

DATE January 27, 2014**REFERENCE No.** 1314260010-013-TM-Rev0-3000**TO** Brad Thompson
Public Works and Government Services Canada (PWGSC)**FROM** David Caughill and John Hull**EMAIL** dcaughill@golder.com;
jhull@golder.com**FIELD INVESTIGATION FOR TAILINGS EXCAVATION PLANNING AT GIANT MINE, YELLOWKNIFE,
NORTHWEST TERRITORIES – JULY 2013**

Public Works and Government Services Canada (PWGSC) requested Golder Associates Ltd. (Golder) to complete a field investigation program to assist in developing a tailings excavation plan for the Giant Mine, NWT. This technical memorandum was prepared to provide a factual field investigation record of the activities undertaken and observations recorded during the field program. The paste evaluation and testing component of this field program is provided under separate cover. All coordinates listed and shown in this technical memorandum are in GMRP coordinate system.

The reader is referred to the Study Limitations section which follows the text and forms an integral part of this technical memorandum.

1.0 INTRODUCTION

Golder completed a field investigation program between July 9, 2013 and July 11, 2013 to assist in the first phase of tailings excavation and stockpiling strategy planning, for the ultimate purpose of production of underground paste backfill through re-use of existing tailings at the Giant Mine Site. The investigation program was adapted to observations in the field and the overall work covered the following tasks, which were completed in a period of two and one half days:

- Excavation of test pits and visual material characterization in South Pond;
- Excavation of test pits and visual material characterization in Central Pond; and
- Access assessment to South and Central Ponds.

The following section describes each component.



2.0 FIELD PROGRAM

2.1 Tailings Test Pit Program

Test pit program was carried out with assistance from the care and maintenance contractor on site (Det'on-Cho Nuna Joint Venture), which provided an excavator and an operator to excavate a series of test pits in South and Central Ponds. All test pits were excavated with a Hitachi Zaxis 270 LC track-mounted excavator which had sufficient reach for the purposes of the test pit program.

A total of 25 test pits were excavated in the South Pond and a total of eight test pits were excavated in the Central Pond. Test pit locations are shown in Figure 1. Test pit depths varied from 2.4 m to 4.0 m and average depth was 3.6 m. The tailings within test pits were visually assessed and characterized by Golder field staff, GPS coordinate readings were taken, depth measurements were made and photographic records were obtained. Samples were collected from selected test pits for subsequent laboratory testing (reported under separate cover). Observations also included presence of water (or lack of it) in the test pits and whether the test pits collapsed during excavation.

Table 1 summarizes data and observations recorded for each of the test pits opened in South and Central Ponds.

During the program, the excavator operator was instructed to backfill the test pits after the program was completed.

2.1.1 South Pond Test Pits

South Pond test pit locations are shown in Figure 1 and information and data pertaining to these test pits are provided in Table 1. A total of 25 test pits were excavated in the South Pond.

In general, coarser material was observed in the northern part of South Pond than in the southern half of the pond. As test pits progressed towards south, more clay was present in the material at shallower depths and the tailings appeared to show a plastic behavior in much of the material in the southern part of South Pond. It is noted that the tailings in general are interlayered with sandier and or silty seams, based on the depositional history of the tailings. This lensing is not noted in the general descriptions and the material may be more variable than it appears based on the descriptions in Table 1.

With the exception of SP-TP-01, SP-TP-08, SP-TP-09 and SP-TP-25 where the moisture profile typically varied from dry to moist (at shallow depths) to moderately wet (in deeper parts of the test pit), material in all of the South Pond test pits typically varied from dry (at shallow depths) to moist (in deeper parts of the test pit).

No seeping water was observed in any of the test pits at the time of excavation. However, overnight water accumulation was observed in SP-TP-08 and SP-TP-09. SP-TP-08 had also collapsed at 3.3 m depth and water was observed to seep in and accumulate at 3.0 m depth on the following day. SP-TP-09 had also collapsed during excavation (no water observed at that time) and one day later water was present in the test pit at 2.4 m.

Other collapsed test pits were SP-TP-01 (collapsed at 4.0 m) and SP-TP-25 (collapsed at 3.6 m).

A small sinkhole (~45 cm in diameter and ~30 cm deep) was observed a few meters from SP-TP-14; however it is not known when the sinkhole occurred.

2.1.2 Central Pond Test Pits

Central Pond test pit locations are shown in Figure 1 and information and data pertaining to these test pits are provided in Table 1. A total of eight test pits were excavated in the Central Pond.

All of the Central Pond test pits were observed to contain coarser material compared to many of the South Pond test pits (particularly when compared to the central and southern parts of South Pond). Field visual observations indicate that material was predominantly sandy silt. Some trace clay was observed to be intermixed with the coarser matrix of sand and silt. It is noted that the tailings in general are interlayered with sandier and or silty seams, based on the depositional history of the tailings. This lensing is not noted in the general descriptions and the material may be more variable than it appears based on the descriptions in Table 1. In general the tailings did not have a plastic behavior in the excavated material.

No seeping water was observed in any of the test pits at the time of excavation. Excavated material in all of the test pits typically varied from dry (at shallow depths) to moist (in deeper parts of the test pit). Fully saturated tailings were not observed.

