

**COBBLE HILL LANDFILL
2017 MINOR CONSTRUCTION WORKS
DETAILED CONSTRUCTION PLAN**

[Cobble Hill Holdings Ltd.]
COBBLE HILL LANDFILL 2017 MINOR CONSTRUCTION WORKS

13/9/2017

1. INTRODUCTION

The Ministry of Environment (Ministry) has requested further detail, as outlined in their letter on August 30th, 2017 (File No. 105809 – Ref. SPO M01701), to support the recently submitted letter *Cobble Hill Landfill – Conditional Approval Update to Second Spill Prevention Order M01701 (reference Letters 311370 & 311372)*, dated August 25th, 2017 from Sperling Hansen Associates (SHA) on behalf of Cobble Hill Holdings (CHH) prior to 2017 Minor Construction Works commencing.

This plan includes a detailed summary / plan of the works to be performed in 2017 prior to the remaining closure works for the Cobble Hill Landfill (CHL) scheduled for 2018. Additionally, lines of communication and important contact personnel are identified, detailed site reporting and records management are included and quality management planning is outlined in Appendix A. Finally, an updated schedule of works has been included in Table 1. Figure 1 outlines a site plan for the landfill.

With respect to environmental monitoring, it is understood that MoE requires monthly monitoring at the landfill. Monitoring of all existing infrastructure (surface water and groundwater sites) is underway and the monitoring program will include additional / new sites by October 31st, 2017 once all 2017 Minor Construction Works are complete.

2. DETAILED SUMMARY OF WORKS

As outlined in the Updated Final Closure Plan, and granted approval on August 11th, the following works will be completed by October 31st 2017:

1. Complete secondary clay liner investigation at four locations along the north toe of the PEA to assess and document the presence and integrity of the layer;
2. Install of new leachate and leak detection tanks within secondary lined lock block facility;
3. Install new twin piping to leachate and leak detection storage tanks from existing PEA collection system and removal of existing storage tanks;
4. Install High Level Alarm system in Leachate collection tank;
5. Decommission contact water containment pond;
6. Stockpile and cover soil in Soil Management Area (SMA) with 6 mil poly tarps and sandbags;
7. Install three Seepage Blanket Monitoring wells along north toe of Permanent Encapsulation Area (PEA);
8. Complete all (PEA) liner repairs and testing;
9. PEA crest ditch ballasting to ensure the integrity of the existing liner for surface water controls, and
10. Run-on ditch extension around the south side of the PEA.

2.1 Complete Secondary Clay Liner Investigation

The secondary clay liner beneath the fully geomembrane encapsulated PEA will be assessed for presence and integrity at the onset of the 2017 Minor Construction Works. In order to assess this layer, the following tasks will be attempted at four (4) locations along the northern toe of the PEA:

- a. Remove by hand or by use of Vac-Truck, all overburden and large rocks from four sampling locations at the northern toe of the PEA.
- b. Once the secondary clay liner is visually identified, the layer should be assessed for depth by digging a test pit with a small excavator and a sample taken for analysis. Spotters should be utilized to ensure the existing PEA basal or cap liner is not compromised. If test pitting is not possible due to the chance of compromising the existing liner system, a Shelby Tube or auger may be used to confirm depth or to draw a sample of the in-situ clay.
- c. Integrity of the clay will be based on laboratory analysis for the following parameters:
 - i. Stability - Structure & Permeability
 - ii. Organic Carbon Content
 - iii. Clay Mineralogy
 - iv. Soil Gradation

It should be noted that SHA does not recommend compromising the existing liner system in order to assess the secondary clay liner for integrity. If through test pitting or other methods, it is not possible to assess the integrity of the clay based on the location of the in-situ clay, the investigation work should be deferred until 2018 during dry summer weather.

2.2 Installation of New Leachate and Leak Detection Tanks within Secondary Lined Lock Block Facility

A new leachate and leak detection storage facility will be constructed north of the landfill toe to replace the existing tanks and provide secondary containment and additional storage capacity. The storage facility will include new tanks and be fitted with a covered structure to keep out precipitation; additionally the facility will include a high-level alarm on the leachate storage tanks. The following construction tasks will be completed as part of this work item:

- a. Figure 2 shows the approximate location of the new leachate storage facility. Construction will begin by excavating (and rock hammering if required) into the existing quarry blast rock and bedrock to allow for the completion of a lock block structure to house the storage tanks.
- b. Figure 3 shows a profile view of the storage tank facility as well as approximate elevations for the base of the storage structure. Once the lock block structure is in place, a pre-fabricated / welded 40 mil secondary containment liner will be installed and secured to the top row of lock blocks with a steel bar and 'hilti-bolts'. The secondary geomembrane liner will be tested and certified in the shop prior to shipping. The secondary containment liner will be installed over a cushion layer of geotextile and bedding sand at the base of the structure.

- c. Two 10,000 gal leachate storage tanks and one 10,000 gal leak detection tank will be placed in the storage facility. The two leachate storage tanks will be connected to provide additional storage capacity.
- d. A covered roof structure will be built over the storage facility to deter precipitation accumulation in the bottom of the storage compound.
- e. The leachate tanks will then be equipped with a high level alarm system, described below in section 2.4.

2.3 Installation of New Twin Piping from Existing PEA Collection Pipe Boots to New Storage Facility

Once the new storage facility is complete, the new leachate and leak detection conveyance piping will be installed, tying together the PEA to the new storage facility, as outlined on Figure 3. The following construction tasks will be completed as part of this work item:

- a. Trenching will be completed from the new storage facility to the existing PEA leachate and leak detection liner boot location. The trench will be approximately 1,100mm in width to accommodate both leachate and leak detection piping in a common trench.
- b. The 100mm solid HDPE DR 17 leachate and leak detection conveyance piping will be installed overtop of sufficient sand bedding material in the trench. Prior to backfill and compaction, warning tape and tracer wire will be included.
- c. The new conveyance piping will be tied into the PEA at the south end and new storage tanks at the north end.
- d. All conveyance piping will need to carry a minimum 2% grade from south to north, draining to the storage facility.

