REPORT N^{O} 161-16816-00

REVIEW OF CONTACT AND NON-CONTACT WATER MANAGEMENT SYSTEMS

COBBLE HILL HOLDINGS

DECEMBER 19, 2016

WSP

REVIEW OF CONTACT AND NON-CONTACT WATER MANAGEMENT SYSTEMS

Cobble Hill Holdings

Project no: 161-16816-00
Date: December 19, 2016

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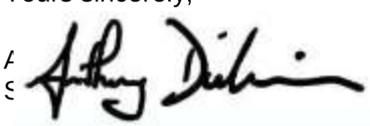
Dear Marty,

Subject: Review of Contact and Non-Contact Water Management Systems

After a site visit by Mr. Neil Hall and Mr. Tomas Oxland and interviews with Rahim Gaidhar at the site located at 460 Stebbings Road, Shawnigan Lake, BC we have prepared the attached review of the Contact and Non-Contact Water Management Systems. This report was compiled to fulfil one of the requirements of the BC Ministry of Environment letter of November 4, 2016 (Reference 305282, File 105809)

This report also includes a section which responds to the specific non-compliance instances raised in the MOE letter of October 11, 2016.

Yours sincerely,



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EXECUTIVE SUMMARY

WSP has been retained by Cobble Hill Holdings (Client) to complete a hydrological review of the contact and non-contact water management systems of the mine, in response to the British Columbia Ministry of Environment letter dated November 4, 2016.

The scope of the study by WSP includes:

1. Review of the contact and non-contact water management systems for the existing condition.
    a. Hydrologic and hydraulic review of the water management systems based on available rainfall and runoff data.
    b. Review the capacity of the water treatment system for the contact water.
    c. Review the capacity of the settling pond and leachate pond.
    d. Review the contingency plans for a single storm and/or a series of storms that exceed the design storm peak flows and/or storage volumes.
2. Review of the contact water management system for future conditions.
    a. Estimate the unit runoff rate and volume from an exposed containment cell.
3. Recommendations for rectification (if any required) of the existing system to address the instances of non-compliance with the permit requirements identified in MOE Letter Oct. 11, 2016:
4. Recommendations for potential interim measures to mitigate the potential for exceedances while the system is being reviewed and potential changes in design are being implemented.

Under permit PR105809 the Client operates a Soil Management Area (SMA) and Permanent Encapsulation Area (PEA), on a gravel quarry operated by South Island Resource Management. During precipitation events runoff from undisturbed areas (non-contact non-disturbed water), the gravel pit (non-contact disturbed water), PEA runoff (contact water), SMA apron (includes wheel wash area – contact water), and the SMA roof (non-contact non-disturbed water) is directed through ditches to the settling pond. The contact water and the PEA leachate are directed to a containment pond and water treatment system prior to entering the settlement pond.

This study analyses the volume, rate of flow and capacity of the water treatment system for contact water and of the settling pond to determine if the current designs are adequate to handle the expected flows from a design storm. A hydrological model (HEC-HMS) was used to estimate volume, flow and capacity of the two systems, based on design storms developed from rainfall intensity curves (IDF curves) for the Lake Cowichan weather station. Model runoff parameters were calibrated from available site rainfall and runoff measurements.

A number of conclusions and recommendations are included in this study as a result of the site visit review, interviews and modeling:

- Non-Contact Water
  - The existing West ditch geometry is sufficient for the design discharge; the ditch does not appear to have any erosion concerns to date.
  - The existing East-West ditch geometry appears to be sufficient for the design discharge, and the ditch does not appear to have any erosion concerns to date. The riprap armouring in the lower portions of the ditch where flow is concentrated could be supplemented to increase the thickness and should extend to the full height of the ditch.
  - The site includes disturbed areas, some of which have been partially revegetated, that drain, uncontrolled, off site. Those areas should be reviewed; areas in use should be regraded to drain toward the settling pond where possible (an exception is the access road), while other areas should be revegetated.
  - The settling pond is estimated to have the capacity to settle a 19 µm sized particle provided that the outlet engages sufficient storage, based on Stokes' Law calculations, with a 1.5 safety factor and flow measurements from the pond outlet. The existing settling pond should be capable of providing approximately 16 hours of residence time as long as the outfall orifices are sized appropriately and located higher to provide a deep retention volume. The following additional items were noted with respect to settling pond operation:
    - A review of the typical sediment particle size distribution observed during a large rainfall event will be required to confirm if the settling pond design meets the permitted requirement of TSS concentrations not exceeding 25 mg/l for a design event.
    - Conversations with the site operations personnel indicate that a portion of the water in the settling pond infiltrates. The measured pond discharge rate will increase with time (per unit catchment size) if the infiltration rate decreases as a result of the soil and rock pore spaces filling with sediment. This change will reduce the effectiveness of the pond; the impact should be considered in future design changes.
    - Settling pond capacity should be reviewed prior to future increases in catchment.
    - The settling pond spillway chute slope, rock size, and riprap thickness were observed to be deficient during a site visit. The spillway design and armouring is recommended to be reviewed and redesigned as soon as possible to provide adequate erosion protection.
    - The effectiveness of the settling pond is impacted by the location of the outlet orifices, which are near the bottom of the pond. As a result, the pond provides a small volume of detention storage and most likely discharges partially settled sediment. The outlet water quality can be improved if the orifices are raised.
  - The settling pond permitted maximum discharge of 42,500 m^3/day is significantly greater than the design discharge volume for the existing catchment extents. The constraint is not anticipated to be exceeded for the site's current mine boundary based on existing runoff rates.
- Contact Water
  - The design runoff depth for contact water catchment is estimated to be 136 mm, based on a 25-year 24-hour design event. Storage should be provided for 100 % of the runoff volume.
  - The existing containment pond storage volume, with freeboard included, is adequate to contain runoff from the existing contact water catchment for a design event. Additional storage will be required for future encapsulation cell construction.

- The permitted Maximum Rate of Discharge should be increased if future encapsulation areas will exceed an additional 0.20 ha, based on a 48-hour drawdown of the stored contact water. This constraint is dependent on sufficient containment storage volume being available.
- The permitted Annual Average Rate of Discharge, 12.1 m^3/day, is not sufficient for the existing contact water catchment, based on calculations using measured rainfall volumes for the year 1997 (peak recorded rainfall year) at Lake Cowichan. These calculations show that the permitted annual average discharge rate is not sufficient for an extreme rainfall year. The permitted discharge rate should be increased to 14.8 m^3/day to cover the existing drainage area, with consideration given to the footprint of future encapsulation cells (additional discharge rate equivalent to 74.3 m^3/ha-day).
- The WTS discharge rate should be limited to not exceed the Maximum Rate of Discharge unless runoff is approaching the storage capacity of the containment system. The intent is to have “checks” on the system to ensure the Maximum Rate of Discharge is exceeded only when absolutely necessary.

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1 BACKGROUND

WSP has been retained by Cobble Hill Holdings to complete a hydrological review of the contact and non-contact water management systems of the mine, in response to the British Columbia Ministry of Environment letter dated November 4, 2016.

Figure 1 provides an overview of the existing site, including the dominant facilities, catchment boundaries, and stormwater conveyance infrastructure. The details provided in the figure are based on recent survey data (2015 and 2016), site visit information, and client documents. In particular, the locations of the Soil Management Area (SMA), Containment Pond, Water Treatment System (WTS), and Permanent Encapsulation Area (PEA) are indicated. The imagery background, acquired from Google Earth, is provided for visual perspective only and is an approximate representation of the existing conditions.

1.1 CLASSIFICATION OF SITE WATER

The classification of surface runoff from the site has been presented in previous analyses, based on conversations with the Ministry of Environment (Stantec, 2015). An outline of the classification is presented below, as presented in the previous analysis with minor modifications:

- Contact Water – Water that comes into contact with contaminated soils. This includes water from the Soil Management Area (SMA) floor, Permanent Encapsulation Area (PEA), wheel wash station, and the contact water containment pond. All contact water is pumped into the containment pond prior to being treated. The Water Treatment System (WTS) pumps contact water from the pond and discharges treated contact water into the settling pond.
- Non-Contact Pit Water – water (excluding contact water) which falls on, or travels through, the active mine pit floor.
- Non-Contact Disturbed Water – water collected above the active pit (excluding the SMA and Contact Pond) where the natural ground has been disturbed by heavy machinery or has been paved.
- Non-Contact Non-Disturbed Water – waters collected within natural vegetated areas that have not been disturbed by machinery.

1.2 SITE OVERVIEW

The Cobble Hill Holdings mine is located at 460 Stebbings road within the Cowichan Valley Regional District on Vancouver Island. The site is approximately three kilometres west northwest of Malahat, and 5.0 km south of Shawnigan Lake. The existing mine is located in the Shawnigan Lake catchment, adjacent to Shawnigan Creek and an unnamed ephemeral tributary. Terrain within the mine boundary is defined by a knob shaped expression of an igneous intrusion (Active Earth Engineering Ltd, 2012). Runoff drains off in all directions toward the two adjacent streams.

The contact water catchment area currently consists only of the SMA pad, the wheel wash facility, and the containment pond. Runoff from the SMA tension fabric cover currently drains to the containment pond; eaves troughs are being installed to direct runoff to non-contact catchment areas. The PEA, which the Client has indicated was sealed in late October, is considered part of the non-contact water area; runoff from this area drains directly to the settling pond.

A drainage system is installed at the base of the PEA to collect any leachate which may be generated. The leachates are classified as contact water and any leachate that is collected is directed to the containment pond for treatment in the WTS.

The non-contact water catchment area consists of both disturbed and undisturbed catchments. Flow from undisturbed catchments, which includes established revegetated areas is allowed to drain uncontrolled offsite. Flow from the southern undisturbed catchment drains offsite through the East-West armoured ditch.

The disturbed catchment extents include two areas, as indicated in **Figure 1**. The settling pond catchment drains into the settling pond through the armoured West Ditch, as well as through a sub-drainage pipe. The other catchment drains into the pit floor. It is understood from the Client that runoff accumulated in the pit floor does not flow offsite via overland flow paths.

