**Photo:3.3-1**
Roberts Bay Jetty

**Direction:**
North / West

**Photo: 3.3-2**
Roberts Bay Jetty

**Direction:**
North


**Photo: 3.3-3**
Roberts Bay Jetty – exposed geogrid at east toe.

**Direction:**
North / East


**Photo 3.3-4**
Roberts bay Jetty – west toe

**Direction:**
North / West

## 3.4 Shoreline Laydown Area

General Description

The Shoreline Laydown Area is located on the shoreline at the south end of the Roberts Bay Jetty. It is used to stage equipment and supplies delivered to the Project site and waste to be backhauled, by annual sealift. It also houses shipping containers containing supplies necessary to respond to potential spills that may occur during fuel transfers, and stockpiled sheet piling. (Photos 3.4-1 to 3.4-4)

An all-weather road extends a short distance beyond (west of) the Shoreline Laydown Area, to a smaller laydown area that was formerly the construction phase helipad. The road continues slightly further west and north terminating at the shoreline. It was originally intended to access a mooring bollard, which was not constructed. Another all-weather road extends to the east, connecting to the Roberts Bay Waste Management Area.

Observations

The laydown areas and all-weather roads are described as thermal rock fill pads between 1 and 2 m thick, placed directly on the tundra. They were constructed using Run of Quarry (ROQ) rock fill, and generally have steep side slopes, estimated to be in the order of 2 Horizontal to 1 Vertical (2H:1V). The laydown pad and helipad are reported to have been constructed in one procedure. The roads west of the laydown area were partially constructed and then completed (to final grade) later. The access road between the jetty and the Roberts Bay Waste Management Area was widened during the 2010 construction season to facilitate barge off-loading activities.

There were no obvious signs of thermal settlement across the surface of the pads or roads. There was some water ponded against the south (upstream) side of the main laydown area, and there were tension cracks through the south end of the main laydown pad (behind the stockpiled sheet piling) and slumping of the edge of the pad, suggesting some degradation of permafrost below the edge of the pad.

Recommendations

It is recommended that the area along the south edge of the main laydown pad be monitored to determine whether water regularly ponds against the main laydown pad. If so, accumulated water should be pumped out during freshet and after significant or prolonged rainfall events.

**Photo: 3.4-1**
Roberts Bay Laydown Area, north edge of stockpiled sheet piling

**Direction:**
West


**Photo: 3.4-2**
Roberts Bay Laydown Area, north edge of stockpiled sheet piling

**Direction:**
East

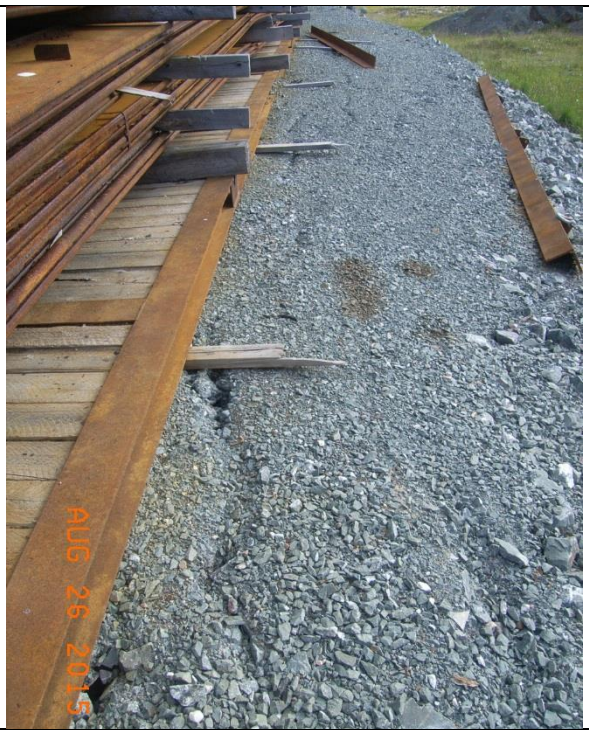


**Photo: 3.4-3**
Roberts bay Laydown Area; tension cracks along south edge of pad

**Direction:**
East


**Photo: 3.4-4**
Smaller laydown area east of main laydown area

**Direction:**
South / West

## 3.5 20 ML Roberts Bay Tank Farm Secondary Containment

General Description

The 20 Million Litre (ML) Roberts Bay Tank Farm is one of three primary fuel storage facilities that supply the Project site. It was constructed in 2011, located south of the Roberts Bay Waste Management Area. The facility presently consists of three, 5ML tanks, with space for two additional tanks. The secondary containment is a gravel covered, High Density Polyethylene (HDPE) lined bunded area. The bund embankments are estimated to be 1.2 to 1.8 m high. The tanks sit on raised gravel pads within the containment area. At the two easterly tanks, the raised gravel pads are contained within metal curbing. The facility is accessed by a ramp at the southeast corner. (Photos 3.5-1 to 3.5-6)

