

Camlaren Mine Tailings Soil Containment Area Geotechnical Inspection

Gordon Lake Group Remediation Project

Crown Indigenous Relations and Northern Affairs Canada –
Contaminants and Remediation Directorate

Project Number: 60710609

April 5, 2024

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Quality information

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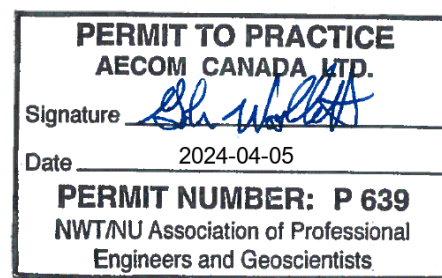
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Revision History

Revision	Revision date	Authorized	Name	Position
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Table of Contents

1. Introduction 1

2. Site Visit 1

 2.1 Health and Safety Plan 1

3. Geotechnical Inspection 1

 3.1 Overview 1

 3.2 Observations 2

4. Discussion and Recommendations 3

5. Statement of Limitations 3

6. References 4

Appendices

Appendix A Photographic Log

Appendix B Figures

1. Introduction

AECOM Canada Ltd. (AECOM) was contracted by Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) to complete an engineering inspection of the tailings soil containment area (TSCA) at the former Camlaren Mine Site. An inspection of the TSCA was completed by Elizabeth Garven, P.Eng., of AECOM on September 29, 2023. This report summarizes observations and recommendations of the engineered components of the TSCA.

Stantec Consulting Ltd. is the Engineer of Record for the design and described the tailings containment facility as a “dam earth structure containing tailings and mine waste, capped in 2018” (Stantec, 2018). The tailings containment facility has been called a tailings soil containment area (TSCA) in previous reports and will be the term used for this report, for consistency. Englobe Corp. notes that the TSCA is in the passive closure phase for a mining dam structure with a “low” dam hazard classification, and is in the process of conversion into a landform structure (Englobe, 2023).

2. Site Visit

On September 29, 2023, AECOM personnel, Elizabeth Garven and Janine Morris, travelled to site to complete the geotechnical inspection concurrently with the quarterly water sampling and monitoring at the site. A wildlife monitor accompanied personnel while on site.

The quarterly water sampling and monitoring results and observations are provided in a separate report.

2.1 Health and Safety Plan

A detailed Health and Safety Plan (HASP) and the WSCC Contaminated Site Safety Plan forms were prepared and submitted for approvals prior to commencement of the field program. The documents were reviewed by all team members prior to mobilizing to the site.

3. Geotechnical Inspection

Elizabeth Garven completed the inspection of the TSCA and associated structures. Elizabeth is a Senior Geotechnical Engineer registered in the Northwest Territories with design and inspection experience. A detailed photo log from the inspection is provided in **Appendix A**.

The inspection was completed by visual observations of the TSCA engineered components at the closed Camlaren Mine Site. The general location and layout of the site is shown in **Figure 1** in **Appendix B** and shown in **Photos 1** and **2**. The subsections below are organized by the three main components and provide details of the inspection and recommendations.

3.1 Overview

It is understood that the TSCA consists of earthfill embankments that contains low-strength tailings, solid mining-related detritus as well as materials imported to the site from nearby former mining operations as part of the Gordon Lake Group Mines Rehabilitation project. The TSCA contains approximately 23,400 m³ waste materials and includes the following features (Stantec, 2018):

- Engineered composite cover that includes bituminous geomembrane, placed over a sand layer, covered with 0.5 m of sand
- Outer slopes regraded to 3.1H:1V to 4.3H:1V
- Bituminous membrane-lined ditch along the west and south perimeter to control drainage so that there is no pooling against the embankments
- Erosion protection including placement of willow branches over the top surface of pile and erosion coir logs along the north, east, and south embankment slopes

The TSCA is generally oval, measuring approximately 200 m (north to south) by 130 m (east to west). The top of the TSCA was conically shaped with 3 to 4% surface grading toward the adjacent outer slopes. The height of the pile varies from 1.5 m to 4.5 m.

3.2 Observations

The site includes the pile that is defined by the top surface, and the four embankments (north, south, east and west) as shown in **Figure 2**. Photos showing an overview of the TSCA are found in **Appendix A (Photos 1 and 2)**. The drainage ditch runs along the toe of the west and south embankments but is separated into the north drainage ditch and south drainage ditch as shown on the Figure from Englobe report (Englobe, 2022). The same names were used, for consistency.