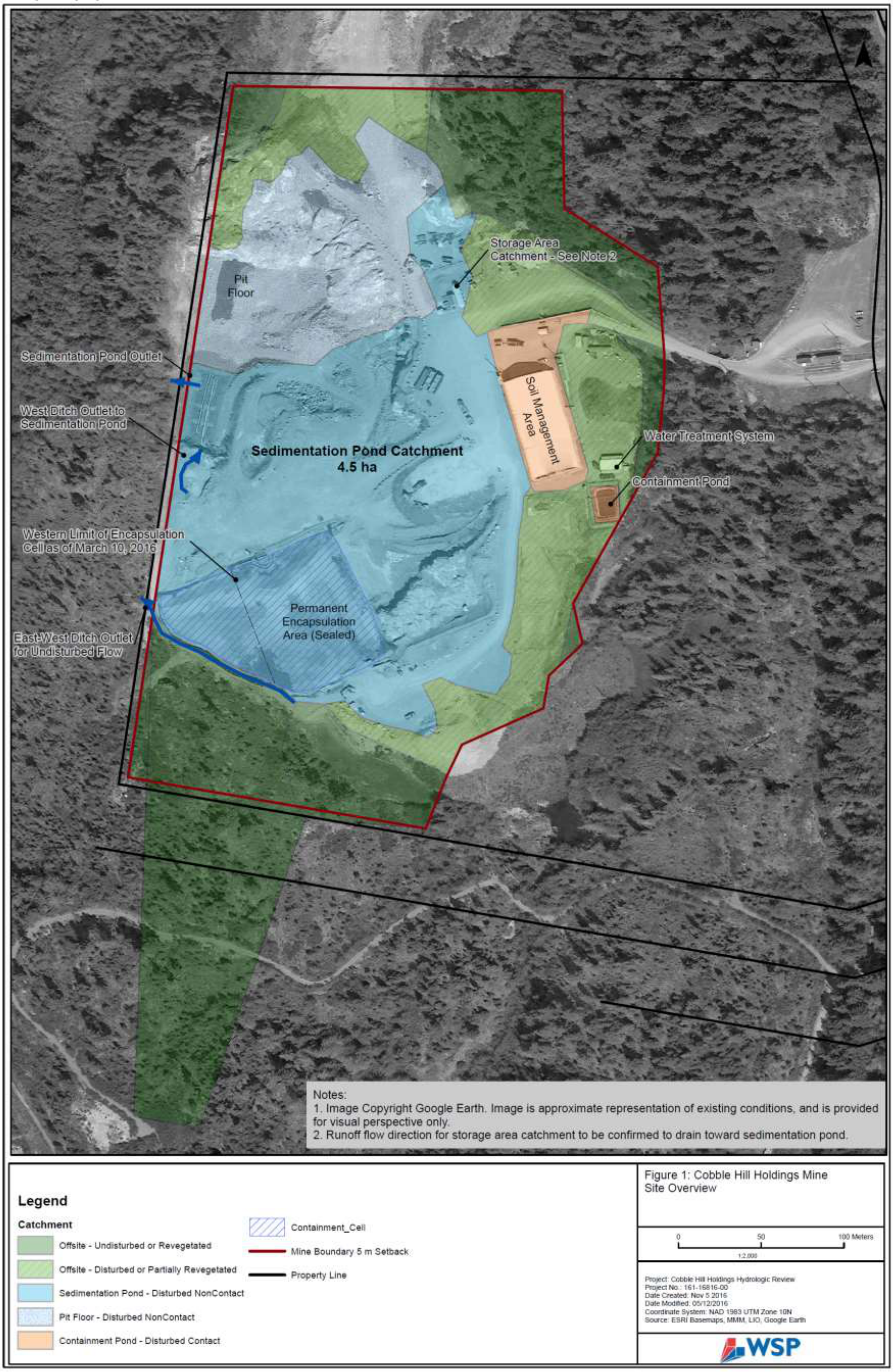


Figure 1 Site Overview

1.3 PREVIOUS SITE CONDITIONS

Site conditions during selected rainfall events have been documented to evaluate changes to the catchment extents that may impact the hydrological review. Following is a summary of the site conditions that vary from existing for each selected event:

- January 21, 2016
  - PEA partially constructed – consisted of Cell 1A and 1B,
  - SMA uncovered,
  - East-West ditch aligned to drain southern undisturbed area into settling pond,
- February 15 and 16, 2016
  - PEA partially constructed – consisted of Cell 1A and 1B,
  - SMA uncovered,
  - East-West ditch aligned to drain southern undisturbed area into settling pond,
- March 10, 2016
  - PEA partially constructed – consisted of Cell 1A and 1B,
  - East-West ditch aligned to drain southern undisturbed area into settling pond,
- October 8, 2016
  - PEA at full extents. Sand layer covering soil exposed
- October 14, 2016
  - PEA covered with temporary cover. Runoff treated as contact water,

Approximate construction dates for changes to site conditions which impacted the hydrological conditions through the year 2016 consist of the following:

→	November 25, 2015	Upper mine terrace (southeast area) regraded to condition shown in **Figure 1**,
→	February 24, 2016	Megadome fabric cover installed over SMA. Runoff from cover directed into containment pond
→	July 1, 2016	East-West ditch realigned to drain runoff from non-contact undisturbed areas off site
		PEA Cell 1C assembled and linked into contact water system
→	Late October, 2016	Sealed HDPE cover installed over PEA. Runoff from cover redirected to settling pond
→	December 2016	Eaves troughs installation on SMA cover in progress, to redirect runoff to non-contact catchment,

1.4 SITE VISITS

A site visit was conducted in preparation of this review. A site visit from Neil Hall (Hydrotechnical Engineer) and Tomas Oxland (Senior Geotechnical Engineer) was conducted on November 25th, immediately following a significant rainfall event.

1.5 SCOPE

WSP proposed the following Scope of Work to be completed by December 19, 2016:

5. Review of the contact and non-contact water management systems for the existing condition.
   a. Hydrologic and hydraulic review of the water management systems based on available rainfall and runoff data.
      i. Rainfall data to be acquired from client meteorological station as well as the Malahat Environment Canada station.
      ii. Review the hydrologic parameters considered for surface runoff calculations, including catchments areas, infiltration parameters, roughness coefficients, and design storms.
      iii. Estimate the non-contact water peak flows and volume reporting to the settling pond for the design storm.
      iv. Estimate the non-contact peak flows through the East-West and West ditches for the design storm.
      v. Estimate the contact water peak flows and volume for the design storm, as well as for 20 and 50-year return period storms.
      vi. Provide volume estimates for 20 and 50-year return period storms.
   b. Review the capacity of the water treatment system for the contact water.
   c. Review the capacity of the settling pond and leachate pond.
   d. Review the contingency plans for a single storm and/or a series of storms that exceed the design storm peak flows and/or storage volumes.
6. Review of the contact water management system for future conditions.
   a. Estimate the unit runoff rate and volume from an exposed containment cell.
7. Recommendations for rectification (if any required) of the existing system to address the instances of non-compliance with the permit requirements identified in MOE Letter Oct. 11, 2016:

a. Max Rate of Discharge exceedances Feb 15/16, Mar 10

b. Turbidity exceedances Jan 21, Feb 15, Mar 10

c. TSS exceedances Feb 15, Mar 10

d. Total Iron exceedance Jan 21, Feb 15, Mar 10

8. Recommendations for potential interim measures to mitigate the potential for exceedances while the system is being reviewed and potential changes in design are being implemented.

1.6 REFERENCES

References cited in this report are listed below:

Active Earth Engineering Ltd. (2012). *Technical Assessment for Authorization to Discharge Waste.*

British Columbia Ministry of Environment. (2015). *Technical Guidance 7, Assessing the Design, Size, and Operation of Sediment Ponds Used in Mining.*

British Columbia Ministry of Transportation. (2007). *BC Supplement to TAC Geometric Design Guide 2007 Edition.*

Environment and Lands. (2001). *Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments, Overview Report.*

Fisheries and Oceans Canada. (1993). *Land Development Guidelines for the Protection of Aquatic Habitat.*

Ministry of Environment. (2016). *British Coumbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report.*

National Resource Conservation Service. (n.d.). *Information on Rainfall, Frequency, and Distributions.* Retrieved 12 7, 2016, from USDA Natural Resources Conservation Service: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/water/manage/hydrology/?cid=stelprdb1044959

Stantec. (2015). *460 Stebbings Road - Review of West Pit Floor Cut off Ditch.*

US Army Corps of Engineers Hydrologic Engineering Center. (2000). *Hydrologic Modeling System HEC-HMS, Technical Reference Manual.*

2 DESIGN CRITERIA AND PERMIT REQUIREMENTS

2.1 DESIGN CRITERIA

Non-contact stormwater infrastructure should be designed to convey the 200-year return period rainfall event. Infrastructure includes:

- Ditches, including those conveying flow from undisturbed areas, and
- Settling pond spillway.

Contact stormwater and primary and secondary containment effluent infrastructure should be designed, at a minimum, to convey the 25-year return period rainfall event, based on best management practice;

- → Containment systems, including ponds and tanks, should have capacity for the entire storm event runoff volume, as a contingency in the event of a WTS failure.
- → Containment storage facilities (ponds and tanks) should be drawn down within 48 hours, based on best management practice as outlined in (Fisheries and Oceans Canada, 1993).

Settling pond design must meet the criteria outlined in the permit requirements.

2.2 PERMIT REQUIREMENTS

The discharge requirements for the mine contact and non-contact water systems are detailed in Permit PR 105809, Sections 1.4 and 1.5 respectively. The requirements relevant to this hydrological evaluation include the following:

- → Ancillary Discharge – Water Treatment System
  - The annual average rate of the WTS discharge if 12.1 cubic metres per day.
  - The maximum rate of the water treatment system discharge is 274 cubic metres per day.
  - The authorized discharge period is continuous.
  - The characteristics of the discharged treated effluent must be equivalent to or better than the most stringent of those British Columbia Approved Water Quality Guidelines (BCAWQG) and A Compendium of Working Water Quality Guidelines for British Columbia (BCWWQG) for Freshwater Aquatic Life (AL) protection and Drinking Water (DW) uses for the parameters of concern: Inorganic Substances including metals, VPHw, LEPHw, VHw_{6-10}, $EPHw_{10-19}$, PAHs, BTEX, Styrene, Chlorinated Hydrocarbons, Phenolic Substances, Chloride, Sodium, Glycols, pH and Oil & Grease.
  - Dioxins and Furans analysis must be conducted at a laboratory and using an analytical method agreed to by the Director and results must be below detection limit at all times.