2.4 Install High Level Alarm System in Leachate Storage Tanks

A high-level alarm system will be installed in the leachate storage tanks to allow for emergency notification to ensure no spills occur into the secondary lined containment facility. The solar powered alarm system will provide audible signal through a cell phone based set up triggered by floats within the leachate storage tanks.

2.5 Decommissioning of Contact Water Containment Pond

The following construction tasks will be completed as part of the decommissioning the Contact Water Containment Pond:

- a. Any existing sludge or contract water will be removed from the pond with a vac-truck and disposed of at a licensed offsite facility.
- b. Existing pond liner will be removed and disposed of offsite.

- c. The pond will be backfilled and compacted with onsite low permeability soil to ensure no ponding water.
- d. The location will be hand seeded to promote vegetation.

2.6 Stockpile and Cover Existing Soil in SMA

The following construction tasks will be completed as part of this work item:

- a. All existing soil in the SMA will be stockpiled in the center of the facility. The concrete floor will be swept and washed.
- b. The stockpiled soil will be covered with 6 mil poly and secured in place with sandbags for the winter.

2.7 Installation of Seepage Blanket Monitoring Wells at Landfill Toe

Three shallow seepage blanket monitoring wells will be installed along the north toe of the landfill. They will be evenly spaced with the centre well strategically down gradient of the leachate / leak detection collection pipe boot on the PEA. The location of the three shallow monitoring wells are presented on Figure 2. The well locations have been selected to ensure the infrastructure will not interfere with the remaining closure works proposed for 2018. The following construction tasks will be completed as part of this work item:

- a. The shallow wells will be excavated down through the blasted quarry rock to the top of competent bedrock, approximately 2-3m (to be confirmed in the field). Once the top of bedrock is established, a rock hammer will be utilized to create a sump in the competent bedrock to a depth of 500 mm minimum.
- b. 100mm diameter PVC pipe will be used to construct the shallow monitoring well. The well construction will include a 500mm perforated section which will be set into the bedrock sump.
- c. The well will be carefully backfilled with clear drain rock to approximately 500mm below the existing surface of the quarry floor at which point a non-woven geotextile filter cloth will be installed and the well will be backfilled with low permeability onsite soil to grade.
- d. Once complete, each well should be protected with 2 lock blocks on either side.

2.8 Complete PEA Liner Repairs and Testing

Existing PEA liner deficiencies will be addressed, repaired and tested during the 2017 Fall work program. The following construction tasks will be completed as part of this work item:

- a. SHA's QP will complete an entire site walk over with the Liner Contractor and identify and map all deficiencies including, tears, rips, punctures, un-finished patches, boots, tie-in seams, etc.
- b. All welding machines will undergo qualification and testing prior to any welding in the field.
- c. Liner Contractor will complete all repairs based on best practices for liner works.

- d. All repairs that were completed with an extrusion welding machine will be tested with a Vac-Box.
- e. All repairs that were completed with a double wedge seam welding machine will be tested by way of air channel pressure test.

2.9 Complete PEA Crest Ditch Ballasting

To ensure the open lined crest ditches on the PEA do not ‘trampoline’ over the winter months, protection and ballasting will be completed. The following construction tasks will be completed as part of this work item:

- a. Crest ditches will be lined with 8oz. Non-Woven Geotextile and secured with coarse gravel and sand bags in strategic locations to minimize velocities.

2.10 Run-On Ditch Extension Around South Side of PEA

Currently, the PEA area is designed on the west side with a surface water run-on ditch to ensure all surface water flows are diverted away from the PEA. Additional construction will be completed to ensure the ditch continues around the south side of the PEA and ties into the west run-on ditch. The south run-on ditch extension will further eliminate the chance of additional leachate generation until final closure is completed.

3. COMMUNICATION

As outlined above, numerous work tasks need to be completed this Fall as part of the 2017 Minor Construction Works. In order for construction, QP signoff and MoE inspections to take place seamlessly, communication between all project team needs to be a priority.

Below is a list of the project team along with their contact information. As the construction works progress, there may be a need to update the contact personnel and contact information. This should be addressed in the weekly inspection reports circulated to all project team.

- 1. Ministry of Environment:
 - AJ Downie 1 (250) 751 3176 (office)
 1 (250) 802 7149 (cell)
 Email – AJ.Downie@gov.bc.ca
 - Maureen Bilawchuk Email – Maureen.Bilawchuk@gov.bc.ca
- 2. GHD Limited (External Monitor):
 - James Reid Email – James.A.Reid@ghd.com
 - Reinhard Trautmann Email – rtrautmann@netidea.com
- 3. Cobble Hill Holdings Ltd:
 - Marty Block 1 (250) 216 9475
 Email – marty@chholdings.ca

Michael Kelly Email – mike@chholdings.ca

4. Allterra Construction:

Todd Mizuik 1 (250) 658 3772

 Email - Todd@allterraconstruction.ca

Raymond Lam Email – Raymond@allterraconstruction.ca

5. Sperling Hansen Associates:

Tony Sperling 1 (604) 986 7723

 Email - sperling@sperlinghansen.com

Scott Garthwaite 1 (604) 803 7120

 Email - sgarthwaite@sperlinghansen.com

Additionally, daily site reports will be completed by Allterra Construction personnel and will include notes and photos of the onsite works and weekly construction progress reports will be completed by SHA and circulated to the project team. The weekly progress reports will also include any changes to construction, construction schedule and inspections.

4. RECORDS MANAGEMENT

All construction records and as-builts for the project will be completed by Allterra Construction throughout the course of the 2017 Minor Construction Works. Records and As-builts include all survey pick up for completed above ground and below ground works. The project QP (SHA) will review and approve all as-builts and records for submission to MoE.

