Summary of Work – Hall Beach
2020 Field Season

Community and Government Services
Government of Nunavut

Type of Document:
Final Report

Project Name:
Hall Beach Sewage Lagoon
Change Order No. 5 & Leak Detection/Resolution

Project Number:
OTT-220382

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Date Submitted:
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Project Number: OTT-220382
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Table of Contents

Project Number: OTT-220382
Date: 11/25/2020

Introduction

The construction of the Sewage Lagoon Upgrades in Hall Beach were completed in November 2016 by Nunavut Excavating, which were the contractor awarded the work through a public tendering process. The scope of the upgrades was the construction of a new cell (referred to as "the Cell") and associated discharge structures associated with the cell. Based upon the information available to EXP Services (EXP), the Cell was first used by the Hamlet of Hall Beach in 2017. EXP was subsequently contacted in 2018 because leaks were observed through the east berm of the Cell. EXP was commissioned to complete an inspection report to try and identify possible causes and remediation measures for the Cell leaks; a report was submitted to the Government of Nunavut in September, 2018 (OTT- 00220382-A0 - Engineering Services – Hall Beach Cell August 2018 Assessment Summary). The report recommended operation changes, operational reviews, and observations as a basis for the development of remediation options (see report in Appendix A). In July 2019, after leaks in the Cell were again observed, remedial work at the discharge locations was sanctioned based upon input from EXP. This work was approved by the GN through Change Order 05 (see Appendix B).

Nunavut Excavating undertook the remedial work during the 2020 construction season. The scope of Change Order No. 5 was the repair of erosion protection features at the truck discharge points of the Cell which had deteriorated from the discharge activities by the Hamlet of Hall Beach. The work was inspected throughout the summer by Martin Boissonnault of EXP. Work began on June 29th, 2020, and the Change Order was completed by July 28th, 2020.

Over the course of the Change Order work, it was noted that sewage was leaking out of the Cell and coming out of the ground on the east side of the east berm. This leak was documented by the Hamlet in a spill report filed on June 29, 2020.

Upon completion of Change Order 5, the contractor began a leak detection and remediation program which extended over the period of July 29, 2020 to September 24, 2020. The leak detection program identified over one hundred nonconformances over the Cell bottom at the edges of the Geosynthetic Clay Liner (GCL) panels. Over successive rounds of testing and leak sealing, the contractor eventually exposed all the seams within the floor of the Cell and resealed them after cleaning and the addition of new bentonite.

Despite the contractor's efforts, the Cell is still leaking as of the end of the leak detection and remediation program. Due to winter conditions that were experienced at the site, with snow accumulation and temperatures falling below zero, the Contractor chose to demobilize on September 25, 2020. The Contractor intends to return to the site in 2021 to continue the leak detection and remediation process. The Contractor intends to prepare a new inspection and remediation plan prior to mobilizing for the 2021 program.

Project Number: OTT-220382
Date: 11/25/2020

Change Order 5 Summary

Change Order No.5, issued on July 15, 2019, covers repair procedures and required upgrades to the discharge stations located in the Cell's northwest and southwest corners. A copy of the change order is provided in Appendix B.

Work summary

The contractor began work on Change Order 5 on June 29, 2020 and work completed as part of the change order is summarized within this section. Daily reports were prepared by the EXP inspector throughout the duration of the change order work, and are included in Appendix C.

The Cell, despite having started to leak, still contained a significant amount of wastewater as of June 30, 2020. This wastewater was pumped out using the Hamlet's pump over the course of approximately 6 days. Once the water level was low enough, the liner was exposed at both discharge stations.

The south discharge station's liner was found to be in excellent condition, with no tears or rips. A levelling course of gravel was placed on the existing liner, and a new liner was placed over a width of approximately 10m. This new liner was anchored at the top of the embankment, using a trench as per manufacturer's recommendations, and runs all the way to the bottom of the embankment. At both sides of the new liner section as well as at the bottom, the new liner was sealed onto the existing liner with bentonite as per manufacturer's instructions.

The existing liner at the north discharge station was found to have several rips, tears and dislodged patches, which were smoothed out or removed as applicable. A levelling course of gravel was placed onto the existing liner and a new section of liner was installed. This liner is anchored through a trench at the top of the embankment and sealed at the bottom and sides with bentonite as per manufacturer's recommendations. The new liner is approximately 18m wide at the top and 12m wide at the bottom, as it curves around the corner of the lagoon.

Gabion cages were installed at the south discharge station, over an expanded area as shown on Change Order 5. The gabion cages were installed with geotextile along the bottom and sides, to help mitigate the issue of the stones falling out due to their small diameter. The steel chute at the south discharge station was also installed and welded onto its piles. The four bollards near the discharge station were re-installed in a similar configuration as the original installation. The locations of the bollards were adjusted to better conform to the observed truck movements.

Measurements were taken between the hamlet truck and the discharge station to size the truck bumper. The bumper is made of 150mm diameter steel pipes welded onto the piles supporting the discharge station. These piles are installed into the permafrost, as opposed to the bollards which are installed approximately 1m into the ground. The bumper is a double frame with a height above ground of approximately 300mm. In its final configuration, the truck discharge station is built such that a truck backing up to the discharge station will impact the truck bumper first with its rear tires, prior to impacting the bollards or the chute.

Remedial work at the north discharge station included the replacement of gabion cages as well as the of addition of 90 m^2 of gabion cages to expand the erosion protected area below the discharge stations defined in Change Order 5. As at the south station, the gabion cages were lined with geotextile to prevent rocks from passing through the gaps in the gabions.

A truck bumper was built at the north station using the same design as the south bumper, with steel pipes welded onto the discharge chute's piles. The bollards and bumper were again adjusted to for the truck position at the discharge by backing a truck up to the discharge station. The truck bumpers and bollards at both discharge stations were painted and the ground around the gabion mats was smoothed and graded. The riprap at the bottom of the steel chutes was restored, using the existing riprap that had been removed at the start of the work. The contractor cleaned up the debris left over from construction of the remedial work.

Results

The work presented in Change Order 5 was successfully completed in accordance with the specifications. The contractor did not experience any major issues in performing the work, and the results meet specifications as stated in the Change Order. No additional issues with the work were noted by EXP. The work on Change Order 5 was deemed to be substantially complete on July 29, 2020.

Leak Detection and Remediation Summary

The Hamlet observed that a leak from the Cell had developed on the east side of the lagoon. The leak was documented in a spill report to the Nunavut Water Board on June 29, 2020. To advance remedial work, the contractor proposed a leak detection program which resulted from a liner issue being found and remediated. Efforts at leak detection were based on a method of filling the Cell until a leak was detected, then tracing the outline of the wetted area to limit the potential leak location. This process was repeated multiple times as leaks were found and sealed with bentonite.

Summary of Work

The leak detection work began on July 29th and the work was documented throughout the activity by Martin Boissonnault of EXP. In addition to the summary provided in this section, daily reports were produced for the duration of work and are provided in Appendix D.

To begin the exercise, the Contractor and their consultant outlined a procedure for identifying the location of potential leaks. Based on this procedure, measurements were taken across the Cell bottom to ascertain the location of the depressions. The lowest spot was found to be against the east berm, directly across from the area where leakage had been observed. The aggregates were then removed in an area approximately 7m by 40m surrounding the low spot. The 100mm sand layer under the aggregates was left intact. After the sand was exposed, water was pumped into the excavated area to determine if the liner in this area was functional. After turning off the pump, it was observed that the water level dropped at a constant rate for several hours, then slowed down significantly. The contractor hypothesized that a leak in the liner had been exposed and was now above water. The contractor proceeded to drain the remaining water and expose the seams within the liner, starting with the embankment side.

At several seams, nonconformances of the GCL were observed which would allow the water to flow through. Nonconformances (wrinkles and/or rolls) were observed at the bottom of the embankment, at locations where the liner on the lagoon slopes transitions onto the Cell floor. The water escape path was often visible from the staining and/or discoloration of the liner. A 1m long tear was also found in one of the liner panels, and a horizontal joint was found to have been forced open by aggregates in the seam. In response to these findings, the entire east berm was eventually exposed for about 4 to 5 meters above and below the bottom of the embankment. Of the 27 seams on the east embankment that were exposed, nonconformances were observed in 11 seams. All of the exposed seams of the liner were cleaned and resealed with bentonite. Horizontal seams were adjusted to make sure of proper lap direction and length.

A new liner was installed over the existing liner. The new liner has a lap distance of approximately 1m at the top (up the embankment). Panel length varied and was adjusted to make sure that the new liner covered all observed defects in the liner. All seams in the new liner were sealed with bentonite according to the manufacturer's instructions.

When this area of assessment had been repaired in full, the contractor proceeded to restore the aggregates. As there was not enough material remaining from the construction phase, the contractor screened new sand to place over the repaired liner installation. The sand was covered with the aggregate that had been removed to expose the liner. The surface was graded to match conditions existing prior to the remediation work.

The contractor then exposed the joints at the embankment-floor interface along the lagoon's south bank. All joints were exposed along this bank, for approximately two metres above and one metre below the embankment-floor interface. No defects were observed.

The contractor then gradually filled the Cell with water. The pump ran for a full day before it was shut off overnight. No seepage through the embankment was observed that day. The following morning water was observed seeping out of the ground on the east side of the lagoon where seepage was previously identified. The contractor did not pump further water into the lagoon. Channels were dug down to the liner, radiating from the pump outlet until dry soil was encountered. This allowed the contractor to delineate the shape and area of the surface that had been wetted by the pumping activities, thereby limiting the possible location of the leak to the wetted area.

The contractor then began exposing liner within the wetted area to search for deficiencies within the liner. One of the east-west seams within the liner was found to be damaged, with dozer tracks being observed in the liner. The dozer tracks allowed voids to form within the seam, some of which were filled with gravel that provided water passageways into the subgrade. Due to this finding the contractor exposed this seam all the way across the lagoon bottom, with issues identified at multiple locations along its length.

The contractor then decided to expose all seams within the Cell floor. The exposure, resealing, and backfilling process took approximately three weeks, and all seams within the south cell were exposed, resealed and backfilled. All of the 29 east-west seams within the Cell were found to have issues which would influence the lagoon's ability to hold water. The most common deficiency was the presence of gravel within the seam of the GCL layers, preventing the liner from sealing properly. Another common deficiency was the presence of dozer tracks on the liner. Several rips, tears, and misalignments were also corrected as part of the remediation process. A full summary of the defects is presented in the inspection reports attached in Appendix D. It should be noted that only the liner seams were exposed during leak detection and remediation activity, and not the liner panels themselves; thus, the liner was not exposed over most of the cell.

After all the seams were remediated, the contractor began pumping water into the Cell to conduct another leak test. Water was first pumped from the North cell, then from freshwater ponds located to the west of the lagoon after submitting a request to and receiving permission from the Nunavut Water Board. Initial filling looked promising, as the water level in the cell appeared to rise much faster than during previous rounds of testing. During the pumping process water seepage was observed flowing again on the east side of the lagoon. The liner manufacturer advised that leakage is expected during initial wetting of the liner seams as the hydration process occurs, and that the liner performance would only be understood after a few days of wetting. The contractor continued to pump water into the cell for several days based upon this information. After over a week of pumping the leak was still flowing, and the seepage was visually consistent over several days. The water level in the Cell was over the aggregates across the whole cell at this point, providing strong evidence to suggest that the liner was completely submerged, and that complete hydration, and hence sealing, of the liner seams would occur.

After the leak test was judged to have failed on September 24, 2020, the contractor made the decision to stop work for the season. The decision to stop work was influenced by the increasing cold weather in Hall Beach that would significantly hamper

any further remedial activity. The contractor expressed their intent to develop a revised remediation plan over the winter and execute the plan in 2021.

Results

The work undertaken as part of the leak detection and resolution program lasted from July 29th to September 24th, 2020. During the process, all seams within the floor of the Cell were exposed and resealed with new bentonite. It is estimated that 100+ leaks were remediated. Despite this work conducted in 2020, the south cell continues to leak. The leak is visually inferred to be at a reduced rate compared to initial observations between June 29 and July 6, 2020.

The Contractor suggested that the future leak detection and remediation plan may be to expose the liner panels between the seams, across the entire south cell. These panels remained mostly buried throughout this summer, and it is possible that further defects exist within them.

Appendix A – August 2018 Summary of Hall Beach Lagoon Cell Work

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Field Report

Project Title:	**Project No.: OTT-00220382-A0**
Hall Beach Lagoon Upgrades	**Date: August 25, 2018**
(2018 Assessment)	**Inspector: A. Thompson**

The inspector arrived onsite at 0700 to conduct an assessment of the Cell, and monitor the survey of the contractor. The contractor's representative (Corey) was not able to get the survey equipment operational, and spent the afternoon trying to troubleshoot. The operator (Chris) after mobilizing the equipment to the site worked on other projects in town in the afternoon due to the survey of the cell bottom not being complete.

During the site assessment, a depression was observed in the south east quadrant of Cell 1. This location was hand dug to view the liner to assess the integrity. The liner was exposed over a minimal area, with the liner having a sag of 200 to 300mm below where the liner was estimated to have been prior to the settlement. Further excavation will be conducted in this area with an excavator.

The cover above the liner consisted of about 0.4m of material; with the upper portion being coarse drainage material (estimated to have been screened between the 10 and 50mm sieves) underlying by a thin layer of sand. The sand layer ranged in thickness at the exposed area between 25 and 125mm.

Photos attached.

Onsite effort for August 25:

- Surveyor (Corey) onsite for 5 hours (0700 to 1200) to try to get survey gear working. Corey worked to get survey gear working for some of the afternoon, but did not have any progress.
- Operator (Chris) worked to get equipment working (2 hours), drove the loader to the site (his transportation during the week assessment), helped hand dig the assessment area. Chris was onsite or preparing equipment between 0700 and 1200, then worked on another project in the afternoon.
- No labour hired for this day.

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Photo 1: View of western side of the lagoon from the south discharge location. Hamlet had been using this cell for disposal, as evidenced by the liquid at the surface at both discharge locations.

Photo 2: View of the eastern berm of Cell 1, where seepage has occurred.

Field Report

Project Title:	**Project No.: OTT-00220382-A0**
Hall Beach Lagoon Upgrades	**Date: August 26, 2018**
(2018 Assessment)	**Inspector: A. Thompson**

The inspector arrived onsite at 0700 to meet with the contractor. Corey was onsite at 0700 to attempt the survey again. The gear was not working again, and no survey was completed on this day.

The areas adjacent to the site to the west have standing water at an elevation that would roughly correspond to the bottom of lagoon elevation. The contractor was asked to pick this information up during their survey.

The operator arrived around 0800 and an excavator was brought into the cell bottom to remove some of the gravels above the liner for assessment. During the assessment an area of the GCL was damaged; this area later had the GCL removed for assessment and repaired.

The exposed area (Area 1) had between 400 and 450mm of material above the liner, with 25 to 125mm of that material being sand. Area 1 had been excavated wider than the hand dug area from August 25. The area showed multiple low areas, that seemed to be isolated to this 4m x 6m area.

Due to the consolidation of the cell granular material, the excavator was removed around 1400 and a mini excavator was mobilized in to finish the exploratory work (mobilized using the loader as the mini was used by the contractor on the other side of town the day previous). At 1500 the mini was onsite and the excavation was continued.

Photos attached.

Onsite effort for August 26:

- Surveyor (Corey) onsite for 10 hours (0700 to 1700, minus lunch) to try to get survey gear working. No progress on the survey.
- Operator (Chris) worked for 10 hours (0800 to 1800, minus lunch). He was the sole worker (operated equipment and was the labourer). Excavator 5hr, Loader 1hr, mini 4hr. Equipment was idle most of the day due to the manual labour that was required.
- No labour hired for this day.

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Photo 1: Excavator onsite at Area 1.

Photo 2: Mini mobilized in to complete the removal. All equipment for August 26 in view.

Field Report

Project Title:	**Project No.: OTT-00220382-A0**
Hall Beach Lagoon Upgrades	**Date: August 27, 2018**
(2018 Assessment)	**Inspector: A. Thompson**

The inspector arrived onsite at 0900 after conducting a quantity estimate of the materials segregation stockpiles. Upon arrival, additional photos and inspection were undertaken on the east berm where some seepage/standing water was noted. Of note, the Hamlet switched from dumping into Cell 1 to Cell 2, allowing us to assess the discharge areas.

The contractor spent the majority of the morning in search of labourers. Late in the morning they returned to the site. At this time we opened up the GCL at Area 1. The GCL had an overlap of about 240mm, with Bentonite observed at the seam. In the low areas, the water seemed to seap through the GCL when the GCL was opened up. Water was present at the bottom of the exposed area, even when some of the water was scooped out. See photo.

After lunch the operator, with the help of 3 labourers for portions of the afternoon, opened up three additional areas to observe the GCL. The areas are as follows:

1. Area 2. 330 mm cover, 80mm sand. GCL in good condition.
2. Area 3. 320mm cover, 130mm sand. GCL in good condition.
3. Area 4. 340mm cover. 150mm sand. GCL in good condition when possible to assess. 100mm of liquid encountered above the GCL. Liquid stable for 24+/-hr.

Conversations with one of the Labourers (Tyler who lives at Civic 120):

- Operated a roller and mini excavator during construction.
- Said compaction effort was limited at the bottom of the cell.
- He did not recall much for snow/ice during liner and cover material placement.

Contractor (Corey) was able to perform most of the survey after figuring out the gear mid-afternoon.

The discharge areas show significant erosion, especially the north discharge. Further assessment is required, and (limited) repairs to maintain the use of the cell will be undertaken.

Photos attached.

Onsite effort for August 27:

- Surveyor (Corey) onsite for 7 hours (1000 to 1800, minus lunch). Survey from about 1500 to 1800.
- Operator (Chris) onsite for 7 hours (1000 to 1800, minus lunch). Mini 6hr.
- Labourers - Al, Peter Jr, Tyler onsite for most of the afternoon..

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Photo 1: Evidence of overlap and bentonite at GCL seam at Area 1.

Photo 2: Area 1 upon removal of GCL. Standing water and depressions noted. Evidence of bulldozer tracks at the surface.

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Client Name and Project Title

Government of Nunavut—Community and Government Services
Hall Beach Lagoon Upgrades

PROJECT NO.:

OTT-00220382-A0

DATE:

August 27, 2018

Photo 3: Excavation effort at Area 2.