- The source of the discharge must be limited to site stormwater runoff and water from the primary and secondary containment systems authorized under Subsections 1.2.1, 1.3.1 and 1.4.5.
- The Director may specify different standard and other substances in writing for the protection of human health or the environment.
- The authorized works are surface runoff collection and diversion ditches associated with the WTS, WTS (including pH control and flocculent injection system, settling tank, bag and activated carbon filters), leachate and leak detection reservoirs, flow measurement device, monitoring and sampling equipment, reservoirs and related appurtenances.
- The authorized works must be complete and in operation while discharging.
- The location of the facilities from which the discharge originates and the point of discharge is Lot 23, Plan VIP78459, Blocks 156, 201 and 323, Malahat Land District.

→ Ancillary Discharge – Settling Pond

- The rate of the settling pond discharge is 42,500 cubic metres per day for up to 1 in 10 year return period flood event of 24-hour duration.
- The authorized discharge period is continuous.
- The characteristics of the settling pond discharge effluent (SW-1) must be equivalent to or better than the most stringent of those BCAWQG and BCWWQG for Freshwater Aquatic Life uses and Total Suspended Solids (TSS) must not exceed 25 mg/l for up to 1 in 10 year return period flood event of 24-hour duration.
- For flood event greater than 1 in 10 year return period flood event of 24-hour duration, the characteristics of the settling pond discharge must not exceed background concentrations (SW-4)
- The source of the discharge must be limited to non-contact site storm water runoff and treated effluent released from the WTS described in Subsection 1.4.
- The Director may specify different standard and other substances in writing for the protection of human health or the environment.
- The authorized works are surface runoff collection and diversion ditches, leachate, surface runoff and leak detection control reservoirs, one surface settling pond, flow measurement device, monitoring and sampling equipment, emergency overflow and related appurtenances.
- The authorized works must be complete and in operation while discharging.
- Settled solids which have accumulated in the settling pond must be removed as required to maintain a minimum water depth below the pond decant of 0.5 metre. The removed solids must be disposed of in a manner approved by the Director.
- The location of the facilities from which the discharge originates and the point of discharge is Lot 23, Plan VIP78459, Blocks 156, 201 and 323, Malahat Land District.

3 NON-CONTACT WATER MANAGEMENT

A hydrologic review of the existing non-contact water management was completed for the disturbed portions of the site using a hydrological modeling system model (HEC-HMS). Results of the model, which include runoff rate and volume, are used to estimate the design requirements for the settling pond.

The hydraulic capacity and erosion protection requirements of site ditches were reviewed with model results for disturbed catchments and with the rational method for undisturbed catchments which extend beyond the modelled extents of the site. Details of the reviews are provided in the following sub-sections.

3.1 DISTURBED CATCHMENTS

Two disturbed catchments have been identified for the site, as indicated in **Figure 1**. Rainfall incident on the settling pond catchment drains into the pond through both the West ditch and a sub-drain system. The site grading allows for a significant amount of ponding. Runoff from the Pit Floor catchment appears to infiltrate; it is understood from the site operators that surface runoff has not been observed from the pool at the base of the pit floor.

Hydrologic modelling of the disturbed catchment is limited to the settling pond catchment since ponding in the pit floor catchment does not contribute to the peak flow into the settling pond or to overland flow offsite.

3.1.1 HYDROLOGIC MODEL, CALIBRATION, AND RESULTS

The HEC-HMS model is a hydrologic modelling system (HMS) that was developed at the Hydrological Engineering Centre (HEC) of the US Army Corps of Engineering. HEC-HMS can estimate the direct runoff rate, runoff volume, hydrologic routing through ditches, channels and water control measures from input precipitation and watershed properties.

The hydrologic model was set up to estimate runoff from the non-contact settling pond catchment using the Green-Ampt Infiltration Method to represent infiltration losses and United States Soil Conservation Service (SCS) unit hydrographs to route runoff. The catchment contributing to the non-contact settling pond was delineated using available terrain data and was modelled as a single node in HEC-HMS. The estimated extents of the 4.5 ha catchment are indicated in **Figure 1**.

Design storm events modelled to evaluate settling pond and ditch capacities include 10-Year and 200-Year frequency events with 6-Hour and 24-Hour durations, based on an SCS Type 1A rainfall distribution as recommended for coastal BC (British Columbia Ministry of Transportation, 2007). Design rainfall depths were taken from Intensity-Duration-Frequency (IDF) curve values for Environment Canada's Lake Cowichan Station. The Lake Cowichan Station was selected since the recorded annual rainfall volumes were a conservative representation of those recorded at the site. Annual rainfall volumes at other local meteorological stations with IDF curves (North Cowichan and

Victoria International Airport) are significantly less than that observed at the Site. Results generated from this rainfall data, including peak discharge and runoff volumes, are anticipated to be conservative. The 6-Hour duration was selected to represent a short rainfall event since it is the shortest duration SCS design event distributed by the Natural Resources Conservation Service. The duration is confirmed to be longer than the observed time delay between the peak rainfall and the peak settling pond discharge (around 2 hours).

The hydrologic model was calibrated and validated using the available local hydrometric and meteorological data. Rainfall data was acquired from three sources.

1. Daily rainfall accumulation from the site meteorological station. 5-Minute data was acquired where available,

2. Hourly rainfall intensity from Environment Canada Station 1014820 at Malahat,

3. 1-Minute resolution rainfall accumulation from the University of Victoria School Based Weather Station Network data for the Shawnigan Lake Station.

Two historical storm events at the site were selected for calibration and validation which occurred on November 24, 2016 and October 14, 2016. Both of these appeared to be well distributed regionally over the selected meteorological stations. Data from the site meteorological station was used where available, which included the November event; the October event was replicated with the Malahat data by applying a factor to adjust the total accumulated rainfall to match that observed at the site. Hourly site data was not available for the majority of October. The November event was used to calibrate the parameters, as it was developed with the most accurate available site data, while the October event was used as validation.

Client flow monitoring measurements at the outlet of the settling pond were used for hydrometric data. The measurements include overland flow only, and do not consider the infiltration that is understood to occur through the base of the settling pond.

Critical parameters developed through the calibration are indicated below:

- Losses: Initial Content: 0.44, Saturated Content: 0.45, Suction (mm): 100, and Conductivity: (mm/hr): 4.2
- SCS Unit Hydrograph: Peak Rate Factor 200, and Time to Peak (min): 135

Results from the hydrologic model are presented in **Table 1**.

3.1.2 WEST DITCH CAPACITY

The West Ditch drains runoff from a portion of the disturbed catchment into the settling pond. Since the ditch’s exact catchment extents are not evident from the available terrain data, the ditch capacity evaluation assumes that the entire settling pond catchment drains through the ditch, to provide a conservative evaluation.

Table 1 HEC-HMS Model Results

Event	Total Rainfall (mm)	Rainfall Duration (hr)	Peak Discharge** (m^3/s)	Runoff Volume** (m^3)
24-Nov-16	28	8	0.0084	250
24-Nov-16 Including Antecedent Precipitation	59	24	0.0084	400
14-Oct-16	84	20	0.013	680
14-Oct-16 Including Antecedent Precipitation	169	48	0.013	850
10-Year 6-Hour	52	6	0.037	1070
10-Year 24-Hour	122	24	0.048	1460
200-Year 6-Hour	67	6	0.059	1750
200-Year 24-Hour	169	24	0.083	3040

** Measurement taken from outlet for historical events

The ditch design capacity is estimated from the 200-Year 24-Hour modelling results, with a 1.2 safety factor included to account for other potential hydrologic conditions such as snow melt, as well as to account for the infiltration losses which are understood to occur within the settling pond. The design discharge is estimated to be 0.10 m^3/s.

The West ditch is riprap armoured with a 0.12 m/m longitudinal slope. Measurements of a typical cross section indicate it has a 1 m base width, 1.5:1 side slopes, and 0.9 m height. The design water level in the ditch is estimated to be 0.12 m, based on a Mannings Roughness n of 0.1. The estimated peak flow velocity is less than 1 m/s as a result of the riprap roughness and flow depth. **The West ditch capacity is adequate for the computed design discharge.**

3.1.3 SETTLING POND CAPACITY

The settling pond capacity was reviewed by estimating the settleable particle size based on the modelled 10-year 24-hour discharge and the pond cross sectional area at the 10-year overflow elevation. The calculation was completed based on a modified Stokes' Law as indicated below. Estimated values for parameters are provided in parentheses:

$$Settling\ Velocity\ V_s = \frac{g}{18\mu}(SG-1)D^2$$

$$Pond\ Surface\ Area\ A_p = SF\frac{Q_p}{V_s}H$$

Where g is the acceleration of gravity, µ is the kinematic viscosity (0.0175 cm^2/s), SG is the specific gravity (2.45), D is the particle diameter, SF is a safety factor (1.5) to account for non-spherical particle shapes, Q_p is the design discharge (0.048 m^3/s), and H is the settling depth, taken to be the depth of the pond (1.6 m). The effective pond surface area is estimated to be 720 m^2 at 318 m elevation, which is the approximate 10-year overflow elevation. The surface area was estimated based on survey derived terrain data.

Based on these calculations, the settling pond should be capable of settling 19 µm sized particles during a design event incident on the existing catchment area. The BC Technical Guidance 7 (British Columbia Ministry of Environment, 2015) recommends designing for a 10 µm sized particle if a particle size distribution is unknown. **A review of the typical sediment particle size distribution observed during a large rainfall event will be required to confirm if the settling pond design meets the permitted requirement of TSS concentrations not exceeding 25 mg/l for a design event. The review should also assess pond functionality for future catchment expansion.**

The discharge rate of the settling pond is measured at the outlet, which may not be a precise measurement of the discharge into the pond from the site, since conversations with the site operations personnel indicate that a portion of the water in the settling pond infiltrates. Outflow from the pond is often not observed despite discharge at the inlet. The measured pond discharge rate will increase with time (per unit catchment size) if the infiltration rate decreases as a result of the soil and rock pore spaces filling with sediment. Conversations with site personnel indicate that the pond may be experiencing increased discharge in past year, which may be a result of reduced infiltration. **The settling pond capacity should be reevaluated in the future if changes in the flow properties are observed to continue. In addition, permeability tests could estimate the location and rate of infiltration. However, ignoring the infiltration rate provides a more conservative estimate for size the settlement pond.**

The settling pond spillway was reviewed during the November 2016 site visit. The chute slope, rock size, and riprap thickness were observed to be deficient. It is recommended that **the spillway design and armouring should be reviewed and redesigned as soon as possible to provide adequate erosion protection.**

The effectiveness of the settling pond is impacted by the location of the outlet orifices, which are near the bottom of the pond. As a result, the pond provides a small volume of detention storage and most likely discharges partially settled sediment. **The outlet water quality can be improved if the orifices are raised or removed, to discharge water from the pond surface. In general, live storage is not required in a sedimentation pond**.**The impact of a higher normal water level on the pond berms would need to be evaluated.**

The total runoff volume for a 10-Year 24-Hour rainfall event is estimated to be 1460 m^3, which is approximately 1.5 times greater than the settling pond volume, 985 m^3, at the 10-Year design water level (approximately 318 m). The BC Technical Guidance 7 (British Columbia Ministry of Environment, 2015) recommends a residence time of 20 hours for a design event. **The existing settling pond should be capable of providing approximately 16 hours of residence time as long as the outfall orifices are sized appropriately and located higher to provide a deep**

retention volume. A sediment storage volume is not considered in this calculation, which assumes that sediment is regularly removed from the pond.

