRD program will provide the direction and coordination required to respond and recover from major emergencies or disasters in the rural (i.e. electoral) areas of the TNRD. To support the program, an emergency operations centre (EOC) will be established at the TNRD Civic Building at 465 Victoria Street in Kamloops. Technical assistance, direction and training will also be given to sub-regional emergency response teams in defined areas of the Regional District. The TNRD program is in place to assist incident commanders when emergencies exceed their response capabilities, training or available resources.*

Royal Canadian Mounted Police

The Royal Canadian Mounted Police (RCMP) provides policing services at three different levels across Canada: federal, provincial/territorial, and municipal. During flood events, the RCMP plays several roles including protecting life and property, controlling traffic and ambulance routes in and around emergency areas, establishing evacuation routes, and maintaining order. RCMPs is also responsible for maintaining open lines of communication to ensure local emergency plans are up-to-date, contingency plans for severe flooding are in place, and potentially affected community members are given the most up to date information.

Ministry of Transportation and Infrastructure

In the event of a potential or actual flood emergency at one of the Highmont TSF dams, the role of the MOTI will be to close the section of highway that the flooding may be affecting (whether it be Highway 97C, Highway 1 the Trans Canada, or any MOTI road within their district). If the flooding has the potential to affect the highway(s), MOTI will assist with protecting the safety of the travelling public. Coordination between Service Area 14 (Nicola) and Service Area 16 (South Cariboo) will need to be established regarding the road closure. Drive BC and surrounding major stakeholders will be notified of the closure by MOTI. The closure will remain in place until the situation has been remedied and it is once again safe for the public to be travelling on the highway.

8.3.1. Municipal or Local Emergency Plans

HVC has developed the *Emergency Preparedness and Response Plan* section of this OMS Manual to communicate potential impacts to people and property downstream of the Highmont TSF in the event of a potential or actual flood emergency. The information will aid in the development of internal response procedures at the mine site, and will be useful to local agencies when developing or updating municipal or local emergency plans. The corresponding responses based on the emergency level will allow municipal or local response agencies to define protocol for notification of the public in the event of a flood emergency at the Highmont TSF. HVC is committed to assisting municipal and local emergency response agencies with the development and refinement of associated plans or annexes to existing plans.

8.3.2. Key Personnel and Responsibilities

Table 13 – Contact Information for Plan Inquiries

Position	Name	Phone Number	Email Address
Superintendent Tailings and Water Management (TSF Manager)	Chris Fleming	250.523.3315	Chris.Fleming@teck.com
Field Supervisor (Plan Administrator)	Ian Haskell	250.523.37354	Ian.Haskell@teck.com

In addition to the incident command structure defined in Section 8.2.3., this section describes the responsibilities of other individuals expected to respond in the event of a potential or actual flood emergency at the Highmont TSF. Overall OMS responsibilities are discussed in Section 3 of this OMS Manual.

Senior Supervisor Tailings

The Senior Supervisor Tailings is the primary alternate for the Superintendent Tailings and Water Management and is responsible for knowing and understanding all of the responsibilities of the Superintendent and the Evacuation Coordinator. If the ERP is activated and a mandatory evacuation has been ordered, the Senior Supervisor Tailings is responsible for assisting with Roll Call.

Security

Security plays a key role in emergency preparedness and response for HVC's tailings and water management facilities. If Security is notified of any unusual or emergency situations at the Highmont TSF, Security is responsible for immediately notifying the Superintendent Tailings and Water Management or his designate. If an emergency or crisis is declared by the Superintendent Tailings and Water Management or his designate, mandatory evacuations will be ordered, and Security is responsible for completing the call-out requirements specified in the Emergency Reporting Procedure.

All HVC Personnel and Contractors

Superintendents are responsible for making sure that all HVC personnel working on or around the Highland TSF attend the annual Tailings Management Workshop, knowing how to identify unusual conditions, and immediately communicating any unusual conditions to their supervisor and Protective Services. Contract administrators are responsible to ensure all required contractors all attend the workshop as well.

8.4. Emergency Response Plan

8.4.1. Activation of Emergency Response Plan and Initial Response

HVC has developed specific criteria to determine if an unusual condition at the dam is severe enough to require activation of the ERP. **Only the Superintendent Tailings and Water Management or their designated alternate have the authority to activate the ERP and initiate appropriate response.** If the Superintendent Tailings and Water Management or their alternate cannot be reached during a potential or actual emergency or crisis, the General Manager has the authority to activate the ERP. The procedure for assessing the level of emergency using predefined criteria to trigger the ERP is described in section 7.7 *Alert Level Determination, Emergency Response Plan Activation and Initial Response.*

8.4.2. Preventative and Remedial Action

Though very unlikely, the dam at the Highmont TSF could fail and cause flooding that threatens the downstream area. The dam breach could be triggered by piping or overtopping. It is difficult to predict where a dam breach would be initiated and precisely what corrective actions would be required. Nevertheless, to assist the mine in dealing with emergency situations threatening dams at the Highmont TSF, this section describes the resources available to the mine and potential course of actions that could be taken promptly to avert a dam breach. These actions are summarized as: (1) lower pond water levels; (2) arrest or retard dam internal erosion; and (3) arrest or retard dam external erosion. The sections below describe the necessary actions to be taken to mitigate potential impacts on the downstream area while the efforts to control the dam incident are underway.

Construction Equipment, Materials, Labour and Engineering Expertise

If a situation arises that requires immediate attention, HVC has at its disposal the equipment, material, labour, and engineering expertise to respond immediately and effectively. The mining operation involves personnel presence on the property 24 hours-a-day, and emergency situations on the property can be attended to immediately. If construction materials are required to carry out any remedial work, overburden and rockfill can be routed to the site using the former haul roads and the equipment operating in the mine. Material from the Valley Pit Operations, the run-away ramp near the highway bridge, and materials from the Huestis waste dumps can be used to conduct repairs.

Lower Impoundment Pond Water Level

In the early stage of either a piping or overtopping scenario, the most effective action to reduce threat of the situation escalating is to lower, as fast as practical, the level of water in the impoundment upstream of the affected dam. The potential actions are grouped under internal actions and actions that require governmental approval, as follows:

Internal Actions

Divert away all incoming water sources into the affected area. This includes ditch water, surface water, or any pumped water.

This action can be taken without acquiring governmental approval, as this would not affect the environment outside of the mine. If this does not improve the dam condition, the following actions can be pursued with government approval.

Actions Requiring Governmental Approval

The mine should request the Ministry of Energy, Mines and Natural Gas to declare a state of emergency, and to allow HVC to gain permission to release pond water downstream of the affected area. Water will be re-routed according to the available possibilities as determined by the Superintendent Tailings and Water Management, or his designate, if approval is granted by the government.

Arrest or Retard Dam Internal Erosion

Once excess and/or murky seepage caused by internal erosion is detected, additional actions can be taken to arrest the further development of the erosion, which could lead to piping failure of the dam. If sinkholes develop, they should be immediately filled with damfill materials compatible with the internal zoning of the dam. If the sinkholes are located upstream, efforts should be made to prevent pond water flowing into the sinkholes. This could be accomplished by placing additional earthfill in the surrounding area to block any potential access of pond water to the sinkholes and/or by discharging tailings materials to move the tailings beach/water contact line further away from the sinkholes. A weighted filter buttress berm should be placed in the exit area where excess and/or murky seepage is observed. The filter berm would allow free exit of seepage water without carrying away existing damfill and/or foundation materials. The filter berm is to be constructed of filter and drainage materials with progressively increasing particle size towards the berm outer surface.

If, in the seepage exit area, the initial flow velocity is too high for the placement of filter materials of appropriate size, materials of larger size and heavier weight may have to be placed first. As the seepage velocity is reduced by these oversized materials, the properly zoned filter berm could then be placed to arrest further development of internal erosion of the dam.

Existing stockpiles that are available in the vicinity of the dams that could be used to construct a seepage-control filter berm should be transported to the affected area..

The selection of materials and dimensions of the filter berm are to be directed by Tailings and Water Management on site in consultation with Klohn Crippen Berger. Digital photographs of seepage conditions prior to and during the construction of the filter berm are to be sent promptly to Klohn Crippen for on-going review.

Arrest or Retard Dam External Erosion

As the dam freeboard decreases during a major hydrological event, additional actions can be taken to arrest external erosion of the dam. Concurrent to lowering the pond water level, the existing dam crest could be raised by placing additional glacial till fill on the crest. While raising the crest uniformly across the entire dam, additional till material should be placed in local areas where signs of weakening such as slope slumps, crest deformations, and cracks are discovered.

In an event that an open channel begins to form on the dam crest, granular materials should be used to plug the channel. Materials of sufficient size and weight can be dozed into the breach from the alternate side of the channel. As the channel is gradually being closed, the materials used to plug the channel should increase in size and weight to cope with the increasing flow velocity. After the channel is completely closed, additional glacial till material should be placed upstream of the granular-fill plug to stop the seepage through the plug.

Actions to Mitigate Downstream Consequence

If preventive and remedial actions are determined to be ineffective against a potential or imminent dam failure, notification procedures should be followed in accordance with the procedures outlined in section 8.3.4 below.

8.4.3. Notification Procedures

Notification procedures for the Highmont TSF in the event of an unusual condition, emergency, or crisis, are defined in the *Emergency Reporting Procedure* on the following page.