Records will also include all testing, changes made in the field, daily inspection reports and reports from MoE and their External Monitors (GHD Limited).

5. SCHEDULE

The attached Table 1 – 2017 Minor Construction Works Schedule, outlines the construction tasks and the proposed dates that each task will commence, task duration and task completion date. If dates to specific work tasks change during construction, an update will be provided on a weekly basis and circulated to the project team.

Construction works are currently planned for weekdays only; Monday through Friday from approximately 7:00am to 5:00pm. If work must be carried into the weekends based on contractor and sub-contractor availability, notice will be provided to all parties by mid-week prior to weekend activities.

6. Onsite Requirements for QP Inspection - Technical Portions of the Construction Works

A Qualified Professional will be present onsite for the technical portions of the construction works. Key construction tasks which will require inspection and documentation by the QP before construction proceeds or for approval include:

1. Secondary Clay liner investigation at the toe of the landfill
2. Inspection of new lock block Facility and liner prior to commissioning of new leachate / leak detection facility
3. Trenching and Installation of twin piping from existing PEA to new storage facility
4. Installation of seepage blanket monitoring wells at landfill toe
5. PEA liner repairs and testing

The above-mentioned tasks and QP involvement in those tasks are further defined in the Quality Management Plan assembled for this project; this is included as Appendix A to this report.

Yours truly,

SPERLING HANSEN ASSOCIATES

Dr. Tony Sperling, P.Eng.
President



September 13th, 2017

[illegible]

No.	Construction Tasks (2017)	September 2017										October 2017			
		18	19	20	21	22	25	26	27	28	29	2	3	4	5
1	Procurement of Materials and Mob / Demob														
2	Complete Secondary Clay Liner Investigation														
3	Construct & Install New Leachate Storage Facility														
4	Install New Leachate Conveyance Piping and Tie-in														
5	Install High Level Alarm for Leachate Tank														
6	Decommission Contact Water Pond														
7	Stockpile and Cover Existing Soil in SMA														
8	Install Shallow Seepage Blanket Monitoring Wells														
9	Complete PEA Liner Repairs and Testing														
10	Complete PEA Crest Ditch Ballasting														
11	Complete Run-On Ditching														



SPERLING
HANSEN
ASSOCIATES

Landfill Services Group

- Landfill Siting
- Design & Operations Plans
- Landfill Closure
- Environmental Monitoring

#8 - 1225 East Keith Road
North Vancouver, B.C. V7J 1J3
Phone: (604) 986-7723
Fax: (604) 986-7734

LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPOSED SURFACE WATER DITCH
- PROPERTY LINES
- PROPOSED SOLID LEACHATE/LEAK COLLECTION PIPING
- EXISTING PERFORATED LEACHATE COLLECTOR/LEAK DETECTION PIPE ALIGNMENT
- CLEAN-OUT (PROPOSED)
- SEEPAGE BLANKET MONITORING LOCATION (PROPOSED)

CLIENT:

COBBLE HILL HOLDINGS LTD.

PROJECT:

COBBLE HILL LANDFILL
DETAILED CONSTRUCTION PLAN FOR
2017 MINOR WORKS

TITLE:

SITE PLAN

SCALE:

1:1250

DATE:

2017/09/07
yyyy/mm/dd

PROJECT NO:

PRJ 17039

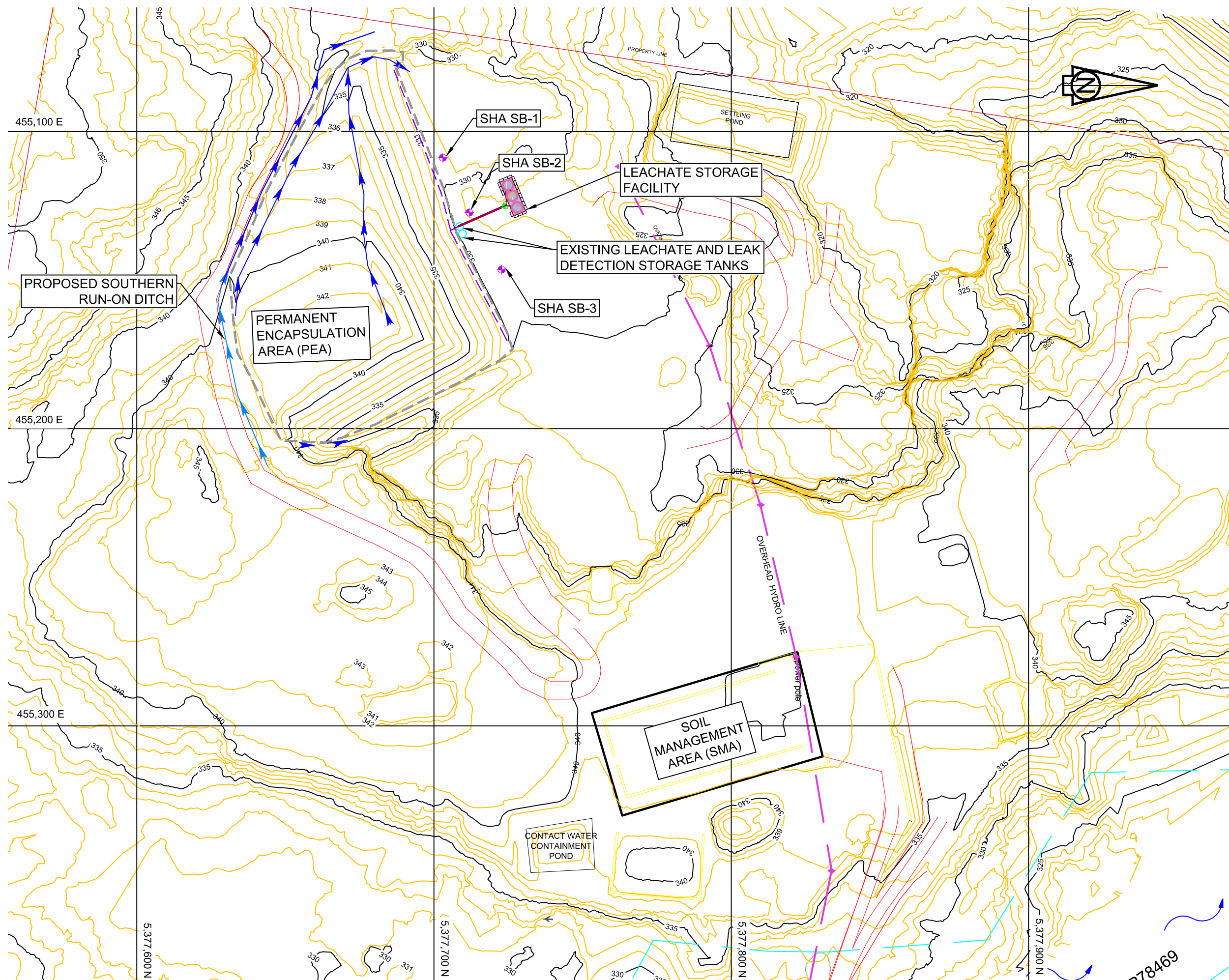
DESIGNED

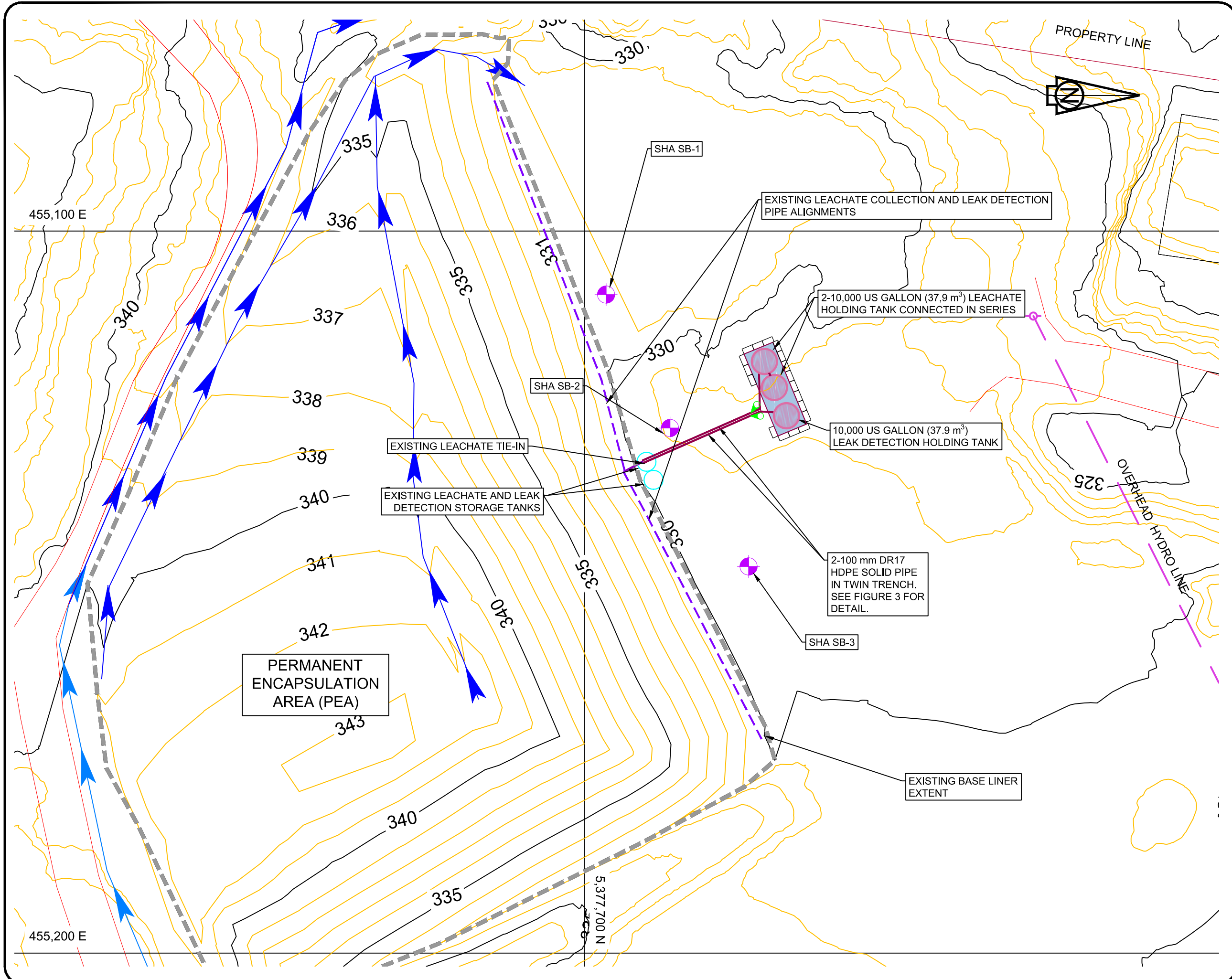
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FIGURE 1





SPERLING
HANSEN
ASSOCIATES

Landfill Services Group
• Landfill Siting
• Design & Operations Plans
• Landfill Closure
• Environmental Monitoring
#8 - 1225 East Keith Road
North Vancouver, B.C. V7J 1J3
Phone: (604) 986-7723
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LEGEND:

- 5m EXISTING CONTOUR
- 1m EXISTING CONTOUR
- ROAD
- SURFACE WATER DITCH
- PROPOSED SURFACE WATER DITCH
- PROPERTY LINES
- PROPOSED SOLID LEACHATE/LEAK COLLECTION PIPING
- EXISTING PERFORATED LEACHATE COLLECTOR/LEAK DETECTION PIPE ALIGNMENT
- CLEAN-OUT (PROPOSED)
- SEEPAGE BLANKET MONITORING LOCATION (PROPOSED)

CLIENT:
COBBLE HILL HOLDINGS LTD.