The TSCA is in generally good condition. Willow branches were placed across the top of the pile and the slopes appear to be generally stable. At the time of the inspection, the bottom of the embankments was dry and no water was observed in the ditches along the west and south sides of the TSCA. The following observations were noted and highlighted on **Figure 2** where applicable:

- The top of the pile has some minor localized settling across the top of the pile (**Photo 3**).
- The willow branches placed across the surface are providing erosion control and allowing vegetation to grow (**Photo 4**).
- Vegetation in the form of young trees and grasses have started to grow but are mainly along the east slope (**Photo 5**) and east area of the top of pile (**Photo 6**). The west side has almost no vegetation (**Photos 7 and 8**). Vegetation continues to establish across the TSCA. (**Photo 9**).
- North embankment is stable and has the start of some young trees growing on it (**Photo 10**). There are the start of some erosion channels from water movement (**Photos 11, 12, 13, and 14**) along the north slope in the area of the northwest corner. In a few areas, sand is washed down the slope and accumulating at the erosion log (**Photo 15**).
- West embankment has occasional patches of grass growing (**Photos 16, and 17**). Minor erosion channels are noted along the length of the embankment (**Photo 17**). The embankment is not very tall and there are no erosion logs along this side.
- East embankment has some vegetation growing along most of the embankment. (**Photo 18, 19, and 20**) Minor erosion is noted in several locations and washout sand is visible at some locations. (**Photo 21**). An erosion channel along the east embankment appears to have been stabilized with coarse aggregate (**Photo 22**).
- There is an area of settlement in the northwest corner of the pile (**Photo 23**). The area of settlement is adjacent to an 8 m long healed crack in the pile (**Photo 24**) Cracking on the west side of the drainage channel in the same area was also noted (**Photo 25, 26, and 27**). This cracking indicates settlement in the area of the drainage ditch.
- Moose tracks are seen on the west embankment (**Photo 28**).
- A healed crack is noted at the south end of the west embankment (**Photo 29**).
- The north drainage ditch is adjacent to the toe of the west embankment. The ditch is in good condition and was dry at the time of the inspection. (**Photos 30, 31, and 32**). The south drainage ditch is adjacent to the toe of the west and south embankments (**Photo 26, 23, 33, 34, 35**). The drainage channel appears to undercut the embankment for approximately 15 m at the southeast corner of the TSCA (**Photo 18**).
- South embankment has some vegetation and is generally stable (**Photos 36 and 37**).
- The erosion coir logs are in varying conditions. Some are pinned and in good condition, while others are loose or have degraded in condition (**Photos 38 and 39**). Along the south embankment, the coir logs have migrated up the slope. Along the east embankment, some of the coir logs have disappeared and migrated to different locations.

- The bituminous membrane was exposed along the south embankment near station 0+340 (**Photo 40**).
- Numerous holes were seen on and near the TSCA (**Photo 41**). The wildlife monitor indicated that they were likely from foxes that enjoy digging in the sand. An area located to the west of the TSCA appears to be occupied by foxes (**Photo 42**).
- A spot of oil contaminated soil (approximately 0.15 m³) was observed adjacent to the north drainage ditch west of the TSCA. (**Photo 43**).

4. Discussion and Recommendations

The structure is generally stable and in good condition based on the visual inspection conducted in September 2023. Vegetation is growing across the pile and is necessary for long term stabilization. Some vegetation has propagated across the pile, but it is still quite limited. Minor erosion channels on the embankments will reduce in size and frequency with the additional vegetation across the pile. Surface erosion should continue to be monitored, and repaired where needed.

Settlement was observed in the northwest area of the pile and the cracking west of the drainage channel has large, open cracks west of the drainage channel that appear to be quite new. The cracks observed on the TSCA pile are narrower and healed. The larger cracks that are open are likely to collect water and may grow during spring thaw. Repairing these cracks to minimize impacts is recommended. The settlement in this area should continue to be monitored to allow that the drainage channel in this area is still effective and be repaired as needed to avoid ponding next to the embankment.

The coir logs reduce erosion and aid in establishing vegetation. Some of the erosion coir logs on the east and south embankments have broken down, or torn, or have come loose and migrated elsewhere. Some of these logs should be replaced on the steeper slopes.

Within the TSCA, holes that have been dug by foxes or other animals in the sand cover should be backfilled to prevent water pooling, and the exposed bituminous liner at the south end should be backfilled with cover material.

5. Statement of Limitations

The findings and conclusions in this 2023 geotechnical inspection report by AECOM for the Camlaren Mine TSCA have been prepared for specific application to this inspection. They have been developed in a manner They have been developed in a manner consistent with that level of care and skill exercised by members of the engineering profession and in accordance with AECOM's standard terms and conditions.

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Background information, design bases, and other data have been furnished to AECOM by CIRNAC, which AECOM has used in preparing this report. AECOM has relied on this information as furnished and is neither responsible for nor has confirmed the accuracy of this information.

This report is based on data, site conditions, and other information that were generally applicable as of September 29, 2023. The conclusions and recommendations herein are therefore applicable only to these time frames.

6. References

Englobe Corp. (Englobe) 2021. Gordon Lake Group Geotechnical Services Program 2021 Dam Safety Review. Final Report.

Englobe Corp. (Englobe), 2023. Gordon Lake Group – Geotechnical Services Program - TSCA Geotechnical Investigation for Dam Declassification. Version 00. Project number 2207077.00. Report dated March 7, 2023.

Stantec Consulting Ltd. (Stantec), 2018. 2018 As-Built Construction – Camlaren TSCA, Part of GLG. FINAL. Project Number 121413573. Report dated December 21, 2018.