2014/2015 Emergency Reporting Procedure: Highmont Tailings Storage Facility

Revised November 24, 2014

LEVEL 1: UNUSUAL CONDITION

Observer → Supervisor → Protective Services

		Local Phone	Offsite	Cell Phone
Protective Services	*Emergency (CH. 7)*	911	([redacted]	
Superintendent Tailings & Water Management	*Chris Fleming*	(250) 523-3315	([redacted]	[redacted]
OR Senior Supervisor Tailings (Primary Alternate)	*Ross Billy*	(250) 523-3502	[redacted]	[redacted]
OR Field Supervisor (Secondary Alternate)	*Ian Haskell*	(250) 523-3735	([redacted]	[redacted]

LEVEL 1 ONLY: Coordinate with General Manager and engineering consultant to perform necessary monitoring

LEVEL 2: EMERGENCY / LEVEL 3: CRISIS / ERP ACTIVATED

		Local Phone	Offsite	Cell Phone
Protective Services	*Emergency (CH. 7)*	911	[redacted]	
Senior Supervisor Tailings	*Ross Billy*	(250) 523-3502	([redacted]	[redacted]
General Manager	*Chris Dechert*	(250) 523-3201	[redacted]	[redacted]
Klohn Crippen Berger Project Manager	*Neil Singh*		([redacted]	[redacted]

1. Initiate HVC Crisis Communication Fan Out
2. Initiate HVC Evacuation Fan Out
3. Initiate Primary External Communications Fan Out

→ **Crisis Management Team**

Other Contacts:	Channel	Primary	Secondary	Additional
HVC EVACUATION FAN OUT (Protective Services)				
General Announcement	CH.7			
Contractors (loggers, drillers, etc.)	CH.7/15			
PRIMARY EXTERNAL COMMUNICATIONS FAN OUT (Protective Services)				
R.C.M.P. (Logan Lake)		911	(250) 523-6222	
R.C.M.P. (Merritt)		911	(250) 378-4262	
Emergency Management British Columbia (EMBC)		(800) 663-3456		
Thompson Nicola Regional Dist. 24 Hour Emergency		(250) 819-4105		
Min. of Trans. & Infrastructure, Service Area 14 – Nicola*		(250) 828-4002		
Min. of Trans. & Infrastructure, Service Area 16 – South Cariboo*		(250) 398-4510		
Lower Nicola Indian Band		(250) 378-5157		
Jennifer Garthwaite		(250) 523-9024		
Gord Garthwaite		(250) 378-5099		
Watson Engineering		(250) 374-2244		

**Secondary contacts for Ministry of Transportation & Infrastructure included in HVC OMS Manuals*

Other Contacts:	Primary	Secondary / Additional
SECONDARY EXTERNAL NOTIFICATIONS (Crisis Management Team)		
Supervisor of Emergency Services (TNRD) - Jason Tomlin	(250) 377-2598	[redacted]
Chief Inspector of Mines (MEMNG) - Al Hoffman	(250) 952-0494	
Section Head, Dam Safety (MFLNRO) - Scott Morgan	(250) 387-3265	
District Inspector, Kamloops (MEMNG) - Steve Rothman	(250) 371-3780	
Regional Director, Kamloops (MEMNG) - Bruce Hupman	(250) 828-4448	
Environmental Emergency Response Officer (MOE) - Rick Wagner	(250) 371-6220	
Sr. Environmental Emergency Response Officer (MOE) - Dennis Redford	(250) 371-6277	
SECONDARY EXTERNAL NOTIFICATIONS - WATER STORAGE FACILITIES ONLY (Crisis Management Team)		
Senior Dam Safety Officer (MFLNRO) - Monty Miedreich	(250) 387-3264	
Regional Office, Kamloops; Dam Safety Officer (MFLNRO) - Brian Nuttall	(250) 371-6329	[redacted]

INTERNAL NOTIFICATIONS

Dept. Superintendents	Name	Local Phone	Offsite	Cell Phone
Safety and Loss Control	*John Arnold*	(250) 523-3210	([redacted]	[redacted]
Mill Operations	*Rick Gibson*	(250) 523-3550	([redacted]	
Env. & Comm. Affairs	*Peter Martell*	(250) 523-3518	[redacted]	

WHEN GIVING A MESSAGE

State nature and exact location of emergency.
Give your name and phone number.
Stand by for further instructions.

WHEN RECEIVING A MESSAGE

You know what will be required.
You will be able to direct someone to the scene.
Relay message as required.

ALL INQUIRIES BY THE MEDIA ARE TO BE DIRECTED TO THE CRISIS COMMUNICATIONS SUPERINTENDENT

8.4.4. Key Contact Numbers

Telephone numbers of key personnel associated with the construction, operation, and maintenance of the Highmont TSF under both normal and emergency operating conditions are given below.

Contacts within HVC

Table 14 – Highland Valley Copper Mine Key Personnel Contact Numbers

Name	Position	Work	Home	Cell
Chris Fleming	Superintendent Tailings and Water Management	250.523.3315	[redacted]	[redacted]
C. Dechert	President, General Manager	250.523.3201	[redacted]	[redacted]
M. Costa	Manager, EHSC	250.523.3217	[redacted]	[redacted]
G. Brouwer	Manager, Operations	250.523.3236	[redacted]	[redacted]
N.J. Frenks	Manager, Maintenance	250.523.3225	[redacted]	[redacted]
Ross Billy	Senior Supervisor Tailings	250.523.3502	[redacted]	[redacted]
Ian Haskell	Field Supervisor	250.523-3735	[redacted]	[redacted]
R.C. (Rick) Gibson	Superintendent, Mill Operations	250.523.3550	[redacted]	[redacted]
C. Ellison	Superintendent, Mill Maintenance	250.523.3558		
W.T. Kelly	Mill Operations General Foreman	250.523.3589		
R. Scott	Mill Operations General Foreman	250.523.3468		
	Mill Control Room	250.523.3321, CH. 10		
	Mill Operations Senior Foremen	250.523.3322		
	Mill Operations Foremen	250.523.3322		
N.A. Eylnuik	Mill Shops Senior Foreman	250.523.3361		

Name	Position	Work	Home	Cell
D.G. Schmidt	Mill Shops Outside Foreman	250.523.3587		
B. Jones	Mill Shops Outside Foreman	250.523.3709		
	Cyclone House	250. 453-9579 or 250.523-3485, CH. 7		
	Protective Services	250.523.3333, CH. 2 or 7		
	Security	250.523.3307		

Contacts External to HVC

Table 15 – Key Community Emergency Contact Numbers

Name	*Position*	*Work*	*Home*	*Cell*
Emergency Management British Columbia (EMBC)				
EMBC Emergency Number (24 Hours)		1.800.663.3456		
Thompson Nicola Regional District (TNRD)				
TNRD Emergency Number (24 Hours)		250.819.4105		
Jason Tomlin	**Supervisor, Emergency Services**	250.377.2598		
Parties Downstream				
Cooks Ferry Band Council		[redacted]		
Canadian National Railway Emergency		1.800.465.9239		
Canadian Pacific Railway Emergency		1.800.716.9132		
Consulting Engineers				
Klohn Crippen Berger Ltd.		**604.669.3800**		
N. (Neil) Singh	**Project Manager**	**604.251.8506**	[redacted]	

Ministry of Forests, Lands and Natural Resource Operations				
Scott Morgan	**Section Head, Dam Safety**	**250.387.3263**		
Monty Miedreich	**Senior Dam Safety Officer**	**250.387.3264**		
Brian Nuttall	**Regional Office, Kamloops; Dam Safety Officer**	**250.371.6329**	[redacted]	[redacted]
Ministry of Environment			[redacted]	[redacted]
Rick Wagner	**Environmental Emergency Response Officer**	**250.371.6220**	[redacted]	[redacted]
Dennis Redford	**Environmental Emergency Response Officer**	**250.371.6277**	[redacted]	[redacted]
Ministry of Transportation & Infrastructure, Service Area 14 – Nicola (Highway 97C east)				
Dan Cumming	**Area Manager**	**250.378.1418**		
Sam Pantaleo	**Acting Area Manager**	**250.378.1431**		
Dennis Kurylowich	**Operations Manager**	**250.378.1414**		
Ministry of Transportation & Infrastructure, Service Area 16 – South Cariboo (Highway 97C west & Highway 1 along the Thompson and Fraser Rivers)				
Brad Bushill	**Area Manager**	**250.256.0329**		
Dan Palesch	**Operations Manager**	**250.398.4518**		
Ministry of Energy, Mines and Natural Gas				
Al Hoffman	**Chief Inspector of Mines**	**250.952.0494**		
Steve Rothman	**District Inspector, Kamloops**	**250.371.3780**		[redacted]
Joe Seguin	**Regional Director**	**250.828.4448**		[redacted]
R.C.M.P.				
Emergency		911		
Logan Lake		250.523.6222		
Provincial Ambulance Service				
Emergency		911		

8.4.5. Site Access

HVC's ERT receives updates on how to access the Highmont TSF in the event of an emergency if access routes are changed. The access roads to the Highmont TSFs are shown on Drawing 114-800-150 (see Appendix III).

The ERT Incident Commander is authorized to request any equipment they deem necessary in an emergency situation. Emergency lighting equipment for use under darkness is described in the following section.

If an emergency situation occurs during winter months, HVC has access to heavy-duty equipment (e.g. bulldozers, excavators, road graders, etc.) that may be used to access areas where snow or mud may be present. Most employees that work outdoors have personal winter coveralls and other winter clothing such as winter gloves. Additional supplies are available at the warehouse and can be made available to ERT members upon request. Large mobile heaters are available if requested by the ERT, along with portable space heaters and quick-setup tents.

HVC does not own a helicopter, but could contact the BC Ambulance Service to request the services of the Interior Air Ambulance.

The HVC Environment and Community Affairs Department maintains a small fleet of boats for environmental sampling that may be used by the ERT in the event of an emergency.

8.4.6. Communication Systems, Equipment, and Materials

Communications systems, equipment, and materials required for internal and external communications in the event of an emergency are made available by the Safety and Loss Control Department. This department is responsible overall for maintaining the Crisis Management Program, which includes designating an equipped crisis room for use as the Crisis Command Centre. The primary location for this is the HVC Boardroom, and the backup location is the Administration Training Trailer. The Safety and Loss Control Department is also responsible for managing equipment, materials and personnel required for emergency response.

The Safety and Loss Control Department is also responsible for managing equipment, materials, and personnel required for emergency response. The following emergency response vehicles are kept fully stocked with first aid and emergency response equipment: ERT Ambulance #1; ERT Ambulance #2; ERT Rescue Unit; ERT Pump #1 CAF; ERT Pumper #2; and ERT Fire Halls #1 and #2.

Checklists are maintained for each unit that list all equipment to be kept on-board the vehicles at all times. The checklists are completed by ERT members on a regular basis.