Photo 4: Area 4 during excavation. Cover material underlain by a coarse sand, with about 100mm of liquid before the GCL.

Photo 5: North discharge area. GCL exposed around the larger stone. Gabion baskets highly eroded.

Photo 6: South discharge area. Areas of localized erosion to expose GCL. Gabion baskets eroded at bottom of discharge.

Field Report

Project Title:	**Project No.: OTT-00220382-A0**
Hall Beach Lagoon Upgrades	**Date: August 28, 2018**
(2018 Assessment)	**Inspector: A. Thompson**

The surveyor spent the majority of the morning finishing up the survey of Cell 1 (0800 to 0930), then conducted the stockpile survey of the Material Segregation contract between 0930 and 1130.

The operator spent the morning collecting material for the south discharge area repair. This included locating larger rock, mobilizing the loader and rock truck, and the second excavator. Repair work started after lunch, and was completed by 2200.

As work was ongoing for the south discharge area, the labourers using the mini backfilled the four assessment areas. Sand was imported to be placed prior to the cover material.

Conversation of note:

- An operator for the Hamlet informed Corey that the main road to the dump this year experienced significant damage from permafrost, and work was required to restore service. (No distress was observed in the other non-road berms of the Cells)

Photos attached.

Onsite effort for August 28:

- Surveyor (Corey) onsite for 6 hours (0800 to 0930 and 1130 to 1800, minus lunch). Survey completed by 0930, then operated the rock truck and excavator.
- Operator (Chris) onsite for 12 hours (0800 to 2200, minus lunch and supper). Mini 4hr, Excavator (1) 10hr, Excavator (2) 4hr, Rock truck 2hr, Loader 2hr.
- Labourers - Al, Peter Jr, Tyler present for a portion of the day.

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Photo 1: Larger rock that the contractor was able to collect for the south discharge repair.

Photo 2: Progress of the south discharge repair. Placed granular material to raise grades, followed by larger stone to reduce erosion.

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Project Title:	**Project No.: OTT-00220382-A0**
Hall Beach Lagoon Upgrades	**Date: August 29, 2018**
(2018 Assessment)	**Inspector: A. Thompson**

At the start of the day the contractor worked to collect material for the repair at the north discharge area. Multiple loads of granular material were delivered to the north discharge area, along with two loads of large stone.

The labourers were onsite to help finalize the GCL repair at Area 1, and place the cover material.

After returning from pricing other work (0900 to 1015), the contractor mobilized the excavator to the north discharge and removed some of the solids from the cover surface. Work was completed to allow for the intrusive investigation to begin after lunch.

As work continued in the afternoon, observations were made regarding the integrity of the liner system:

- Multiple small holes in the GCL were noted on the slope below the discharge chute (i.e. 200mm and smaller)
- The GCL (at least the bentonite within the GCL) is sliding down the slope.
- There was an overlap of the GCL centered on the discharge chute. The seam had opened in a few areas.
- There was a repair observed immediately to the west of the discharge chute. Bentonite was not observed (or staining from previous bentonite) at the seam. About 150mm of gravel was observed between the two layers (i.e. the two GCL layers were not touching each other).
- The seam at the bottom of the slope did not have adequate overlap and bentonite seal.
- The gabion baskets are highly eroded at the top of the slope.
- The discharge chute is damaged, and directs water into the granular material as flow rates decrease.

Photos attached.

Onsite effort for August 29:

- Surveyor (Corey) onsite for 10 hours (0730 to 1730, minus lunch and the time pricing other work). Corey operated the rock truck in the morning, and then since his flight was cancelled, he was around the site the rest of the day. He did not have work clothes on, so he sat in the excavator.
- Operator (Chris) onsite for 13.5 hours (0730 to 2200, minus lunch, supper, and pricing another job).
- Mini 6hr, Excavator (1) 8hr, Excavator (2) 4hr, Rock truck 2hr, Loader 2hr.
- Labourers – Al present for about 12hr, while Peter Jr, Tyler present for a portion of the day.

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Photo 1: Large stone removed to reveal holes in GCL. Gabion baskets have had all stone eroded out.

Photo 2: Mini Excavator and labourers removing the cover material above the GCL in the discharge area.

Photo 3: Limits of excavation on August 29. Seams on right side of photo had about 150mm of granular between layers, with no evidence of bentonite. Repairs to GCL evident in this area.

Photo 4: Water pumped from the bottom of the exposed area. Bentonite placed on the GCL seam and closed.

Field Report

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(2018 Assessment)	**Inspector: A. Thompson**

EXP inspector and Operator (Chris) work from 0700 to 0830 to place the liner in the repair area. Liner and bentonite was collected from their storage area, delivered to the site, and cut to size.

Due to flight, EXP departed at 0830, returning for a brief visit before the flight out of Hall Beach at 0910 to take pictures of the liner prior to material placement. Additional liner was to be required to fully repair the area.

Photos are to be sent by the contractor to document the progress of the repair.

Onsite effort for August 30 (until 0915):

- Operator (Chris) onsite for 2.5 hours.
- Excavator (1) 1hr, Excavator (2) 0.5hr, Loader 0.5 hr.
- Labourers – Al arriving onsite at 0915.

Effort required to see the repair to completion unknown. Estimated that it will have taken the duration of August 30 to complete.

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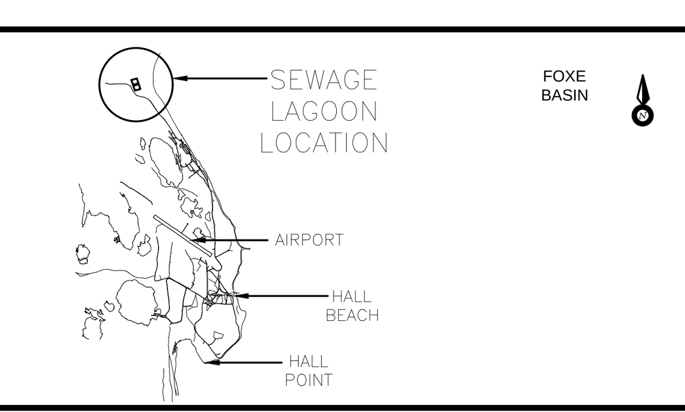
NOTES
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

PROJECT KEYPLAN



REV	REVISION DESCRIPTION	DATE	BY	APP

SCALE: 0 5m 10m 30m HORIZONTAL 1:750

NORTH

DESIGNED BY

REVIEWED BY

CLIENT: GOVERNMENT OF NUNAVUT—COMMUNITY AND GOVERNMENT SERVICES

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CAD	JNS
PROJECT MANAGER	–
APPROVED	–

PROJECT: HALL BEACH LAGOON UPGRADES
HALL BEACH, NUNAVUT

TITLE: OVERALL SITE PLAN (AS—BUILT)

PROJECT No. OTT—00220382—A0
SURVEY exp
DATE
DRAWING No. FIG 1

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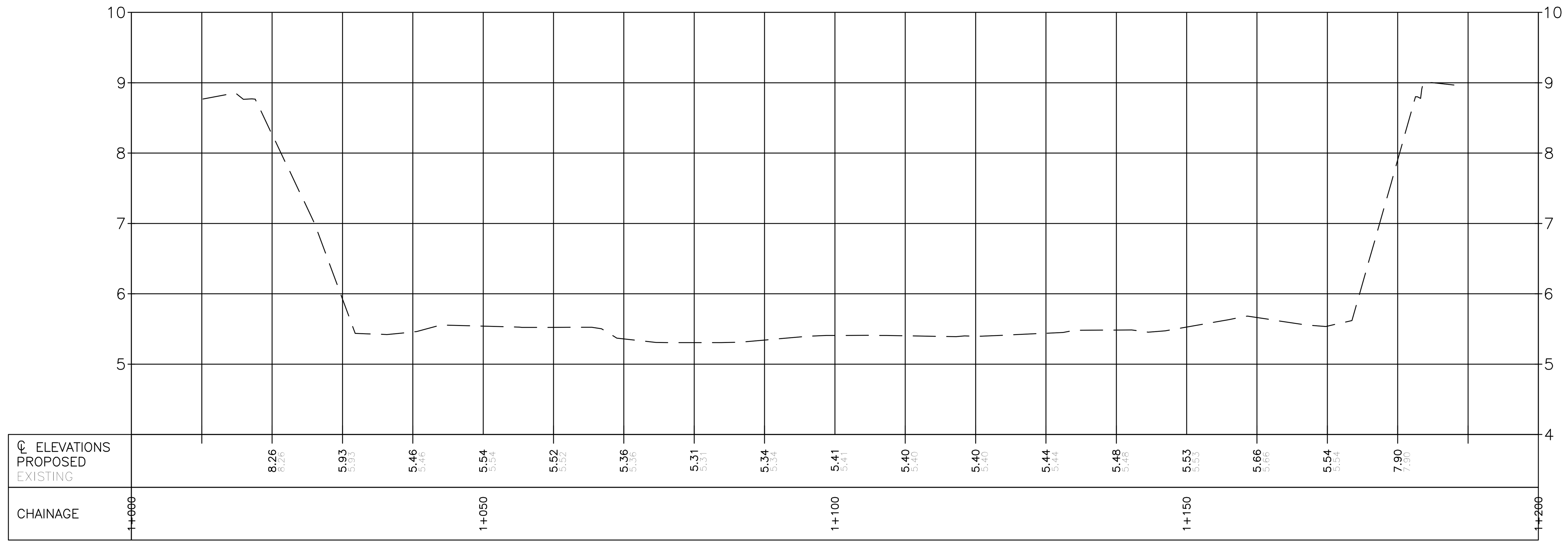
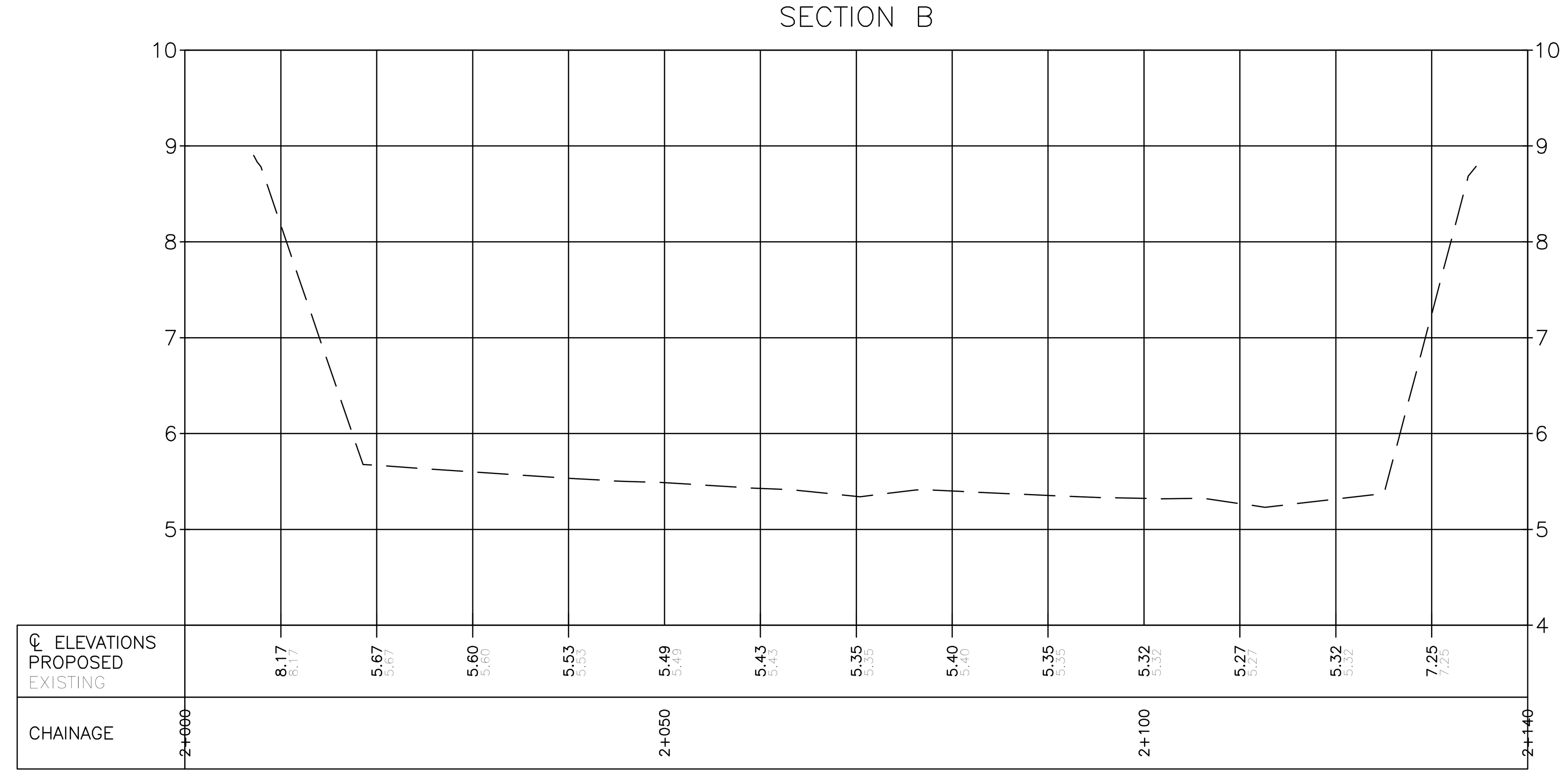
SECTION A



SECTION B



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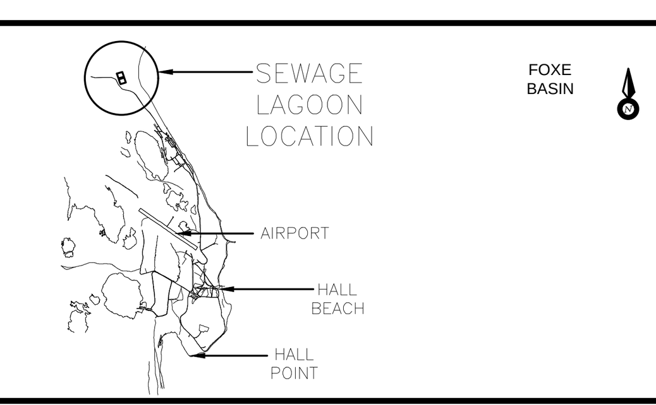
PROJECT KEYPLAN



REV	REVISION DESCRIPTION	DATE	BY	APP

SCALE

NORTH

DESIGNED BY

REVIEWED BY

CLIENT: GOVERNMENT OF NUNAVUT–COMMUNITY AND GOVERNMENT SERVICES

exp Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7330
2650 Queensview Drive, Unit 100
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BASEPLAN	exp
DESIGN	–
CHECKED	AT
CAD	JNS
PROJECT MANAGER	–
APPROVED	–

PROJECT: HALL BEACH LAGOON UPGRADES
HALL BEACH, NUNAVUT

TITLE: PROFILES

PROJECT No.: OTT–00220382–A0
SURVEY: exp
DATE
DRAWING No.: FIG 2

P1 - DETAIL

PHOTO - SOUTH DISCHARGE - EXISTING CONDITION

P2 - DETAIL

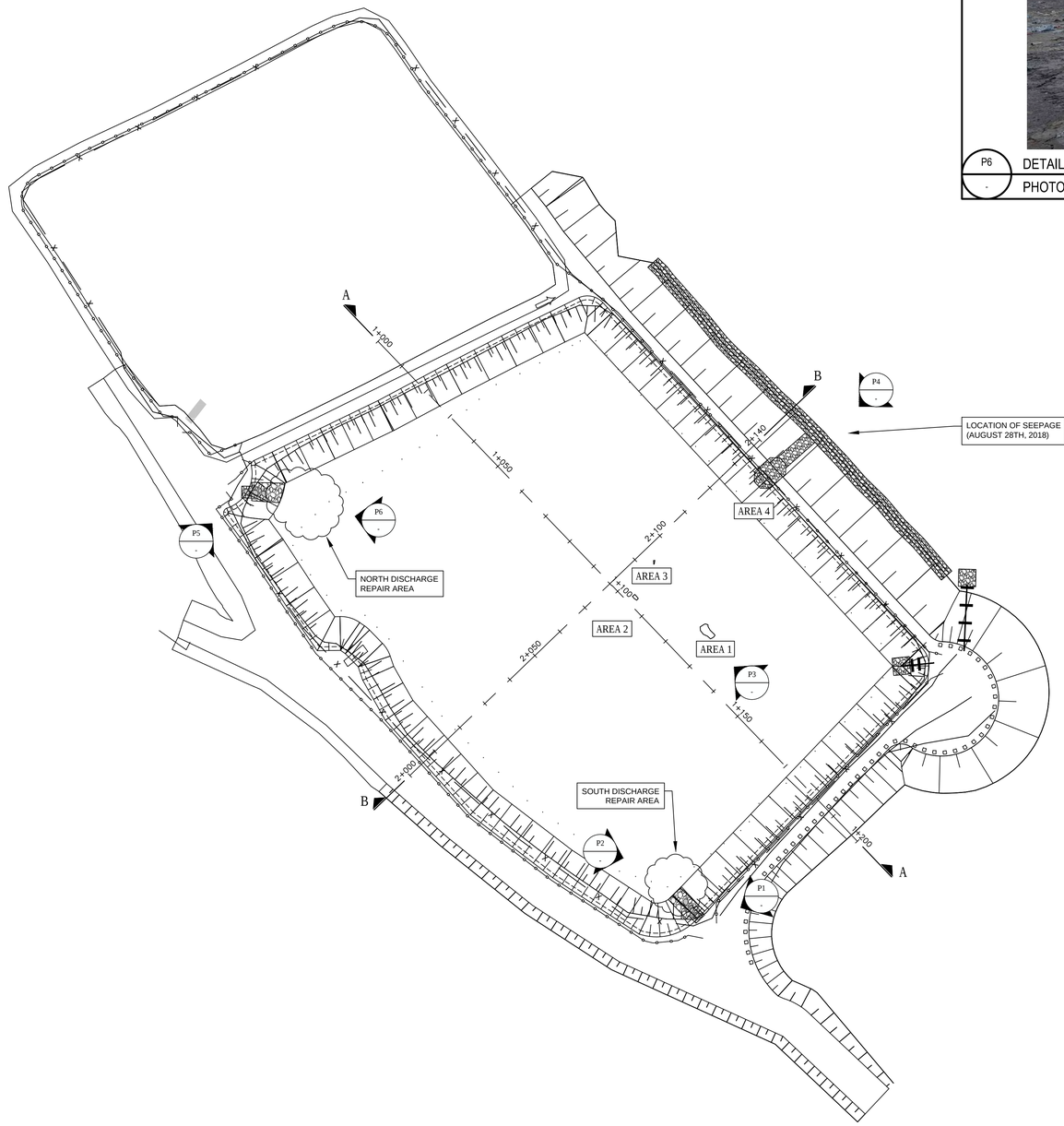
PHOTO - SOUTH DISCHARGE - REMEDIATION

P3 - DETAIL

PHOTO - AREA 1 - SUBGRADE CONDITION

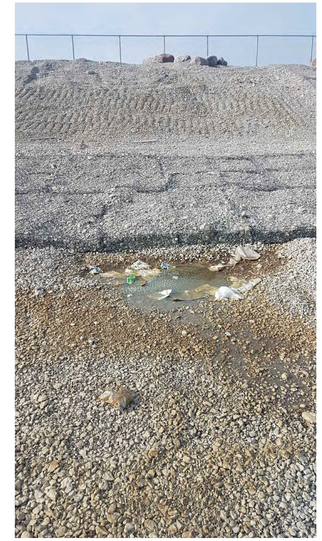
P5 - DETAIL

PHOTO - NORTH DISCHARGE - EXISTING CONDITION



P6 - DETAIL

PHOTO - NORTH DISCHARGE - PRIOR TO REMEDIATION



P4 - DETAIL

PHOTO - SEEPAGE OBSERVED AUGUST 2018

NOTES

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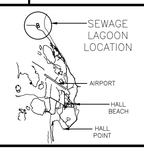
PROJECT KEYPLAN