Appendix A

Photographic Log

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date	
1	9/29/2023	
Direction Photo Taken		
North		
Description		
General site photo of the TSCA.		

Photo No.	Date	
2	9/29/2023	
Direction Photo Taken		
Southwest		
Description		
General site photo.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
3	9/29/2023
Direction Photo Taken	
Southwest	
Description	
Minor settlement across the surface of the pile.	

North East Elevation

☼ 229°SW (T) ● 12 N 388316 6985982 ±4m ▲ 291m



Photo No.	Date
4	9/29/2023
Direction Photo Taken	
Northwest	
Description	
Willow branches placed for erosion control.	

South East Elevation

☼ 304°NW (T) ● 12 N 388350 6985962 ±9m ▲ 293m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
5	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Vegetation is growing on the east slope.	

South West Elevation

☼ 40°NE (T) ● 12 N 388350 6985963 ±14m ▲ 293m



Photo No.	Date
6	9/29/2023
Direction Photo Taken	
West	
Description	
Willow cover with vegetation including small trees and grasses.	

East Elevation

☼ 287°W (T) ● 12 N 388323 6986027 ±9m ▲ 288m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 7	Date 9/29/2023	NE 30 60 90 120 150 180 S ☀ 109°E (T) ● 12 N 388283 6986025 ±4m ▲ 287m 
Direction Photo Taken East		
Description Vegetation sparse on the west side.		

Photo No. 8	Date 9/29/2023	SE 120 150 180 210 240 270 W ☀ 188°S (T) ● 12 N 388287 6985999 ±4m ▲ 288m 
Direction Photo Taken South		
Description Lack of vegetation along the west side		

Site Name: Camlaren Mine Site – Geotechnical Inspection	Site Location Gordon Lake, NT	Project No. 60710609
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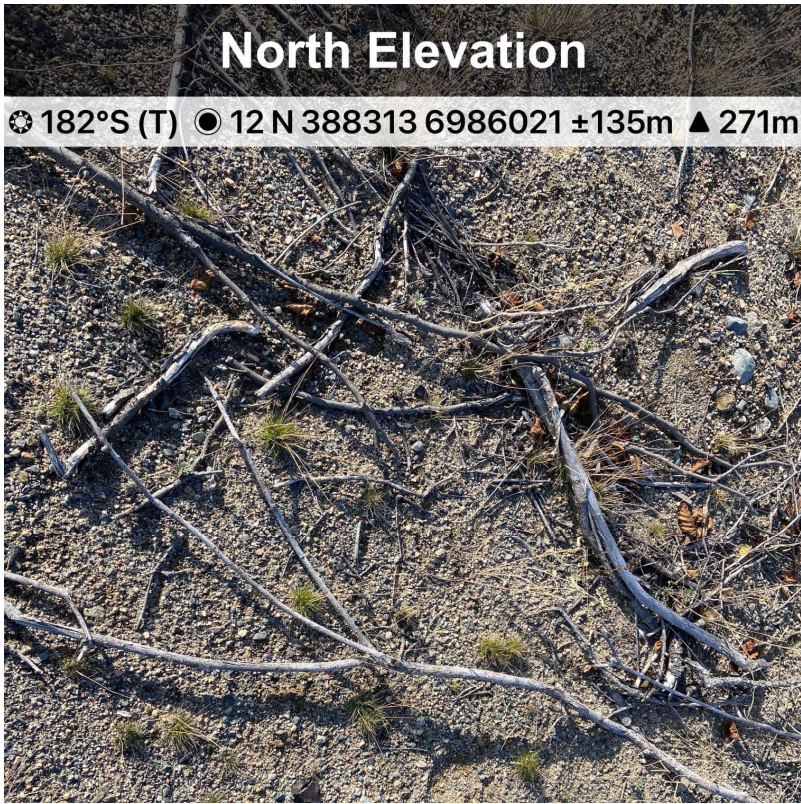
Photo No. 9	Date 9/29/2023	
Direction Photo Taken n/a		
Description Vegetation continues to grow.		

Photo No. 10	Date 9/29/2023	
Direction Photo Taken Southeast		
Description North slope is generally stable with the start of vegetation growth.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
11	9/29/2023
Direction Photo Taken	
North	
Description	
Minor erosion channels from water movement along north embankment of pile.	

South Elevation

☼ 2°N (T) ● 12 N 388334 6986109 ±24m ▲ 276m

Photo No.	Date
12	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Erosion channel on north slope.	

South West Elevation

☼ 22°NE (T) ● 12 N 388327 6986119 ±11m ▲ 289m

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date	South Elevation ☼ 19°N (T) ● 12 N 388315 6986125 ±11m ▲ 291m 
13	9/29/2023	
Direction Photo Taken		
North		
Description		
Erosion channels or minor settlement likely caused by water movement along the north embankment (toward the northwest corner).		