Emergency equipment available in the ERT vehicles and Hazmat/ERT equipment building includes first aid supplies, rescue equipment, personal safety gear, forest fire equipment, hazmat response equipment, remote field command centre, generators and emergency lighting, a Rapid Intervention Team Kit, dedicated HVC radio channel (HVC ERT Only), satellite radio, and UHF Band radios for special team tasks. Also included are 110v small space heaters that can be connected to generators or on-board CAF inverter. The remote field command centre is 2 quick setup canopies, using folding tables, space heaters, tarps, portable lighting, and vehicle or portable radios. ERT has access to extra first aid and rescue equipment beyond vehicles to set up a dedicated first aid equipment station.

Emergency lighting for use under darkness, at night time, or in poor visibility is available through on board lighting on fire trucks, ERT Pump #1 CAF and ERT Pumper #2, a generator with portable lighting on the ERT Rescue Unit, portable pelican lighting in Pump #1 CAF, and assorted hand-held lighting. For emergency situations that require larger mobile lighting stations, the ERT is able to call Pit Operations to obtain one or more of the mobile lighting stations used on haul roads. The ERT is also able to source emergency lighting from of any dump or lighted section at the mine and shut that area down if needed.

8.4.7. Warning Systems

Systems to warn parties downstream of the Highmont TSF of a potential or actual flood emergency are under consideration and have not yet been established.

8.5. Training, Testing and Updating

8.5.1. Training

Dam safety awareness training is provided annually during the Tailings Management Workshop to personnel responsible for operations, maintenance, and/or surveillance of the TSFs at HVC including: foremen, relief foremen, operators, tradesmen, Klohn Crippen Berger's site engineers, and selected dam contractors. Attendees are trained on how to identify warning signals and dangerous occurrences on dams. Updates and modifications to relevant emergency preparedness and response materials are communicated annually during the Tailings Management Workshop and as needed during special training sessions in the event that protocol changes shortly after the annual workshops have been delivered.

HVC ERT members will be familiar with all aspects of this EPRP. The Safety and Loss Control Department provides regular training to ERT members on response procedures in the event of a crisis or emergency at HVC, including tailings/water storage facilities. Emergency responders are trained on the appropriate responses to protect the safety and health of personnel, and to protect property and the environment against further damage.

HVC is responsible for providing staff with regular training on the Crisis Management / Emergency Call-out Procedure, assembling the Crisis Management Team, and overall Emergency/Crisis response. Municipalities and other responders are responsible for their Emergency Measures.

8.5.2. Testing

HVC's Tailings and Water Management will co-ordinate with the Safety and Loss Control Department to periodically review and test the EPRP and associated evacuation procedures with HVC personnel and contractors. Testing will comprise of tabletop scenarios, review of the EPRP and associated working documents (evacuation procedures, routing maps, etc.), and HVC's OMS manuals. Testing may also include simulations of a dam safety emergency/crisis. The purpose of these tests and reviews will be to ensure that EPRPs and associated procedures are comprehensive, accurate, and up-to-date.

Downstream agencies and stakeholders will be contacted periodically to ensure that all contact information is accurate and to provide input on HVC's EPRP for the Highmont TSF. It is the responsibility of each responding agency to have adequate plans and trained staff in place to deal with any emergency within their jurisdiction.

8.5.3. Updating

The HVC Tailings and Water Management Department staff are responsible for updating the *Emergency Preparedness and Response Plan* section of this OMS manual as part of the annual OMS manual review process. Updates may include but are not limited to: procedures, phone list, roles, and responsibilities. Revisions will be circulated to all affected agencies identified earlier in this section. Any revisions and/or comments to this section should be forwarded to the Superintendent Tailings and Water Management or the individual designated by the Superintendent to distribute this EPRP to external agencies and other stakeholders.

8.5.4. Additional Information

Table 16 - Emergency Preparedness and Response Plan Record of Revisions

Revision #	Date	Section(s) Revised/Added/Deleted and Reason
1*	November 2012	All of Section 8 fully reviewed and revised including: internal and external contact information revised, site overview figures added, alert level determination and ranking process developed, Emergency Reporting Procedure revised, overall structure and content updated to improve conformance to CDA Dam Safety Guidelines.
2	December 2013	Expanded section 8.2.3 Overview of Emergency Response Structure and added associated figure. Moved Emergency Identification and Evaluation content to section 7, Surveillance. Reviewed and updated internal and external contacts. Reviewed and updated Emergency Reporting Procedure. Added process for notification of downstream residents.
3	November 2014	Expanded section 8.2 to include 8.2.2 Effects of Inundation for each dam. Included beach width information. Updated dam consequence ratings based on March 2014 Dam Classification Workshop. Reviewed and updated internal and external contacts.

* Denotes first occurrence of tracking revisions to this section.

Table 17 – EPRP Distribution List

Teck Resources Limited (1)	
Vice President, Environment	M. Davies
Highland Valley Copper (17)	
President, General Manager	C. Dechert
Manager, EHSC	M. Costa
Manager, Maintenance	N. Frenks
Manager, Operations	G. Brouwer
Superintendent, Mill Operations	R.C. Gibson
Superintendent, Tailings and Water Management	C.T. Fleming
Superintendent, Mill Maintenance	C. Ellison
Superintendent, Environment and Community Affairs	P.K. Martel
Superintendent, Safety and Loss Control	J. Arnold
Superintendent, Mine Engineering	R.W. Graden
General Forman Mill Operations	W.T. Kelly & R. Scott
Mill, Operations Senior Forman	A,B,C,D Crews
Senior Supervisor Tailings	W.R. Billy
Field Supervisor	I.C. Haskell
Senior Forman Mill Shops	N. Elvnuik
Office Files	(1)
Security	(1)
Klohn Crippen Berger Ltd. (4)	
Project Manager(s) - Vancouver Office	N. Singh, P. Eng.
Site Office Files	(1)
Vancouver Office Files	(2)
Ministry of Energy, Mines and Natural Gas (3)	
District Mines Inspector, Kamloops	S. Rothman
Chief Inspector, Victoria	A. Hoffman
Manager Geotechnical Engineer, Victoria	G. Warnock
Ministry of Forests, Lands and Natural Resource Operations (1)	
Section Head, Dam Safety	S. Morgan
Ministry of Environment (2)	
Emergency Response Officer(s)	R. Wagner
	D. Redford
Thompson Nicola Regional District (1)	
Supervisor, Emergency Services	J. Tomlin

Emergency Management British Columbia (1)	
Regional Manager, Central Region	**S. Newton**
Ministry of Transportation and Infrastructure (2)	
Service Area 14 – Nicola (Highway 97C east)	**(1)**
Service Area 16 – South Cariboo (Highway 97C west & Highway 1 along the Thompson and Fraser Rivers)	**(1)**

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CDA 1999. Dam Safety Guidelines, Canadian Dam Association, January.

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Hamaguchi, Robert A., November 5, 2010. Highmont Water Management Plan.

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Teck Highland Valley Copper Partnership – March 2011 - 2010 Annual Reclamation Report.

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MAC 2011. Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities, The Mining Association of Canada.

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Ripley, Klohn & Leonoff International June 30, 1971- File: VA1526 – Report on Tailings Dam Site Investigations and Embankment Design.

Klohn Leonofff Consultants Ltd. August 17, 1979 – File: VA 1526 – Temporary Water Storage Dams

Klohn Leonoff Consultants Ltd. October 30, 1979 – File: VA 1526 – Highmont Tailings Disposal System - Report No. 2 Borrow Materials

Klohn Leonoff Consultants Ltd. December 6, 1979 – File: VA 1526 – Highmont Tailings Disposal System – Report No. 3 Hydrology, Water Balance and Diversions.

Klohn Leonoff Consulting Engineers. November 7, 1980 – File: VA 1526 – Highmont Tailings Disposal System – Report No. 6 Tailings Dams Volume 2 of 2

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Klohn Leonoff Consulting Engineers. March 21, 1984 - File: PB 1526 0201 – Highmont Tailings Dams Testing of Spigotted Tailings Beach.

Klohn Leonoff Consulting Engineers. April 11, 1984 – File: PB 1526 0303 – Highmont Mine Report on North Waste Dump.

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Klohn Leonoff Consulting Engineers. August 1, 1984 – File: PB 1526 0401 – Proposed Cycloned Sand Tailings Dam Construction Conceptual Review and Cost Estimate.

Highmont Operating Corporation 1984 – Tailings Construction Report.

Highmont Operating Corporation – Joe Bellandi – May 1984 Preliminary Upstream Tailings Sands Construction Proposal.

Highmont Operating Corporation – August 1982 – Draft copy of 1981 Dam Construction report, dated March 15, 1982.

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Highmont Operating Corporation – July 18, 1984 – 1983 Tailings Construction Report.

The Government of British Columbia – Amended Permit PE 376, Waste Management Act dated December 20, 2000

The Government of British Columbia, Ministry of Mines and Petroleum Resources – Permit 55, Teck Corporation December 16, 1971

The Government of British Columbia, Ministry of Mines and Petroleum Resources – Reclamation Permit M-55, Highmont Operating Corporation July 14, 1981

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Revegetation Plan of Lornex South Waste dump, Highland Valley Copper dated July 16, 1998

Klohn Leonoff and Klohn Crippen – Annual Review of Tailings Dams, 1989-2001, Bethlehem and Highmont Tailings Facilities, PB and PM2916, 1991 to 2002.

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Klohn Crippen – Highmont Pond – Flood levels with spillway, Letter report dated November 7, 2002 – A. Dalpatram

Klohn Crippen – Highmont Pond – Flood levels without spillway, Letter report dated November 14, 2002 – A. Dalpatram

Klohn Crippen – Highmont Tailings Facility – Surveillance Requirements, Letter dated December 2, 2002 – R. Lo, P. Eng.

Klohn Crippen – Highland Valley Copper Dams Downstream Consequence Classifications, Letter dated March 31, 2003

Klohn Crippen – Highmont Tailings Dam Spillway completed report 2003 and 2004 Construction Letter dated July 25, 2005

Klohn Crippen – Highmont Tailings Dam – Reclamation, Report and Letter dated August 12, 2005 – R. Lo, P. Eng.