3.1.4 SETTLING POND DISCHARGE CONSTRAINTS

The peak settling pond discharge is limited to the permitted 42,500 m^3/day for a 10-year 24-Hour event. The discharge is significantly larger than the modelled discharge for the same design event and the existing catchment area. **The permitted discharge constraint is not anticipated to be exceeded for the site's current mine boundary, based on existing runoff rates.**

3.2 UNDISTURBED CATCHMENTS

Undisturbed catchments include those which have not been altered by the mine development, as well as those which have been revegetated. In general, flow from undisturbed catchments drains uncontrolled offsite. Along the southern portion of the site, the East-West ditch has been constructed to redirect flow from an undisturbed catchment around the disturbed portion of the site. An estimate of the design capacity of this ditch is provided in the sub-section below.

The site includes disturbed areas, some of which have been partially revegetated, that drain, uncontrolled, off site, as indicated in **Figure 1**. **Those areas should be reviewed; areas in use should be regraded to drain toward the settling pond where possible (an exception is the access road), while other areas should be revegetated.**

3.2.1 EAST-WEST DITCH CAPACITY

The design capacity of the East-West Ditch, which redirects non-contact undisturbed runoff around the site, has been estimated using the Rational Method for a 200-year rainfall event, based on recommendations outlined in the BC Supplement to TAC Geometric Design Guideline (British Columbia Ministry of Transportation, 2007). Time of concentration was estimated using methodology from the Guideline. 15 minutes was found to be a reasonable, conservative estimate. Rainfall intensity was estimated from the Lake Cowichan IDF curves. Values for a 200-year event were approximated by extrapolating from the 50 and 100-year event curves for a particular duration. The HEC-HMS model calibration was not used to estimate a peak discharge since the catchment is outside the modelled extents of the site. Critical parameters and results include:

- → Catchment Area — 2.0 ha
- → Time of Concentration for small natural undeveloped catchments — 15 minutes
- → Runoff Coefficient for moderate slope with snowmelt — 1.1
- → Rainfall Intensity (approximated) — 32.1 mm/hr
- → Design Discharge — 0.27 m^3/s

The design water level in the East-West ditch was estimated to be 0.2 m for the average ditch slope of 0.15 m/m, with 2H:1V side slopes and a 0.3 m base width. The riprap ditch armouring was estimated to have a Mannings Roughness n of 0.06. The estimated peak flow velocity is 1.5 m/s.

The existing ditch geometry appears to be sufficient for the design discharge, with a bank height of approximately 0.3 m. The ditch does not appear to have any erosion concerns to date. **The riprap armouring in the lower portions of the ditch where flow is concentrated could be supplemented to increase the thickness and should extend to the full height of the ditch. The ditch should be monitored for erosion concerns following major rainfall events. Additional rock could be added if the existing riprap appears to be impacted by the flow.**

4 CONTACT WATER MANAGEMENT

The hydrological review of the contact water management system assesses the runoff volumes from the existing catchment, as well as projects the unit containment volume requirements for future encapsulation areas. Calculations are based on the projected runoff from a 25-year return period rainfall event, as a minimum requirement based on best management practice. The results are compared against runoff volumes from a 50-year return period rainfall event to assess the impact of a more severe event.

The existing contact water catchment consists of the wheel wash facility and the containment pond, as well as minor seepage from the covered SMA. Runoff from the SMA cover was excluded to represent the near future condition when eaves troughs will redirect runoff to non-contact catchments. Installation of eaves is in progress. Other sources of contact water have been eliminated, at present, since the encapsulation area is sealed and the SMA is covered. Additional catchment area will be added to the system when new encapsulation areas are constructed.

4.1 HYDROLOGIC CALCULATIONS

Hydrologic calculations for the contact water management catchment consist of estimating the runoff volume for a design event. The containment facilities (currently a containment pond with supplementary storage tanks brought in when necessary) should be sized to contain the entire design event runoff volume. The capacity of the WTS to draw down the containment facilities during an event is not considered, to evaluate the “worst case” scenario where the WTS is not operational.

The runoff depth for a design event is estimated to be 100% of the rainfall depth for all contact water management catchment areas. This estimate is reasonable for impermeable graded surfaces such as the wheel wash and the containment pond. The estimate is conservative for future encapsulation areas with temporary covers since some runoff will penetrate the cover and infiltrate into the soil.

Runoff depths from 25-Year and 50-Year 24-Hour events are estimated to be 136 and 147 mm respectively, based on IDF data from the Environment Canada Lake Cowichan Station. As indicated previously in **Section 3.0**, the Lake Cowichan Station was selected since the recorded annual rainfall volumes were a conservative representation of those recorded at the site. Annual rainfall volumes at other local meteorological stations with IDF curves (North Cowichan and Victoria International Airport) are significantly less than that observed at the Site. Results generated from this rainfall data, including runoff volumes, are anticipated to be conservative.

4.2 CONTACT WATER RUNOFF VOLUMES

Runoff volumes for the existing and future contact water catchments are indicated in **Table 2**, based on a 0.2 ha contact water catchment area. The volumes are determined from the design runoff depths for 25-year and 50-year 24-hour events, as indicated previously.

Table 2 Contact Water Runoff Volumes

Catchment	Total Area (ha)	25-Year Event (m^3)	50-Year Event (m^3)
Wheel Wash and Containment Pond	0.2	272	294
Future Encapsulation (unit area)	0.1	136	147

The existing containment pond is estimated to have a total volume of 320 m^3, based on survey data provided by the client. The pond high water level (HWL) is defined by the inlet pipe from SMA piped drainage system, which is approximately 0.5 m below the top of bank. Approximately 206 m^3 of storage is available below the HWL. Sediment accumulated in the pond is assumed to be cleaned out regularly. **The pond storage volume, with freeboard included, is adequate to contain runoff from the existing contact water catchment for a design event. Additional storage will be required for future encapsulation cell construction.** The additional volume can be determined from **Table 2**, based on projected future encapsulation cell footprints.

4.3 WATER TREATMENT SYSTEM DISCHARGE CONSTRAINTS

The discharge requirements for contact water management are laid out in the mine permit, which limit the maximum rate of discharge to 274 m^3/day and the annual average rate of discharge to 12.1 m^3/day. The sub-sections below evaluate the anticipated rate of discharge during a design event for the existing condition, and project if a change to the permit criteria may be required in the future.

4.3.1 MAXIMUM RATE OF DISCHARGE CONSTRAINT

The WTS Maximum Rate of Discharge during a design event is determined based on the maximum storage drawdown period following a design event. Best management practice suggests that 48 hours is a reasonable drawdown period, to reduce the risk that back-to-back events exceed the storage capacity. The maximum allowable contact water catchment is estimated to be 0.40 ha, which is calculated from the design event runoff depth as indicated below:

$$Maximum\ Contact\ Water\ Catchment = \frac{274\frac{m^3}{day} * 2\ days * 10000\ m^2/ha}{136\ mm * 1000\ mm/m} = 0.40\ ha$$

The existing contact water catchment area is approximately 0.20 ha. The permitted Maximum Rate of Discharge should be increased if future additional unsealed encapsulation areas will exceed 0.20 ha.

It should also be noted that this constraint is dependent on sufficient containment storage volume being available. The WTS discharge rate should be limited to not exceed the currently permitted Maximum Rate of Discharge unless runoff is approaching the storage capacity of the containment system. The intent is to have "checks" on the system to ensure the Maximum Rate of Discharge is exceeded only when absolutely necessary.

4.3.2 ANNUAL AVERAGE RATE OF DISCHARGE CONSTRAINT

The WTS Annual Average Rate of Discharge (AARD) is determined based on the average contact water catchment area throughout a given year, as well as the maximum annual rainfall depth. A design maximum annual rainfall depth was selected based on 40 years of records from the Environment Canada Lake Cowichan meteorological station, where years with missing rainfall measurements were removed. The largest recorded annual rainfall was 2711 mm, for the year 1997.

A revised AARD should be calculated for the site once the future maximum contact water catchment has been projected. The calculation methodology is indicated in the equation below, where A is the future maximum unsealed PEA footprint. The equation assumes a runoff coefficient of 1.0.

$$AARD = Existing\ Catchment\ Discharge + Future\ Unsealed\ PEA\ Discharge$$

$$= \frac{2711 \frac{mm}{year} * 0.2\ ha}{36.5} + \frac{2711 * A}{36.5} = 14.8 + 74.3A\ m^3/day$$

The permitted WTS AARD should be increased, based on this calculation methodology, with consideration given to the footprint of future unsealed encapsulation cells.

5 HISTORICAL NON-COMPLIANCE EVENTS

This section of the report provides comments relating to the permit non-compliance events identified in the October 11, 2016 MOE letter.

5.1 WATER TREATMENT SYSTEM MAXIMUM RATE OF DISCHARGE

In the first quarter report for 2016 there were three days when the daily rate of discharge from the WTS exceeded the permitted maximum of 274 m^3/day. The exceedances occurred on:

- February 15, 2016 – 331 m^3/day
- February 16, 2016 – 303 m^3/day
- March 10, 2016 – 344 m^3/day

The two days of exceedance in February coincided with a heavy rainfall event of over 90 mm in a day. Figure 2 shows the daily WTS discharge and the daily precipitation for the six days preceding the February 15/16 exceedance. Similarly the exceedance in March followed a heavy rainfall event of over 80 mm as shown in Figure 3.

Corrective Action Taken To Address Flow Exceedances:

A review of the flows to the WTS indicated that water other than contact water had been entering the WTS resulting in flows exceeding the capacity of the system. SIRM has already constructed a roof over the soil area and is in the process of attaching a gutter system to direct this source of non-contact away from the WTS.