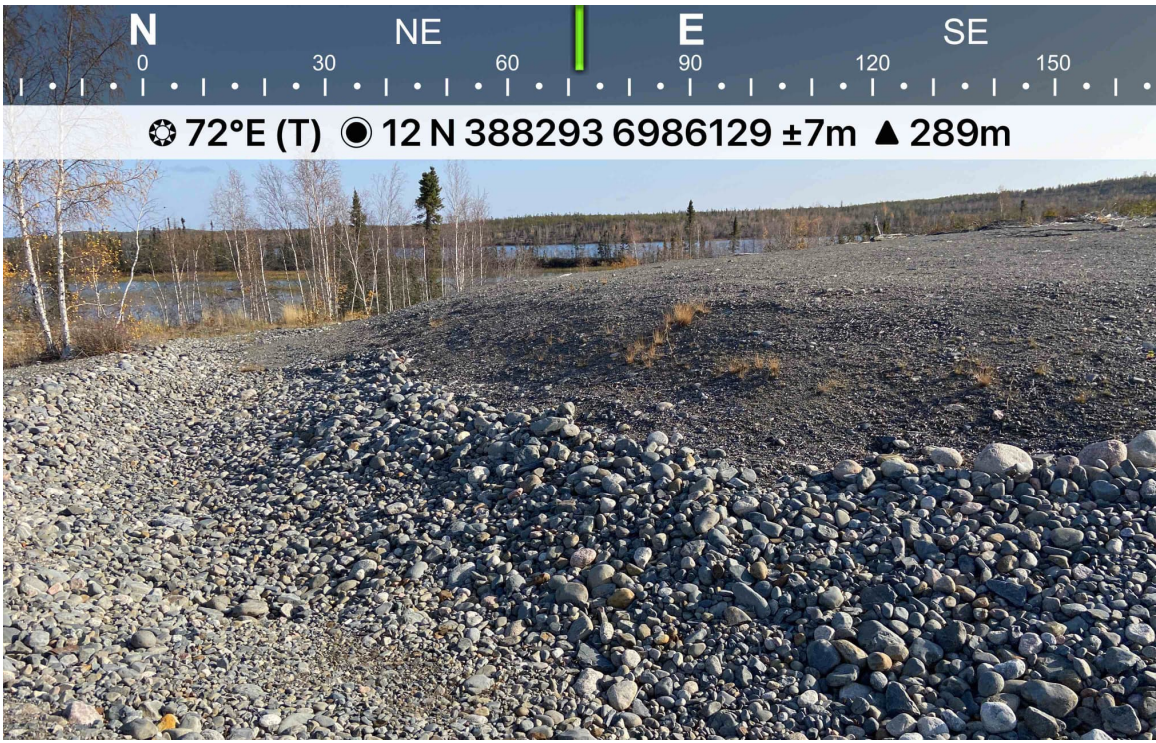
Photo No.	Date	South West Elevation ☼ 33°NE (T) ● 12 N 388311 6986135 ±22m ▲ 292m 
14	9/29/2023	
Direction Photo Taken		
Northeast		
Description		
Erosion channels down the embankment in the northwest corner of the TSCA flowing toward the start of the drainage channel		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
15	9/29/2023
Direction Photo Taken	
North	
Description	
Erosion on north embankment slope (toward the northwest corner) from water movement.	



Photo No.	Date
16	9/29/2023
Direction Photo Taken	
East	
Description	
West slope has very little vegetation except occasional patches of grasses.	



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date	North East Elevation ☼ 209°SW (T) ● 12 N 388295 6986077 ±7m ▲ 292m 
17	9/29/2023	
Direction Photo Taken		
Southwest		
Description		
West embankment with very little vegetation. A series of erosion channels are shown along the left side of the photo.		

Photo No.	Date	South West Elevation ☼ 40°NE (T) ● 12 N 388326 6985920 ±4m ▲ 287m 
18	9/29/2023	
Direction Photo Taken		
Northeast		
Description		
East embankment with erosion logs. Some vegetation growth. The south drainage channel in this photo undercuts the south embankment for approximately 15 m.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
19	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Vegetation is well established in some areas along the east embankment.	

South West Elevation

☼ 38°NE (T) ● 12 N 388383 6986011 ±48m ▲ 294m



Photo No.	Date
20	9/29/2023
Direction Photo Taken	
Southwest	
Description	
Erosion embankment and vegetation on the north end of the east embankment.	

North East Elevation

☼ 210°SW (T) ● 12 N 388411 6986044 ±7m ▲ 289m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
21	9/29/2023
Direction Photo Taken	
North	
Description	
Erosion on the east embankment resulting in sand movement down the slope.	

South Elevation

☼ 354°N (T) ● 12 N 388377 6985969 ±6m ▲ 289m



Photo No.	Date
22	9/29/2023
Direction Photo Taken	
Northwest	
Description	
An erosion channel appears to have been repaired using coarse aggregates placed within the channel.	

South East Elevation

☼ 336°NW (T) ● 12 N 388376 6985966 ±8m ▲ 288m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
23	9/29/2023
Direction Photo Taken	
Northwest	
Description	
Area of settlement in northwest area of TSCA.	

South East Elevation

☼ 321°NW (T) ● 12 N 388306 6986113 ±4m ▲ 288m



Photo No.	Date
24	9/29/2023
Direction Photo Taken	
South	
Description	
Healed crack on top of pile in northwest area of TSCA.	