Klohn Crippen Berger – Highmont Seepage Recovery Pond S1 Replacement of Outlet Pipe – Letter dated May 23, 2007

Klohn Crippen Berger – Highmont Spillway – Installation of Slide Gate at the Flow Control Structure – Letter dated May 24, 2007

APPENDIX IV – EFFECTS OF INUNDATION – SUPPORTING INFORMATION

All Highmont TSF Dams

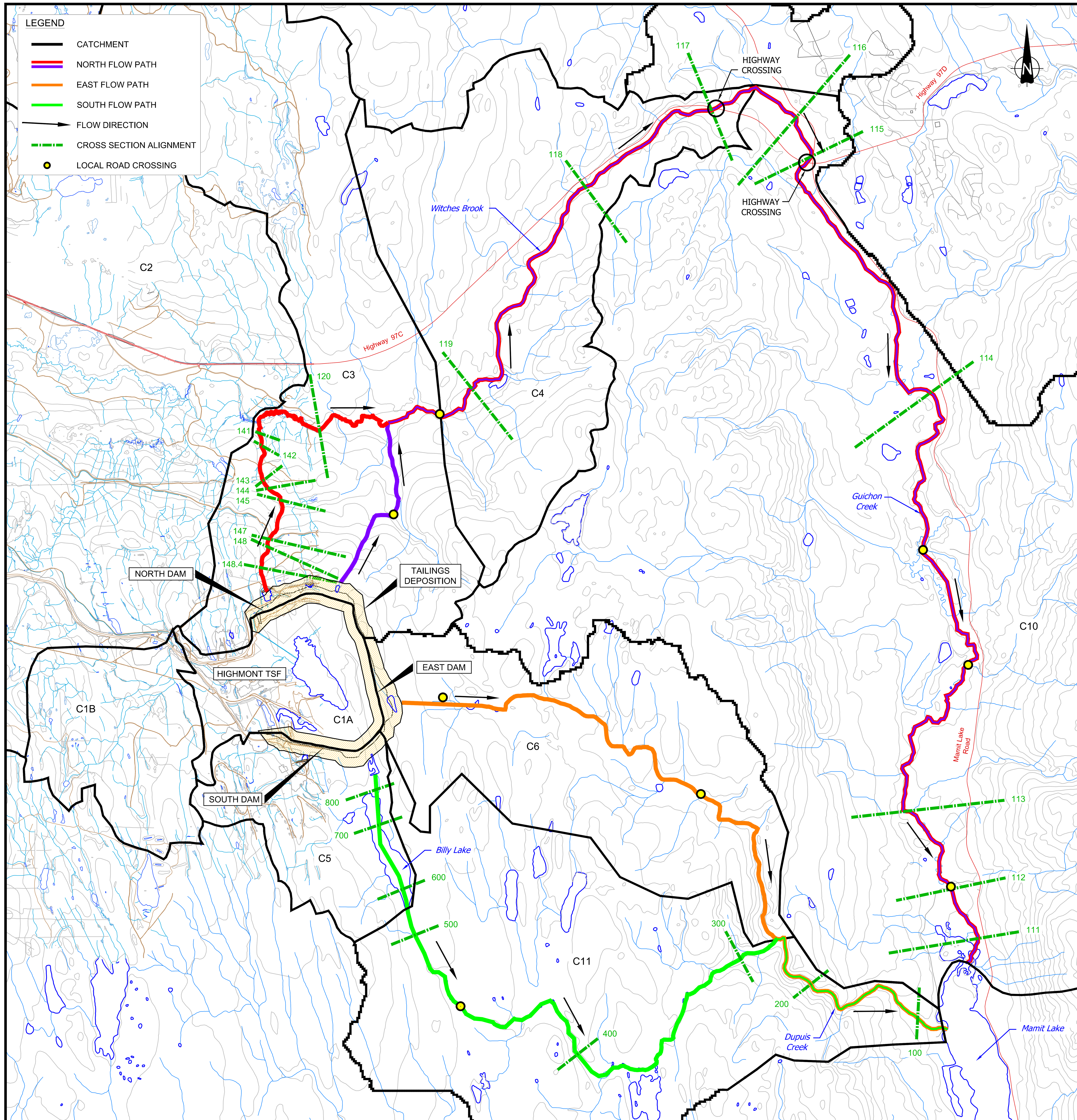
Drawing Number	Drawing Title
Figure 01	HEC-RAS Dam Break Model

Highmont Tailings Dam North

Drawing Number	Drawing Title
Table 6.6	Incremental Impacts (Flood) for the North Dam
Table 6.7	Incremental Impacts (Sunny Day) for the North Dam
Appendix B – Dam Breach Modelling Results North Dam	Figure B1 – B4

Highmont Tailings Dam South

Drawing Number	Drawing Title
Table C3	Incremental Impacts for South Dyke – Flood Failure
Table C4	Incremental Impacts for South Dyke – Sunny Day Failure
Appendix C – Dam Breach Modelling Results North Dam	Figure C2 – C5



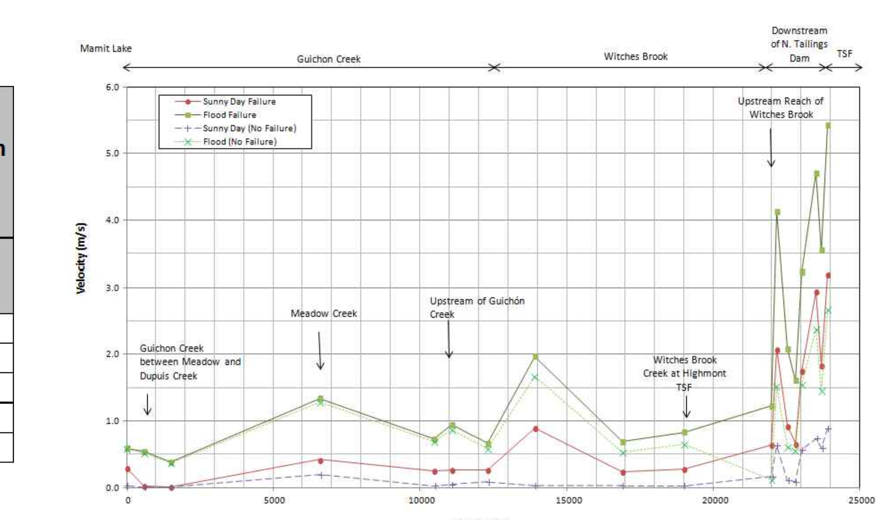
NORTH DAM HEC-RAS MODEL RESULTS SUMMARY

Reach	River Station	Channel Length (m)	Station (m)	Min. Channel Elevation (m)	Flood: Peak Flow (m³/s) No Failure	Flood: Peak Flow (m³/s) Failure Mode	Flood: Maximum Velocity (m/s) No Failure	Flood: Maximum Velocity (m/s) Failure Mode	Flood: Maximum Surface Water Level (m) No Failure	Flood: Maximum Surface Water Level (m) Failure Mode	Flood: Depth (m) No Failure	Flood: Depth (m) Failure Mode	Sunny Day Failure: Peak Flow (m³/s) No Failure	Sunny Day Failure: Peak Flow (m³/s) Failure Mode	Sunny Day Failure: Maximum Velocity (m/s) No Failure	Sunny Day Failure: Maximum Velocity (m/s) Failure Mode	Sunny Day Failure: Maximum Surface Water Level (m) No Failure	Sunny Day Failure: Maximum Surface Water Level (m) Failure Mode	Sunny Day Failure: Depth (m) No Failure	Sunny Day Failure: Depth (m) Failure Mode
TSF Dam	150	350	24260	1478.6	8	211			1481.5	1481.5	2.9	2.9	0.5	18			1480.2	1480.2	1.6	1.6
D/S of North Dam	148.4	210	23910	1438.3	8	211	2.7	5.4	1439.1	1441.2	0.8	2.9	0.5	18	0.9	3.2	1438.6	1439.5	0.3	1.2
	148	180	23700	1394.4	8	209	1.5	3.6	1395.1	1396.6	0.7	2.1	0.5	18	0.6	1.8	1394.6	1395.3	0.2	0.9
	147	500	23520	1372.6	8	208	2.4	4.7	1373.3	1375.2	0.7	2.6	0.5	18	0.7	2.9	1372.9	1373.6	0.3	1.0
	145	220	23020	1269.5	8	205	1.6	3.2	1269.8	1270.7	0.4	1.3	0.5	18	0.6	1.8	1269.6	1270.0	0.1	0.5
	144	260	22800	1250.0	8	203	0.6	1.6	1250.1	1250.8	0.1	0.8	0.5	18	0.1	0.7	1250.0	1250.2	0.0	0.2
	143	380	22540	1240.0	8	202	0.6	2.1	1240.2	1241.1	0.2	1.1	0.5	18	0.1	0.9	1240.0	1240.2	0.0	0.2
	142	160	22160	1222.8	8	200	1.5	4.1	1223.3	1224.6	0.5	1.7	0.5	18	0.6	2.1	1223.0	1223.5	0.2	0.6
	141	3000	22000	1200.0	7	199	0.1	1.2	1201.0	1202.4	1.0	2.4	0.5	18	0.2	0.6	1200.0	1200.5	0.0	0.5
Witches Brook Creek	120	2100	19000	1170.0	170	337	0.7	0.8	1171.0	1171.5	1.0	1.5	0.5	15	0.0	0.3	1170.0	1170.2	0.0	0.2
	119	3000	16900	1160.0	170	320	0.5	0.7	1160.6	1160.8	0.6	0.8	0.5	10	0.0	0.2	1160.0	1160.1	0.0	0.1
	118	1600	13900	1140.0	206	344	1.7	2.0	1140.4	1140.5	0.4	0.5	0.5	11	0.0	0.9	1140.0	1140.0	0.0	0.0
	117	1200	12300	1060.0	230	355	0.6	0.7	1063.2	1063.6	3.2	3.6	1.0	10	0.1	0.3	1060.4	1060.9	0.4	0.8
Guichon Creek	116	600	11100	1040.0	230	333	0.9	1.0	1040.3	1040.5	0.3	0.5	1.0	10	0.1	0.3	1040.0	1040.1	0.0	0.0
	115	3900	10500	1030.0	611	717	0.7	0.7	1030.8	1030.9	0.8	0.9	1.0	10	0.0	0.3	1030.0	1030.0	0.0	0.0
	114	5100	6600	1000.0	612	715	1.3	1.3	1003.6	1003.8	3.5	3.8	1.0	9	0.2	0.4	1000.3	1000.8	0.3	0.8
	113	900	1500	980.0	1142	1209	0.4	0.4	983.4	983.5	3.4	3.5	1.0	8	0.0	0.0	980.1	980.5	0.1	0.5
	112	600	600	980.0	1286	1358	0.5	0.5	983.0	983.1	3.0	3.1	1.0	7	0.0	0.0	980.1	980.5	0.1	0.5
Mamit Lake	111	0	0	980.0	1286	1357	0.6	0.6	982.5	982.6	2.5	2.6	1.0	7	0.0	0.3	980.0	980.0	0.0	0.0