Figure 2 Daily Discharge February 9-18, 2016

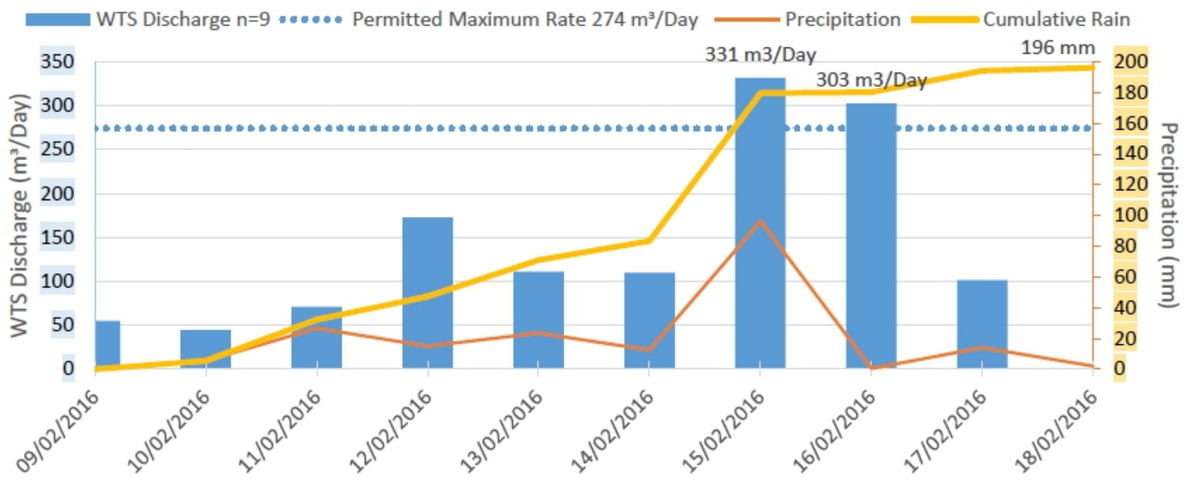
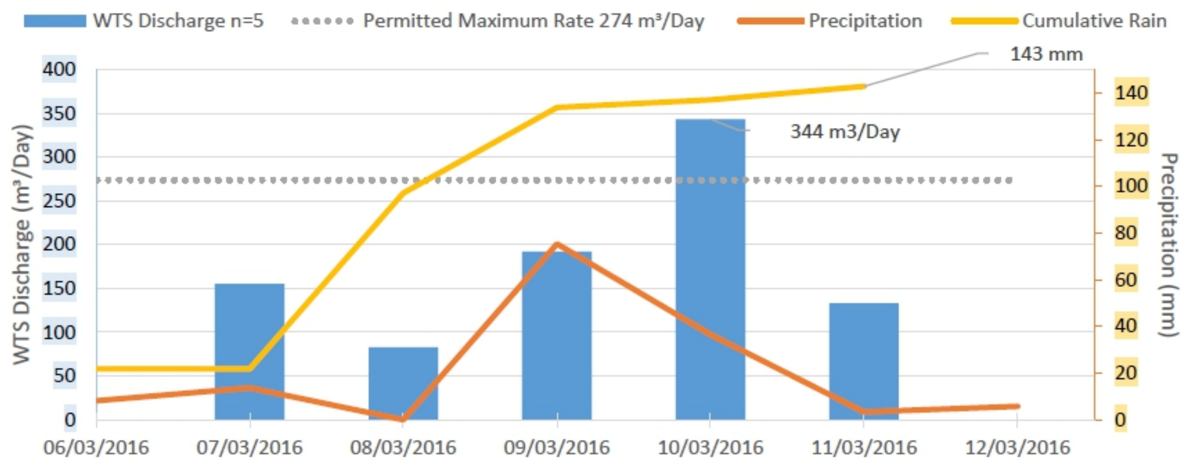


Figure 3 Daily Discharge March 6-12, 2016



5.2 SETTLING POND DISCHARGE TURBIDITY & TSS

In the first quarter report for 2016 there were three days when the discharge turbidity exceeded the Aquatic Life (AL) guideline of 1 NTU above background. On two of those days the Total Suspended Solids (TSS) also exceed 25 mg/L. The exceedances occurred on:

- January 21, 2016 – 31.7 NTU
- February 15, 2016 – 27.7 NTU & 43 mg/L
- March 10, 2016 – 89.0 NTU & 45 mg/L

All three turbidity events and the two TSS events were associated with heavy rainfall resulting in non-contact disturbed water (from the active mine footprint) rich in particulate draining directly to the settling pond. Normally, there is sufficient time for the particulate to settle out in the settling pond. However, during heavy rainfall events the residence time in the settling pond is shorter resulting in a smaller reduction in the turbidity.

Corrective Action Taken To Address Turbidity Exceedances:

The first step was to evaluate the adequacy of the current settling pond. Section 3.1.3 of this report provides estimates of the current settling pond capacity. Moving forward, the next step will be to determine the actual particle size distribution in runoff from the site during a heavy rainfall event. With the particle size distribution it will be possible to provide a better estimate for a suitable settling pond size. This may result in a need to increase the capacity of the settling pond.

5.3 TOTAL IRON

In the first quarter report for 2016 there were three days when the Total Iron exceeded 1 mg/L guideline. The exceedances occurred on the same days as the Turbidity exceedances:

- January 21, 2016 – 1.61 mg/L
- February 15, 2016 – 2.16 mg/L
- March 10, 2016 – 4.47 mg/L

Total iron samples from the WTS in January, February and March were all below 0.31 mg/L (see Table 3 below). Thus the source of the excess iron is from the non-contact water draining from the mine operations.

Table 3 Total Iron from the WTS January to March 2016

SAMPLES	TOTAL IRON CONCENTRATION (mg/L)			
	January 27, 2016*	February 15, 2016	February 24, 2016	March 8/16, 2016
Aux 1A	0.19 (0.12)	0.02	0.23	<0.01
Aux 1B	0.31 (0.12)	0.16	0.12	0.12

*Note: values in brackets were for a duplicate sample set

Corrective Action Taken To Address Total Iron Exceedances:

Elevated levels of iron are believed to be naturally occurring from the mine pit. Thus the heavy turbidity loading from the non-contact mine water likely contains suspended iron particles. Analysis to verify the proportion of dissolved and suspended iron will confirm if a reduction in the TSS and turbidity will be sufficient to keep total iron levels below the 1 mg/L guideline.

5.4 SOURCE OF DISCHARGE

During October the PEA encapsulation was underway. A layer of sand was placed over the area as the base for a geomembrane. However, on October 8, 2016 heavy rains caused the uncovered sand to erode and flow down the PEA slope, interfering with the contact water collection system and exposing bare areas of the PEA surface. The contact water conveyance system for the PEA filled with sand, causing the untreated contact water to bypass the WTS system and flow with non-contact stormwater into the settling pond and to ultimately discharge to the environment.

In spite of the collection ditch failure, the leachate collection remained intact with authorized works consistent with the requirements of permit PR 105809.

Analysis results for the samples collected on October 8, 2016 of the Contact Water, Discharge Weir and SW1 (the ephemeral creek where the settling pond discharges) is included in Appendix D. Elevated levels of Total Iron and Total Copper were apparent at all three sample locations.

Corrective Action Taken To Address The Contact Water Bypassing the WTS:

The PEA is now completely enclosed with 40mil LLDPE liner as per section 1 of the October 12, 2016 Pollution Prevention Order.

6 SUMMARY

Below is a concise summary of the report results and conclusions:

→ Non-Contact Water

- The existing West ditch geometry is sufficient for the design discharge; the ditch does not appear to have any erosion concerns to date.
- The existing East-West ditch geometry appears to be sufficient for the design discharge, and the ditch does not appear to have any erosion concerns to date. The riprap armouring in the lower portions of the ditch where flow is concentrated could be supplemented to increase the thickness and should extend to the full height of the ditch.
- The site includes disturbed areas, some of which have been partially revegetated, that drain, uncontrolled, off site. Those areas should be reviewed; areas in use should be regraded to drain toward the settling pond where possible (an exception is the access road), while other areas should be revegetated.

- The settling pond is estimated to have the capacity to settle a 19 µm sized particle provided that the outlet engages sufficient storage, based on Stokes' Law calculations, with a 1.5 safety factor and flow measurements from the pond outlet. The existing settling pond should be capable of providing approximately 16 hours of residence time as long as the outfall orifices are sized appropriately and located higher to provide a deep retention volume. The following additional items were noted with respect to settling pond operation:
  - A review of the typical sediment particle size distribution observed during a large rainfall event will be required to confirm if the settling pond design meets the permitted requirement of TSS concentrations not exceeding 25 mg/l for a design event.
  - Conversations with the site operations personnel indicate that a portion of the water in the settling pond infiltrates. The measured pond discharge rate will increase with time (per unit catchment size) if the infiltration rate decreases as a result of the soil and rock pore spaces filling with sediment. This change will reduce the effectiveness of the pond; the impact should be considered in future design changes.
  - Settling pond capacity should be reviewed prior to future increases in catchment.
  - The settling pond spillway chute slope, rock size, and riprap thickness were observed to be deficient during a site visit. The spillway design and armouring is recommended to be reviewed and redesigned as soon as possible to provide adequate erosion protection.
  - The effectiveness of the settling pond is impacted by the location of the outlet orifices, which are near the bottom of the pond. As a result, the pond provides a small volume of detention storage and most likely discharges partially settled sediment. The outlet water quality can be improved if the orifices are raised.
- The settling pond permitted maximum discharge of 42,500 m^3/day is significantly greater than the design discharge volume for the existing catchment extents. The constraint is not anticipated to be exceeded for the site's current mine boundary based on existing runoff rates.

→ Contact Water

- The design runoff depth for contact water catchment is estimated to be 136 mm, based on a 25-year 24-hour design event. Storage should be provided for 100 % of the runoff volume.
- The existing containment pond storage volume, with freeboard included, is adequate to contain runoff from the existing contact water catchment for a design event. Additional storage will be required for future encapsulation cell construction.
- The permitted Maximum Rate of Discharge should be increased if future encapsulation areas will exceed an additional 0.20 ha, based on a 48-hour drawdown of the stored contact water. This constraint is dependent on sufficient containment storage volume being available.
- The permitted Annual Average Rate of Discharge, 12.1 m^3/day, is not sufficient for the existing contact water catchment, based on calculations using measured rainfall volumes for the year 1997 (peak recorded rainfall year) at Lake Cowichan. These calculations show that the permitted annual average discharge rate is not sufficient for an extreme rainfall year. The permitted discharge rate should be increased to 14.8 m^3/day to cover the existing drainage area, with consideration given to the footprint of future encapsulation cells (additional discharge rate equivalent to 74.3 m^3/ha-day).
- The WTS discharge rate should be limited to not exceed the Maximum Rate of Discharge unless runoff is approaching the storage capacity of the containment system. The intent is to have "checks" on the system to ensure the Maximum Rate of Discharge is exceeded only when absolutely necessary.