North Elevation

☼ 168°S (T) ● 12 N 388302 6986097 ±9m ▲ 286m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
25	9/29/2023
Direction Photo Taken	
North	
Description	
Cracking west of drainage channel at northwest corner of TSCA.	

South Elevation

☀ 6°N (T) ● 12 N 388290 6986108 ±4m ▲ 293m



Photo No.	Date
26	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Cracking west of drainage channel near northwest area of TSCA.	

South West Elevation

☀ 49°NE (T) ● 12 N 388287 6986095 ±11m ▲ 291m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
27	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Large, open cracks adjacent to north drainage channel in the northwest area of the TSCA.	

South West Elevation

☼ 39°NE (T) ● 12 N 388288 6986112 ±4m ▲ 289m



Photo No.	Date
28	9/29/2023
Direction Photo Taken	
Southwest	
Description	
Moose tracks observed on the west embankment.	

North East Elevation

☼ 245°SW (T) ● 12 N 388302 6986087 ±9m ▲ 286m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 29	Date 9/29/2023	 ☀ 271°W (T) ● 12 N 388283 6985979 ±40m ▲ 287m 
Direction Photo Taken West		
Description Healed crack on the top of the pile in the southwest of the TSCA.		

Photo No. 30	Date 9/29/2023	 ☀ 72°E (T) ● 12 N 388293 6986129 ±7m ▲ 289m 
Direction Photo Taken East		
Description North drainage channel at northwest corner of TSCA.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No.	Date
31	9/29/2023
Direction Photo Taken	
South	
Description	
North drainage channel. Healed cracks visible adjacent to the drainage channel.	

North Elevation

☼ 175°S (T) ● 12 N 388290 6986109 ±7m ▲ 288m



Photo No.	Date
32	9/29/2023
Direction Photo Taken	
Northeast	
Description	
Interface between north and south drainage channels.	

South West Elevation

☼ 35°NE (T) ● 12 N 388271 6986043 ±6m ▲ 290m



Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 33	Date 9/29/2023
Direction Photo Taken South	
Description South drainage channel.	

SE

S

SW

W

120

150

180

210

240

270

☼ 188°S (T)

● 12 N 388287 6985999 ±4m

▲ 289m

Photo No. 34	Date 9/29/2023
Direction Photo Taken Southeast	
Description Drainage channel at southwest corner of TSCA.	

North West Elevation

☉ 133°SE (T)
● 12 N 388265 6985975 ±4m
▲ 290m

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 35	Date 9/29/2023	West Elevation ☀ 108°E (T) ● 12 N 388270 6985957 ±4m ▲ 290m 
Direction Photo Taken East		
Description South drainage channel along south embankment. Sand is migrating into part of the channel from the south.		

Photo No. 36	Date 9/29/2023	NE 60 90 120 150 180 210 SW ● 134°SE (T) ● 12 N 388289 6985955 ±17m ▲ 285m 
Direction Photo Taken Southeast		
Description South embankment with erosion logs, willow branches and some vegetation.		

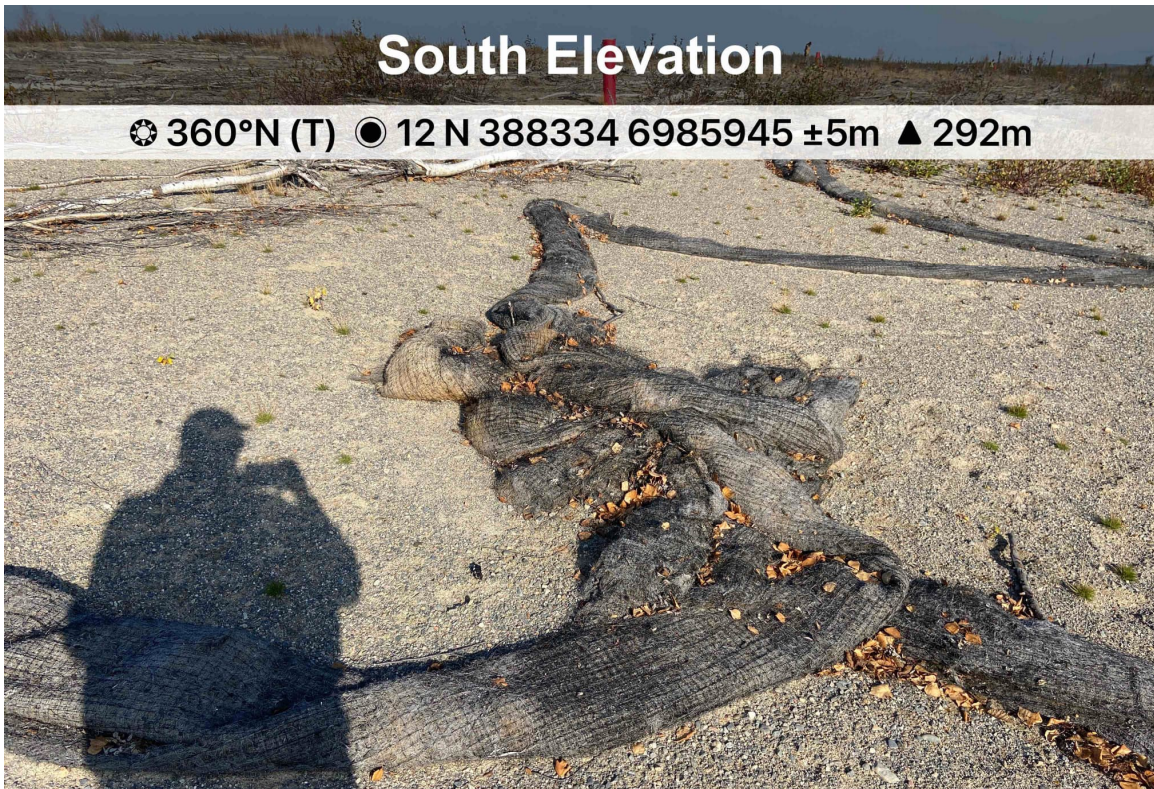
Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 37	Date 9/29/2023	South East Elevation ☼ 322°NW (T) ● 12 N 388326 6985919 ±4m ▲ 287m 
Direction Photo Taken Northwest		
Description South embankment and drainage ditch.		