FOXE BASIN

REV	REVISION DESCRIPTION	DATE	BY	APP

SCALE: 0 5m 10m 30m — HORIZONTAL 1:750

NORTH

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BASEPLAN: exp
DESIGN: —
CHECKED: AT
CAD: JNS
PROJECT MANAGER: —
APPROVED: —

PROJECT: HALL BEACH LAGOON UPGRADES
HALL BEACH, NUNAVUT

TITLE: WORK AREAS AND PHOTOS

PROJECT No.: QTT-00220382-A0
SURVEY: exp.
DATE: —
DRAWING No.: FIG 3

Filename: I:\USERS\Vladar\HALL_BEACH\FIGURES 1 TO 3.dwg
Last Saved: Sep 19, 2018 2:25 PM Saved by: Vladar
Last Plotted: Sep 19, 2018 2:25 PM Plotted by: Vladar
Reference: monochrome.ctb

Appendix B – Change Order No. 5

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CONTEMPLATED CHANGE NOTICE NO. 5

Project Name:	Hall Beach Sewage Lagoon Upgrade	Project No.	OTT-00220382-A0
Owner:	Government of Nunavut-CGS		
Contractor:	Nunavut Excavating		
Date:	July 15th, 2019	Page	1 of 1

1. **Scope of Work**

The contractor shall make repairs at both discharge locations inside lagoon cell #1. An area of 20m by 25m around each discharge location shall be prepared to install new GCL liner, as per the marked-up Site Plan. The new liner shall be keyed in at the crest of the berm and tie into the existing liner as per the manufacturer's recommendations. The dimensions of the gabion matting around both discharge locations has been increased as per the figure included. All existing contract specifications shall apply to all work. The following is an anticipated list of activities which the contractor will need to complete to properly perform the repairs:

Removals & Salvage as Needed

- Remove existing granular cover material and salvage
- Remove 75mm of existing sand cover material and properly dispose
- Remove existing gabion baskets – salvage aggregates if possible
- Remove steel chute for re-adjustment, grinding and welding may be required
- Remove steel plate

Installation

- Re-grade existing sand subgrade
- Install new GCL liner, tie-into existing liner as per Manufacturers recommendations
- Produce sand and aggregate as needed
- Install new sand layer above liner
- Install new Geotextile
- Install new Gabion baskets
- Re-Install steel chute, field verification required to ensure correct placement
- Re-Install steel plate, field verification required to ensure correct placement
- Install new truck bumpers - a welded steel frame from minimum 8"steel HSS, channel or pipe
- Level and reset existing bumper posts

To expedite the procurement of 1,000m^2 (excluding overlap) of GCL liner, the contractor shall provide pricing for the purchasing of the GCL liner and freight on a cost-plus basis. Pease provide the markup requested as a percent, and the estimated total cost. 20 % $ 18,444

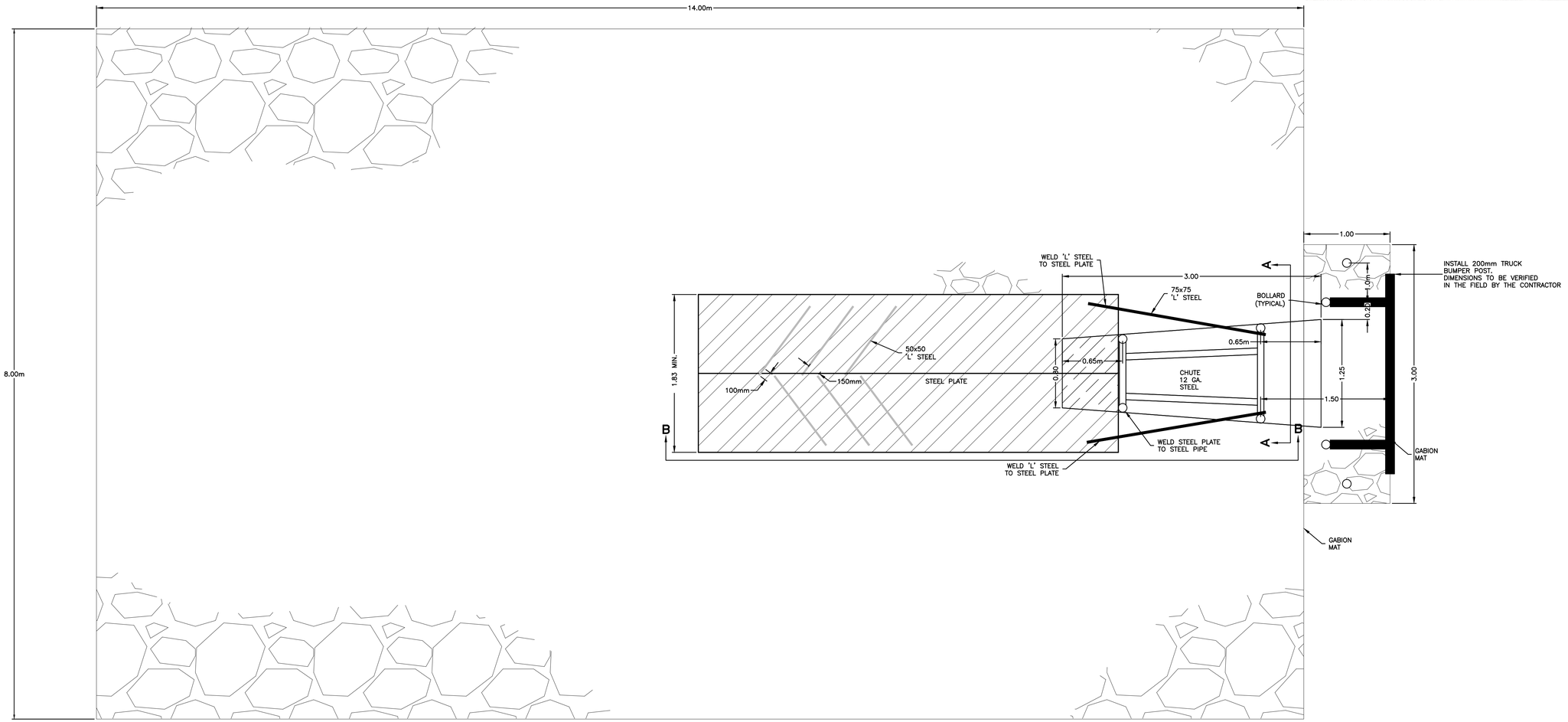
All other works and costs shall be paid as Lump Sum. This shall include all liner installation costs, labor, accommodations, material, all removals, adjustments, and installation. $ 206,688

TOTAL **$** 225,132

The contractor shall provide separate prices for each of the items listed above. The price shall also include all associated labor, materials, and locates, where required.

Prepared by: _____ Date: _____

Quotations by Contractor: _____ Date: _____



MODIFICATIONS TO DISCHARGE LOCATION

N.T.S.

NOTES

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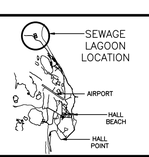
PROJECT KEYPLAN



REV	REVISION DESCRIPTION	DATE	BY	APP
1	ISSUED FOR CCN 5	7/16/2019	IPC	SLB

SCALE: AS SHOWN

NORTH

DESIGNED BY

REVIEWED BY

CLIENT: GOVERNMENT OF NUNAVUT–COMMUNITY AND GOVERNMENT SERVICES

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BASEPLAN: exp
DESIGN: IPC
CHECKED: SLB
CAD: IPC
PROJECT MANAGER: SLB
APPROVED: SLB

PROJECT: HALL BEACH LAGOON UPGRADES
HALL BEACH, NUNAVUT

TITLE: LAGOON DETAILS
TRUCK DISCHARGE AND MISC. DETAILS

PROJECT No.: OTT-00220382-A0
SURVEY: exp.
DATE:
DRAWING No.: DET-2A

Filename: P:\Projects\Civil Engineering Services\220000\OTT-00220382-A0 - Hall Beach Sewage Lagoon Upgrade - GN\D - DRAWINGS\05-DET-2.dwg
Last Saved: Jul 16, 2019 2:52 PM
Last Plotted: Jul 16, 2019 2:52 PM Plotted by: Forkert
Plot Scale: 1.000 '=' 1.000 '
References:

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Last Saved: Aug 22, 2016 9:09 AM
Last Plotted: Aug 22, 2016 9:26 AM Plotted by: crawfordi
Pen Table: exp-64.ctb
References:

NOTES

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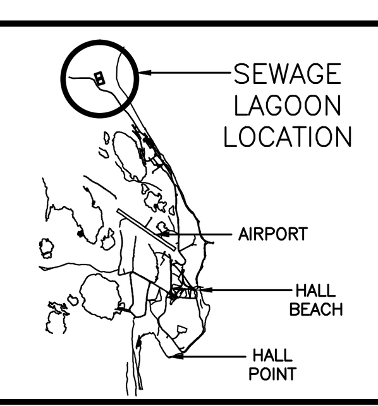
PROJECT KEYPLAN



REV	REVISION DESCRIPTION	DATE	BY	APP
5	ISSUED FOR CONSTRUCTION	8/22/2016	IPC	SLB
4	ISSUED FOR TENDER	10/23/2015	IPC	SLB
3	ISSUED FOR NWB REVIEW	4/9/2015	IPC	SLB
2	ISSUED FOR 100% REVIEW	3/16/2015	IPC	SLB
1	ISSUED FOR 75% REVIEW	1/26/2015	IPC	SLB

SCALE: 0 5m 10m 30m HORIZONTAL 1:750

NORTH

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REVIEWED BY

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BASEPLAN: exp
DESIGN: IPC
CHECKED: SLB
CAD: IPC
PROJECT MANAGER: SLB
APPROVED: SLB

PROJECT: HALL BEACH LAGOON UPGRADES
HALL BEACH, NUNAVUT

TITLE: OVERALL SITE PLAN

PROJECT No.: OTT–00220382–A0
SURVEY: exp
DATE:
DRAWING No.: OSP

Appendix C – Daily Reports for Change Order No. 5

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Kingston, Ontario K7K 6A9
Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson, P.Eng.
WEATHER:	Sunny, 10°C	**DATE OF VISIT**:	6/30/2020
ITEMS REVIEWED AND INSTRUCTIONS:		Lagoon Preliminary Investigation	

M. Boissonnault on site for review of existing lagoon conditions. A video walkthrough of lagoon berm (exterior and interior) was completed. Several pictures were taken of the area surrounding the lagoon, as well as the truck discharge stations, including chute and erosion control measures. The following was noted:

- The erosion control measures at the bottom of the south discharge station appear to have been significantly eroded. The fines appear to have washed out from between the larger rocks at the bottom of the chute.

- The erosion control measures at the bottom of the north discharge station also appear to have been eroded, with the gabion baskets being somewhat emptier than as originally placed.

- The lagoon appears to be leaking from the east side, near where the leak was observed in 2018. While it is difficult to discern whether the water flowing from the bank might be partially caused by snowmelt, volumes suggest it should be investigated. Pictures were taken to ensure comparisons can be made once the lagoon is emptied.

- Some of the fenceposts around the lagoon, particularly at the east side of the north cell, appear to have had major settlement around them. In some cases, the holes, approximately 10cm larger in radius than the posts themselves, appear to be almost a meter in depth.

- The north cell of the lagoon is quite full, and contains a significant percentage of ice and snow. The south cell is ice-free, and its water level is significantly lower than the north cell's.

A short meeting was had between Louis Primeau, administrator for the hamlet, Daniel, foreman for the hamlet, and EXP. The hamlet mentioned that they had noticed the leak as of June 29, and filed a spill report with the GN. They mentioned that they were ok with the contractor decanting the lagoon, though they would be taking samples first, as of tomorrow morning (July 1).

The contractor spent the day getting their equipment ready. Both their excavator and loader have had their windows, lights and other glass pieces smashed over the winter.

The hamlet's pump and hoses were dropped off at the lagoon by the hamlet, intended for contractor's use.

The client was notified by EXP that pumping would begin on the morning of July 1, 2020.

Photos of the site are included below: (5 photos).

Report by: Reviewed by:

Martin Boissonnault
Project Specialist

Ken Johnson, P.Eng.
Project Manager

Photograph #1: Potential leak at east side of lagoon.

Photograph #2: South discharge station, showing significant erosion of fines between larger rocks.

Photograph #3: South discharge station, discharge in progress. Note concentrated plume of sewage entering lagoon through rocks.

Photograph #4: Significant settlement around fence post, northeast corner of north cell.

Photograph #5: North discharge station. Very few fines between large rocks, concrete slab running down centerline of discharge path quite apparent.

- END OF REPORT -

EXP Services Inc.
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Kingston, Ontario K7K 6A9
Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault, MScE, P.Eng.	**Reviewed By:**	Ken Johnson, P.Eng.
WEATHER:	Sunny, 12°C	**DATE OF VISIT**:	7/1/2020
ITEMS REVIEWED AND INSTRUCTIONS:		Setup for lagoon decanting	

Contractor set up for lagoon decanting in the morning. Foreman from the hamlet came by to take some samples from the lagoon and leak site at the east side of the lagoon. The contractor obtained the key to the pump from the foreman and connected hoses, as well as moved the lower end of the decanting line further into the lagoon, as its default location was not low enough to pump water from the lagoon.

Based on information noted in the water license, sampling being complete and notification provided to the CIRNAC inspector, the pump was turned on at 0955. Shortly after, an email from CGS suggested that further information was required and the pump was turned off around 1010. No further work on the decanting process was completed for the rest of the day as permission was awaited from the CIRNAC inspector. Permission was received in late afternoon.

Pumping according to the lagoon Operation and Maintenance manual is expected to carry on in the morning tomorrow (July 2).

Contractor spent the rest of the day sorting out equipment and preparing for other tasks related to lagoon repairs (taking apart truck discharge stations, etc.).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, P.Eng.
Project Manager

- END OF REPORT -

EXP Services Inc.
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Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:10°C, Afternoon: 14°C, Sunny	**DATE OF VISIT**:	7/2/2020

Lagoon pump was started at 0705 as per permission received from CIRNAC inspector. Pump ran all day. Local worker was hired by Nunavut Excavating to watch the pump overnight, as it will likely have to run for several days before the lagoon is empty.

With Norm acting as operator and Chris as labourer, south truck station was dismantled. Bollards were pulled out with excavator. Chute was cut off its piles using a torch, then moved using excavator. Rocks were removed from below chute by using a sling wrapped around rocks, rather than dragging them, which could potentially damage liner. Liner is not visible, but geofabric placed under chute is visible in several locations. Gabion baskets were removed carefully, to avoid damaging them as much as possible.

Stone within gabion baskets is much to small in relation to size of baskets weaving. Baskets could be easily lifted and shaken, even by hand, to allow gravel to fall out. As such, erosion protection capabilities of gabion baskets are significantly inferior than if the stone was large enough not to fall out of the baskets. Contractor indicated that they would look around town to see whether larger stone is available or could be produced prior to replacing gabion baskets.