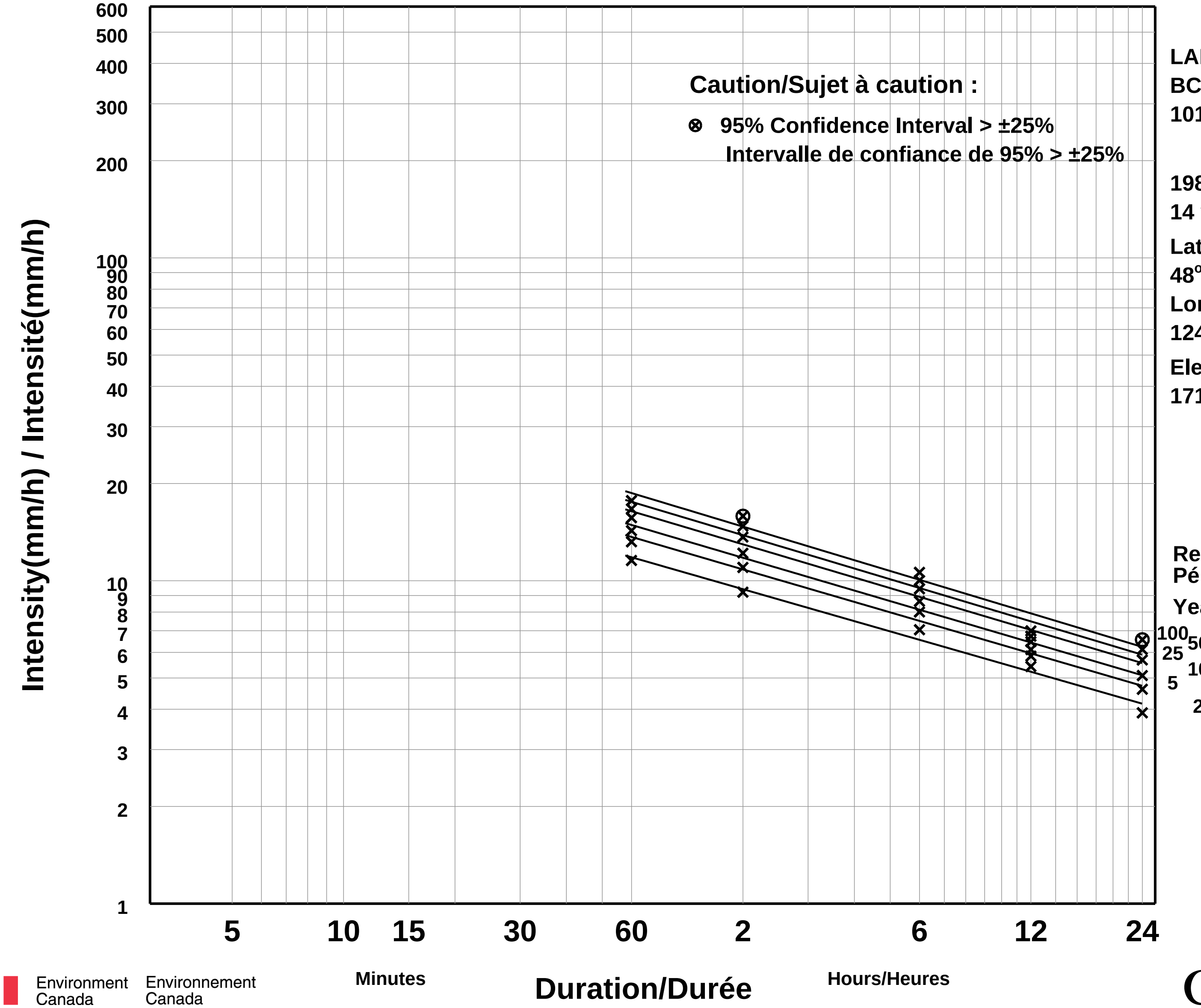
Appendix A

LAKE COWICHAN IDF DATA

Short Duration Rainfall Intensity−Duration−Frequency Data

2014/12/21

Données sur l’intensité, la durée et la fréquence des chutes de pluie de courte durée



LAKE COWICHAN
BC
1012055

1983 − 2002
14 years / ans

Latitude
48° 50’N

Longitude
124° 3’W

Elevation / Altitude
171 m

Return Periods/
Périodes de retour

Years / ans

Environment Canada Environnement Canada

Canada

Appendix B

SITE PHOTOS

Photo 1: Site overall view, with SMA and encapsulation cell in the distance. Looking South (1 of 2)

Photo 2: Site overall view, with sedimentation pond in the distance. Looking South. (2 of 2)

Photo 3: Close up of inlets for sedimentation pond. Looking South

Photo 4: Close up of outlet and overflow of sedimentation pond. Looking West.

Photo 5: Close up of outlet pipes of sedimentation pond.

Photo 6: West ditch to sedimentation pond. Looking North.

Photo 7: Upstream end of East-West Ditch with encapsulation cell. Looking West.

Photo 8: Downstream end of East-West Ditch with encapsulation cell. Looking East.

Photo 9: Outlet of East-West Ditch looking West.

Photo 10: Pit floor overall view, with ponding. Looking North-West

Appendix C

REGULATORY CORRESPONDENCE

BRITISH COLUMBIA

Reference: 305282 File: 105809

November 4, 2016

Cobble Hill Holdings Ltd. (BC0754588)
Location address:
460 Stebbings Road
Shawnigan Lake BC V0R 2W3

Mailing address:
10-536 Herald Street
Victoria BC V8W 1S6

Email: marty.sia@shaw.ca

Dear Mr. Block:

Re: Suspension or Cancellation of Permit 105809

Thank you for your letter of October 13, 2016, which provided your response for my consideration regarding the status of Permit 105809.

Your letter is not directly responsive to the specific instances of non-compliance with the permit requirements that were identified in my letter of October 11, 2016, which I enclose again for your reference. Your response also did not clarify your specific intentions to rectify the non-compliances.

The non-compliances related to the updated closure plan, revised cost estimate, revised security, and reports detailing the review of contact and non-contact water management systems, are significant in nature and must be addressed in a timely manner.

I am affording Cobble Hill Holdings Ltd. the opportunity to submit information to me by December 20, 2016, which specifically addresses the non-compliant requirements identified. I will reserve my decision regarding the status of Permit 105809 at this time.

Lastly, I disagree with some of the background information provided in your letter and have asked ministry staff to follow up with you accordingly on these matters.

Yours truly,

Mary Polak
Minister

Enclosure

Date: October 12, 2016 File: 108608

Cobble Hill Holdings Ltd. (BC0754588)
Herald Street Law
101 - 536 Herald St
Victoria BC V8W 1S6

POLLUTION PREVENTION ORDER

I have reason to believe that an activity or operation is being performed by Cobble Hill Holdings Ltd. (BC0754588) ("**Cobble Hill Holdings**") in a manner that is likely to release a substance that will cause pollution from a property at 460 Stebbings Road, Shawnigan Lake, BC, V0R 2W3, legally described as Lot 23, Block 156, 201 Plan VIP78459, Malahat Land District, & BLK 323 (the "**Property**"). The Property and the landfill operation on the Property is owned and/or operated by Cobble Hill Holdings.

On October 8, 2016, Rahim Gaidhar, South Island Resource Management, reported a spill of untreated contact water onto the Property (DGIR 161899). That day, Conservation Officer Sergeant Scott Norris attended and confirmed with Mr. Gaidhar that heavy precipitation resulted in the erosion of a sand layer on top of the landfill. The eroded sand obstructed the contact water collection ditches and approximately 3000 to 6000 gallons of untreated contact water spilled onto the Property, mixed with non-contact water, flowed into the settling pond and subsequently discharged to the environment.

Subsequent inspection conducted by Ministry of Environment Compliance staff (IR 30547) has determined that Cobble Hill Holdings was in non-compliance with Permit 105809 due to the discharge of untreated contact water into the settling pond.

I understand that the contaminated soil remains on site in the landfill facility, without a final cover and with sand on the surface of the landfill.

As of October 11, 2016, Environment Canada has issued a Special Weather Statement calling for heavy rain on Vancouver Island, and the winter wet weather season has commenced.

Therefore based on the review of available information, I am satisfied on reasonable grounds that the operation of Cobble Hill Holdings is being performed in a manner that is likely to release untreated contact water from the Property into the environment and cause pollution.

Pursuant to Section 81 of the *Environmental Management Act*, [SBC 2003], c. 53 (the "**Act**") Cobble Hill Holdings is hereby ordered to comply with the following requirements:

1. Immediately take action, under the direction of a Qualified Professional, to continue with implementation of cleanup activities, mitigation measures, site restoration, and management actions in order to prevent any further discharge of untreated contact water to the environment, including the following actions by 11:59 P.M. PST on October 12, 2016:

    a. Cover the landfill areas completely with weighted and secured impermeable cover, and provide sufficient weather protection for the cover in order to ensure its effectiveness;

    b. Maintain, and if necessary construct, appropriate lined ditching and/or other collection and conveyance systems to capture all contact water so it can be managed in accordance with Permit 105809; and

    c. Ensure appropriate contingency measures are in place to manage contact water, including but not limited to, provision of additional onsite storage capacity and arrangement of backup transport for contact water to other authorized facilities, in the event that this is needed.

2. Conduct ongoing inspection and monitoring activities at the site as follows:

    a. Conduct ongoing inspection of the landfill cover and contact water collection system as needed to ensure they remain in place and functional, and maintain documentation of inspection activities for review by the Director upon request;

    b. Monitor and sample the quantity (24 hr volume in m^3/d) and quality of effluent discharged from the settling pond outlet (site E292898) on a daily basis when there is a discharge from the settling pond, in accordance with procedures and parameters listed in Permit 105809; and

    c. Estimate the flow of the ephemeral creek immediately downstream of the settling pond outlet (site E305365) daily, and collect a daily water quality sample when there is a discharge from the settling pond.