Photo No. 38	Date 9/29/2023	SE S SW 120 150 180 210 240 ☼ 184°S (T) ● 12 N 388289 6985951 ±7m ▲ 285m 
Direction Photo Taken South		
Description Erosion log on south embankment – degraded and loose.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

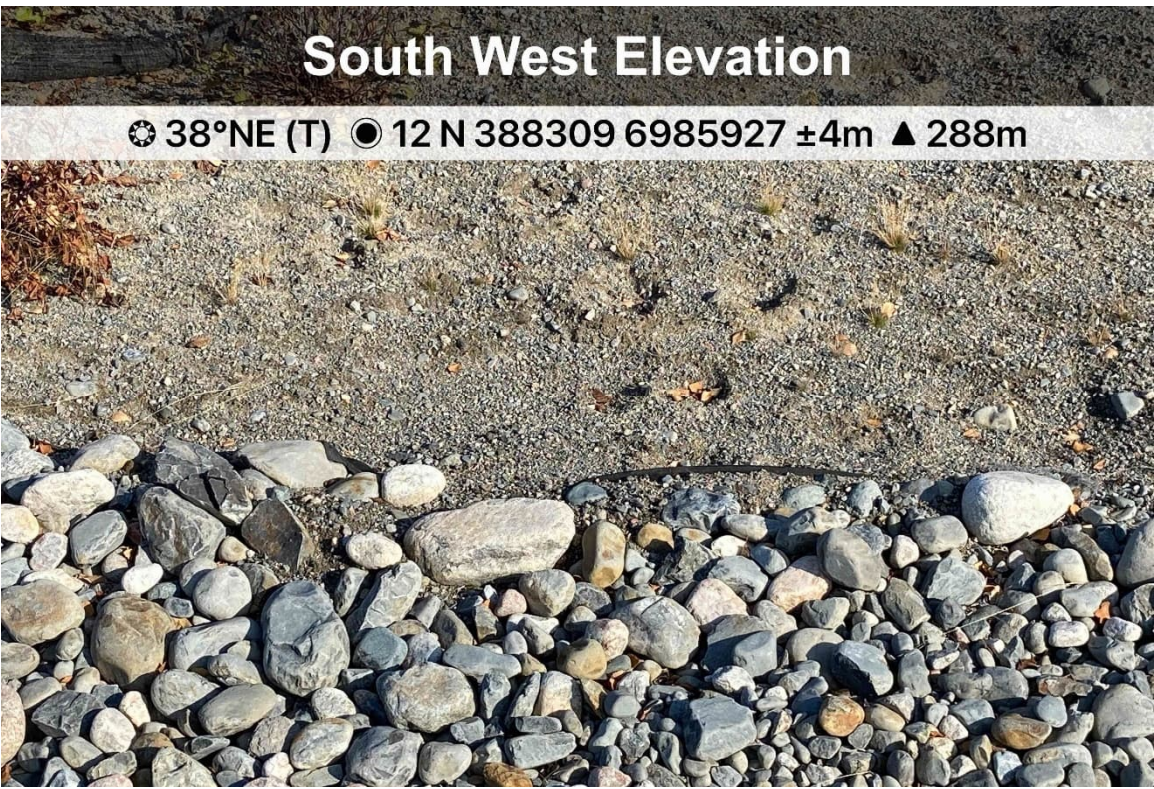
Photo No.	Date
39	9/29/2023
Direction Photo Taken	
North	
Description	
Bunched erosion coir logs.	



South Elevation

☼ 360°N (T) ● 12 N 388334 6985945 ±5m ▲ 292m

Photo No.	Date
40	9/29/2023
Direction Photo Taken	
n/a	
Description	
Bituminous membrane is visible along south embankment near station 0+340.	



South West Elevation

☼ 38°NE (T) ● 12 N 388309 6985927 ±4m ▲ 288m

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

Photo No. 41	Date 9/29/2023	 122°SE (T) 12 N 388279 6985964 ±6m ▲ 280m 
Direction Photo Taken n/a		
Description Foxes have been digging in and around the TSCA including several locations on top of the pile.		