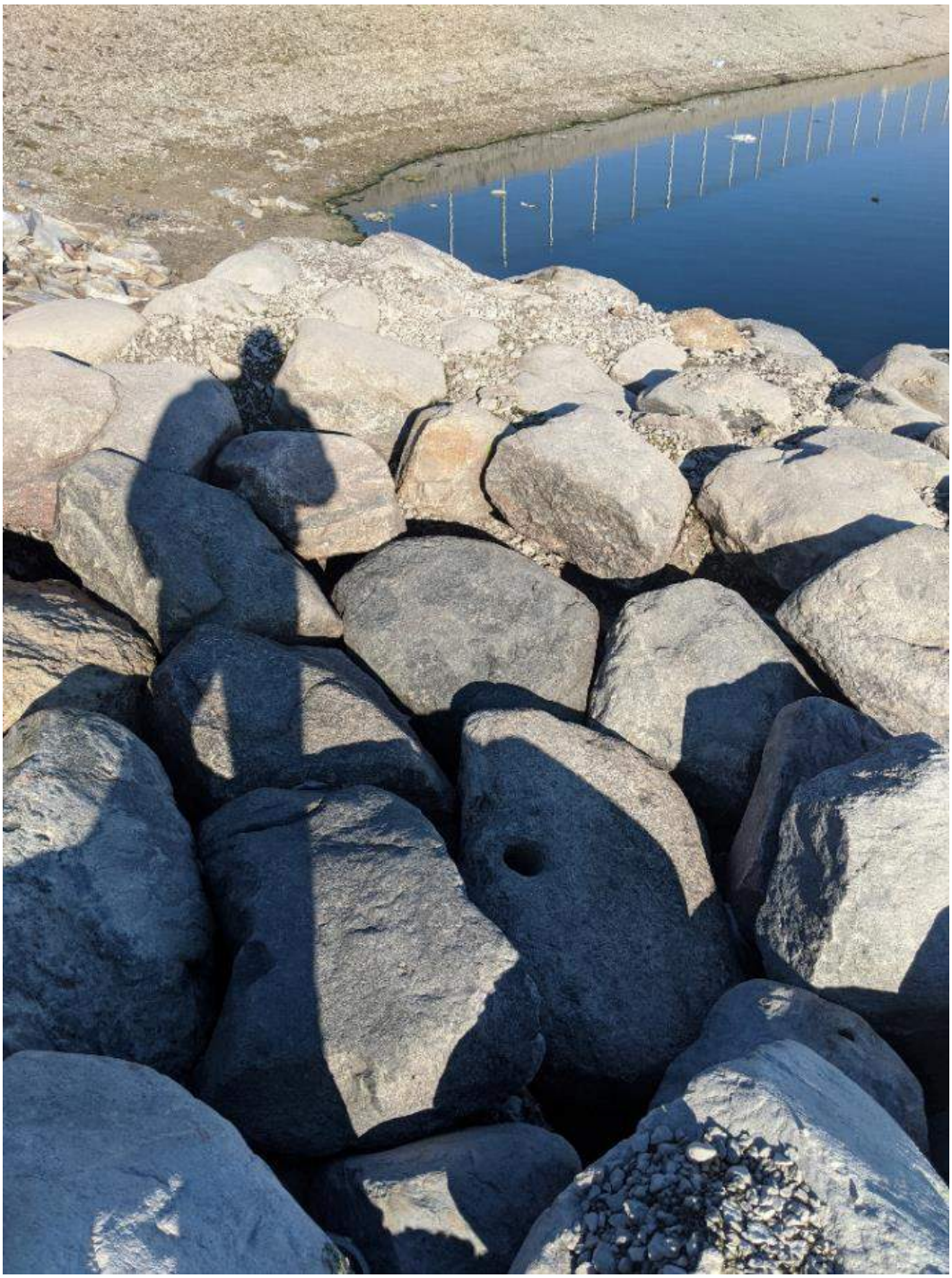
Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager



Photograph #1: Boulders at the base of south discharge station. Note the erosion of fines from between rocks in foreground as opposed to background.

Photograph #2: Gabion baskets have a tendency to empty themselves over time owing to the small diameter of gravel contained within.

Photograph #3: After being cut off its piles, chute was removed with excavator.

Photograph #4: Liner was exposed by hand to gauge depth. There appears to be approx. 0.4m of material left over liner, as a general average.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 12°C, Afternoon: 15°C	**DATE OF VISIT**:	7/3/2020

Pump continued running throughout the day. Pump will run overnight again tonight, watched by a local worker.

North discharge station was dismantled today, in a manner similar to the southern station dismantled yesterday.

As with the south station, the gabion baskets have partially emptied at the north station, and erosion of fines at the bottom of the chute is significant. The chute was cut off its piles and removed by excavator, and the large rocks were removed from the portion of the bottom of the chute that is above water. Water levels are dropping and expected to take another 2 to 3 days to fully empty.

The liner is clearly visible and in bad shape at the bottom of the discharge chute. Once the water level is dropped fully, the plan will be to take the excavator partly down the slope and clean off the sludge and gravel from the liner to expose it, with the excavator working its way up the hill. The contractor will also clean the top surface of the liner with hand shovels, brooms and/or a pressure washer, as is found appropriate, to ensure a complete picture of the state of the liner can be attained. From that point a plan will be developed for repair of the liner.

The contractor found a new set of gabion baskets in their sea can, and so all baskets installed as part of the repairs will be new. Still no word on whether larger aggregates to fill the baskets with will be available.

Both truck discharge stations were blocked off to traffic by closing the fence gates and parking equipment in front of them around noon. Work will continue once the water level is lowered fully and the excavator can begin to remove sludge and gravel from the bottom of the slope. Sludge will remain in the lagoon, to avoid requiring permits for disposal.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Fines are largely eroded from between the large rocks at the base of the chute.

Photograph #2: Several of the large rocks were resting directly on the liner. Once the rocks were removed, the liner can clearly be seen to be folded over and damaged. A clearer picture will be obtained once the fines are removed, which will occur once the water within the lagoon is drained (seen here at left).

- END OF REPORT -

EXP Services Inc.
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Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:12°C, Afternoon:14°C	**DATE OF VISIT**:	7/4/2020

Pump was kept running all day today, and will run overnight tonight as well.

No significant work was accomplished on the lagoon today. There will likely be a few more days of waiting for the water level to drop. It is currently dropping approximately 250mm per day, with an estimated 750mm to go.

More pictures were taken of the leak on the east side. The snow being completely melted from this bankit is now clear that the water discharging from the outer toe of the lagoon berm is originating from the lagoon. The discharge from the lagoon has increased noticeably since Tuesday when the initial assessment was completed. Discharge estimated at twice the original output. The water is leaking from the toe of the slope, just under the gabion baskets, over a width of approximately 15m having its northern bound in line with the north side of the line of gabion baskets running down the slope approximately halfway along the eastern bank of the lagoon.

Contractor spent about ten hours today doing maintenance on equipment, cleaning storage in sea cans, and other miscellaneous tasks.

Photos of the site are included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Significant amount of water is leaking from the east side of the lagoon.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 8°C, Afternoon: 12°C	**DATE OF VISIT**:	7/5/2020

Pump continued running all day today. Though water level is still dropping, there is likely another day or two of pumping required.

No significant work done on lagoon repairs today apart from pumping. Contractor spent the day doing maintenance and cleanup on their equipment.

Leak is similar in size, shape, flowrate and location as it was yesterday.

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

- END OF REPORT -

EXP Services Inc.
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Telephone: 613-542-1253
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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 7°C, Afternoon: 10°C	**DATE OF VISIT**:	7/6/2020

Pump continued running all day today. Water level is dropped enough that islands are showing within the lagoon. It is expected that by tomorrow morning, the water level will be low enough to allow for repair work to begin.

No significant work done on lagoon repairs today apart from pumping. Contractor spent the day doing maintenance and cleanup on their equipment.

Leak is similar in size, shape, flowrate and location as it was yesterday.

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:9°C, Afternoon: 11°C	**DATE OF VISIT**:	7/7/2020

Pump was shut off in the morning as the water level is now low enough to work. There is still some water in the lagoon, but no further water will be decanted as the remaining water will be beneficial for eventual testing of the lagoon by saving valuable time when it comes time to refill the cell.

The leak remains similar in size, location and discharge as it has been the last few days.

The liner was exposed at the south discharge station. It appears to be in good condition, with no rips or tears. Based on this condition assessment, the liner was only exposed over a width of approximately 12m. To expose it further was deemed unnecessary, especially as exposing the liner runs the risk of damaging it.

A new liner will be installed in this location as a precautionary measure, and to cover the few nicks and tears that were created during the exposition of the liner with excavation equipment. A gravel levelling course will be placed over the existing liner and the new liner will be placed over the existing, using bentonite to seal along the edges as per manufacturer's recommendations.

The liner will be allowed to dry overnight, with new liner installation taking place tomorrow.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Existing liner seam, showing bentonite staining within lap joint.

Photograph #2: Exposed liner, seen from top. Liner is largely intact. Minor damage due to process of exposing. A second liner will be applied over this one, thereby patching the holes.

Photograph #3: Seam within existing liner. New liner will be glued to existing liner using bentonite as per manufacturer's instructions. Existing liner will be cleaned off with broom at location of seam prior to applying bentonite.

- END OF REPORT -

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1407 John Counter Blvd, Unit 180
Kingston, Ontario K7K 6A9
Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220832
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:9°C, Afternoon:12°C	**DATE OF VISIT**:	7/8/2020

Contractor spent the day (10h) cleaning the liner at the south discharge station. The new liner will be installed over the existing one, with a layer of granular in between liners to ensure an even surface for placement of the new liner. The edges of the area where the new liner will be placed were cleaned with a broom. A new trench was dug at the top of bank behind the existing liner's tie-down area to anchor the new liner.

The leak is still flowing at a rate similar to that of the last few days. The water level within the lagoon is still dropping. See below for pictures depicting the drainage rate.

Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Area of leak, with swale in background. All water in swale originated from leak.

Photograph #2: Lagoon in the morning.

Photograph #3: Lagoon in late afternoon. Note the ponding in the right foreground has gotten much smaller, and to the left several ponds have disappeared.

Photograph #4: Anchor trench for new liner is being dug behind existing anchor trench.

- END OF REPORT -

EXP Services Inc.
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Telephone: 613-542-1253
Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 10°C, Afternoon:14°C	**DATE OF VISIT**:	7/9/2020

The new liner was placed at south discharge station. Liner was installed over layer of granulars and tucked into anchor trench at the top of the embankment as per manufacturer's recommendations.

Two sections of liner were used to cover the area that had been exposed. The liner was sealed onto the existing liner using bentonite clay in powdered form. The bentonite was placed in two lines running parallel to the seam, at all seams under the liner.

The liner was then covered with approximately 450mm of granular material. The granular material that had been scraped off the existing liner was re-used as cover.

The leak at the east side of the lagoon is still similar in size, shape, location and volume as yesterday. The water level in the lagoon is still dropping.

Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Liner was placed on embankment and tucked into anchor trench. Excess material was trimmed before burial.

Photograph #2: A double line of bentonite was used to seal liner at the edges.

Photograph #3: Liner was covered with granular material.

Photograph #4: Water level in lagoon is still dropping.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:7°C, Afternoon:10°C	**DATE OF VISIT**:	7/10/2020

The liner was exposed at north discharge station. Several issues were found with the liner:

- Several pieces of liner that appeared to form patches, presumably placed in 2018, were poorly attached to the underlying liner, and had rolled or slid down the embankment.
- Several pieces of liner apparently forming the original liner basin were torn or rolled up, and had significant quantities of gravel within their joints
- The liner within the top half of the embankment to the east of the discharge station appeared delaminated. The top geotextile is worn out to the point of falling apart during the exposure process. More liner will have to be exposed along the embankment, proceeding east until competent liner is found against which the new liner can be sealed.

The process of exposing the liner will continue tomorrow.

The leak at the east of the south cell is still flowing at a similar rate, and the water level within the south cell is dropping.

Water was observed to be coming out of the lagoon berm near the northeast corner of the north cell. Pictures were taken and this area will be monitored as well, with the water treated as a leak for observation purposes, until its origin can be determined.

Photos of the site are included below: (7 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Damaged existing liner at the top of the embankment, north discharge station.

Photograph #2: Water coming out of the ground on the outside of the lagoon berm. This picture was taken at the bottom of the berm at the northeast corner of the lagoon's north cell, looking northeast.

Photograph #3: Another view of the new potential leak. This picture was taken at the northeast corner of the north cell, at the bottom of the berm looking south along the berm.

Photograph #4: Leak at east side of lagoon's south cell is still flowing at a significant rate.

Photograph #5: Patch on embankment at north discharge station was removed. Patch was not sealed onto underlying liner.

Photograph #6: Liner in some areas is delaminating, with the frayed and worn top geotextile coming apart to expose the bentonite within the liner. In areas where this is occurring, a new liner will be placed.

Photograph #7: Liner in some areas at the north discharge station is rolled and torn, and no longer sealed to underlying liner.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 10°C, Afternoon: 15°C	**DATE OF VISIT**:	7/11/2020

Liner was exposed further and cleaned at the north discharge station. The various panels of existing liner were exposed, cleaned and laid flat so as to form a relatively even surface onto which the new liner will eventually be placed. As the existing liner will be completely covered by the new liner in a similar fashion as at the south discharge station, the existing liner panels were not sealed with bentonite, and the granular materials within the joints were not fully removed.

Liner was exposed further along the embankment to the east of the discharge station, in an attempt to find competent liner onto which the new liner can be sealed. Competent liner was found approximately 5m further along the embankment. Allowing the liner to dry appears to restore some of its structural strength, so the granulars above the liner were removed down to the final 20 to 30mm, which will be allowed to dry in place before being removed to fully expose the liner.

The bottom of the embankment was cleaned up. There is still water in the bottom of the lagoon, below the level of the original ground. A pump was installed to move water out of the excavation and further into the lagoon, but the granular nature and low fines content of the material at the lagoon bottom result in a high recharge rate in the excavation. The pump is having trouble keeping up, and so efforts were instead focused on cleaning up the top of the embankment and preparing the anchor trench for the new liner. The water level is expected to continue falling as it has been doing for the past several days.

The leak at the east side of the south cell is still flowing in a similar fashion as it has been for the past few days.

Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: A thin layer of granular material was left on the liner until dried. This allowed the liner to recover some of its structural strength before being exposed.

Photograph #2: A pump was used to drain the water at the bottom of the embankment, but had difficulty keeping up. The soil to the right of the picture still needs to be removed in order to prepare a clean dry joint for the new liner.

Photograph #3: Competent liner was found approximately five meters further than originally exposed. This is where the new liner will seal onto the existing liner once the latter is cleaned.

Photograph #4: The anchor trench for the new liner, located immediately behind the existing liner's anchor point, was dug.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 14°C, Afternoon: 16°C	**DATE OF VISIT**:	7/12/2020

Contractor spent the day further preparing the existing liner at the north discharge section In particular, the liner at the edges of the excavation was swept free of any debris to ensure the new liner can bond properly to the existing liner. The pump at the bottom of the excavation is able to keep up with the water better than yesterday, but the area remains too wet to attempt to place the new liner.

Water bubbles were also noted under the existing liner. As the existing liner at the bottom of the lagoon is exposed, the removal of the granular material is allowing the liner to lift approximately 50 to 70mm, effectively floating on the underlying water. The bottom of the excavation was left exposed and will be monitored over the next few days to see if the situation improves.

The leak on the east side of the lagoon seems to have a slightly lower discharge than in previous days. While it is still of the same order of magnitude, as well as similar general shape and location, the depth of the flow seems slightly lower. The leak will continue to be monitored on a daily basis. The water level in the lagoon is now below grade, but above liner, everywhere in the south cell.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Apart from a very small puddle, the lagoon cell is now completely empty. Note that there is still >300mm of water in much of the cell, above the liner but below final grade.

Photograph #2: The leak is still flowing, but its volume may be starting to diminish.

Photograph #3: The bottom of the embankment at the north discharge station is starting to dry. It will be allowed to dry further in order to ensure a proper seal of the new liner to the existing, as well as to help mitigate the issue of water bubbles under the liner.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 8°C, Afternoon:11°C	**DATE OF VISIT**:	7/13/2020

In order to let the existing liner at the north discharge station dry further, efforts were focused on the south discharge station. A geotextile was placed under the truck discharge station and covered with a thin layer of gravel. Gabion cages were then installed on the embankment, with the second row of cages being installed around the discharge station's posts, preventing movement. The lower cages were attached to the ones immediately above with wire. Prior to filling the cages, they were lined with a layer of geotextile along their bottom and sides. This is intended to help retain the gravel within the cages, since the aggregate diameter is significantly smaller than the holes in the gabion cages' panels.

Two rows of gabion cages were installed today.

The leak on the east side is starting to diminish in volume, though remains similar in area.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Geotextile installed at south discharge station.

Photograph #2: Installation of gabion cages. The discharge station's lower piles pass through the second row of cages, anchoring the entire gabion mat in place.

Photograph #3: This photo taken on July 14 demonstrates the geotextile used to prevent the granular material from falling out of the cages.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:10°C, Afternoon: 14°C	**DATE OF VISIT**:	7/14/2020

The contractor spent the day installing gabion cages at the south discharge station. The cages were tied to the row above them on the embankment with wire, in addition to being wired shut. They were also lined on the bottom and sides with geotextile to prevent the granular contents from falling out.

Three additional rows of gabion cages were installed today.

The leak along the east side of the lagoon is significantly smaller than it was at its peak. It is beginning to diminish not only in volume but also in area.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The gabion cages, once filled, were wired shut as well as wired to the previous row of cages to form a complete mat.

Photograph #2: The leak is beginning to recede significantly in area. The orange discolored region represents the area formerly covered by flowing water.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 17°C, Afternoon: 22°C	**DATE OF VISIT**:	7/15/2020

The north discharge station was found to be dry enough to install the new liner. The water bubbles under the existing liner have also receded, and the ground under the existing liner seems solid.

The existing seams near the edge of the excavation were cleaned out and resealed with new bentonite. The depressions in the existing liner were filled and worn out pieces were removed to obtain an even surface on which to place the new liner.

The new liner was anchored at the top of the embankment in a trench as recommended by the manufacturer. Seams were sealed with a double row of bentonite. The new liner panels extend down the entire embankment down to the existing liner panels at the bottom of the lagoon, completely covering the damaged existing liner. The new liner covers an area just over 15m wide at the top of the embankment, and 12m wide at the bottom. The difference is due to the liner turning the corner of the lagoon.

The new liner was covered with approximately 0.4m of granular material. The material is the same that was removed from the existing liner when the latter was exposed.

Photos of the site are included below: (3 photos).