PROJECT:
**COBBLE HILL LANDFILL
DETAILED CONSTRUCTION PLAN FOR
2017 MINOR WORKS**

TITLE:
**2017 MINOR CONSTRUCTION
WORKS - PROPOSED WORK
OVERVIEW**

SCALE: 1:400	DATE: 2017/09/07 yyyy/mm/dd	PROJECT NO: PRJ 17039
DESIGNED	DRAWING NO: FIGURE 2	
DRAWN		SG
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- Landfill Siting
- Design & Operations Plans
- Landfill Closure
- Environmental Monitoring

#8 - 1225 East Keith Road
North Vancouver, B.C. V7J 1J3
Phone: (604) 986-7723
Fax: (604) 986-7734

TYPICAL TOE DITCH SECTION INCLUDING LEACHATE MANAGEMENT SYSTEM UPGRADES

EXISTING 40mil LLDPE GEOMEMBRANE LINER

EXISTING 100mm PVC PERFORATED LEACHATE PIPE INV. ELEVATION 329.964 m

EXISTING 100mm PERFORATED LEAK DETECTION PIPE INV. ELEVATION 329.664 m

EXISTING LEACHATE AND LEAK DETECTION TRENCH

EXISTING SEEPAGE BLANKET LAYER

APPROXIMATE BEDROCK SURFACE

ENSURE 500 mm MINIMUM COVER OVER LEACHATE/LEAK DETECTION CONVEYANCE PIPING

EXISTING LINER BOOT

200 mm SAND

12 oz NON-WOVEN GEOTEXTILE

100 mm Ø PVC SOLID PIPE FOR SHALLOW DRAINAGE BLANKET MONITORING WELL

500 mm CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR

EXISTING ROCK QUARRY SURFACE

2% MINIMUM

100 mm Ø DR17 HPDE SOLID PIPE - TWIN PIPE TRENCH

25 to 50 mm CLEAN DRAIN ROCK

100 mm Ø PVC PERFORATED PIPE

8oz NON-WOVEN GEOTEXTILE WRAP

TIE-IN LOCATION PIPES TO BE WELDED IN THE FIELD AND PRESSURE AND HYDRAULICALLY TESTED

ROOF STRUCTURE

LOCK BLOCK

CLEAN-OUT

HIGH LEVEL ALARM

+ 329.25 m EL.

100 mm DR17 HPDE PIPE INV. ELEVATION 328.5 m

SECONDARY CONTAINMENT 40 mil HPDE GEOMEMBRANE LINER

4 m

2- 10,000 US GALLON (37.85 m³) LEACHATE HOLDING TANK

1- 10,000 US GALLON (37.85 m³) LEAK DETECTION HOLDING TANK

12 oz NON-WOVEN GEOTEXTILE

150 mm SAND CUSHION LAYER

ELEVATION 325.25 m

SCALE 1:100



SCALE: 1:50	DATE: 2017/09/07 yyyy/mm/dd	PROJECT NO: PRJ 17039
DESIGNED		DRAWING NO: FIGURE 3
DRAWN	SG/MG	
CHECKED	TS	

APPENDIX A
Quality Management Plan

**COBBLE HILL LANDFILL
2017 MINOR CONSTRUCTION WORKS
QUALITY MANAGEMENT PLAN**

[Cobble Hill Holdings Ltd.]
COBBLE HILL LANDFILL 2017 MINOR CONSTRUCTION WORKS

13/9/2017

Quality Management Plan
Cobble Hill Landfill 2017 Minor Construction Works

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Quality Management Plan Cobble Hill Landfill 2017 Minor Construction Works

Introduction

The Quality Management Plan (QMP) for the Cobble Hill Landfill 2017 Minor Construction Works project will establish the activities, processes, and procedures for ensuring a quality product upon the conclusion of the project. The purpose of this plan is to:

- Ensure quality of work is planned and managed accordingly
- Define how each portion of construction work will be managed
- Define quality assurance activities
- Define quality control activities
- Define acceptable quality standards

Purpose and Objectives

The purpose of the Cobble Hill Landfill 2017 Minor Construction Works Quality Management Plan is to establish the goals, processes, and responsibilities required to implement effective quality management functions for the 2017 Minor Construction Works to be undertaken at the Cobble Hill Landfill in support of the Updated Final Closure Plan. This QMP defines how the Project Team will implement, support, and communicate project quality practices during the Cobble Hill Landfill 2017 Minor Construction Works construction.

The Quality Management Plan will accomplish the following objectives for the Cobble Hill Landfill 2017 Minor Construction Works project:

- Outlines the purpose & scope of quality activities
- Defines how quality will be planned and managed
- Defines quality assurance (QA) activities
- Defines quality control (QC) activities
- Defines acceptable quality standards
- Defines roles and responsibilities for quality management activities

Quality Management Roles and Responsibilities

All members of the Cobble Hill Landfill 2017 Minor Construction Works project team will play a role in quality management. It is imperative that the team ensures that work is completed at an adequate level of quality from individual work packages to the final project deliverable.