The facility is founded on an area of flat bedrock formed by drilling and blasting a portion of a bedrock outcrop. As a result, bedrock walls rise above the facility along the south and east perimeter. The bedrock wall is reported to be up to 17 m in height, and has a safety catchment bench. Sections of the rock wall are covered with rockfall protection netting secured with rock bolts.

A sump is located along the north side of the facility. It collects water from inside the facility as well as runoff from bedrock walls along the perimeter, and is pumped out as required.

Observations

There are a number of areas where the gravel cover has slipped and exposed portions of the HDPE liner along the bund slopes. There are also some wheel / track marks in the cover gravel from equipment moving fuel lines and snow removal.

At the time of the inspection, the sump was full of water. There is a buildup of sediment on top of (and likely within) the gravel cover surrounding the sump.

General traffic is discouraged from entering the containment area with pylons across the access ramp.

Recommendations

Pieces of spalled rock should be removed from within the limits of the HDPE liner area. The pieces have sharp edges that can damage the liner, particularly if they are pushed into the liner under the weight of equipment moving within the containment area.

Sections of exposed liner should be documented and inspected for damage. The gravel cover at wheel and track marks should be measured. Where the gravel is less than the design thickness, the gravel should be scraped back to expose the liner for inspection. The liner should be repaired if required by qualified personnel, and the cover gravel replaced.

Appropriate snow clearing and water management practices should be maintained to prevent water from building up inside the containment berm that can cause potential erosion of the cover gravel and the raised tank pedestals.

The construction of the sump should be checked to see if it was designed to allow water to enter from the sides. If so, the sump should be pumped out and monitored to see if water is entering from the sides. The concentration of sediment may be blinding the gravel cover in the immediate vicinity of the sump, and the gravel may need to be replaced with cleaner material at some time.

Recommendations from inspections carried out by specialists examining the stability of the rock face and rockfall protection system should be implemented

Only essential traffic should be permitted inside the containment area.