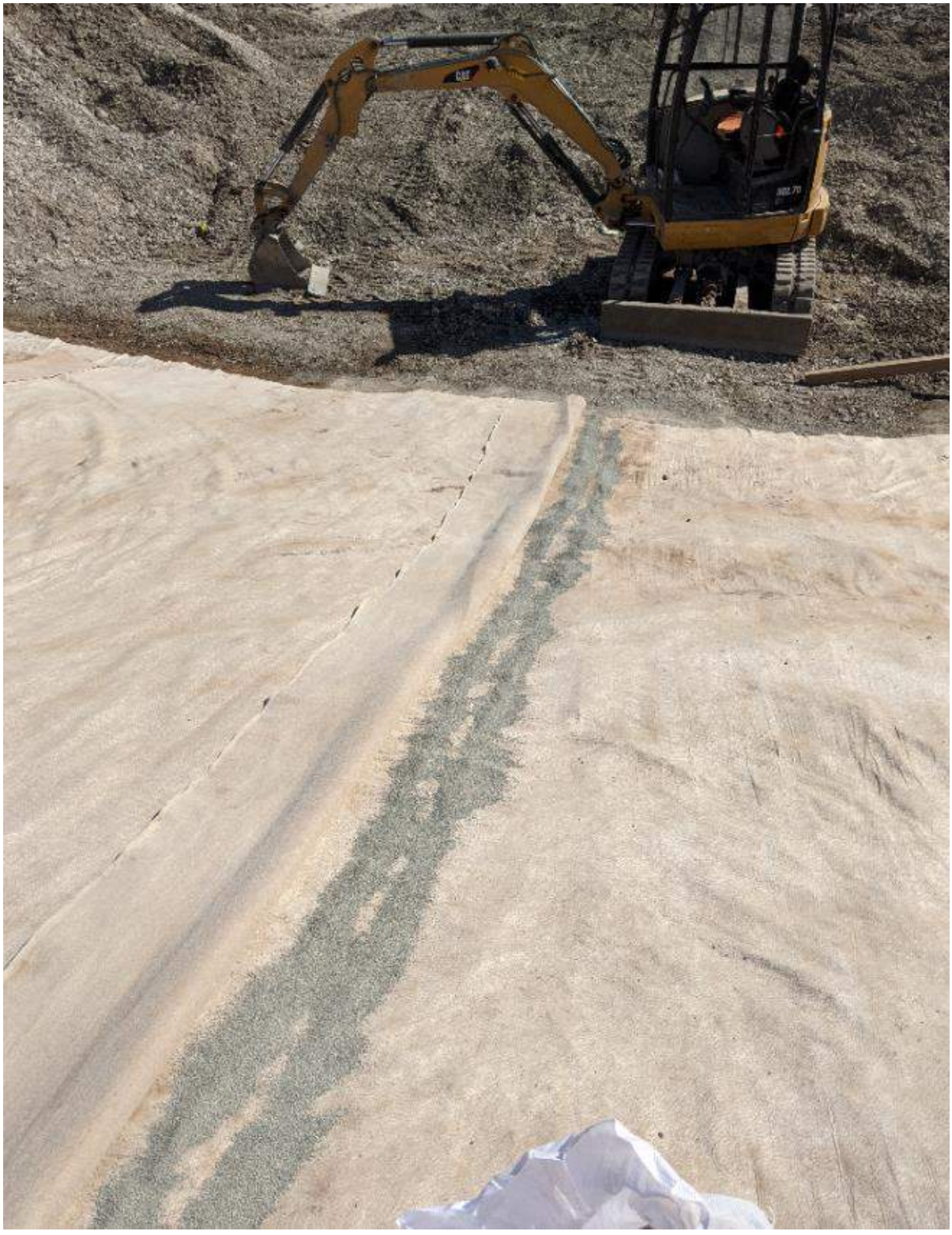
Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

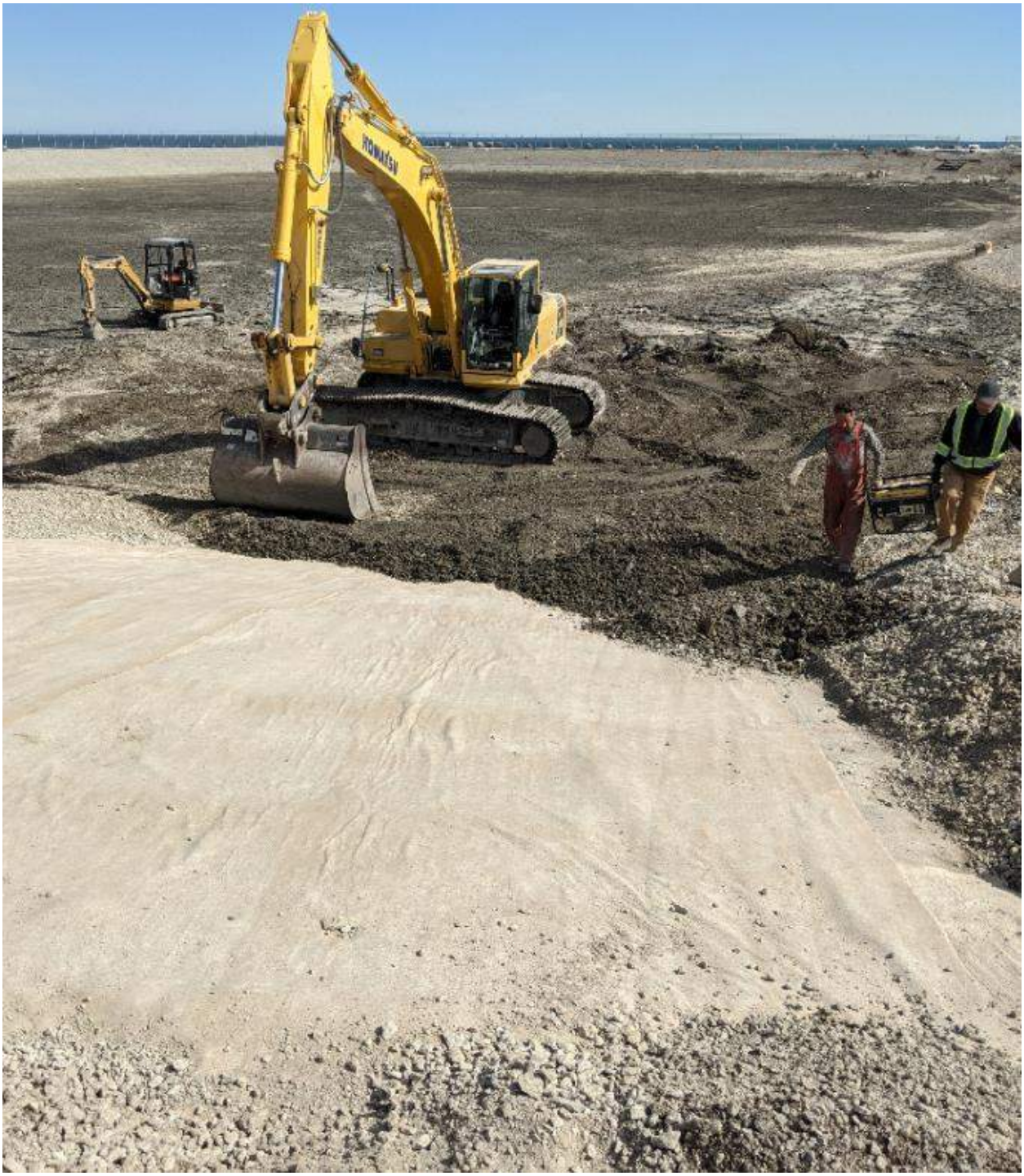
Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Seams in existing liner were cleaned out and sealed with additional bentonite.



Photograph #2: A double row of bentonite was used to seal the seams of the new liner.



Photograph #3: The liner was covered with approximately 0.5m of granular material.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 6°C, Afternoon: 8°C	**DATE OF VISIT**:	7/16/2020

The contractor spent the first few hours of the day doing general cleanup and maintenance of their tools and equipment, and storing the remaining roll of liner properly in a sea can to avoid damage and/or deterioration.

At 1015, the contractor started investigation work on the leak in the east side of the lagoon. The mini-ex was used to dig an exploratory hole at the low point in the lagoon (determined visually), which is immediately across from the leak. This is the area where the last of the water was seen above the granular material as the lagoon drained. It was hoped that water could be found retained on the liner, which could help locate the leak. However, no water was found.

The liner was exposed at a seam. During exposure, the liner was damaged and will need a patch, so an area approximately 2m by 2m was exposed. The liner was found to be very uneven, with depressions of up to 50mm over 300mm being quite common in this particular area.

One area, located directly on a seam, presented a local depression approximately 250mm diameter and 80mm deep. Clean water was poured into the depression and left over lunch to see whether the liner would retain it. While no immediate draining was observed, the water had completely drained an hour after pouring it. The seam was opened and found to contain lots of bentonite.

In order to determine with more accuracy the low point of the lagoon, a series of exploratory holes were then dug around the area. A level was used to determine the liner elevation. A total of 11 measurements were taken, which demonstrate that the lagoon liner is generally sloped towards the east berm. This is consistent with visual observation of the general shape of the granular material in the bottom of the lagoon, and the recession of the water during the draining of the lagoon. Work on the leak stopped at 1500, so would total 3.25h for an operator and a labourer, and 2h for a mini-excavator (1.5h taken for lunch, and time was spent going to get the level borrowed from Inukshuk).

The measurements taken are included with this report (2 pages).

Pending discussions between the contractor’s management and the engineer, the contractor’s plan (verbal discussion), is to exposed a larger area around the low point of the lagoon, and look for points of potential leakage.

The east side leak is significantly diminished, and the swale into which it has been discharging is drying up significantly.

The leak at the northeast corner is still flowing significantly. The water level of the pond into which this leak discharges seems to be rising.

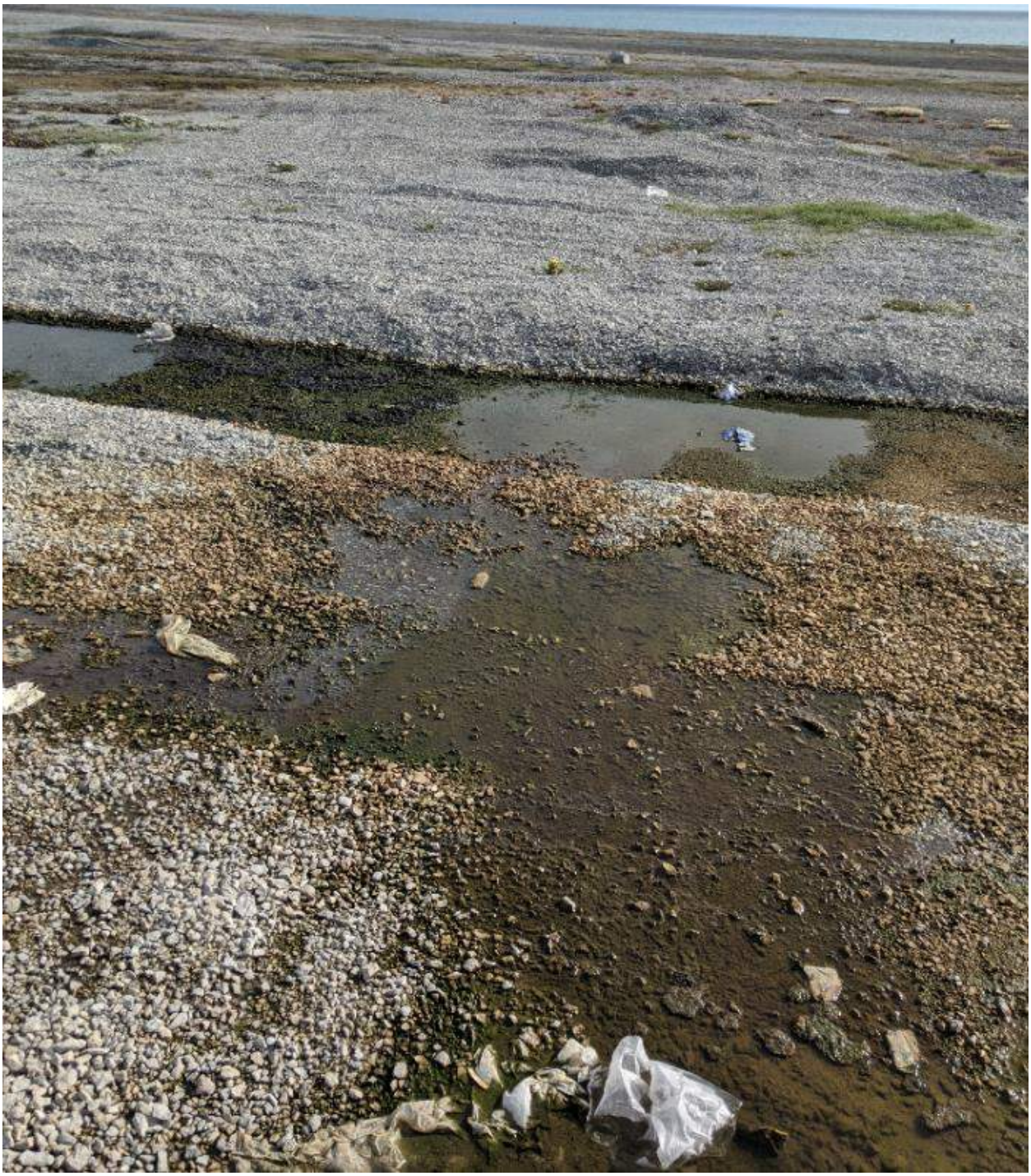
Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager



Photograph #1: The leak at the east side of the lagoon is significantly diminished, and the swale is starting to dry up.

Photograph #2: The water coming out the ground near the northeast corner of the north cell is still flowing. The water level of the pond into which it is discharging is rising.

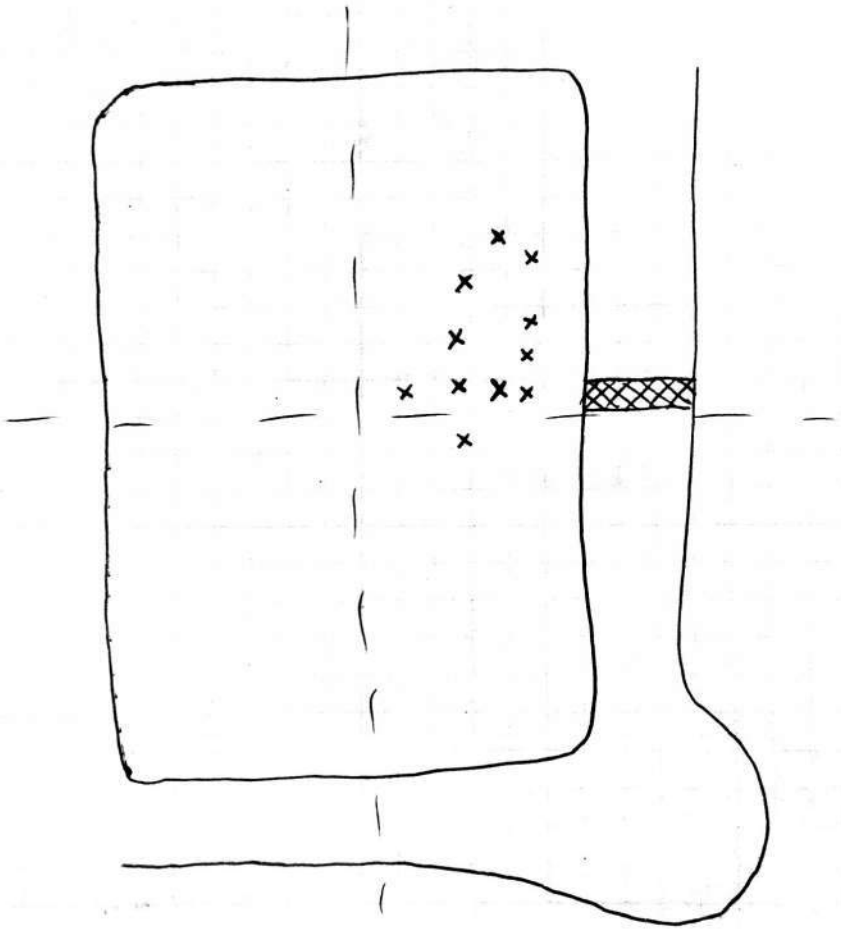
Photograph #3: The liner at the bottom of the lagoon is not even. Significant local depressions are commonplace.

Photograph #4: The seam that was exposed was opened to examine the overlap and bentonite. The bentonite missing on the bottom flap is present on the top flap. It appears that a continuous strip of bentonite is formed.

- END OF REPORT -

Project: Hall Beach Lagoon	Project N°: OTT-220382	
Description: Elevation shots on liner - July 16, 2020	Prepared By: MB	Date: July 16, 2020
	Other:	Page: 112

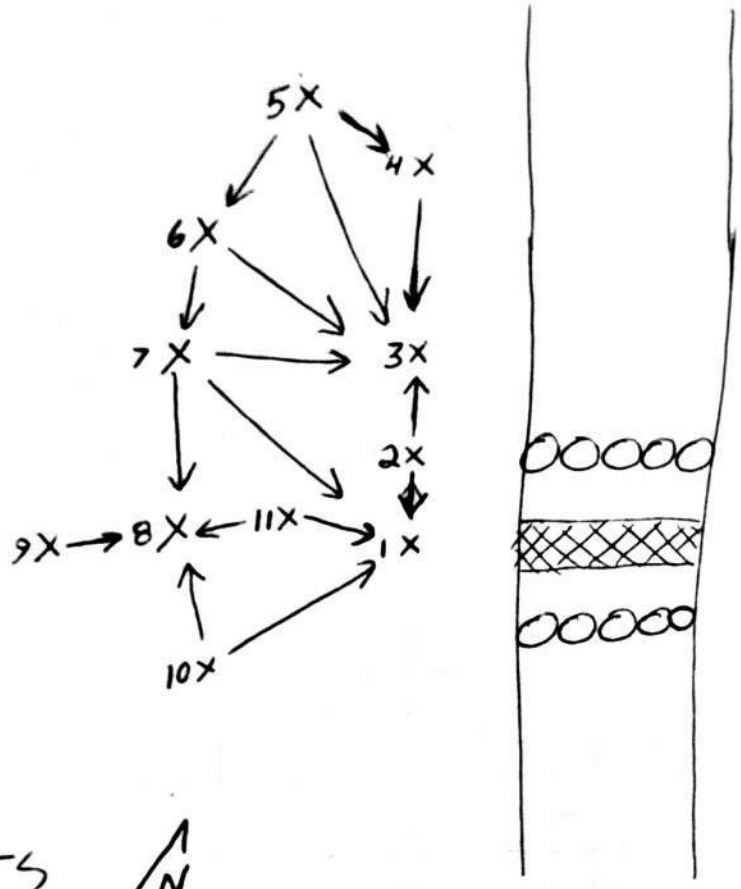
Location plan



NTS

N

Project	Project N°
Hall Beach Lagoon	OTT-220382
Description: Elevation shots on liner - July 16, 2020	Prepared By: MB / Date: July 16, 2020
	Other: / Page: 212



Elevations
Assumed datum

Point	Elev
1	0.146
2	0.200
3	0.087
4	0.264
5	0.312
6	0.283
7	0.231
8	0.195
9	0.270
10	0.227
11	0.212

NTS N

Water generally flows towards the berm, with low points at points 3, 1, and 8 based on these measurements.