In this order, a "Qualified Professional" means an applied scientist or technologist specializing in an applied science or technology applicable to the duty or function, including, if applicable and without limiting this, agrology, biology, chemistry, engineering, geology or hydrogeology and who

a) is registered with the appropriate professional organization, is acting under that organization's code of ethics and is subject to disciplinary action by that organization, and

b) through suitable education, experience, accreditation and/or knowledge, may be reasonably relied on to provide advice within their area of expertise.

This order will remain in effect until instructed otherwise in writing by the Director. This order does not supersede monitoring requirements of Permit 105809 and all conditions and requirements of the permit remain in effect. Monitoring that is conducted as a requirement of Permit 105809 and that satisfies the monitoring requirements of the order will be accepted to avoid duplication.

Failure to comply with the requirements of this order is a contravention of the *Environmental Management Act* and may result in legal action. I direct your attention to Section 120(10) of the *Environmental Management Act*, which reads:

> "(10) A person who contravenes an order...that is given, made or imposed under this Act by a ...director...commits an offence and is liable on conviction to a fine not exceeding $300 000 or imprisonment for not more than 6 months, or both."

Failure to comply with the requirements of this order may also result in an administrative penalty under the Administrative Penalties Regulation (*Environmental Management Act*) (B.C. Reg 133/2014) (Regulation). I direct your attention to Section 12(4) of the Regulation, which reads:

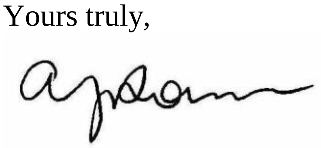
> "(4) A person who fails to comply with an order under the [*Environmental Management*] Act is liable to an administrative penalty not exceeding $40 000."

This order does not authorize entry upon, crossing over, or use for any purpose of private or crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with you. It is also your responsibility to ensure that all activities are carried out with due regard for the rights of third parties, and comply with other applicable legislation that may be in force, such as municipal bylaws relating to the discharge of waste to municipal storm or sanitary sewers.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date notice is given. For further information, please contact the Environmental Appeal Board at 250 387-3464.

If you have any questions, please call the undersigned or Laura Hunse at 250 751-3224.

Yours truly,



A.J. Downie, M.Sc., P.Ag.
For Director, *Environmental Management Act*

cc: Environment Canada
Jim Dunkley, Ministry of Energy & Mines
Gord Hitchcock, Conservation Officer Service

October 11, 2016

File: 105809

Cobble Hill Holdings Ltd. (BC0754588)
Location address:
460 Stebbings Road
Shawnigan Lake BC V0R 2W3

Mailing address:
10-536 Herald Street
Victoria BC V8W 1S6

Email: marty.sia@shaw.ca mike.sia@shaw.ca

Dear Mr. Martin Block and Mr. Michael Kelly,

Re: Suspension or Cancellation of Permit PR 105809

Pursuant to section 18(3)(c) of the *Environmental Management Act* [SBC 2003], c. 53 (the "**Act**"), I am considering suspending or cancelling Permit PR-105809 (the "**Permit**") held by Cobble Hill Holdings Ltd. (the "**Permitee**") for failure to comply with the terms of the Permit. Specifically, the following requirements of the Permit are outstanding and are in a state of non-compliance:

- Quarterly reporting by the Permittee has identified non-compliance with regards to the Permit limits for discharge water quality, as follows:
    - *Section 1.4.2* Maximum rate of discharge from the water treatment system was exceeded on February 15 and 16, and March 10, 2016 with rates of 331, 303 and 344 m^3/day respectively (2016 Q1 Report, p. 16)
    - *Section 1.5.3* Settling pond discharge turbidity results exceeded the aquatic life (AL) guideline of 1 NTU above background on January 21, February 15 and March 10, 2016 with values of 31.7, 27.7 and 89.0 NTU respectively. Total Suspended Solids (TSS) permit limit of 25 mg/L was exceeded with values of 43 and 45 mg/L on February 15 and March 10, 2016.
    - *Section 1.5.3* Total Iron exceeded 1 mg/L guideline on January 21, February 15 and March 10, 2016 with concentrations of 1.61, 2.16 and 4.47 mg/L (2016 Q1 Report, pp. 17-18).
- The Director has not received an updated closure plan, which the Permittee was required to submit by July 29, 2016;
- The Director has not received a revised cost estimate for the closure plan, which the Permittee was required to submit by July 29, 2016;
- The Director has not received revised security in accordance with the cost estimate, which the Permittee was required to submit by July 29, 2016;

- The Director has not received a report detailing the review of non-contact water management systems, which the Permittee was required to submit by August 31, 2016, nor has the director received the related interim deliverables; and
- The Director has not received a report detailing the review of contact water management systems, which the Permittee was required to submit by September 30, 2016, nor has the director received the related interim deliverables.

Given the rain event that occurred on October 8, 2016, I am informed by ministry staff that the management of contact water on the site by the Permittee was not in accordance with the requirements of the Permit, as follows:

- Section 1.5.3 The source of the discharge must be limited to non-contact site stormwater runoff and treated effluent released from the WTS described in Subsection 1.4.

The permittee allowed contact water to discharge into the settling pond, which is contrary to the permit requirement.

In accordance with section 18(6) of the Act, a permit that is suspended or cancelled is not a valid and subsisting permit or approval.

With this letter, I am providing you with notice and the opportunity to provide comments to me, prior to making my decision. Please provide any comments, along with any other relevant information that you think should be taken into consideration, by no later than **4:30 p.m. on October 14, 2016**.

Yours truly,

Mary Polak

Mary Polak
Minister

Appendix D

OCTOBER 8, 2016 SAMPLE ANALYSIS DATA

Analytic Results			CONTACT WATER	E292898 ANCILLARY DISCHARGE	E305365 SW-1		
Laboratory ID	BCAWWQG[2]		**6100550-01**	**6100550-02**	**6100550-03**	**6100550-04**	**6100550-06**
Sample ID			**PEA**	**Weir**	**SW1**	**SW1**	**SW1**
Date Sampled/Time			**08-Oct-16/10:00**	**08-Oct-16/11:15**	**08-Oct-16/11:00**	**08-Oct-16/18:00**	**09-Oct-16/9:00**
Physical Tests							
Colour, True (Colour Units)	**15 [4] units absolute, or 5 units above background**		8	14	<5	<5	<5
Conductivity (uS/cm)	**-**		1390	275	1360	861	1060
Hardness (as CaCO3)	**-**		651	98.6	479	345	413
pH	**-**		6.72	7.35	7.22	7.33	7.26
Total Suspended Solids (mg/L)	**25 mg/L above background (24-hr during clear**		**25200**	**95**	28	3	<2
Total Dissolved Solids (mg/L)	**-**		1050	159	833	534	663
Turbidity (NTU)	**8 NTU above background (24-hr during clear flow**						
	Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters						
	Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters		**8960**	**416**	45.8	6.41	1.79
Anions and Nutrients mg/L							
Alkalinity Total (as CaCO3)	**<10 high sensitivity to acid inputs**		25	25	118	86	77
Acid Sensitivity	**10-20 moderate sensitivity to acid inputs**		Low	Low	Low	Low	Low
Chloride (Cl)	**600 (instant max)**		39.3	12.6	225	93	132
Fluoride (F)	**1.5 (instant max)**		<0.10	<0.10	<0.10	<0.10	<0.10
	Hardness-Dependent BCAWWQG to protect AW [7]		**2.09**	**1.33**	**1.96**	**1.83**	**1.90**
Nitrate (as N)	**32.8 (instant maximum)**		1.49	0.29	0.309	0.886	1.12
Nitrite (as N) [3] Cl <2 mg/L	**0.06 (max)**	**0.02 (30-day average)**					
Cl 2 - <4 mg/L	**0.12 (max)**	**0.04 (30-day average)**					
Cl 4 - <6 mg/L	**0.18 (max)**	**0.06 (30-day average)**					
Cl 6 - <8 mg/L	**0.24 (max)**	**0.08 (30-day average)**					
Cl 8 - <10 mg/L	**0.3 (max)**	**0.1 (30-day average)**					
Cl > 10 mg/L	**0.6 (max)**	**0.2 (30-day average)**	0.222	<0.010	0.019	0.018	<0.010
Sulfate (SO4) H 0-30 mg/L	**128 (30-day average)**						
H 31 - 75 mg/L	**218 (30-day average)**						
H 76 - 180 mg/L	**309 (30-day average)**						
H 181 - 250 mg/L	**429 (30-day average)**						
H > 250 mg/L	**TBD**		666	79	259	215	265
Notes: Refer to Table Endnotes (attached)							
Table B2: Analytical Results for Total and Dissolved Metals in Surface Water			**CONTACT WATER**	E292898 ANCILLARY DI	**E305365 SW-1**		
Laboratory ID	BCAWWQG[2]		**6100550-01**	**6100550-02**	**6100550-03**	**6100550-04**	**6100550-06**
Sample ID			**PEA**	**Weir**	**SW1**	**SW1**	**SW1**
Date Sampled/Time			**08-Oct-16/10:00**	**08-Oct-16/11:15**	**08-Oct-16/11:00**	**08-Oct-16/18:00**	**09-Oct-16/9:00**
Physical Tests							
Background Hardness (as CaCO3) (mg/L)	**-**				30	30	30
Hardness (as CaCO3) (mg/L)	**-**		651	98.6	479	345	413
pH	**-**		6.72	7.35	7.22	7.33	7.26