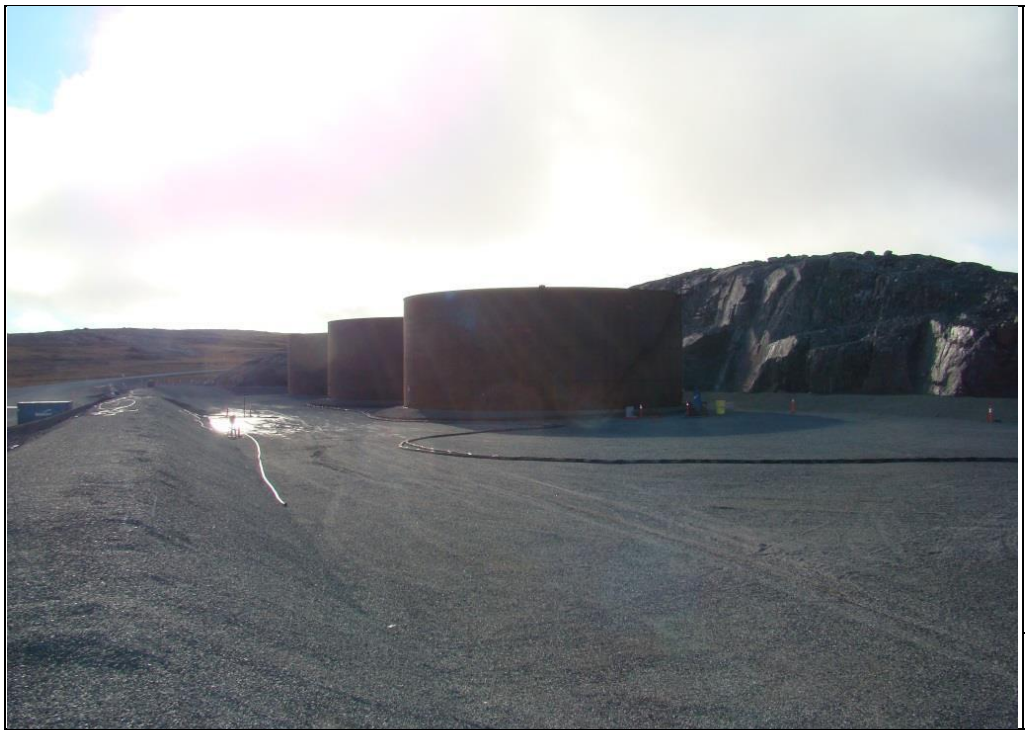

**Photo: 3.5-1**
Roberts Bay Tank Farm

**Direction:**
South

**Photo: 3.5-2**
Roberts bay Tank Farm; rock cut

**Direction:**
South/ East


**Photo: 3.5-3**
Roberts Bay Tank Farm; north containment bund

**Direction:**
West


**Photo: 3.5-4**
Roberts Bay Tank Farm; cover material slippage

**Direction:**
n/a


**Photo: 3.5-5**
Roberts Bay Tank Farm; rock cut

**Direction:**
North / West

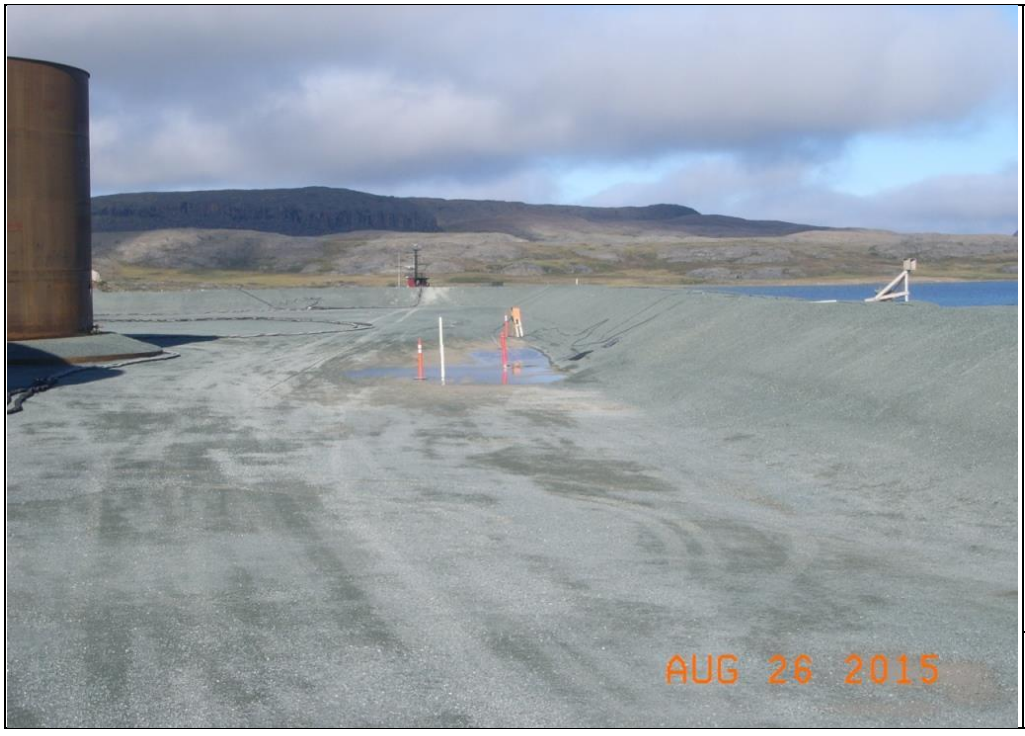


**Photo: 3.5-6**
Roberts Bay Tank Farm; east containment bund and sump

**Direction:**
North

## 3.6 5 ML Roberts Bay Tank Farm Secondary Containment

General Description

The 5ML Roberts Bay Tank Farm consists of a single tank located in an engineered containment facility, constructed inside the former Quarry #1 at Roberts Bay. The tank is presently empty but will be used for fuel storage in the future. There are sea cans and drums stored inside the containment area. Sea cans and a decommissioned fuel transfer station are located on top of the crest of the south bund embankment. (Photos 3.6-1 to 3.6-6)

The secondary containment system was designed and constructed by SNC Lavalin Engineers and Contractors in 2008. It is a bunded area lined with a geosynthetic clay liner overlain by an HDPE liner, and protected with a gravel cover. The 5ML tank sits on a raised gravel pad inside the containment area. The bund embankments are estimated to be 1.2 to 1.8 m high. The facility is accessed by a ramp at the southeast corner of the containment area. A sump is also located in the southeast corner, adjacent to the access ramp.