No water observed pooling on liner in any of the excavations.

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast/Rain Morning: 6°C, Afternoon: 8°C	**DATE OF VISIT**:	7/17/2020

Contractor spent much of the day getting their truck started in order to use its compressor to power their crimping tool. This will greatly speed up the gabion placement process. Only one more gabion cage was placed today on the south discharge station.

After discussion with the hamlet, it was determined that the water coming from the northeast corner of the north cell is intended, as part of the lagoon's automatic decanting process. Thus this area will no longer be considered a potential leak.

The leak at the east side of the south cell is similar to yesterday in terms of discharge, shape and location.

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Foggy. Morning: 10°C, Afternoon: 12°C	**DATE OF VISIT**:	7/18/2020

The contractor spent the day installing gabion cages at the south discharge. Approximately half of the south discharge's gabion mat is now installed.

Some additional granular material to fill the cages was imported using a dump truck. The imported material is slightly larger than the existing material within the lagoon, and contains rock up to 100mm to a side.

The leak at the east side of the lagoon is now completely stopped. Some puddles of stagnant water remain in the area where the leak used to be.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The leak at the east side of the south cell is no longer flowing, and the remaining water is stagnant.

Photograph #2:The day was spent installing gabion cages at the south discharge station.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Foggy, Morning:7°C, Afternoon:10°C	**DATE OF VISIT**:	7/19/2020

Contractor spent morning installing gabion cages at south discharge station. The mat at the south station is now complete.

No work completed in the afternoon.

The leak at the east side is still dry.

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Foggy, Morning: 8°C, Afternoon:11°C	**DATE OF VISIT**:	7/20/2020

The contractor graded and shaped the granular material around the completed gabion mat at the south discharge station. The steel chute was placed onto the discharge station's piles, to be welded at a later date.

The rest of the day was spent constructing the gabion cages for the north discharge station, as they come in individual panels that must be assembled into cages.

The leak is still not flowing, with the remaining puddles still drying.

Photos of the site are included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The south discharge station's chute was placed onto its piles, but. The granular material is shaped over the gabion cages, and the riprap at the bottom of the chute will be installed once the chute is welded in place.

-END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Foggy, Overcast Morning:5°C, Afternoon:7°C	**DATE OF VISIT**:	7/21/2020

The contractor spent the day constructing gabion cages for the north discharge station. Installation to begin tomorrow.

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 8°C, Afternoon: 13°C	**DATE OF VISIT**:	7/22/2020

The contractor spent the day installing gabion cages at the north discharge station. Approximately a third of the cages were installed, starting at the top of the embankment.

The cages are lined at the bottom and sides with geotextile to avoid losing granular material through the holes in the cage. The cages are being filled with granular material imported from the stockpiles at the south of town. The stones are a bit larger than the existing material within the lagoon, with the larger stones being approximately 100mm to a side.

Installation of cages will continue tomorrow. It is expected to take an additional two days.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Gabion cages installation at north discharge station.

Photograph #2: Filling of lined gabion cages with granular material.

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 9°C, Afternoon: 12°C	**DATE OF VISIT**:	7/23/2020

The contractor welded the steel chute in place at the south discharge station. The riprap was installed at the bottom of the steel chute. The riprap overlaps the bottom of the chute by approximately half a meter. The bollards surrounding the discharge station were also reinstalled. These were installed approximately 1m into the ground, which is similar to their original depth. Their position was adjusted by backing up one of the hamlet's trucks to the discharge chute, to ensure the trucks can back up easily to the station without hitting the bollards.

Some pieces were also cut to make the truck bumper for the south discharge station. The truck bumper will consist of two frames stacked on top of each other. Each frame will be built according to the drawings attached to the change order. When stacked, the trucks will have a 300mm bumper against which to rest their back wheels. The exact dimensions of the truck bumper were determined by backing up the hamlet's truck to the discharge station and measuring the required dimensions in situ.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Installation of the bollards.

Photograph #2: Torch cutting of the pieces for the truck bumper at the south discharge station.

- END OF REPORT -

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SITE REVIEW REPORT

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 10°C, Afternoon: 14°C	**DATE OF VISIT**:	7/24/2020

The contractor continued cutting and welding together the pieces for the truck bumpers, starting with the south discharge station.

By the end of the day, the south discharge station was constructed. The steel frame is welded onto a 12mm plate, which in turn is welded against the piles holding up the discharge chute. This design allowed the contractor more freedom in the alignment of the frame's parts, which were adjusted based on measurements taken after backing up one of the hamlet's trucks to the discharge station.

The north discharge station's truck bumper is constructed, but the steel chute is not yet installed. The chute will be installed so that measurements can be taken, prior to welding the truck bumper in place.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Final design of the truck bumper (north station). The structure will eventually be moved so that the back end of the truck bumper, to the right in this picture, is against the front piles of the discharge station.

Photograph #2: Welding the truck bumper onto the 12 mm steel plate that will in turn connect to the discharge station piles.

Photograph #3: The front o the piles was lightly grinded to remove paint and rust in preparation for the weld.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 14°C, Afternoon: 18°C	**DATE OF VISIT**:	7/25/2020

The truck bumper for the discharge station at the south end, constructed yesterday, was welded to the discharge station's piles and painted. The contractor also cleaned up the remainder of the construction debris and fine graded the granular materials around the south discharge station. The south discharge station is now complete as per CO5. The rest of the work under CO5 is at the north discharge station.

The steel chute for the north discharge station was installed and welded in place. The front end of the chute had been badly crumpled by trucks backing into it and was cut off, leaving a clean edge. The length of the truck bumper will be adjusted to suit. The truck bumper is now largely constructed, with the final adjustments requiring measurements which will be taken after backing a hamlet truck up to the discharge chute.

The north cell of the lagoon, which is expected to become the source of water for leak testing of the south cell, was noted to have a water level far below what was observed previously. While some drop in the water level is expected as part of the cell's normal operation, the significant drop raises concerns as to whether there will be enough water in the cell to draw from during the testing process.

A walkthrough of the area where the north cell discharges revealed that the water level outside the northeast corner of the north cell is now higher than the level at which the water comes out of the berm during the normal operation of the lagoon cell. It is therefore difficult to tell whether the cell is still draining, and at what rate.

In addition to this, it was observed that an accumulation of black matter similar to that observed near where the south cell's leak was coming out of the ground is forming around the area. There is also an extremely potent smell of sewage, far more pungent and potent than that coming from the lagoon itself. The situation will be monitored further while work continues first on CO5, then leak detection and repair in the south cell.

Photos of the site are included below: (5 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The bumper at the south discharge station, installed and painted. Preference would have been for red paint to match the bollards, but the contractor could only obtain enough red paint to touch up the bollards themselves.

Photograph #2: The crumpled metal at the front of the chute at the north discharge station was cut off, leaving a straight edge.

Photograph #3: While the angle is not ideal, this picture shows the water level in the north cell on July 11th.

Photograph #4: The north cell's water level has dropped significantly. This picture was taken July 24th, 13 days after Photograph #3. The water level has dropped by about a meter.

Photograph #5: There is an accumulatio of black matter outside the north cell's northeast corner. The water level in the area is also at or higher than the level where the water was coming out of the ground in this area. It is difficult to tell whether there is still water coming from the ground, and in what quantity.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning:9°C, Afternoon: 12°C	**DATE OF VISIT**:	7/26/2020

The contractor spent the day finalizing the truck bumper at the North discharge station. The various pieces of the assembly were welded together and welded to the piles holding up the discharge chute. The bollards were reinstalled, ensuring that they were placed out of the way of the Hamlet trucks' path. A Hamlet truck was backed up to the discharge chute prior to final assembly to ensure that the truck bumper was placed in the proper location.

The truck bumper and bollards were painted to improve their longevity.

Remaining work at the North discharge station includes installation of gabion cages and site grading and cleanup.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Various pieces of the truck bumper prior to assembly onto the discharge station piles.

Photograph #2: Final configuration of discharge station, with bollards and truck bumper installed and painted.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning:10°C, Afternoon: 14°C	**DATE OF VISIT**:	7/27/2020

The contractor spent the day installing additional gabion cages at the North discharge station. As was done at the South station, the cages are lined with geotextile. This helps prevent the cages from emptying, as the average diameter of the granular material used to fill the cages is small relative to the cages' openings.

The cages were covered with granular material once placed. The granular material used to fill the gabion cages is imported from the pit at the south of the hamlet and is coarser than the existing material inside the lagoon. The imported material contains a significant amount of rocks with diameter up to 100mm.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Lined cages ready to be filled.

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SITE REVIEW REPORT

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning: 9°C, Afternoon: 11°C	**DATE OF VISIT**:	7/28/2020

The contractor completed the installation of the gabion cages at the North discharge station. The cages were lined as usual with geotextile to prevent the aggregates from falling out. The gabion mat extends to the bottom of the embankment.

The riprap that had been removed for construction was reinstalled. The reinstalled riprap is not at the bottom of the slope, but instead overlaps the steel plate at the bottom of the chute slightly and sits on the gabion mat.

With the North discharge station now complete, the last of the tasks associated with Change Order 5 are finished. The contractor cleaned up the area around the discharge station, including smoothing out the gravel around the discharge station, both at the top of the embankment and at the bottom of the discharge chute.

Efforts over the next few days will focus on the leak at the east side of the lagoon. Work will begin at the low spot in the lagoon, which coincides roughly with the section of berm through which water seems to be passing.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Covering the newly installed gabion mat with a thin layer of aggregates.

Photograph #2: Riprap placed at the bottom of the chute.

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 8°C, Afternoon: 11°C	**DATE OF VISIT**:	7/29/2020

The contractor spent the day removing aggregate from the east side of the lagoon, starting at the low point and extending to an area approximately 40m by 7m, against the east berm and roughly centered on the overflow channel. The area was not excavated down to the liner. A layer of sand approximately 75 to 125mm thick was left on the liner for protection. Due to the uneven nature of the liner, some areas had less coverage.

A patch was placed over the section of liner that had been accidentally damaged during preliminary investigations last week. The patch was sealed with bentonite according to manufacturer's instructions.

The exposed area will be flooded tomorrow, using water from the North cell of the lagoon.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: A patch was placed over the damaged area in the liner, and covered with small-diameter aggregate.

Photograph #2: Clearing aggregate from along the East berm of the south cell.

- END OF REPORT -

Appendix D – Daily Reports for Leak Detection and Resolution Program

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning: 9°C, Afternoon: 11°C	**DATE OF VISIT**:	7/30/2020

The contractor set up the Hamlet's pump over the embankment between the lagoon's two cells. The pump pulled water from the North cell and through several lengths of hose and pipe, up to the exposed area within the South cell. A piece of plywood was used for erosion control at the hose outlet.

The pump was turned on around 0900 and ran until 1800. Around 1500, the contractor managed to flush the air from the pump intake, resulting in a much higher flow for the last three hours of the pumping operation.

At the end of the day, the water in the exposed area had reached a depth of approximately 0.6m at its deepest point.

The water will be allowed to sit overnight to see how much if any is lost by morning.

A piece of steel was found within one of the seams. The piece is relatively small and flat, and the bentonite seemed well sealed around it. It was originally covered by 0.5m of sand and aggregates, and sandwiched between two liner panels. It was found during the pumping operations and removed. The joint where it was found appears otherwise healthy.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Pump, with series of hoses leading to the area to be flooded.

Photograph #2: Piece of steel found within a seam during excavation and removed. Length is approximately 40cm.

Photograph #3: Flooded lagoon as of the end of the day. Water depth is approximately 0.6m at the deepest.

- END OF REPORT -

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EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning: 7°C, Afternoon: 9°C	**DATE OF VISIT**:	7/31/2020

It was noted that after the pump was shut off at approximately 1800, the water level in the excavation began to drop. By 2000, the water level had dropped to less than 150mm in the deeper areas against the berm, from a maximum of approximately 600mm.

In the morning, the pump was turned on again at approximately 0700. The air was drained out of the intake hose, resulting in a higher discharge. The exposed area filled much more quickly than yesterday, reaching the high-water marks at approximately 0750. The pump was turned off. By 0810, the water level had dropped by approximately 100mm. The water level dropped at a relatively constant rate until approximately 1000, when it began to slow down drastically. It was hypothesized that the water level had dropped below a significant leak around that time, thus causing the drop in leakage rate. After discussion, the contractor opted to expose the liner's seams on the berm side of the exposed area. These were deemed the most likely spot for a leak to occur.

A 50mm pump was used to remove the remainder of the water and several seams were exposed. Issues were found in four of the eight seams exposed today. The issue deemed to contribute most to the leakage was a large wrinkle in the liner, shown in photograph 1 below. As seen in photograph 2, the staining pattern under the liner suggests that the wrinkle was folder prior to the bentonite getting wet, and that water could use this channel to penetrate under the liner into the berm.

The wrinkle pattern occurred in another seam as well, and this one showed clear signs of water running through the seam into the subgrade material. The wrinkles seem to occur consistently on the northern edge of the liner panels at the point where the embankment transitions into the lagoon floor.

It was also observed that at least one seam did not have proper lap distance. The manufacturer recommends 200mm minimum. The observed seam had a lap distance of 150mm.

Photos of the site are included below: (6 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Uncovering a wrinkle in a vertical seam on the lagoon's east embankment. This issue is directly across the berm from the area from which water was leaking.

Photograph #2: Staining pattern within the seam. Note the lack of staining running along the center fold, suggesting that no bentonite was ever present in this fold, which was tightly closed and weighed down with aggregates. This fold is the one pointed to with the shovel in photograph 1.

Photograph #3: Further evidence of water penetration within a liner seam. In this case, granular material was pushed within the seam, allowing water to wash out two paths into the subgrade.

Photograph #4: Narrow lap distance in one of the inspected seams. Manufacturer recommends at least 200mm lap distance.

Photograph #5: Horizontal seam has rolled. Top of embankment is towards the right in this photo.

Photograph #6: Evidence of significant water flow under the liner, with algal growth suggesting this area was quite wet and nutrient-rich.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 8°C, Afternoon: 10°C	**DATE OF VISIT**:	8/1/2020

The contractor finished exposing all the seams along the interface between the east bank and the lagoon floor. 11 of 27 seams were found to be defective during this preliminary investigation

The contractor exposed the liner wider near one of the seams, beginning with the lower part of the embankment. The first seam to be exposed was the one that seemed to have the worst issues, presenting wrinkling at the interface between the embankment and the lagoon floor that suggested further issues. This seam had been partially exposed yesterday but was further investigated today.

As it was exposed, several issues were found, including the wrinkling, which would allow water through the liner, gravel in the seam, which would prevent the seam from sealing, and a horizontal seam that appeared to have rolled back. The horizontal joint had the bottom section of liner running over the top section, rather than the top section over the bottom one. It was observed that some sand had been pushed into the joint, separating it and causing the top edge of the bottom flap to roll over. This effectively resulted in a gravel seam running through the liner along the berm, approximately 1m above the lagoon bottom. When the liner was peeled back and the gravel cleaned out, algae growth was observed on the underside of the liner, suggesting water is often present at this location.

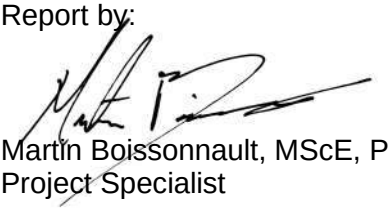
A large tear was also found in the middle of a liner panel. This tear appeared the right width and shape to have been done by the tread of a piece of equipment sliding back along the embankment. This defect will be corrected by placing a patch over the hole.

At this point a decision was made by Nunavut Excavating to expose the liner along the entire east bank of the lagoon, and to systematically examine, clean and re-seal all joints in the existing liner. Inventory was also taken of the remaining liner repair supplies and it was found that enough liner and bentonite remain from previous repairs to resurface the entire east bank, if necessary. Decisions on how much repair the lagoon will need and how much preventative maintenance will be done will be taken as the existing liner is exposed. The contractor will be flying in two more workers (to a total of four), as soon as possible to expedite the work. The contractor will also ask the Hamlet for permission to use their screener to produce more sand/fine aggregate, as salvaging the existing sand without mixing it into the coarse aggregate is proving difficult.

The contractor spent the rest of the day exposing panels along the east embankment, progressing about 15m over the course of the day.

Photos of the site are included below: (3 photos).