PEAK WAVE TRAVEL TIME (NORTH DAM)

River Station		Channel Length (m)	Station (m)	Flood: Time to Reach Max. Water Level since the Start of the Breach (hr)	Flood: Peak Wave Travel Time from the Dam (hr)	Sunny Day: Time to Reach Max. Water Level since the Start of the Breach (hr)	Sunny Day: Peak Wave Travel Time from the Dam (hr)
D/S of North Dam		148	23910	4.0	0.0	1.0	0.0
		141	22000	4.3	0.3	1.3	0.3
Witches Brook		117	12300	6.5	2.5	9.8	8.8
Ghichon Creek		114	6600	7.5	3.5	15.0	14.0
Mamit Lake		111	0	9.0	5.0	23.0	22.0

NORTH DAM VELOCITY



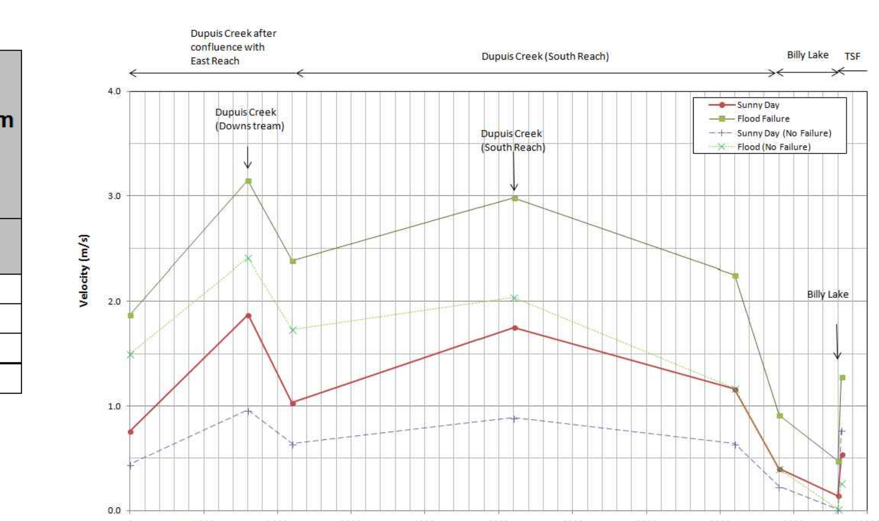
SOUTH DAM HEC-RAS MODEL RESULTS SUMMARY

Reach	River Station	Channel Length (m)	Station (m)	Min. Channel Elevation (m)	Flood: Peak Flow (m³/s) No Failure	Flood: Peak Flow (m³/s) Failure Mode	Flood: Maximum Velocity (m/s) No Failure	Flood: Maximum Velocity (m/s) Failure Mode	Flood: Maximum Surface Water Level (m) No Failure	Flood: Maximum Surface Water Level (m) Failure Mode	Flood: Depth (m) No Failure	Flood: Depth (m) Failure Mode	Sunny Day Failure: Peak Flow (m³/s) No Failure	Sunny Day Failure: Peak Flow (m³/s) Failure Mode	Sunny Day Failure: Maximum Velocity (m/s) No Failure	Sunny Day Failure: Maximum Velocity (m/s) Failure Mode	Sunny Day Failure: Maximum Surface Water Level (m) No Failure	Sunny Day Failure: Maximum Surface Water Level (m) Failure Mode	Sunny Day Failure: Depth (m) No Failure	Sunny Day Failure: Depth (m) Failure Mode
D/S of South Dam	800	50	9650	1451.9	1	199	0.26	1.28	1452.0	1453.7	0.1	1.83	0.2	18	0.77	0.54	1451.9	1452.4	0.0	0.5
Billy Lake	700	800	9600	1448.0	1	185	0.01	0.47	1448.8	1450.7	0.8	2.68	0.2	15	0.01	0.14	1448.2	1448.8	0.2	0.8
	600	600	8800	1448.0	13	180	0.40	0.91	1448.3	1449.4	0.3	1.42	0.4	13	0.23	0.40	1448.0	1448.3	0.0	0.3
Dupuis Creek (South Reach)	500	3000	8200	1443.4	13	175	1.17	2.25	1444.5	1446.6	1.1	3.22	0.4	13	0.64	1.16	1443.6	1444.5	0.2	1.1
	400	3000	5200	1368.6	13	170	2.04	2.98	1371.0	1372.8	2.4	4.16	0.4	13	0.89	1.75	1368.8	1369.8	0.2	1.2
	300	600	2200	1223.7	78	208	1.73	2.38	1224.7	1225.3	1.0	1.64	0.6	12	0.64	1.03	1223.7	1224.1	0.1	0.5
Dupuis Creek D/S	200	1600	1600	1142.0	78	206	2.41	3.15	1144.4	1145.6	2.4	3.56	0.6	12	0.96	1.87	1142.3	1143.0	0.3	1.0
	100	300	0	982.5	106	223	1.50	1.87	985.2	986.4	2.8	3.94	0.8	12	0.44	0.76	982.7	983.5	0.3	1.0

PEAK WAVE TRAVEL TIME (SOUTH DAM)

River Station	Channel Length (m)	Station (m)	Flood: Time to Reach Max. Water Level since the Start of the Breach (hr)	Flood: Peak Wave Travel Time from the Dam (hr)	Sunny Day: Time to Reach Max. Water Level since the Start of the Breach (hr)	Sunny Day: Peak Wave Travel Time from the Dam (hr)
D/S of South Dam	800	9650	4.0	0.0	1.0	0.0
Billy Lake	600	8800	4.3	0.3	2.0	1.0
Dupuis Creek (South Reach)	300	2200	5.0	1.0	3.3	2.3
Dupuis Creek D/S	100	0	5.3	1.3	3.8	2.8

SOUTH DAM VELOCITY



NOTES:

- THE NORTH DAM BREAK COULD HAVE TWO FLOW PATHS. ONLY THE PATH FURTHER UPSTREAM AT WITCHES BROOK CREEK WAS MODELED. THE TWO FLOW PATHS AT THE SHORT REACH BETWEEN THE NORTH DAM AND WITCHES BROOK CREEK ARE ASSUMED TO BE SIMILAR.
- THE FLOW PATHS FROM THE EAST DAM AND THE SOUTH DAM ARE ASSUMED TO BE SIMILAR. ONLY THE SOUTH DAM FAILURE WAS MODELED.
- WHEN VIEWING THE RESULTS OF A DAM BREACH ANALYSIS, IT IS IMPORTANT TO CONSIDER NUMEROUS SIMPLIFICATIONS AND UNCERTAINTIES INHERENT IN SUCH MODELING EXERCISE. THE RESULTS PRESENTED HEREIN SHOULD BE REGARDED AS APPROXIMATE AND WITHIN THIS CONTEXT WHEN DEVELOPING AND EXECUTING EMERGENCY PREPAREDNESS AND RESPONSE PROCEDURES.
- INFORMATION INCLUDED HEREIN SHOULD BE USED IN CONJUNCTION WITH THE HIGHMONT DAM BREAK ANALYSIS REPORT ISSUED IN SEPTEMBER 2014.

NOTE:
THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE AMEC ENVIRONMENT & INFRASTRUCTURE REPORT No. VW1028 DATED SEPTEMBER 2014.

NOT FOR CONSTRUCTION

REV	D	M	Y	ISSUE / REVISION DESCRIPTION	ENG.	APPR.
G						
F						
E						
D						
C						
0	23	09	2014	ISSUED AS FINAL	A.F.	J.S.
A	08	04	2014	ISSUED FOR CLIENT REVIEW	A.F.	J.S.

Client Logo:

Client: Teck Highland Valley Copper Partnership
Teck

AMEC Environment & Infrastructure
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amec

DRAWN BY: TH
CHECKED BY: AF
DATUM: NAD 83
PROJECTION: UTM Zone 10
SCALE: AS SHOWN

PROJECT: HIGHMONT DAM DAM BREAK STUDY

TITLE: HEC-RAS DAM BREAK MODEL

DATE: SEPTEMBER 2014
PROJECT NO: VW1028
REV. NO: 0
FIGURE NO: D1
SHEET NO: 1 of 1

Highmont Tailings Dam North

Drawing Number	Drawing Title
Table 6.6	Incremental Impacts (Flood) for the North Dam
Table 6.7	Incremental Impacts (Sunny Day) for the North Dam
Appendix B – Dam Breach Modelling Results North Dam	Figure B1 – B4

Table 6.1: Incremental Impacts (Flood) for the North Dam

Reach	River Station	Channel Length (m)	Station	Min. Channel Elevation (m)	Flood	
					Incremental Flow (m^3/s)	Incremental Depth (m)
					Failure Mode	
TSF Dam	150	350	24260	1478.6	203	0.0
D/S of North Dam	148	210	23910	1438.3	203	2.1
	148	180	23700	1394.4	202	1.4
	147	500	23520	1372.6	200	1.9
	145	220	23020	1269.5	197	0.9
	144	260	22800	1250.0	195	0.7
	143	380	22540	1240.0	194	0.9
	142	160	22160	1222.8	192	1.3
	141	3000	22000	1200.0	192	1.4
Witches Brook	120	2100	19000	1170.0	166	0.5
	119	3000	16900	1160.0	150	0.3
	118	1600	13900	1140.0	139	0.2
	117	1200	12300	1060.0	125	0.4
Guichon Creek	116	600	11100	1040.0	103	0.1
	115	3900	10500	1030.0	107	0.1
	114	5100	6600	1000.0	103	0.2
	113	900	1500	980.0	67	0.1
	112	600	600	980.0	72	0.1
Mamit Lake	111	0	0	980.0	72	0.1