The limits of the former Quarry #1 form raised bedrock walls along much of the west and north perimeter of the containment area. Water that collects on the uneven bedrock surface above the containment area is directed away from the containment area, onto the surrounding tundra.

The portion of the secondary containment area below the tank is founded on bedrock; however the eastern limit and the former fuel transfer station (south bund embankment) are supported on engineered fill (compacted quarry rock) overlying a permafrost overburden foundation.

Observations

At the time of the inspection, the only area of ponded water inside the containment facility was at the sump in the southeast corner. There is a buildup of sediment on top of (and likely within) the gravel cover surrounding the sump.

Some spalling had occurred from the rock walls surrounding the west and north perimeter of the containment facility.

A number of small excavations were previously carried out to expose the liner, as part of an investigation to confirm the extents of the liner and hence the capacity of the secondary containment facility. Some of these excavations have not been backfilled and the liner is exposed. Liner is also exposed along the downstream side of the south bund embankment.

There are wheel / track marks in the cover gravel across the base and embankment slopes, from equipment working inside the secondary containment (e.g. sea cans and drums, and snow removal).

Recommendations

Pieces of spalled rock should be removed from within the limits of the secondary containment area. The pieces have sharp edges that can damage the liner, particularly if they are pushed into the liner under the weight of equipment moving within the containment area.

Sections of exposed liner should be documented and inspected for damage. The gravel cover at wheel and track marks should be measured. Where the gravel is less than the design thickness, the gravel should be scraped back to expose the liner for inspection. The liner should be repaired if required by qualified personnel, and the cover gravel replaced.

If an extension of the liner limits is required to meet the design capacity of the tank farm, it should be completed before the re-commissioning of the tank.

Because a portion of the secondary containment facility bears on bedrock and a portion on engineered fill, regular inspections should include an assessment for differential settlement.

The construction of the sump should be checked to see if it was designed to allow water to enter from the sides. If so, the sump should be pumped out and monitored to see if water is entering from the sides. The concentration of sediment may be blinding the gravel cover in the immediate vicinity of the sump, and the gravel may need to be replaced with cleaner material.