Report by:

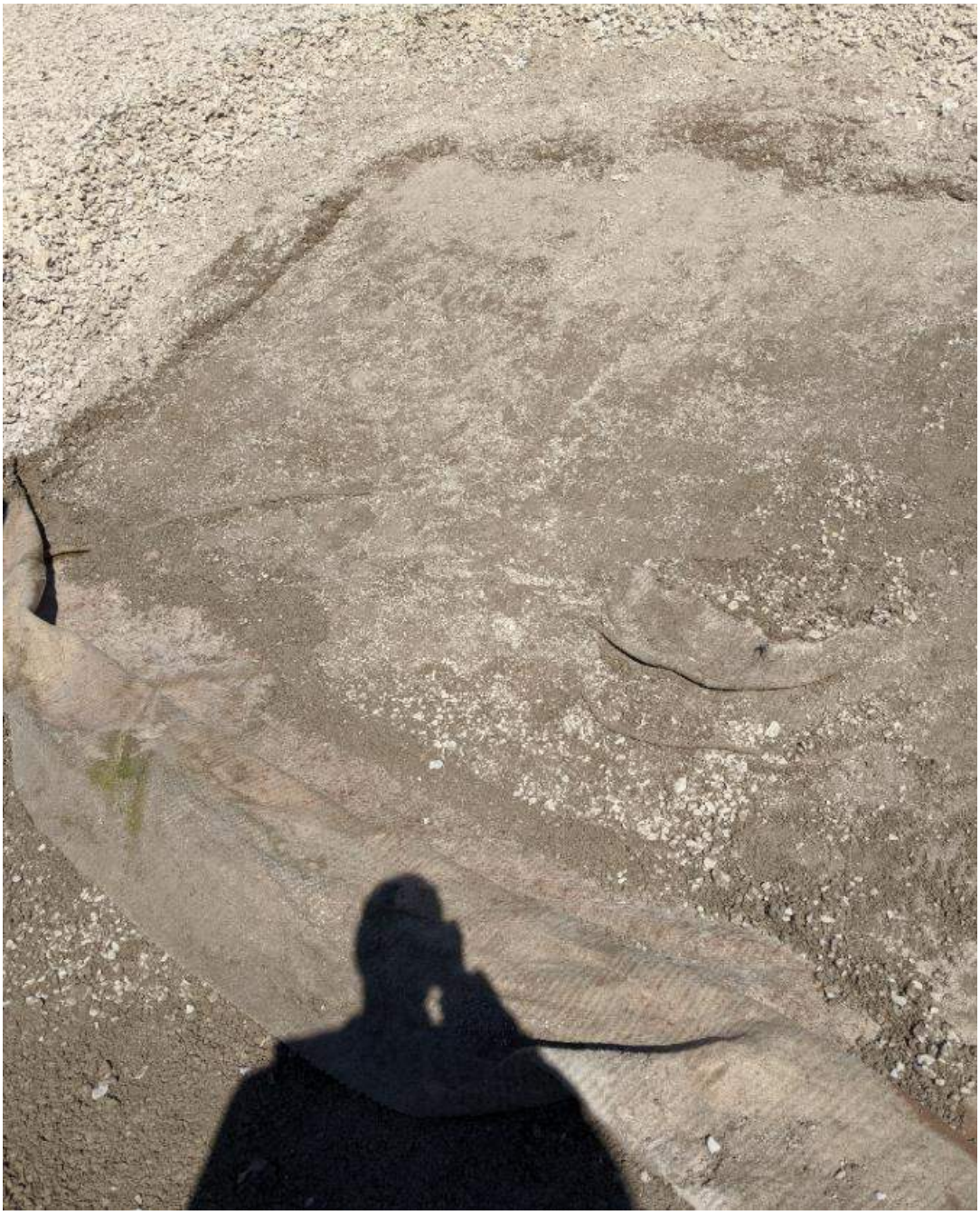


Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Wrinkling found on a liner panel, leaving the lower left side open for water to flow under the liner.



Photograph #2: Horizontal joint after peeling back. Note the boundary of the gravel is well below the edge of the liner when the latter is laying flat. Also note the algal growth on the underside of the rolled back panel, and the tear in the upper panel. The bentonite seal is located under the still-rolled-up portion of the liner, over a meter from the edge of the seam.

Photograph #3: Area exposed by end of day.

- END OF REPORT -

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning: 7°C, Afternoon:10°C	**DATE OF VISIT**:	8/2/2020

The contractor spent the day exposing additional liner, moving along the east bank towards the south of the cell. Several additional areas of potential leakage were uncovered. Examples can be found in the pictures below.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Evidence of water travelling through a seam. The edge of the seam is held open by gravel.

Photograph #2: Corner of a liner panel, at the bottom of the east embankment. The lower panel shows proper overlap, but the top liner seems short. The bentonite strip running horizontally on the embankment (vertically in this picture) is also quite low on the hill, considering the large overlap of the horizontal joint. This joint should also be lapped in the other direction, similar to roof shingling, as opposed to the configuration found here. The configuration found here tends to accumulate aggregates into the joint from the top (cleaned away in this picture).

- END OF REPORT -

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SITE REVIEW REPORT

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning:6°C, Afternoon: 8°C	**DATE OF VISIT**:	8/3/2020

The day was spent exposing additional liner along the east embankment. Additional progress was made towards the south of the cell. A total of approximately 15m of liner was exposed today, including both the embankment and floor of the lagoon, each to a distance of approximately 4m from the embankment/floor interface.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Liner exposure operations continue along the east bank.

- END OF REPORT -

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Web Site: www.exp.com

SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Rain, Fog. Morning:6°C, Afternoon: 9°C	**DATE OF VISIT**:	8/4/2020

The contractor continued exposing liner for the entire day. The large (Komatsu) excavator was used to remove the bulk of the material from the embankment and part of the lagoon floor. The final layer of sand (150mm thick or so) was left in place to protect the liner and will be removed by the mini-ex/by hand. Approximately two-thirds of the east embankment was partially exposed in this fashion. The northern third will be completed in the morning.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Using the Komatsu to remove the top layer of aggregate. The final 100 to 150mm of sand will be removed using the mini-ex and hand tools for more accuracy and lower likelihood of damaging the liner.

Photograph #2: Picture taken on Aug 5 showing final result of aggregate removal with excavator.

- END OF REPORT -

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SITE REVIEW REPORT

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 7°C, Afternoon: 9°C	**DATE OF VISIT**:	8/5/2020

The contractor spent the morning scraping away the bulk of the aggregates layer from the liner, using the excavator, on the remaining third of the east embankment. The sand layer was left in place to be removed later by hand and mini-excavator.

The afternoon was spent cleaning, maintaining, and preparing the Hamlet's screener to produce new fine aggregates (<19mm). The screener had not been used in several years, and the screens had to be changed, the various parts greased, and the battery changed. Once powered on, the screener appeared to function well, and an attachment was welded onto the front to allow transport to the gravel pit to the south of the Hamlet.

Two additional workers (Paul and Gord) also arrived today, doubling the contractor's workforce.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: East bank, with most of the aggregate layer removed, leaving only the sand layer.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning:7°C, Afternoon: 9°C	**DATE OF VISIT**:	8/6/2020

The contractor continued to expose liner at the east embankment, proceeding towards the north end of the east berm, and nearly reaching it. Only the embankment was exposed so far, and the floor of the lagoon will be exposed tomorrow.

The screener also ran all day today, producing fine aggregates for eventual burial of the new liner.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Clearing of the existing liner along the east embankment, towards the north end of the cell.

Photograph #2: The Hamlet's screener ran all day, producing fine aggregates.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 8°C, Afternoon: 10°C	**DATE OF VISIT**:	8/7/2020

The contractor continued exposing liner along the east berm. The north end of the cell was reached, both on the embankment side and the floor side of the floor-embankment interface. Several issues were uncovered, such as uneven subgrade forming a wave pattern, and evidence of equipment having travelled on the liner.

Liner exposure work continued towards the south end of the lagoon and should be completed with one or two more days of excavating.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Subgrade forming a wave pattern along the bottom of the cell.

Photograph #2: Evidence of equipment having travelled on the liner. By the shape and width of the imprints, it is suspected to have been an excavator.

Photograph #3: Attaching a piece of 15mm thick flexible rubber to the front of the mini-excavator's bucket greatly sped up work by allowing the operator to scrape much closer to the liner, leaving less work to be done by hand. It also greatly reduced the incidence of accidental tearing of the liner by the excavator.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny Morning: 8°C, Afternoon: 10°C	**DATE OF VISIT**:	8/8/2020

The contractor spent the day exposing the existing liner. By the end of the day, the entire width of the east berm was exposed, for approximately 3 to 4 meters up the embankment and 3 to 4 meters along the bottom of the lagoon.

One of the contractor's employees spent the day at the pit, using the screener to make sand to cover the eventual new liner. By the end of the day, it was estimated that he had a sufficient quantity of sand stockpiled to cover the new liner completely to a depth of approximately 150mm.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The result. Existing liner exposed along the bottom of the lagoon. Some wrinkles and rolls present, which will be smoothed out prior to placing the new liner down.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 10°C, Afternoon: 14°C	**DATE OF VISIT**:	8/9/2020

Contractor used bentonite to re-seal the seams of the existing liner, after cleaning them up to ensure a proper seal. The existing liner panels were also smoothed out to remove as many wrinkles and folds as possible prior to sealing the seams.

A cut was made in the existing liner panels, approximately 1m from the top of the exposed area. The top part of each panel was then rolled up, exposing the soil underneath in preparation for installation of a new liner.

New liner panels were then installed over the exposed area, ensuring proper lap between new panels and between new and existing liner at the top of the new liner. The rolled-over top part of the existing liner will be rolled back onto the new liner and sealed in place. Overlap at the top of the new liner panels is approximately 1m. This was done to ensure that even if the new panels slip a bit, the top joint would not leak. In addition, the seams on the new liner were offset by half a panel relative to those of the existing liner, so that the seams within both liners do not align.

The last few panels at the south end of the existing berm are a different type of liner (Bentomat DN-SFT). This liner is left over from the original lagoon construction, as opposed to the liner used so far in these repairs, which is left over from CO5 and was sent up in 2019. According to Nunavut Excavating, the two types of liner are compatible, and installation method is the same for both, according to information received from the manufacturer.

Photos of the site are included below: (5 photos).

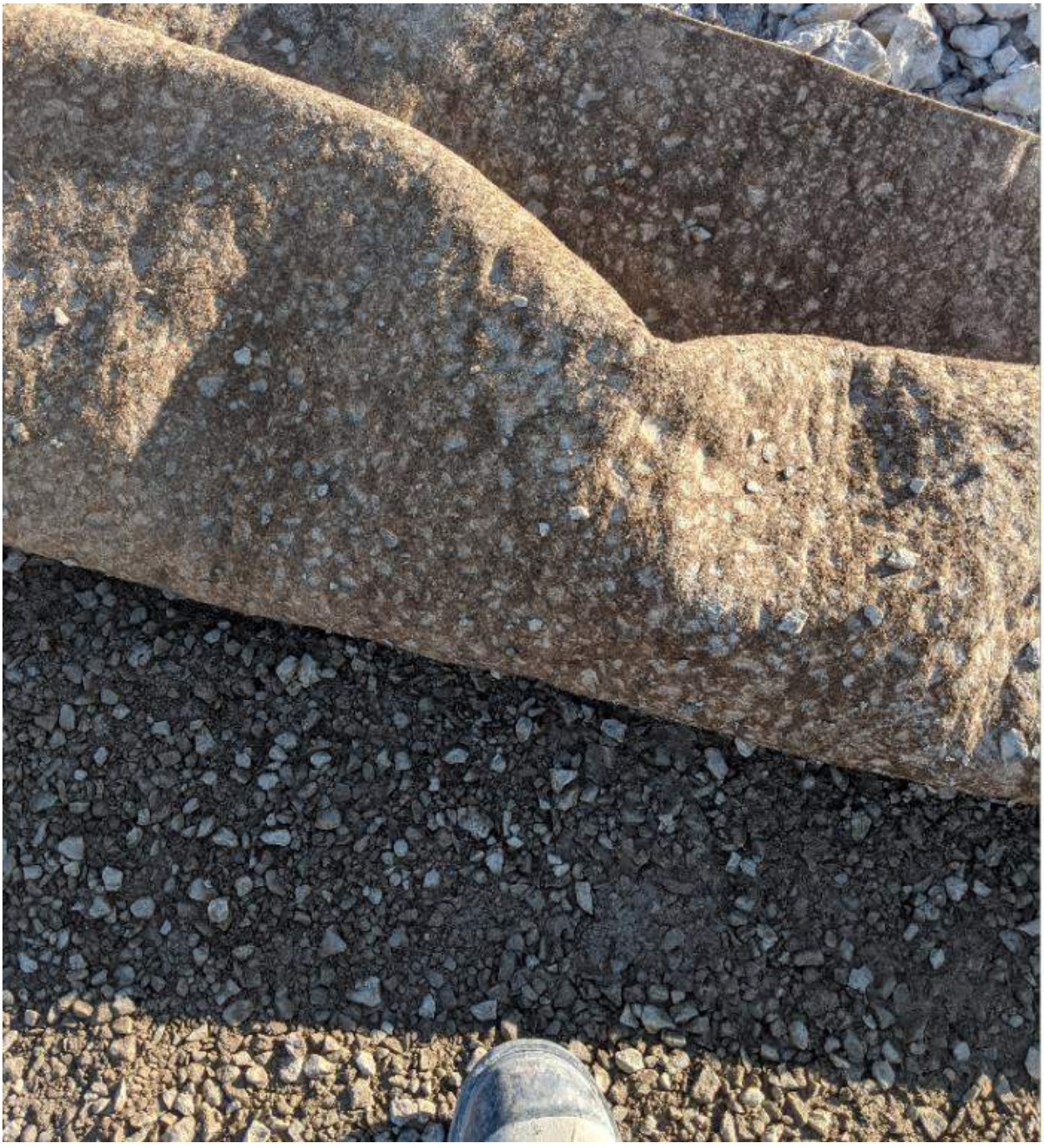
Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The existing liner was cut and the top part rolled back to expose the soil underneath. In some parts, the soil showed patterns of having been driven over with a vehicle with cleated tracks.



Photograph #2: The existing liner shows signs of having been wet on its underside. This color pattern is only present in the middle section of the berm, coinciding roughly with the area where seepage was observed on the outside of the lagoon.

Photograph #3: Some wrinkles and folds were cut out in order to allow the liner to sit flat. The new liner will completely cover these cuts.

Photograph #4: New liner installed. The top flap of the existing liner will be rolled down once the seams are properly sealed with bentonite.

Photograph #5: The final panels of the new liner are a different material than the rest of the panels. The new material is from a different shipment, and is approximately twice as thick as the rest of the liner.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 8°C, Afternoon: 11°C	**DATE OF VISIT**:	8/10/2020

The contractor sealed all seams in the new liner installed yesterday with bentonite according to manufacturer's instructions. Care was taken to ensure wrinkle-free seams, and to ensure the new liner properly seals with the existing liner in the appropriate locations and configurations.

Newly screened sand was imported and placed onto the liner. The aggregates which had been removed to expose the liner were then restored, to a depth of approximately 0.5m.

Great care was taken to ensure that no vehicles or equipment travelled on the exposed liner, or on the sand layer. The sand and overlying aggregates were placed and compacted using the excavator bucket. The mini-ex's blade was used to smooth out the surface.

Approximately half of the newly placed liner was covered today. The southern half of the excavation will be backfilled tomorrow using the same procedure.

Photos of the site are included below: (2 photos).

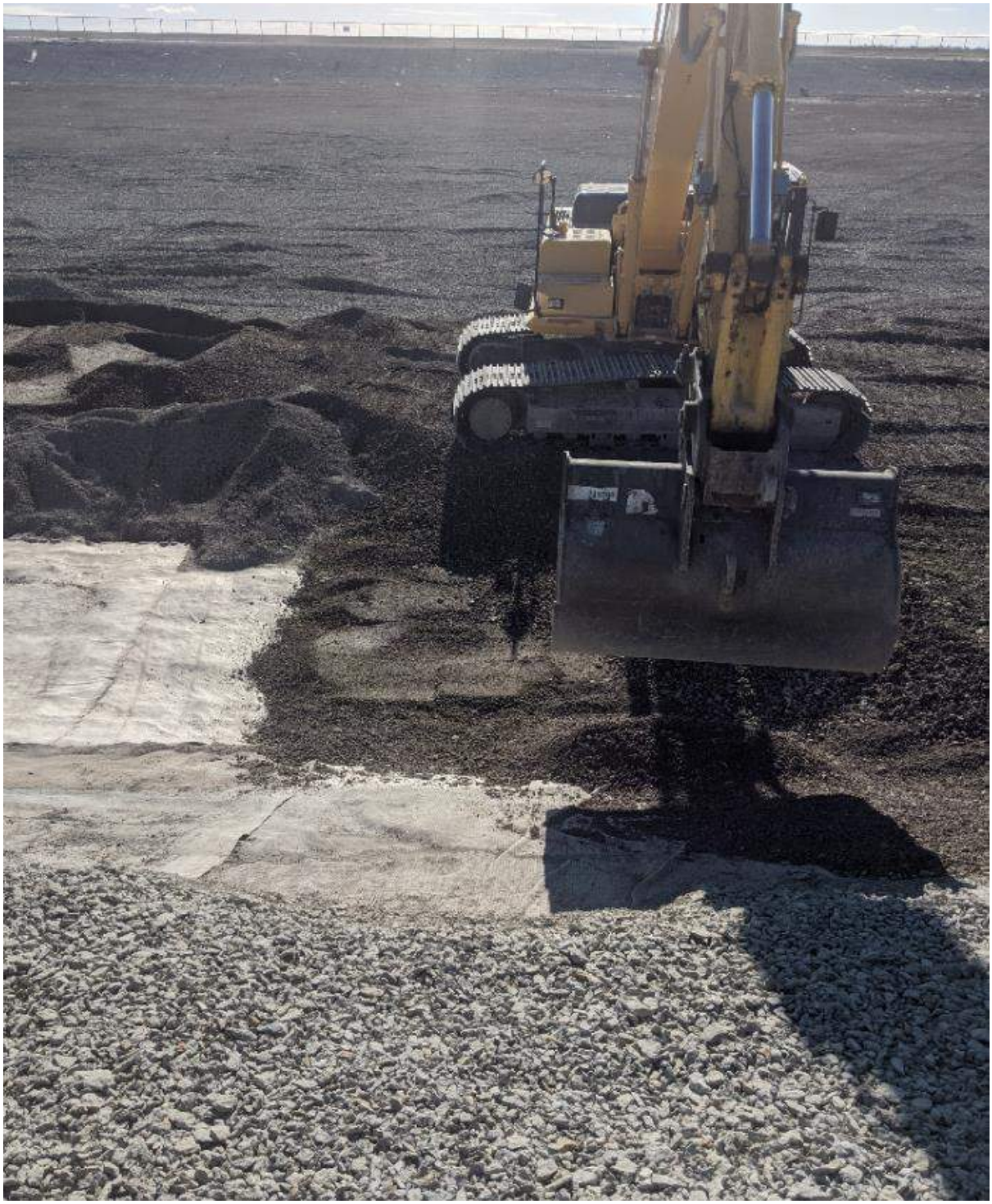
Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Sealing the liner seams with bentonite.



Photograph #2: Sand was placed onto the liner using the excavator. The excavator did not travel onto the liner or the sand layer and did not travel onto the embankment even once the aggregates had been placed down.

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EXP PROJECT NUMBER:	OTT-220382
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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 9°C, Afternoon: 11°C	**DATE OF VISIT**:	8/11/2020

The contractor finished covering up the newly installed liner. The surface of the aggregates was smoothed out with the mini excavator.

The contractor used the mini-excavator to expose the liner seams on the south side of the lagoon. The seams were deemed most likely to show signs of failure in the event that the south side of the lagoon suffered from the same issues as the east side. All 14 seams were exposed, for a length of approximately 3m, starting at the interface between the lagoon floor and the embankment and going up the embankment. No issues were observed in any of the seams. All seams appeared properly sealed.