Table 6.2: Incremental Impacts (Sunny Day) for the North Dam

Reach	River Station	Channel Length (m)	Station (m)	Min. Channel Elevation (m)	Sunny Day Failure	
					Incremental Flow (m^3/s)	Incremental Depth (m)
					Failure Mode	
TSF Dam	150	350	24260	1478.6	18	0.0
D/S of North Dam	148.4	210	23910	1438.3	18	0.9
	148	180	23700	1394.4	18	0.7
	147	500	23520	1372.6	18	0.8
	145	220	23020	1269.5	18	0.4
	144	260	22800	1250.0	18	0.2
	143	380	22540	1240.0	18	0.2
	142	160	22160	1222.8	18	0.4
	141	3000	22000	1200.0	17	0.4
Witches Brook Creek	120	2100	19000	1170.0	15	0.2
	119	3000	16900	1160.0	10	0.1
	118	1600	13900	1140.0	11	0.0
	117	1200	12300	1060.0	9	0.4
Guichon Creek	116	600	11100	1040.0	9	0.0
	115	3900	10500	1030.0	9	0.0
	114	5100	6600	1000.0	8	0.4
	113	900	1500	980.0	7	0.4
	112	600	600	980.0	6	0.4
Mamit Lake	111	0	0	980.0	6	0.0

Figure B1 – Failure of North Dam – Maximum Flow (Flood)

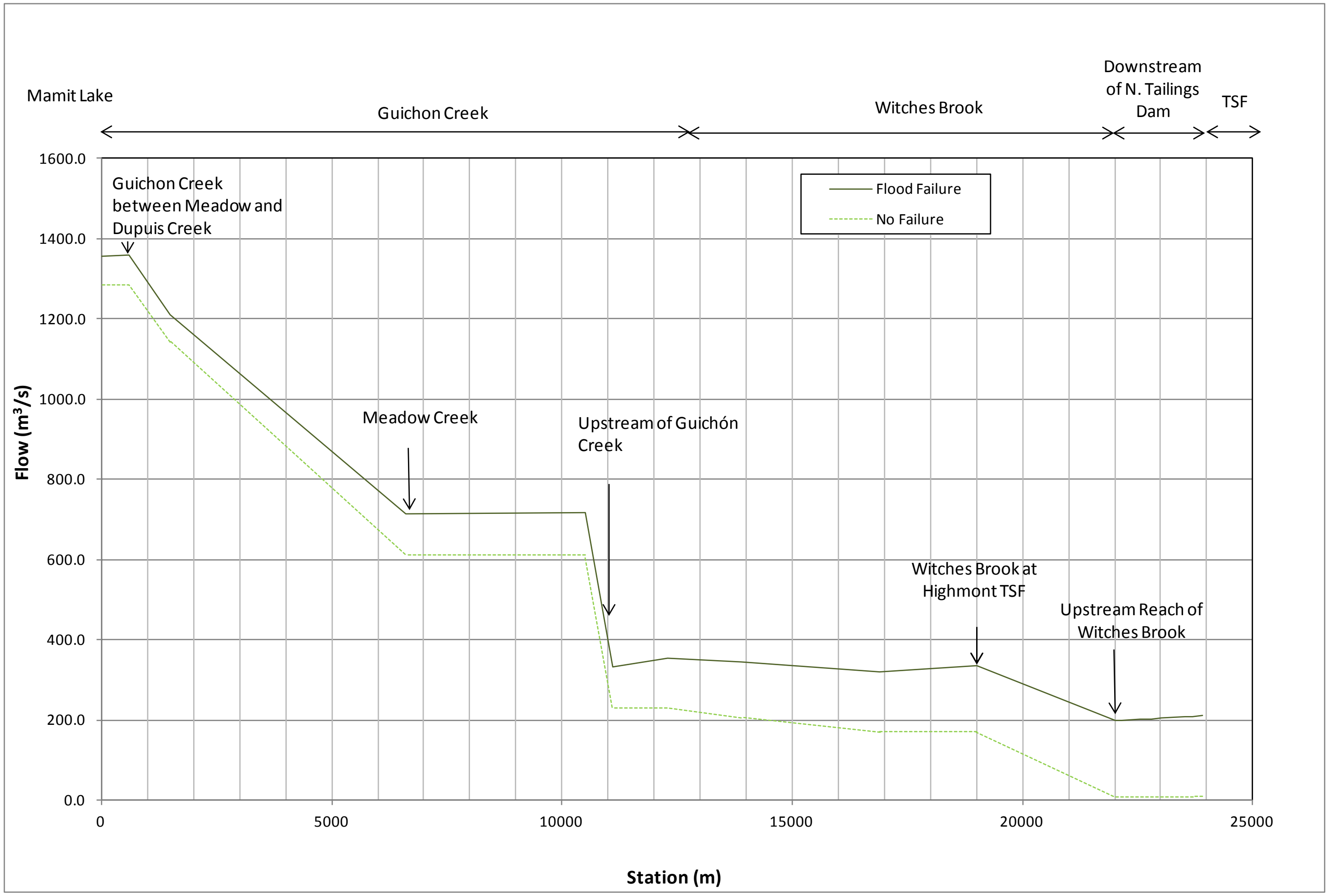


Figure B2 – Failure of the North Dam – Maximum Flow (Sunny Day)

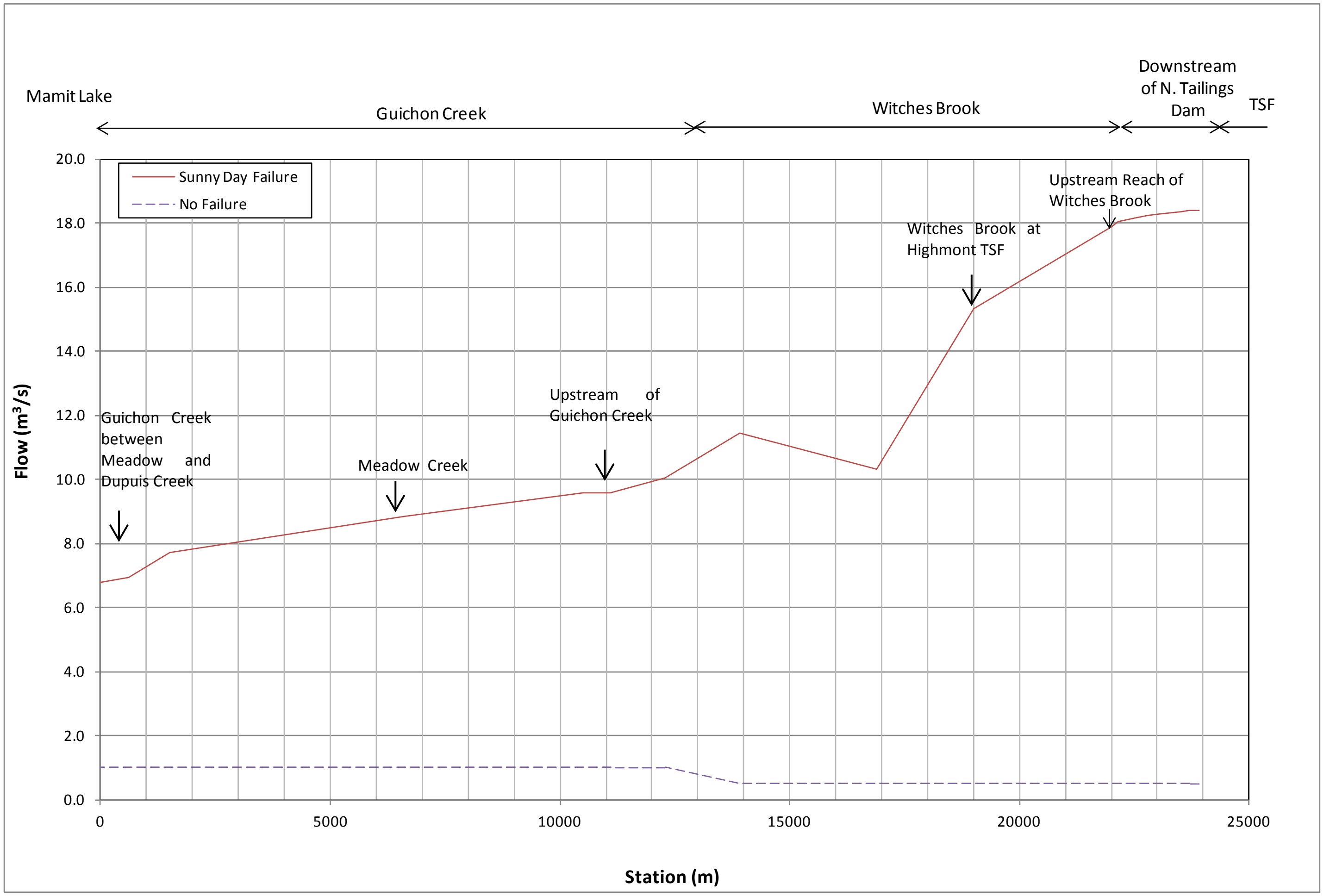


Figure B3 – Failure of North Dam – Maximum Water Depth (Flood)