**Photo: 3.6-1**
Quarry #1 Tank Farm; east corner of containment bund and sump

**Direction:**
South / West


**Photo: 3.6-2**
Quarry #1 Tank Farm

**Direction:**
North / West


**Photo: 3.6-3**
Back slope of Quarry #1 Tank Farm / North edge of Roberts Bay Waste Management Area

**Direction**:


**Photo: 3.6-4**
Quarry #1 Tank Farm; west side, rock cut and fallen rock pieces

**Direction:**
North


**Photo: 3.6-5**
Quarry #1 Tank Farm; liner cover

**Direction:**
**n/a**

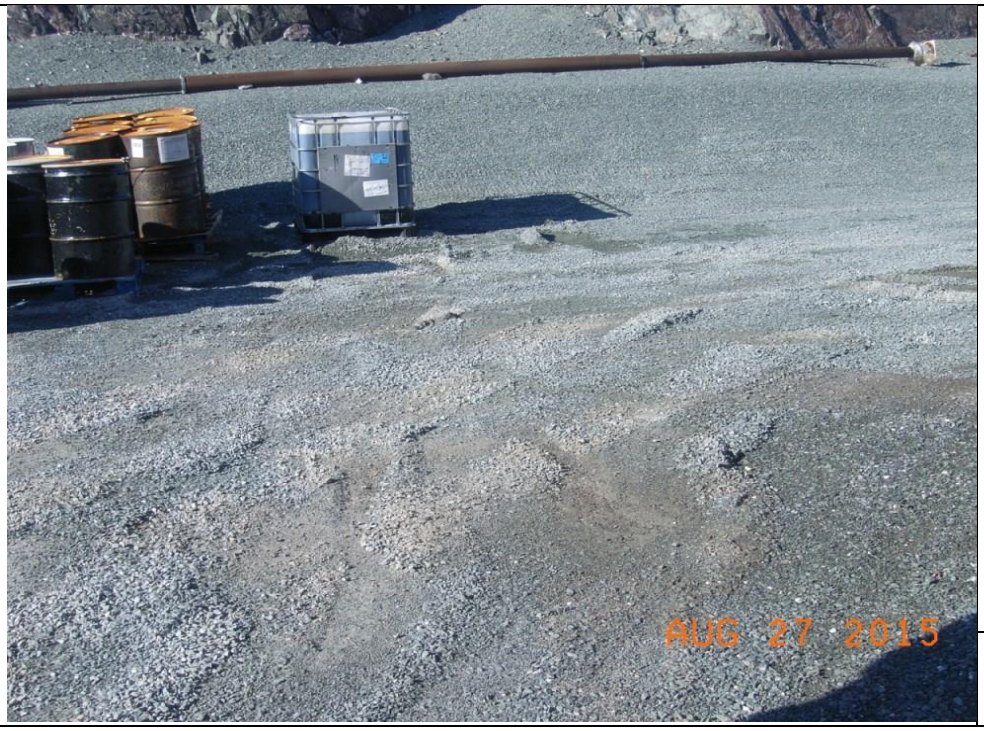


**Photo: 3.6-6**
Quarry #1 Tank Farm; liner cover

**Direction:**
**n/a**

## 3.7 Roberts Bay Waste Management Area

General Description

The Roberts Bay Waste Management Area (formerly called the Roberts Bay Laydown Area) is located east of the 20ML Tank Farm and south of the 5ML Tank Farm. It is a roughly triangular shaped, thermal rock fill pad founded directly on the tundra. The pad generally follows the contours of the original ground surface, with some variations in thickness (tiering) to provide level storage. (Photos 3.7-1 to 3.7-5)

The laydown area presently houses the incineration facilities and waste management sorting and staging areas. Sea cans are used to warehouse / store non-hazardous waste for future removal / disposal. It is also used for empty barrel and pallet storage. A new incinerator has been constructed within a concrete lined pad, southeast of the original incinerator.

Observations

The laydown pad shows no obvious signs of distress in the form of thaw settlement, and there was no evidence of ponding water on the pad or along the toe of the pad.

The thermal pad was constructed over several drainage channels that carried overland surface runoff towards the southeast, to Roberts Bay. There were no improvements made as part of the thermal pad design to preserve the drainage (e.g. rock drains). However, water was observed flowing from beneath the pad along the southeast limit, indicating that the rock fill used to construct the thermal pad has not blocked the overland drainage.

There is a thin patchy layer of gravel located across an area of tundra beyond the southeast limits of the thermal pad. It is reported that quarry rock was temporarily stored there and was subsequently relocated. Areas where rock has been removed from the tundra should be monitored visually for deterioration. Even if the rock was carefully removed a thin layer of sand and gravel generally remains that will affect the vegetation and underlying thermal properties. This could depress the active layer and result in thawing and settlement.

No standing water was observed against the toe of the perimeter of the rock fill pad or along the driveway, and no signs of thermal settlement. There was no standing water on top of the pad or areas of significant settlement. Significant tension cracks were noted on the north, east, and south sides of the pad.

Recommendations

Continue monitoring areas where rock was relocated from the tundra for signs of thermal settlement, and for ponded water along the edges of the thermal pad.


**Photo: 3.7-1**. Roberts Bay Waste Management Area

**Direction: North**


**Photo: 3.7-2** Roberts Bay Waste Management Area

**Direction: North / East**


**Photo :3.7-3**
Roberts Bay Waste Management Area; east edge of pad

**Direction:**
North / West


**Photo :3.7-4**
Roberts Bay Waste Management Area; east edge of pad

**Direction:**
North / West


**Photo :3.7-5**
Roberts Bay Waste Management Area; east edge of pad

**Direction:**
North / West

## 3.8 Quarry #1 Overburden Dump

General Description

The overburden stripped from the original development of Quarry #1 was placed just east of the quarry outcrop. Other material placed in the dump include organics, snow, ice, and oversize material from the development of the former quarry into the 20ML Fuel Tank Farm. A runoff sedimentation control berm was constructed around the toe of the dump in 2011. The sedimentation control berm was extended in 2011 to become the Roberts Bay Access Road. (Photos 3.8-1 to 3.8-4)

The surface of the pile was levelled and covered with a layer of surfacing material to allow the pile to be used as a general laydown area, although at the time of the inspection there was nothing stored at this location

Observations

Areas of subsidence were noted across the top of the overburden dump as has been reported in previous inspections. The sinkholes are considered to result from the loss of the finer surfacing material into the void spaces of the oversized material

Recommendations

The perimeter of the sedimentation control berm should be visually monitored to see that it is performing as designed and that there is no sediment transport from the overburden pile onto the tundra.

The areas of subsidence are expected to require periodic ongoing maintenance with the placement of additional material. If this area is used for storage at some time in the future, increased maintenance requirements can be expected.