Quality roles and responsibilities for the Cobble Hill Landfill 2017 Minor Construction Works Project are as follows:

Construction Project Manager - *Alterra Construction Ltd.*

- Implement the Quality Management Plan to ensure all tasks, processes, and documentation are compliant with the plan
- Responsible for quality management throughout the duration of the project
- Ensure team member compliance with quality management processes
- Support the project team in securing resources to perform quality management
- Provide oversight to the closure of corrective actions arising from quality reviews
- Communicate quality standards to the project team
- Provide daily updates to the QP on progress and status of all construction activities

On-site Engineering Support and Qualified Professional Oversight – *Sperling Hansen Associates*

- Oversee and support the application of quality standards for the Cobble Hill Landfill 2017 Minor Construction Works Project processes and products to their respective team members
- Collaborate with the project management team in the development of the quality plan, including quality metrics and standards.
- Participate in quality management reviews as required
- Perform QA activities and QC inspections daily or as appropriate
- Create and maintain Quality Control and Assurance Logs throughout the project
- Provide weekly inspection / progress reports to be distributed to appropriate parties.
- Communicate results from assessments with appropriate parties
- Ensure resolution of non-compliance instances and escalate any issues that cannot be resolved within the project
- Identify lessons learned that could improve processes for future products

Cobble Hill Landfill 2017 Minor Construction Works Owners – *Cobble Hill Holdings*

- Oversee and support the application of quality standards for the Cobble Hill Landfill 2017 Minor Construction Works Project processes to their assigned processes
- Collaborate with the Senior Project Director, Quality Manager, and Quality Specialists in the development of quality metrics and standards
- Participate in quality management reviews as required

Quality Management Scope

This QMP defines the activities and processes related to managing the quality of the Minor Construction Works which will be undertaken at the Cobble Hill Landfill. The scope of this project includes:

- Project Management – Cobble Hill Holdings Ltd. & Allterra Construction Ltd.
- Construction of Minor Works (as defined below) – Alterra Construction Ltd.
- On-site Engineering and QA / QC – Sperling Hansen Associates
- Construction Progress Reporting – Sperling Hansen Associates

The construction tasks to be included in the Minor Construction Works for 2017, as outlined in SHA's Updated Final Closure Plan and as required by the Ministry of Environment are as follows:

1. **Procurement of Materials and Mobilization** – Includes mobilization and procurement of construction materials such as lock blocks, piping, aggregates, and liner material.
2. **Complete Secondary Clay Liner Investigation** – Includes assessing the secondary clay liner for presence and integrity at four locations along the northern toe of the PEA.
3. **Install New Leachate and Leak Detection Storage Facility:** includes excavation of lock block sump with a pre-fabricated secondary 40 mil geomembrane liner, installation of storage tank and construction of roof cover over top of facility.
4. **Tie-In And Extend Leachate And Leak Detection Conveyance Piping To New Storage Facility:** includes rerouting conveyance piping to new storage facility including trenching and backfill with engineer approved material and warning tape.
5. **Install New High-Level Alarm System for Leachate Storage Tanks:** includes installing a solar powered cell phone based alarm system in the leachate storage tanks.
6. **Contact Water Pond Decommissioning** – includes removal and off-site disposal of any liquid currently in the pond, removal and off-site disposal of the pond liner, and backfill and compaction of the pond with engineer approved material.
7. **SMA Soil Tarping / Containment & SMA Washing** – Includes covering existing soil in the SMA with 6 mil Poly to eliminate leachate generation and washing and securing SMA for winter.
8. **Seepage Blanket Monitoring Well Installation** – includes installation of three (3) seepage blanket monitoring wells at the North Toe of the PEA into competent Bedrock surface.
9. **Complete PEA Liner Repairs & Testing and QAQC** – Once the existing storage facility is removed and new conveyance piping is in place all repairs to the existing PEA will be completed with testing and QAQC performed by the liner contractor and review by Sperling Hansen Associates.

Quality Management Plan Cobble Hill Landfill 2017 Minor Construction Works

10. Ditch Ballasting on Crest of PEA – Includes installation of sand and gravel ballast to be installed in crest ditch lines.

11. Run-on Ditch Excavation – Includes excavation and extension of the existing run-on diversion ditching south of the PEA.

A detailed construction work plan has been completed as a separate document titled “Detailed Construction Plan”.

Quality Management Approach

The quality management approach for Cobble Hill Landfill 2017 Minor Construction Works will help ensure quality is planned for both the construction works and the final closure of the landfill.

In the subsequent sections of this document, the following quality management approach elements are described and defined:

- Quality Planning, Quality Assurance, and Quality Control
- Quality activities & standards relevant to Cobble Hill Landfill 2017 Minor Construction Works
- Appropriate quality metrics and measures for standards for project processes, product functionality, project deliverables, project management performance, documentation, and testing
- QA & QC roles and responsibilities

Quality Planning

Quality planning is the process of identifying quality requirements and/or standards for the project and product, and documenting how the project will demonstrate compliance. The deliverables and processes to be reviewed for the Cobble Hill Landfill 2017 Minor Construction Works project, and their corresponding quality standards, are detailed in the Quality Assurance and Quality Control sections of this document.

Implementation of and compliance with the QMP is the shared responsibility of all project personnel. Both project management and technical staff are thus integrated with and committed to the success of overall quality management.

Quality planning also includes establishing the quality standards, identification of the quality metrics to be applied, creating the quality checklists, and conducting problem remediation activities. These processes are described at a high level below:

Review Compliance Requirements

The Closure design and construction of all associated works will be completed in accordance with the second amended Spill Prevention Order (SPO) MO1701 and the conditional approval requirements listed in the August 11th letter from Mr. George Heyman (reference 311372). All

Quality Management Plan Cobble Hill Landfill 2017 Minor Construction Works

members of the project team will be familiar with the site- specific regulatory requirements at the Cobble Hill Landfill.

Establish Quality Standards

This quality planning process establishes the QA & QC standards (the process descriptions, standards, and procedures) the Cobble Hill Landfill 2017 Minor Construction Works Project Team will use. Quality process descriptions, standards, and procedures that are applicable to the Cobble Hill Landfill 2017 Minor Construction Works project phases have been defined. The required tests and specifications are discussed further in the Quality Control Section of this plan.

Identify Quality Metrics

This quality planning process identifies the metrics the Team will use. The metrics, which are based on the quality standards established by the Project Team, will be refined during the different phases of the project, and documented in updates to this Quality Management Plan. The quality metrics will be used to evaluate whether the project is achieving its goals.

Document Construction Activities

Site inspections are an integral part of the process and product quality review. A Qualified Professional (QP) will be present for the technical portions of the construction works. Site inspections will include preparatory meetings – to be performed before the start of work each day and to include a review of planned daily activities and the required health and safety; initial inspections – to be performed for each new construction task item and will establish a level of workmanship that meets design requirements; and follow-up inspections – to be performed following any non-conformance to ensure construction is following the elements of design.