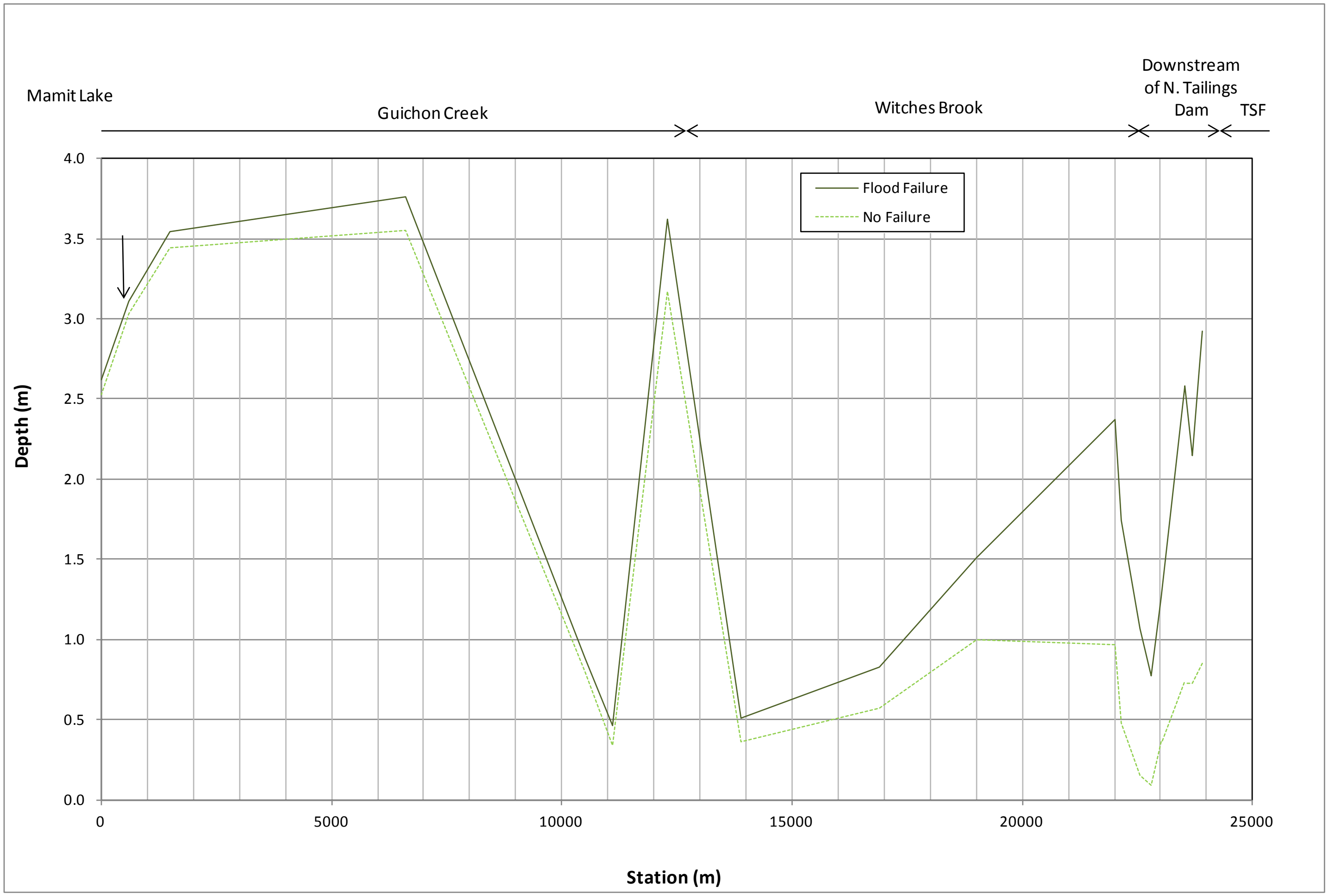
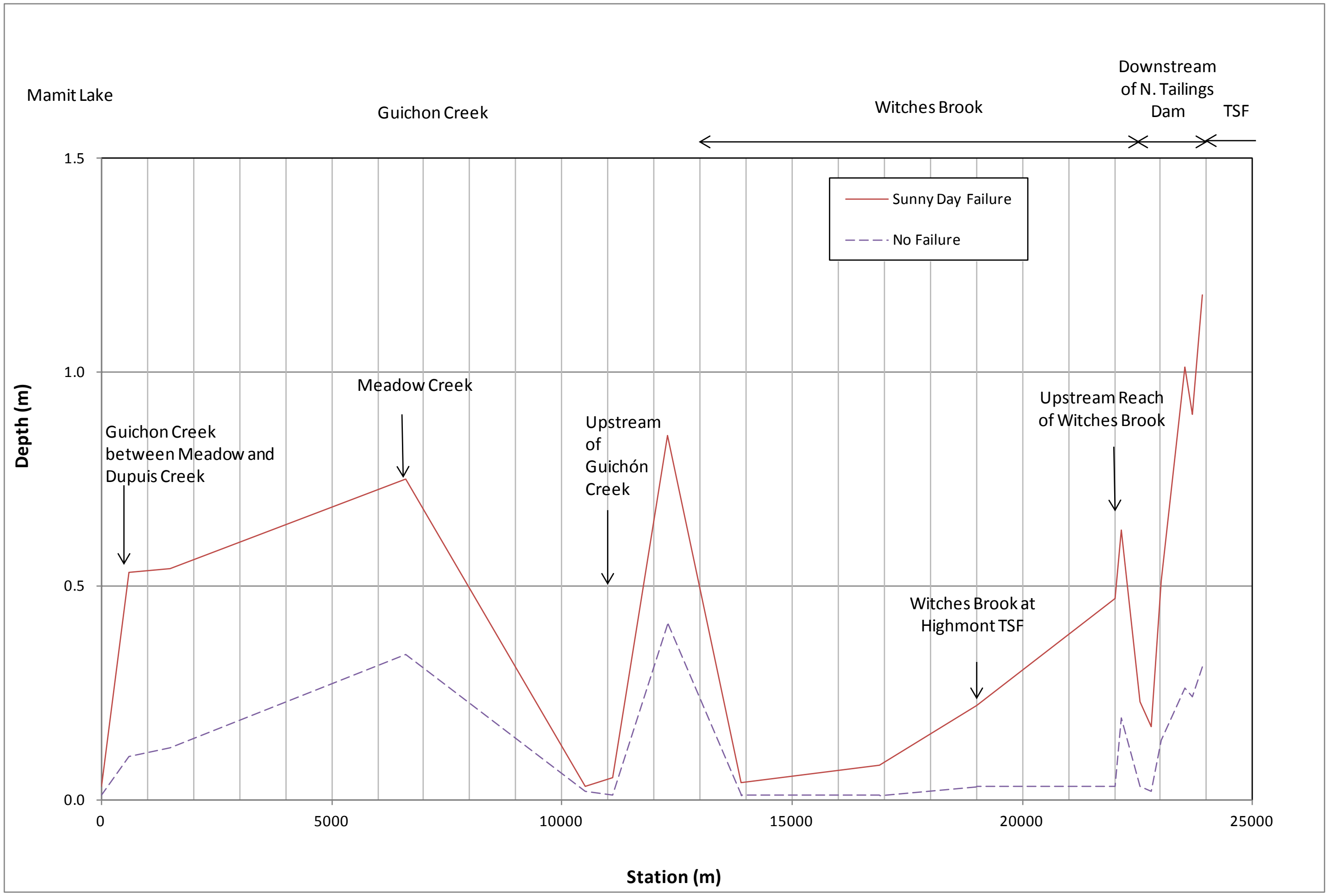


Figure B4 - Depth for the North Dam Break (Sunny Day)



Highmont Tailings Dam South

Drawing Number	Drawing Title
Table C3	Incremental Impacts for South Dyke – Flood Failure
Table C4	Incremental Impacts for South Dyke – Sunny Day Failure
Appendix C – Dam Breach Modelling Results North Dam	Figure C2 – C5

Table C3 - Incremental Impacts for South Dyke – Flood Failure

Reach	River Station	Station (m)	Flood	
			Incremental Flow (m^3/s)	Incremental Depth (m)
			Failure Mode	
D/S of South Dam	800	9650	198	1.7
Billy Lake	700	9600	184	1.9
	600	8800	167	1.2
Dupuis Creek (South Reach)	500	8200	162	2.1
	400	5200	157	1.7
	300	2200	130	0.6
Dupuis Creek D/S	200	1600	129	1.2
	100	0	117	1.2

Table C4 - Incremental Impacts for South Dyke – Sunny Day Failure

Reach	River Station	Station (m)	Sunny Day Failure	
			Incremental Flow (m^3/s)	Incremental Depth (m)
			Failure Mode	
D/S of South Dam	800	9650	18	0.5
Billy Lake	700	9600	15	0.6
	600	8800	13	0.3
Dupuis Creek (South Reach)	500	8200	13	0.9
	400	5200	12	1.0
	300	2200	12	0.4
Dupuis Creek D/S	200	1600	12	0.7
	100	0	12	0.8

Figure C2 – Failure of the South Dam – Maximum Flow (Flood)