Photo No. 42	Date 9/29/2023	
Direction Photo Taken Northeast		
Description Numerous fox holes and dens west of the TSCA.		

Site Name:	Site Location	Project No.
Camlaren Mine Site – Geotechnical Inspection	Gordon Lake, NT	60710609

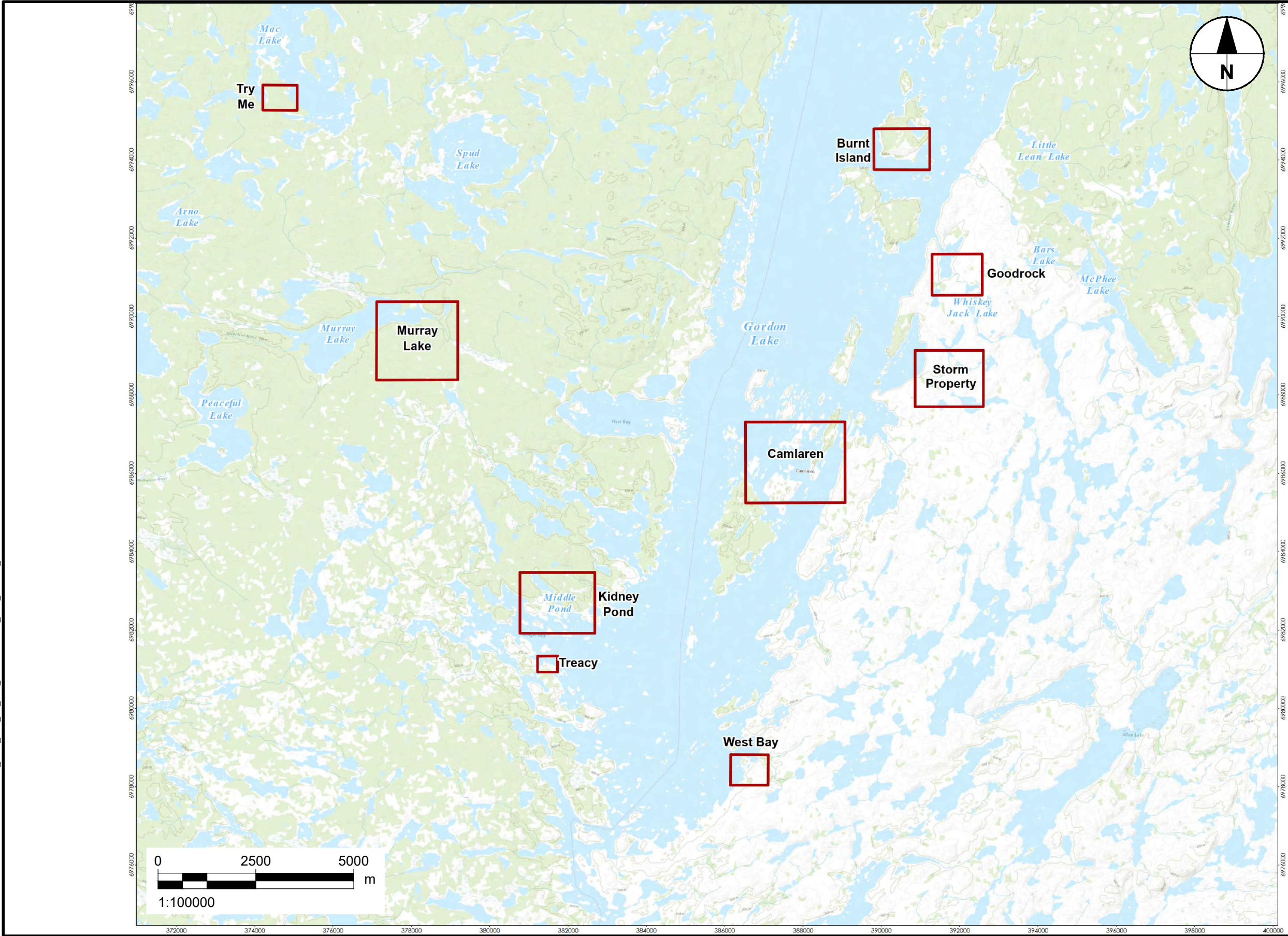
Photo No.	Date	
43	9/29/2023	
Direction Photo Taken	n/a	
Description	Oil-stained soil west of TSCA.	