The seams were backfilled, taking care to place sand against the liner before replacing the aggregates.

The lagoon will be filled with water starting in the morning tomorrow in order to test the integrity of the new liner.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Covering the newly installed liner with sand, then aggregates.

Photograph #2: Exposing the liner seams on the south berm of the south cell. No defects were found in any of the seams on the south berm.

- END OF REPORT -

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EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 6°C, Afternoon: 8°C	**DATE OF VISIT**:	8/12/2020

The contractor installed the Hamlet's pump on the berm between the lagoon's cells and started pumping from the north cell into the south cell around 0700. The pump ran all day and was shut down around 1800. The air was drained form the pump intake, so that the pump ran at full capacity.

Around 1600, it was noted that the water l8evel in the north cell had dropped significantly, and that the bottom of the cell was showing in several locations within the cell. Alternate sources of water are being considered, but a permit will be required for any source outside the north cell.

The water pumped into the south cell had initially pooled around the area where the pump's outlet is located but receded into the aggregates shortly after the pump was turned off. No evidence of any leak was observed on the outside of the cell.

Photos of the site are included below: (5 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Completed backfill of new liner along east berm.

Photograph #2: Water being pumped form the North cell into the South cell.

Photograph #3: Water pooling into the northeast corner of the south cell.

Photograph #4: The North cell is rapidly depleting, and the bottom is visible in most of the cell.

Photograph #5: Shortly after shutting down the pump, the water had receded into the aggregates.

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 7°C, Afternoon: 9°C	**DATE OF VISIT**:	8/13/2020

A leak was observed in the east bank, at the same location as previously, as soon as the contractor arrived on site.

The contractor spent the day scraping aggregates off the liner within the lagoon, starting at the pump outlet and radiating outwards in order to delineate the wet area and thus limit the area within which the leak could be located.

Water was periodically added to the lagoon in order to perform localized retention tests on the liner. Towards the end of the afternoon, a larger area was cleared, with the intent of adding water in the morning.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: New leak noted at the location of previous leak.

Photograph #2: Single channel dug to delimit the extent of the pool created yesterday. By digging until dry material was encountered, the area to be searched for leaks can be restricted to within the wet area.

Photograph #3: Exposing liner to check for leaks.

- END OF REPORT -

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 4°C, Afternoon: 5°C	**DATE OF VISIT**:	8/14/2020

The contractor spent the day cleaning off liner on the lagoon floor, proceeding from yesterday's excavation towards the pump outlet. Multiple instances of track imprints from equipment driving over the liner were exposed. These imprints seem consistent with a deep-cleated track, such as that of a dozer. No other significant damage to the liner was noted in the exposed area.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Track patterns in liner (in foreground). The patterns are difficult to capture in a photo, but should be more visible once the water has dried up and the sand can be brushed away.

Photograph #2: Exposed area at end of day. Water appears to be retained on the liner in several areas, which was taken as an encouraging sign.

- END OF REPORT -

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EXP PROJECT NUMBER:	OTT-220382
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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning: 5°C, Afternoon: 7°C	**DATE OF VISIT**:	8/15/2020

Contractor spent the day exposing liner seams to look for defects. One seam running east-west was exposed along its entire length, from the east berm to the west berm. The seam coincided with a dozer track and showed several signs of failure. In several instances, the lap had been unevenly pressed down by the dozer track and gravel was found to have entered the seam, propping it open. Near the west embankment, the seam was stuffed with gravel, holding it open. In another instance, the bentonite within the seam was non-continuous, leaving gaps to allow water through.

In light of these findings, the contractor has decided to expose and re-seal all seams within the cell. Based on the rate at which they are currently exposing seams, work is expected to take approximately four weeks, with additional time for any extra repairs. The cell will then be tested for leaks again.

Photos of the site are included below: (X photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Non-continuous bentonite strip within seam.

Photograph #2: Dozer track pattern along seam. Liner on right hand side was imprinted deeper than its counterpart, allowing gravel to slip between the liners.

Photograph #3: Gravel was present throughout the width of this portion of the seam. A wider swath of liner will be exposed and the liner will be rolled back further, allowing for a thorough cleaning of the joint. Dozer track pattern still present here.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Rain, Morning: 4°C, Afternoon: 5°C	**DATE OF VISIT**:	8/16/2020

The contractor exposed a second east-west seam across the lagoon's south cell. As with the first, this seam showed signs of leaking at several locations across the cell. Gravel in the seams was the most common issue, with dozer tracks being apparent at several locations across the seam.

Two seams are now complete, with an estimated 24 seams left to expose in the east-west direction.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Seam exposure in the east-west direction. Heavy rain all day caused water to pool in the exposed area.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Fog, Morning: 4°C, Afternoon: 5°C	**DATE OF VISIT**:	8/17/2020

Contractor exposed two additional east-west seams today. Additional issues with gravel in the joints were found. Over 50% of the seams by length exposed so far were compromised in some form. The seams are being cleaned as they are exposed, but additional effort will be expended once the seams are re-sealed with bentonite. The contractor has ordered 120 bags of bentonite, which will be flown in, to complete the seam repairs.

A large torn segment was also found. This tear exposed the subgrade directly, presumably allowing water to flow under the liner. This tear will be patched before backfilling.

A total of four seams were exposed so far, with an estimated 24 east-west seams remaining.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Tear in the liner. While the flap has been cleaned and unfolded in this photo, the patch of subgrade visible at the back of the tear was found completely uncovered., allowing water a direct pathway into the subgrade.

Photograph #2: Gravel compressed between the liner layers, even deep into the joint.

Photograph #3: In-seam gravel thicknesses up to 25mm were encountered while exposing the seam.

- END OF REPORT -

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning:5°C, Afternoon: 6°C	**DATE OF VISIT**:	8/18/2020

The contractor spent the day uncovering further seams along the bottom of the lagoon. Three seams were uncovered today, bringing the total to seven and leaving a further estimated 21 east-west seams to be uncovered. An estimated 56 north-south seams will also have to be uncovered, corresponding to the ends of the liner rolls. The north south seams are only five metres long, and their ends are already uncovered where they intersect with the east-west seams.

As with previous seams, signs of improperly sealed seams were found throughout the liner uncovered today.

Photos of the site are included below: (4 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Overview of work completed so far.

Photograph #2: The dozer track pattern is a common feature of every seam uncovered so far.

Photograph #3: Liner edge sticking straight up as it is uncovered. The bottom side of the liner (lower left side of liner as seen here) is full of gravel, preventing the seam from properly closing.

Photograph #4: Major roll next to a liner seam. The roll will be cut out and patched later on during the seam re-sealing process, prior to backfilling.

- END OF REPORT -

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SITE REVIEW REPORT

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Sunny, Morning: 4°C, Afternoon: 6°C	**DATE OF VISIT**:	8/19/2020

The contractor once again spent the day uncovering some east-west seams in the liner. While the seams uncovered today were in a generally better condition than others exposed so far, they still presented deficiencies such as wrinkles, gravel in the seams, and uneven subgrade. At one location, it was observed that the total depth of aggregates covering the liner, including both sand and coarse aggregates, was less than 200mm.

The total number of uncovered east-west seams is now 10, leaving an estimated 18 yet to be uncovered.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: In one location, the total depth to liner was less than 200mm. The mini-excavator's bucket is level with the undisturbed aggregate surface in this photo.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Overcast, Morning:7°C, Afternoon:5°C	**DATE OF VISIT**:	8/20/2020

The contractor once again spent the day exposing east-west seams within the south cell. 3 seams were exposed today, bringing the total to 13. The exposed seams presented the usual signs of deterioration, namely gravel in the joints, dozer tracks and/or localized settlement of the subgrade. A large tear was also found in one of the joints.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Large tear found in one of the seams.

Photograph #2: Dozer tracks over the joint.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 4°C, Afternoon: 5°C	**DATE OF VISIT**:	8/21/2020

The contractor exposed an additional three seams today, bringing the total to 16. The seams exposed presented similar damages to the ones found on the first 13 seams, including gravel within the seam, dozer imprints, and wrinkles.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Overview of progress so far.

Photograph #2: In addition to damage to the seam's upper layer, gravel was present through the full width of this particular defect, creating a path for water to penetrate all the way to the bentonite seal, and potentially to the subgrade.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:5°C, Afternoon: 5°C	**DATE OF VISIT**:	8/22/2020

The contractor exposed two more seams today, for a total of 18. The seams presented some defects such as gravel in the seam, dozer imprints, or damage to the edges of the panels. A patch was also found next to one of the seams, presumably dating from the 2018 repairs. The bentonite that will be used to re-seal some of the seams also arrived today. Work on re-sealing some of the seams will begin tomorrow.

A full record of the damages found within each seam was also prepared for the seams exposed so far. Once the seam exposure is complete for all seams, the document will be finalized. This will serve as a record of defects corrected as part of the re-sealing.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: The familiar wave pattern presented by the dozer track imprints, which is common to most seams exposed so far.

Photograph #2: A mini-excavator is used to remove most of the aggregates, the sand layer is removed by hand, and a broom is used to clean off the liner.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382		
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5		
OWNER:	Government of Nunavut		
CONTRACTOR:	Nunavut Excavating		
ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 4°C, Afternoon: 5°C	**DATE OF VISIT**:	8/23/2020

The contractor re-sealed 3 seams with bentonite today. The seams were first opened far enough to ensure no gravel remains, then a new strip of bentonite was placed between the two layers of liner at the seam. The existing bentonite strip is, for most seams, approximately 300mm back from the edge of the top liner, allowing plenty of room to place the new 100mm wide bentonite strip approximately 100mm from the edge of the seam. Once repaired, most seams therefore contain two strips of bentonite within the overlap.

Once repaired, the seams were covered with approximately 100mm of newly screened sand, then backfilled with aggregates. All backfilling activities were done with the excavator, and care was taken to ensure that the excavator's treads did not damage the liner. In particular, the operator minimized the amount of turning required, and when turning, used the boom to lift the front end of the excavator off the ground. This minimized the twisting motion applied to the ground. The excavator did not enter or drive over an open trench at any time, remaining instead on areas where the full thickness of the aggregates protected the liner.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Placing bentonite within the seam, in a strip running parallel to the existing strip (further into the seam, not visible in this photo).

Photograph #2: Seams were covered in sand prior to being covered with the aggregates.

Photograph #3: Sand was lowered into the lagoon using the excavator, rather than repeatedly driving equipment down the slope, which could damage the underlying liner.

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 3°C, Afternoon: 6°C	**DATE OF VISIT**:	8/24/2020

The contractor resumed the re-sealing of the seams with new bentonite. Two more seams were re-sealed today. During the re-sealing process, the liner is smoothed out to ensure a proper bond between both sides of the seam. Any rocks, garbage or debris within the seam are cleaned out, and a generous amount of bentonite is added according to manufacturer's instructions. The liner is immediately covered in aggregates with diameter <19mm, then with the aggregates that were removed to expose the seam. This provides confining pressure prior to the hydration of the bentonite, as is recommended by the manufacturer.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Bentonite has been applied and the seam buried with fine aggregates. The areas around the north-south seams are being left open to allow for easy location and exposure of these seams once the east-west seams have been restored.

Photograph #2: In areas where multiple layers of liner are stacked, all layers are being re-sealed with bentonite.

Photograph #3: Covering of the fine aggregates with the aggregates removed during the exposure process, shortly after placement of the bentonite and fines.

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EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 5°C , Afternoon: 7°C	**DATE OF VISIT**:	8/25/2020

The contractor spent the day re-sealing further seams with bentonite. Defects in the existing liner such as tears and punctures were covered with patches. In one seam, the existing overlap between panels was found to be less than 100mm, over a length of approximately 20m. A 400mm wide strip of liner was placed over the seam in order to ensure proper overlap.

The re-sealed seams were then covered in aggregates with diameter <19mm, then backfilled with full size aggregates.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Strip of liner placed over the existing seam, in a location where the existing overlap was too narrow.

Photograph #2: Re-sealing the seams with bentonite.

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning: 5°C, Afternoon: 10°C	**DATE OF VISIT**:	8/26/2020

The contractor spent the day re-sealing further seams with bentonite. Defects in the existing liner such as tears and punctures were covered with patches. A patch that is presumed to have been installed during the 2018 lagoon repairs was found and replaced. All patches were given ample overlap around the defect they cover, keeping in mind the manufacturer's recommended 200mm overlap.

The re-sealed seams were then covered in aggregates with diameter <19mm, then backfilled with full size aggregates.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Patch covering a local defect within one of the seams.

Photograph #2: Ample bentonite was applied to this patch, which replaces the patch placed in 2018.

Photograph #3: Final installation of the patch replacing the 2018 patch.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Partly Sunny, Morning:6°C, Afternoon: 6°C	**DATE OF VISIT**:	2020-08-27

The contractor spent the day exposing, then re-sealing and backfilling the north-south seams within the lagoon. These seams are only five metres long and occur at the end of a roll of liner. There are on average five per two liner runs, for an estimated 70 across the entire south cell. The contractor completed the north-south seams over approximately the northern third of the lagoon today. This leaves the north-south seams in the middle third and all seams in the southern third still to be done.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: North-south seam, exposed and re-sealed, awaiting backfilling. This particular seam features a key cut into the edge of the panel. No apparent feature was observed that would require this key, but it does not appear to compromise the liner integrity.

Photograph #2: North-south seam re-sealing.

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Mostly Sunny, Morning:5°C, Afternoon: 8°C	**DATE OF VISIT**:	2020-08-28

The contractor continued work on exposing and re-sealing the liner seams. The remainder of the north-south seams in the middle third of the lagoon were completed, leaving only the southern third of the lagoon to work on (both north-south and east-west seams).

The northernmost seam, directly against the bottom of the north embankment, was also exposed, and found to have several instances of gravel in the seam. This prevented the seam from closing properly in some areas. The seam was cleaned, resealed, covered in sand, then backfilled.

The contractor will continue work tomorrow with the east-west seams in the southern third of the lagoon. The nineteenth east-west seam was partially exposed today.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Gravel in the northernmost east-west seam. Full penetration through the seam.

Photograph #2: Dozer tracking in the 19th east-west seam from the north.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Partly Sunny, Morning:7°C, Afternoon: 11°C	**DATE OF VISIT**:	2020-08-29

The contractor spent the day exposing further seams. An additional three east-west seams were exposed, with an estimated nine remaining.

A patch was found over one of the seams. It is presumed to have been placed in 2018. There appears to have been a generous amount of bentonite placed under the patch, as bentonite was being squeezed out of the edges. This was taken as a good sign, and the patch was not disturbed.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Bentonite being squeezed out of the joint around a patch.

Photograph #2: Longitudinal view of one of the seams, showing wave pattern.

Photograph #3: Overview of work completed today.

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Morning:5°C, Afternoon:7°C	**DATE OF VISIT**:	8/30/2020

The contractor exposed further seams along the lagoon bottom. Issues were corrected, mainly gravel within the seams. An estimated seven east-west seams remain.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Exposed seam.

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SITE REVIEW REPORT

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Cloudy, Morning:7°C, Afternoon: 7°C	**DATE OF VISIT**:	2020-08-31

The contractor spent much of the day resealing exposed seams with bentonite. In particular, several patches were installed over areas where damage to the liner was observed. The largest patch placed today was over an area where the existing overlap within the liner was quite small, less than 75mm in some areas. The new patch ensures a minimum of 150mm of overlap around any opening within the liner.

Work on seam exposure and resealing continues.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Installation of patch over area where liner overlap is insufficient.

Photograph #2: Installed patch.

Photograph #3: Joints are broom cleaned prior to the placement of new bentonite.

- END OF REPORT -

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SITE REVIEW REPORT

EXP PROJECT NUMBER:	OTT-220382
PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Mostly Cloudy, Morning:4°C, Afternoon: 4°C	**DATE OF VISIT**:	2020-09-01

The contractor spent the day exposing further seams along the cell floor. Similar issues were found in the seams uncovered today as have been found in previously uncovered seams. The contractor completed the exposure, resealing and backfilling of two seams today. There are an estimated three or four seams remaining, plus additional seams in the southwest corner due to the lagoon's trapezoidal shape.

Photos of the site are included below: (2 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Exposed seams.

Photograph #2: Installation of patches over damaged areas, including partial backfill to hold the patch down, is being completed as resealing work progresses, with backfilling occurring at the end of the day.

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OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Partly Sunny, Morning:5°C, Afternoon: 6°C	**DATE OF VISIT**:	2020-09-02

The contractor once again spent the day exposing liner. The second-to-last east-west seam was exposed today. In the western third of the lagoon, this seam was found to split apart, with the southern liner panel deflecting slightly towards the south. Patches were placed over the split, bridging the gap between the panels. It is assumed that this deflection was introduced in order to compensate for the triangular section remaining in the southwest corner of the lagoon (the cell having a trapezoidal shape). A section approximately 6m long prior to the start of the patches had insufficient seam overlap, with the section closest to the first patch being separated and allowing water to flow directly into the subgrade. The seams around each liner patch were completely exposed and resealed, like all other seams within the lagoon.

Photos of the site are included below: (3 photos).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Straight portion of the second to last seam.

Photograph #2: Patches bridging the gap over the widening divergence between two liner panels. The patches get wider as they get closer to the west bank.

Photograph #3: The seams around each patch were exposed and resealed.

- END OF REPORT -

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SITE REVIEW REPORT

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PROJECT NAME:	Hall Beach Sewage Lagoon – Change Order 5
OWNER:	Government of Nunavut
CONTRACTOR:	Nunavut Excavating

ISSUED BY:	Martin Boissonnault	**Reviewed By:**	Ken Johnson
WEATHER:	Rain Showers, Morning:4°C, Afternoon: 4°C	**DATE OF VISIT**:	2020-09-03

The contractor continues to expose, reseal and backfill joints in the liner at the southwest corner of the cell. The final east-west joint was partially exposed. As with the previous east-west joint, this joint meets a series of patches as it approaches the southwest corner of the cell.

Photo of the site is included below: (1 photo).

Report by:

Martin Boissonnault, MScE, P.Eng.
Project Specialist

Reviewed by:

Ken Johnson, MASC, RPP, FCAE, P.Eng.
Project Manager

Photograph #1: Final east-west joints, partially exposed.

- END OF REPORT -