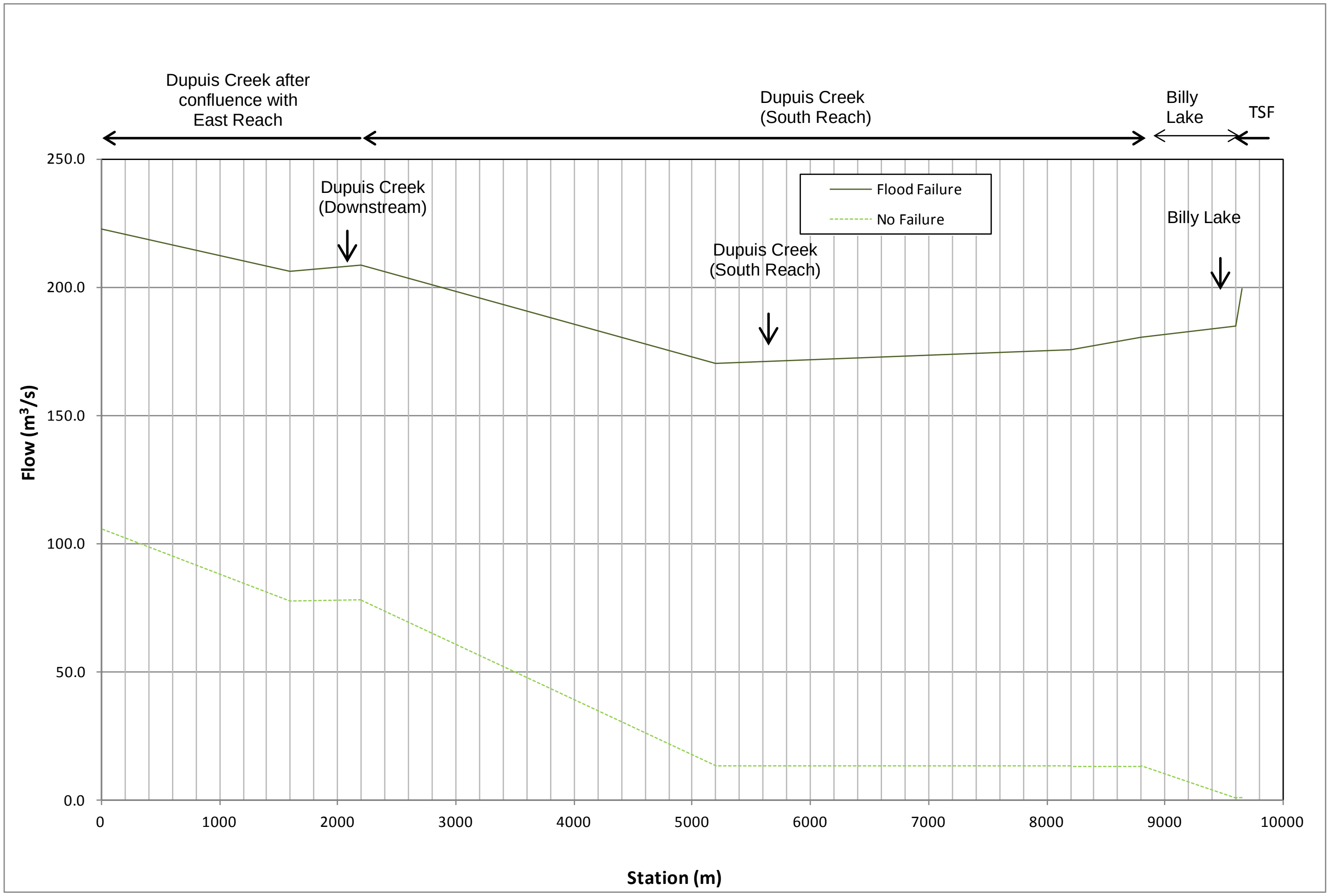


Figure C3 - Failure of the South Dam – Maximum Flow (Sunny Day)

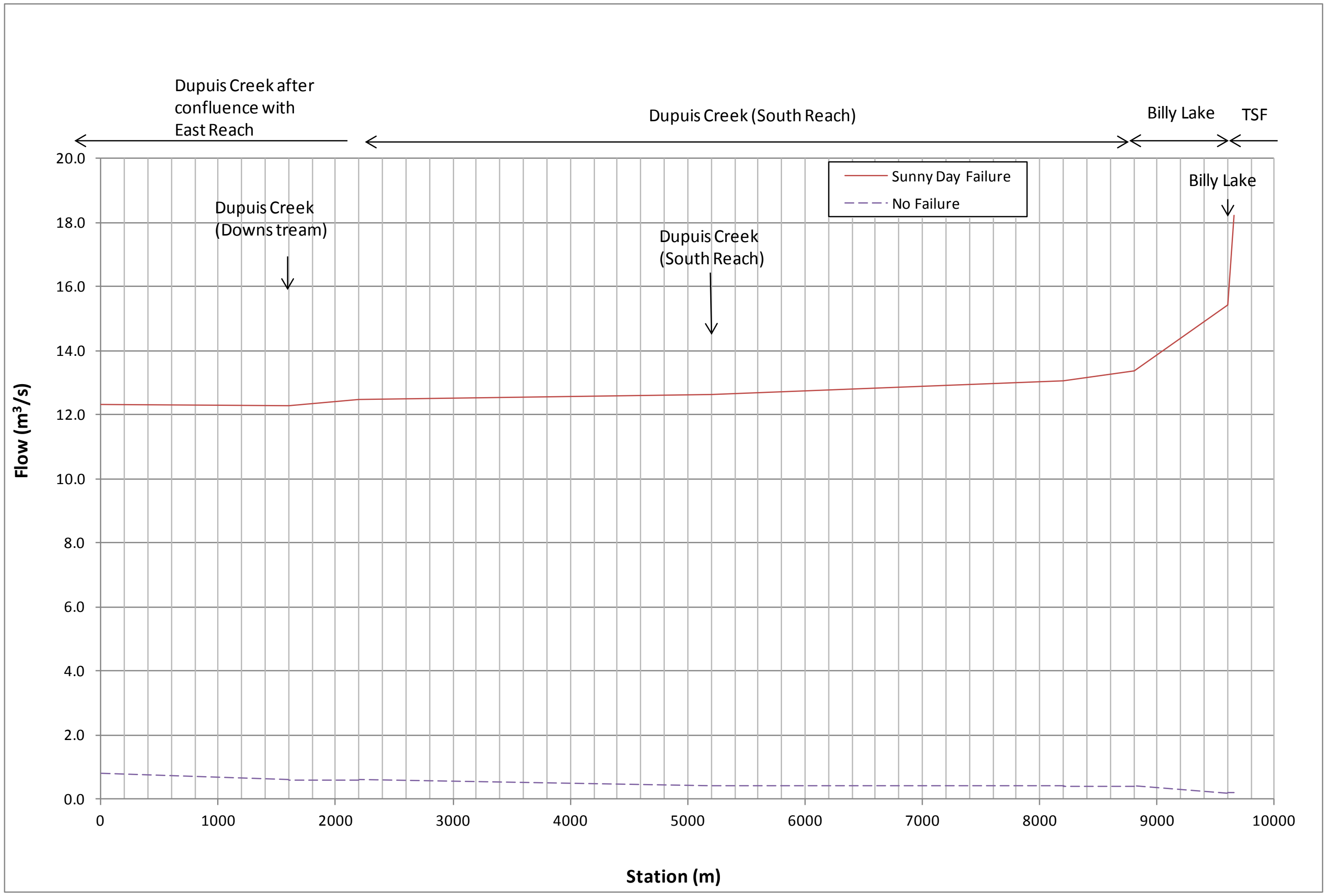


Figure C4 - Failure of the South Dam – Maximum Water Depth (Flood)

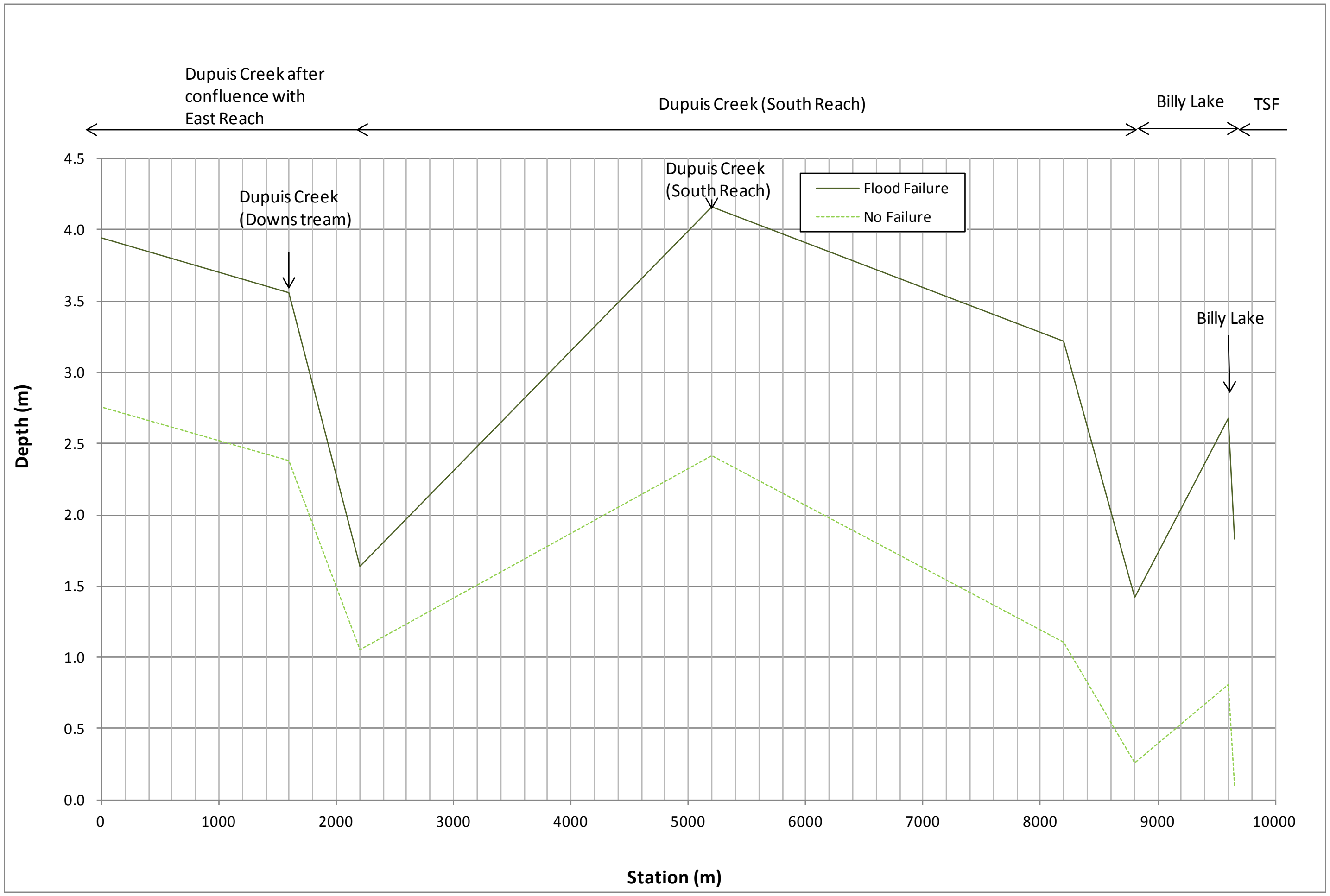


Figure C5 - Failure of the South Dam – Maximum Water Depth (Sunny Day)