Appendix B

Figures

Last saved by: SERBND/2023-12-04 | Last Plotted: 2024-04-04
Filename: L:\DCS\PROJECTS\ENV\60710609_INAC_GSL_GL_LTM_PROGRAM\900_CAD_GIS\910_CAD\30-FIGURES\B0060710609-FIG-00-0000-B-0001.DWG
Project Management Initials: _____ Designer: _____ Checked: _____ Approved: _____
ANSI B 279.4mm x 431.8mm



Service Layer Credit: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

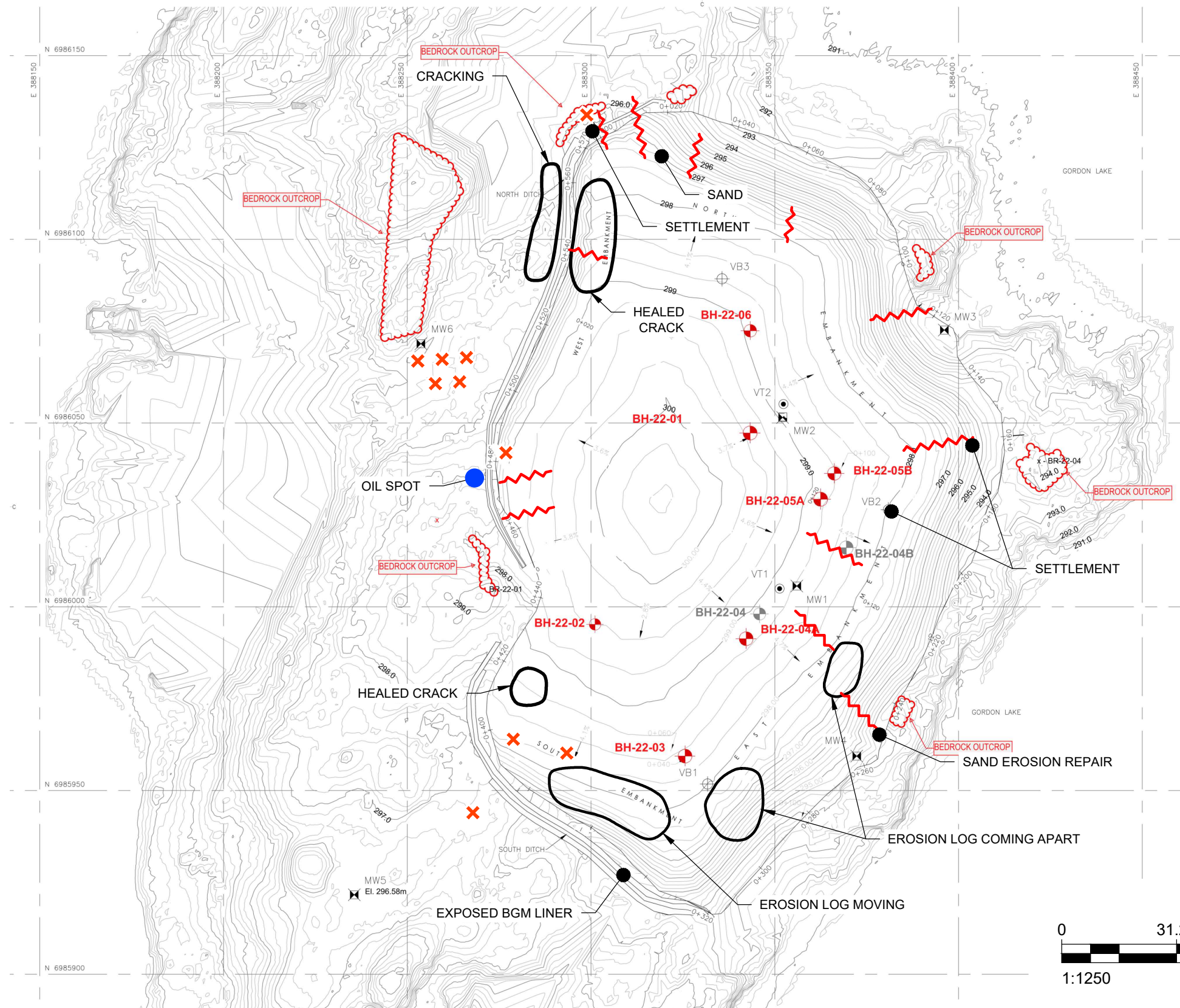
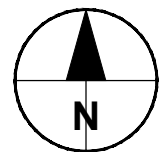
Legend
 Site Location

NOTES:
1. COORDINATES BASED ON NAD83 UTM ZONE 12.

SOURCE:
FIGURE GRAPHIC FROM "FINAL REPORT: PHASE I
LONG-TERM MONITORING PLAN - GORDAN LAKE
GROUP OF SITES", PREPARED BY STANTEC
CONSULTING LTD., DATED DECEMBER 19, 2018.

Issue Status: FINAL

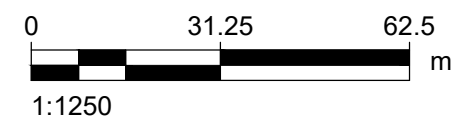
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Project Management Initials: Designer: Checked: Approved: ANSIB 279.4mm x 431.8mm



LEGEND

- MONITORING WELL
- THERMISTOR
- VIBRATING WIRE PIEZOMETER
- BOREHOLE LOCATION (ENGLOBE, 2022)
- BOREHOLE LOCATION (ENGLOBE, 2022)
- ANIMAL HOLE
- EROSION CHANNEL

NOTE: BASE PLAN USED FROM ENGLOBE REPORT
(ENGLOBE, 2023)



Issue Status: FINAL

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