Preparatory meetings are to be performed before the start of each work day and will include all members of the project team and associated contractors that will be working on site during this day. The meetings will include a review of planned daily activities and the required health and safety. Follow-up inspections will be performed by the QP at key stages in construction and following any non-conformance identifications.

Problem Remediation

The Cobble Hill Landfill 2017 Minor Construction Works Senior Project Manager will schedule separate meetings as needed to determine corrective actions and process improvements. The results of the activities are then acted on, where possible, to improve the success of future project phases by incorporating experiences and lessons learned into subsequent phase planning activities. Through the incorporation of quality management recommendations from the preceding review stage into the activities and related deliverables for the next stage, the quality of project activities and deliverables will increase incrementally throughout the project life cycle. This approach minimizes issues at the end of the project.

Quality Assurance

Quality assurance, which is focused on the project processes, provides confidence that the quality requirements of closure can be fulfilled. Quality Assurance helps ensure the processes used to manage and deliver the construction of closure works are effective and being applied.

Quality Management Plan Cobble Hill Landfill 2017 Minor Construction Works

The quality assurance measures for the Cobble Hill Landfill 2017 Minor Construction Works project are described below:

Project Schedule Management – the project schedule will be reviewed as works proceed. A project schedule review meeting will be held once weekly (mid-week) immediately following the morning construction preparatory meeting on site. Modifications to the project schedule will be tracked and reported to all parties including the Ministry.

Progress Documentation – As outlined in previous sections, daily site reports will be completed by the Contractor and provided to the QP for review. Weekly status reports will be completed by the QP and will be circulated to the project team to provide assurance the project quality is being achieved.

Design Review – Design review meetings will occur at strategic points during construction prior to tasks commencing and at the completion of tasks. All construction works will be surveyed in place once completed, prior to the next stage of construction commencing. This will ensure construction is proceeding according to the engineered planned and ensure accurate as-built drawings are produced. Modifications to the construction design will be tracked and documented accordingly.

Quality Control

Quality control is focused on the products and deliverables of the project. It is the process of monitoring project components to verify that the construction works are of acceptable quality and are complete and correct. Quality Control includes the inspection, analysis, and actions required to ensure quality construction. The Cobble Hill Landfill 2017 Minor Construction Works QC process involves the following steps:

- Verifying, validating, and monitoring of work to ensure the requirements for quality and scope of work are being fulfilled.
- Inspecting construction works and documentation and comparing these items to applicable engineering standards.
- Monitoring construction progress, detecting problems and defects, and allowing for corrections prior to completion.

Progress & Construction Monitoring

Site inspection reports will be completed which will include a summary of work completed as well as work to be completed and discussions with contractors. The site inspection reports will be completed by the QP during technical portions of the construction works. Photo evidence of key construction tasks will be included in the site inspection reports as well as daily notes and photos provided by the Contractor to the QP.

As outlined in second amended Spill Prevention Order (SPO), SHA will provide weekly progress reports including status of closure activities, inspection results QC testing, inspection reports and supporting documents. Deviations to the construction work plan will be identified, and upcoming activities and associated timing will be outlined.

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QA/QC Testing

The QP will review the testing requirements for each construction task in accordance with design documents and be present to witness the testing. Calibration certificates (if required) will be provided to SHA by the technician performing the test and included in the weekly inspection reports along with the test results. Failed tests can be cleared by one of the following methods:

1. Re-test
2. Re-work, re-inspect and re-test.
3. Remove and replace the failed material; re-inspect and re-test.

Key Inspections

QA / QC observations and inspections will be specific per each construction task milestone. Key construction tasks which will be inspected and documented by the QP before construction proceeds include:

1. Secondary Clay liner investigation at the toe of the landfill
2. Inspection of new lock block Facility and liner prior to commissioning of new leachate / leak detection facility
3. Trenching and Installation of twin piping from existing PEA to new storage facility
4. Installation of seepage blanket monitoring wells at landfill toe
5. PEA liner repairs and testing

The QC requirements for the above-mentioned tasks are described in detail below

1. Secondary Clay Liner Investigation at the Northern Toe of the PEA
 - a. A QP will be present during the secondary clay liner investigation at the toe of the landfill.
 - b. The QP is to ensure no damage to the existing liner or collection infrastructure occurs.
 - c. If test pitting using an excavator is not feasible due to site conditions, all available non-invasive methods will be employed to investigate the liner system.
 - d. The existing liner and leachate collection / leak detection infrastructure is to be continuously inspected during test pit investigations and during and following any backfill activities.
2. Inspection of New Lock Block Facility and Liner prior to Commissioning of New Leachate / Leak Detection Facility
 - a. All excavations shall be in open cut unless otherwise permitted by the QP.
 - b. Excavations should strictly follow WCB work procedures for safe trenching work.
 - c. The top perimeter of excavation should be graded to prevent surface water from draining into the excavation.
 - d. The QP should be notified immediately if any water seeps into the excavation since this may be an excavation stability concern.
 - e. The QP to inspect lock block construction and base surface prior to pre-fabricated secondary liner system is installed and secured.

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- f. The QP to inspect all pipe connection and potential liner boots through secondary liner system.
 - g. The QP to approved lock block containment structure and secondary liner prior to placement / installation of storage tanks.
 - h. The QP to inspect and approved all tank and pipe connections once complete
 - i. The QP to ensure the High-Level Alarm System is operating properly once installed.
3. Trenching and Installation of twin piping from existing PEA to new storage facility
- a. Trenching will be completed to provide installation of twin piping from the PEA to the new location of the leachate and leak detection tank storage facility and left open for inspection.
 - b. The QP will inspect the twin piping system once installed (but not backfilled) to ensure design grades are met and pipe is welded properly.
 - c. The pipe bedding shall be composed of inert, clean, tough and durable particles of crushed rock capable of withstanding the deleterious effects of exposure to water, freeze-thaw, handling and spreading.
 - d. The material is to be capable of compacting to specified density.
 - e. The particles shall have a gradation falling within the limits specified below.