Analytic Results		CONTACT WATER	E292898 ANCILLARY DISCHARGE	E305365 SW-1		
Total Metals (mg/L)						
Aluminum (Al)-Total	**-**	492	13.7	1.06	0.193	0.064
Antimony (Sb)-Total	**0.009**	0.0016	0.0006	0.0003	0.0004	0.0005
Arsenic (As)-Total	**0.005**	**0.0516**	0.0026	0.0007	<0.0005	<0.0005
Barium (Ba)-Total	**1**	2.37	0.085	0.08	0.037	0.052
Beryllium (Be)-Total	**0.00013**	**0.0111**	0.0002	<0.0001	<0.0001	<0.0001
Boron (B)-Total	**1.2**	0.078	0.035	0.073	0.038	0.055
Cadmium (Cd)-Total	**-**	0.00346	0.0001	0.00003	0.00004	0.00005
Calcium (Ca)-Total	**-**	313	36.2	164	113	149
Chromium (Cr)-Total Chromium (Cr(III))	**-**	0.743	0.0276	0.0025	0.0008	0.0007
Chromium (Cr(III))	**0.0089**	-	-	-	-	-
Chromium (Cr(VI))	**0.001**	-	-	-	-	-
Cobalt (Co)-Total	**0.004**	**0.246**	**0.00871**	0.0042	0.00111	0.00089
Copper (Cu)-Total	**Hardness-Dependent(7)**	**0.877**	**0.0307**	**0.0052**	**0.0022**	0.002
	Hardness-Dependent BCAWWQG to protect AW (7) (instant max)	**0.0632**	**0.0113**	**0.0048**	**0.0048**	**0.0048**
	Hardness-Dependent BCAWWQG to protect AW (7) (30-d average)	**0.0260**	**0.0039**	**0.0020**	**0.0020**	**0.0020**
Iron (Fe)-Total	**1**	**369**	**14.8**	**1.37**	0.22	0.07
Lead (Pb)-Total	**Hardness-Dependent(7)**	0.266	0.0113	0.0013	0.0003	<0.0001
	Hardness-Dependent BCAWWQG to protect AW (7) (instant max)	**0.8864**	**0.0802**	**0.0176**	**0.0176**	**0.0176**
	Hardness-Dependent BCAWWQG to protect AW (7) (30-d average)	**0.0379**	**0.0064**	**0.0040**	**0.0040**	**0.0040**
Magnesium (Mg)-Total	**-**	105	10.5	29.8	18.8	24.7
Manganese (Mn)-Total	**Hardness Dependent (7)**	**11.8**	0.26	0.746	0.173	0.134
	Hardness-Dependent BCAWWQG to protect AW (7) (instant max)	**7.7**	**1.6**	**0.9**	**0.9**	**0.9**
	Hardness-Dependent BCAWWQG to protect AW (7) (30-d average)	**3.5**	**1.0**	**0.7**	**0.7**	**0.7**
Mercury (Hg)-Total	**0.00002**	0.00026	<0.00002	<0.00002	<0.00002	<0.00002
Molybdenum (Mo)-Total	**≤1 (instant max)2 (30-d average)**	0.0128	0.0018	0.0043	0.0028	0.003
Nickel (Ni)-Total	**0.025 (Hardness-Dependent BCAWWQG to protect AW H<60mg/L)**	**0.403**	0.0199	0.0033	0.0018	0.0021
	Calculated Hardness-Dependent BCAWWQG to protect AW 60≤H≤180 mg/L CaCO3	**0.397**	**0.095**	**0.025**	**0.025**	**0.025**
Potassium (K)-Total	**-**	17.5	4.35	5.04	2.63	3.62
Selenium (Se)-Total	**0.002**	**0.0047**	<0.0005	<0.0005	0.0005	0.0006
Silver (Ag)-Total	**Hardness-Dependent(7)**	**0.00196**	<0.00005	<0.00005	<0.00005	<0.00005
	Hardness-Dependent BCAWWQG to protect AW (7) (instant max)	**0.003**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
	Hardness-Dependent BCAWWQG to protect AW (7) (30-d average)	**0.0015**	**0.00005**	**0.00005**	**0.00005**	**0.00005**
Sodium (Na)-Total	**-**	70	13.5	100	40.4	62.1
Thallium (Tl)-Total	**0.0008 (30-day average, site-specific objective for lower Columbia River**	**0.00085**	0.00005	<0.00002	<0.00002	<0.00002

Analytic Results		CONTACT WATER	E292898 ANCILLARY DISCHARGE	E305365 SW-1		
Uranium (U)-Total	**0.0085**	0.0148	0.00036	0.00285	0.00216	0.00176
Zinc (Zn)-Total	**Hardness Dependent [7]**	**2.05**	**0.043**	0.006	<0.004	<0.004
	Hardness-Dependent BCAWWQG to protect AW [7] (instant max)	**0.454**	**0.039**	**0.033**	**0.033**	**0.033**
	Hardness-Dependent BCAWWQG to protect AW [7] (30-d average)	**0.428**	**0.014**	**0.008**	**0.008**	**0.008**
Dissolved Metals (mg/L)						
Aluminum (Al)-Dissolved	**0.05 (30-day average where median pH > 6.5) 0.1 (maximum where instantaneous pH > 6.5) "*" indicates pH-dependent maximum where instant pH $\leq$ 6.5**	0.009	0.022	0.02	0.007	<0.005
Antimony (Sb)-Dissolved	**-**	0.0016	0.0004	0.0003	0.0004	0.0005
Arsenic (As)-Dissolved	**-**	0.0008	<0.0005	<0.0005	<0.0005	<0.0005
Barium (Ba)-Dissolved	**-**	0.156	0.009	0.066	0.035	0.049
Boron (B)-Dissolved	**-**	0.042	0.026	0.061	0.035	0.042
Cadmium (Cd)-Dissolved	**Hardness-Dependent[7]**	0.00006	0.00003	0.00002	0.00004	0.00004
	Calculated Hardness-Dependent BCAWWQG to protect AW [7] (short-term max) e[1.03 * ln(Hss) -	**Hardness exceeds 455mg/L**	**0.00058**	**0.00017**	**0.00017**	**0.00017**
	Calculated Hardness-Dependent BCAWWQG to protect AW [7] (long-term max) e[0.736 * ln(Hss) -	**Hardness exceeds 285mg/L**	**0.00021**	**0.00009**	**0.00009**	**0.00009**
Calcium (Ca)-Dissolved	**up to 4, highly sensitive to acid inputs 4 to 8, moderately sensitive over 8 low sensitivity**	234	31.6	148	109	129
		Low	Low	Low	Low	Low
Chromium (Cr)-Dissolved [8]	**-**	0.0016	0.0006	<0.0005	0.0006	0.0006
Copper (Cu)-Dissolved	**-**	0.0041	0.0017	0.0014	0.0014	0.0014
Iron (Fe)-Dissolved	**0.35**	0.011	0.024	0.136	<0.010	<0.010
Lead (Pb)-Dissolved	**-**	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Magnesium (Mg)-Dissolved	**-**	16.2	4.79	26.5	17.9	22.4
Manganese (Mn)-Dissolved	**-**	0.85	0.0154	0.435	0.155	0.117
Mercury (Hg)-Dissolved	**-**	0.00003	<0.00002	<0.00002	<0.00002	<0.00002
Molybdenum	**-**	0.0125	0.0017	0.0039	0.0027	0.0027
Potassium (K)-Dissolved	**-**	8	2.54	4.59	2.57	3.46
Selenium (Se)-Dissolved	**-**	0.0013	<0.0005	<0.0005	0.0005	0.0006
Sodium (Na)-Dissolved	**-**	65.8	12.2	93.6	40.1	59.6
Uranium (U)-Dissolved	**-**	<0.00002	0.00006	0.00268	0.00215	0.00159
Zinc (Zn)-Dissolved	**-**	0.011	<0.004	<0.004	<0.004	<0.004

Analytic Results		CONTACT WATER	E292898 ANCILLARY DISCHARGE	E305365 SW-1		
Volatile Organic Compounds (ug/L)						
Benzene	**40**	<0.5	<0.5	<0.5	<0.5	<0.5
Bromodichloromethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Bromoform	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon Tetrachloride	**13.3**	<1.0	<1.0	<1.0	<1.0	<1.0
Chlorobenzene	**1.3**	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroethane	**-**	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform	**1.8**	<1.0	<1.0	<1.0	<1.0	<1.0
Chloromethane	**-**	<2.0	<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichlorobenzene	**0.7**	<0.5	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene	**150**	<1.0	<1.0	<1.0	<1.0	<1.0
1,4-Dichlorobenzene	**26**	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloroethane	**100**	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethene	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,2-Dichloroethene	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Methylene chloride	**98.1**	<3.0	<3.0	<3.0	<3.0	<3.0
1,2-Dichloropropane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,3-Dichloropropene	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
trans-1,3-Dichloropropene	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Dichloropropene (cis & trans)	**-**	-	-	-	-	-
Ethylbenzene	**200**	<1.0	<1.0	<1.0	<1.0	<1.0
Methyl t-butyl ether (MTBE)	**3400**	<1.0	<1.0	<1.0	<1.0	<1.0
Styrene	**72**	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,1,2-Tetrachloroethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2,2-Tetrachloroethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Tetrachloroethene	**110**	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	**0.5**	**<1.0**	**<1.0**	**<1.0**	**<1.0**	**<1.0**
1,1,1-Trichloroethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
1,1,2-Trichloroethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene	**21**	<1.0	<1.0	<1.0	<1.0	<1.0
Trichlorofluoromethane	**-**	<1.0	<1.0	<1.0	<1.0	<1.0
Vinyl Chloride	**-**	<2.0	<2.0	<2.0	<2.0	<2.0
Xylenes	**30**	<2.0	<2.0	<2.0	<2.0	<2.0

Analytic Results		CONTACT WATER	E292898 ANCILLARY DISCHARGE	E305365 SW-1		
Hydrocarbons ug/L						
LEPH	**-**	<250	<250	<250	<250	<250
HEPH	**-**	899	<250	<250	<250	<250
Polycyclic Aromatic Hydrocarbons ug/l						
Acenaphthene	**6**	0.08	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	**-**	<0.20	<0.20	<0.20	<0.20	<0.20
Acridine	**3**	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	**4**	0.12	<0.01	<0.01	<0.01	<0.01
Benz(a)anthracene	**0.1**	**0.19**	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	**0.01**	**0.26**	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	**-**	0.2	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	**-**	0.36	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	**-**	0.13	<0.05	<0.05	<0.05	<0.05
Chrysene	**-**	0.21	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	**-**	0.1	<0.05	<0.05	<0.05	<0.05
Fluoranthene	**4**	0.86	<0.03	<0.03	<0.03	<0.03
Fluorene	**12**	0.06	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	**-**	0.27	<0.05	<0.05	<0.05	<0.05
Naphthalene	**1**	<0.20	<0.20	<0.20	<0.20	<0.20
Phenanthrene	**0.3**	**0.41**	<0.10	<0.10	<0.10	<0.10
Pyrene	**0.02**	**0.45**	<0.02	<0.02	<0.02	<0.02
Quinoline	**3.4**	<0.10	<0.10	<0.10	<0.10	<0.10
Glycols mg/l						
Diethylene Glycol	**-**	<5	<5	<5	<5	<5
Ethylene Glycol	**192**[6]	<5	<5	<5	<5	<5
1,2-Propylene Glycol	**500**[6]	<5	<5	<5	<5	<5

Notes: Refer to Table Endnotes (attached)