Minus 19 mm Crushed Aggregate

Sieve Opening (mm)	Size Percent Passing (by weight)
19	100
15	85-100
10	50-100
5	35-88
2.5	25-65
1.25	12-40
0.315	2-15
0.08	0

- f. Backfilling is not to proceed until the QP has inspected and approved installation.
- g. Where excavated material is required for controlled density fill or for backfill requirements as indicated on the drawings, place backfill material in uniform layers not exceeding 300 mm.
- h. Backfill material should be compacted using suitable mechanical compacting equipment.

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- i. Roots, debris or stones greater than 75 mm shall be completely removed from the backfill material.
4. Excavation / rock hammering and installation of seepage blanket monitoring wells at landfill toe
 - a. As outlined in the above sections, excavations will follow WCB work procedures for safe trenching work.
 - b. The QP will inspect the seepage blanket well locations prior to installation of the well to ensure the wells will be placed into competent bedrock and to required depths.
 - c. The QP will inspect the condition of the solid and perforated piping sections prior to installation of the monitoring well to ensure it is sufficient for seepage blanket monitoring.
 - d. The QP to be present and inspection the backfilling of each monitoring well.
5. PEA Liner Repairs and Testing - The QP will inspect all liner works completed by the contractor and sub-contractors including repairs and testing to the existing PEA and any required liner boots for leachate / leak detection conveyance piping.

Geomembrane QAQC will include the following:

- a. Installation of the Geomembrane will be completed by a certified contractor.
- b. Before the installation begins, the QP shall inspect and certify all geomembrane materials are free from damage during transit. Materials that cannot be repaired, in the QP's judgment, shall be rejected and removed from the site.
- c. The geomembrane shall be kept clean and free of debris during placement.
- d. The Contractor shall weigh down the membrane, using sand bags, sufficiently to prevent uplift, displacement, and damage by wind.
- e. The geomembrane shall be manufactured from new first quality polyethylene resin.
- f. The sheet geomembrane shall demonstrate the typical properties shown on the manufacturer's specification sheet. The geomembrane rolls should meet the following specifications, or engineer approved equivalent:

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40 mil LLDPE Geomembrane - Smooth

Property	Value Required	Test Method	Standard
Thickness (mm)	1.0 (40 mil)	ASTM D5994	Nominal
Thickness (mm)	0.90 (36 mil)	ASTM D5994	Minimum
Density g/cm ³	0.939	ASTM D1505	Minimum
Carbon Black Content (%)	2.0 – 3.0	ASTM D1603	Minimum
Tensile Break Strength (kN/m)	27	ASTM D6693	Minimum
Tensile Break Elongation (%)	800	ASTM D6693	Minimum
Tear Resistance (N)	100	ASTM D1004	Minimum
Puncture Resistance (N)	250	ASTM D4833	Minimum
Dimensional Stability (%)	N/A	ASTM D1204	Maximum

The Liner Contractor will complete all repairs to the PEA based on best practices for liner works.

- a. All welding machines will undergo qualification and testing prior to any welding in the field; appropriate reports and documentation will be included in weekly reporting.
- b. All repairs that were completed with an extrusion welding machine will be tested with a Vac-Box.
- c. All repairs that were completed with a double wedge seam welding machine will be tested by way of air channel pressure test.

As outlined in the Detailed Construction Plan the QP will complete an entire site walk over with the Liner Contractor and identify and map all deficiencies including, tears, rips, punctures, unfinished patches, boots, tie-in seams, etc.

It is understood that all aspects of the 2017 Minor Construction Works will need to be signed off and approved by a QP, thus the above-mentioned works identify when the QP will be required onsite. Work tasks not included above will be inspected by the QP during progress inspection, inspections for other work tasks as well as during the final inspection when construction is complete.

Additionally, the QP will be available for the Construction Kick-Off Meeting prior to the commencement of the 2017 Minor Construction Works.

Non-Conforming Items

The QP will be responsible for documenting conditions that deviate from the closure design and preventing non-conformance items from being installed. Minor non-conformance items which are corrected in the same date will be documented in the site inspection report. All other non-conformances are to be documented in a Non-conformance report prepared by the QP sequentially numbered and dated. The Non-conformance report will include:

- a) Description of the non-conformance including relevant details of the occurrence.
- b) Identification of material, component or system by part number, plan, shop drawing

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- and/or specification number and intended installation location.
- c) Source of material or item (name of supplier, owner or subcontractor).
- d) Current status or item in shop, warehouse, lay-down yard or structure.
- e) Individual and organization which detected the non-conformance.
- f) Recommendation for corrective action including sketches, test data and/or repair procedures necessary to substantiate the recommendation.
- g) Cause of the non-conformance and steps taken to prevent reoccurrence indicating action(s) taken, positions or titles of persons contacted, letters written and/or procedural changes proposed.

The QP will sign and forward the Non-Conformance Report to the appropriate parties. Re-inspection and/or re-testing of the work in question will be completed by the QP and verification of correction will be included in an update to the Non-Conformance Report. Non-Conformance Reports will be included in weekly reporting activities.

Deficiency List

A “punch list” of deficiencies will be maintained throughout the life of the project. The punch list is to be consistently updated. The QP will perform follow-up inspections to ensure deficiencies have been corrected prior to final inspection.

Quality Management Records and Reports

The Cobble Hill Landfill 2017 Minor Construction Works project team will maintain records that document assessments performed on the project. Maintaining these records will provide objective evidence and traceability of assessments performed throughout the landfill closure. Example records include but are not limited to: daily inspection reports, QA/QC testing reports, environmental monitoring notes and reports, meeting minutes and weekly status reports.