Table 1: Central and South Pond Test Pit Summary

Area	Test Pit ID	GMRP (Converted from UTM)		Depth (m)	Visual Description / Comments / Notes
		GMRP Easting	GMRP Northing		
Central Pond	CP-TP-01	36700	33237	0-3.7	Sandy Silt to Silt, trace sand. Material varied from dry (shallow depths) to moist (deeper)
	CP-TP-02	36681	33205	0-3.4	Sandy Silt to Silt, trace sand. Material varied from dry (shallow depths) to moist (deeper)
	CP-TP-03	36682	33265	0-3.6	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	CP-TP-04	36652	33275	0-3.5	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	CP-TP-05	36684	33292	0-3.5	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	CP-TP-06	36700	33282	0-2.0	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				2.0-3.6	Clayey Silt
	CP-TP-07	36719	33293	0-2.5	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				2.5-3.7	Clayey Silt
	CP-TP-08	36718	33266	0-2.5	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
2.5-3.7				Clayey Silt	

Area	Test Pit ID	GMRP (Converted from UTM)		Depth (m)	Visual Description / Comments / Notes
		GMRP Easting	GMRP Northing		
South Pond	SP-TP-01	36553	33100	0-3.0	Sandy Silt. Material varied from dry to moist (shallow depths) to moderately wet (deeper)
				3.0-4.0	Sandy Clayey Silt. Test pit collapsed at 4.0 m depth
	SP-TP-02	36526	33063	0-2.9	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	SP-TP-03	36535	32968	0-3.4	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	SP-TP-04	36597	32962	0-2.4	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	SP-TP-05	36585	33029	0-3.4	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
	SP-TP-06	36624	33056	0-3.0	Sandy Silt intermixed with clayey silt. Material varied from dry (shallow depths) to moist (deeper)
				3.0-4.0	Clayey Silt, trace sand.
	SP-TP-07	36589	33068	0-3.5	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				3.5-4.0	Clayey Silt, trace sand.
	SP-TP-08	36555	33047	0-2.0	Silty Sand. Material varied from dry to moist (shallow depths) to moderately wet (deeper)
				2.0-3.0	Clayey Silt. Collapse at 3.3 m. Water at 3 m, accumulated overnight.
	SP-TP-09	36551	32998	0-2.0	Sandy Silt. Material varied from dry to moist (shallow depths) to moderately wet (deeper)
				2.0-4.0	Sandy Silt. Collapse at 3.0 m. Water at 2.4 m, accumulated overnight.
	SP-TP-10	36567	32952	0-2.5	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)
				2.5-3.5	Sandy Clayey Silt.
SP-TP-11	36524	32923	0-1.9	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)	
			1.9-3.7	Sandy Clayey Silt.	
SP-TP-12	36563	32907	0-1.0	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)	
			1.0-3.7	Sandy Clayey Silt.	
SP-TP-13	36599	32903	0-2.4	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)	
			2.4-3.4	Clayey Silt	
SP-TP-14	36595	32861	0-4.0	Clayey Silt (small sinkhole observed nearby test pit afterwards, probably existing sinkhole, ~45 cm diameter, 20-30 cm deep). Material varied from dry (shallow depths) to moist (deeper)	
SP-TP-15	36549	32857	0-3.5	Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)	
SP-TP-16	36509	32855	0-3.7	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)	

Area	Test Pit ID	GMRP (Converted from UTM)		Depth (m)	Visual Description / Comments / Notes
		GMRP Easting	GMRP Northing		
	SP-TP-17	36491	32807	0-3.4	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)
	SP-TP-18	36545	32794	0-1	Sandy Clayey Silt. Material varied from dry (shallow depths) to moist (deeper)
				1-3.5	Clayey Silt.
	SP-TP-19	36579	32792	0-1.0	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				1.0-3.8	Clayey Silt
	SP-TP-20	36608	32792	0-1.2	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				1.2-3.5	Clayey Silt
	SP-TP-21	36613	32759	0-1.3	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				1.3-3.8	Clayey Silt
	SP-TP-22	36582	32745	0-2.3	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				2.3-3.7	Clayey Silt
	SP-TP-23	36555	32749	0-2.0	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				2.0-3.7	Clayey Silt
	SP-TP-24	36513	32757	0-1.0	Sandy Silt. Material varied from dry (shallow depths) to moist (deeper)
				1.0-3.7	Sandy Silt
	SP-TP-25	36627	32877	0-1.5	Sandy Silt. Material varied from dry to moist (shallow depths) to moderately wet (deeper)
				1.5-3.6	Clayey Silt. Collapse at 3.6 m

Table 2: Grain Size Analysis of Selected Samples

Area	Test Pit ID	Depth (m)	Sand Content (%)	Silt Content (%)	Clay Content (%)
Central Pond	CP-TP-01	0-3.7	42	53	5
	CP-TP-02	0-3.4	40	55	5
South Pond	SP-TP-01	0-3.0	39	57	4
	SP-TP-02	0-2.9	43	54	3
	SP-TP-03	0-3.4	42	54	4
	SP-TP-04	0-2.4	15	79	6
	SP-TP-05	0-3.4	45	51	4
	SP-TP-06	0-3.0	37	58	5

2.2 Access Assessment

Access to both South Pond and Central Pond was evaluated. Both ponds can be accessed from the embankment between the two ponds (Figure 1). For the South Pond another access point is available at the southwest corner of the pond and two other smaller roads are present on the central west side of South Pond (Figure 1). Field observations indicated that the most feasible option for South Pond is access from the embankment in the north. However, access planning needs to be considered in conjunction with the excavation plan, which is outside the scope of this document.

3.0 CLOSURE

We trust that the information provided in this technical memorandum meets your present needs. Should you have any questions or require additional information, please feel free to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

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Associate, Senior Geotechnical Engineer

DC/JAH/rs/kp

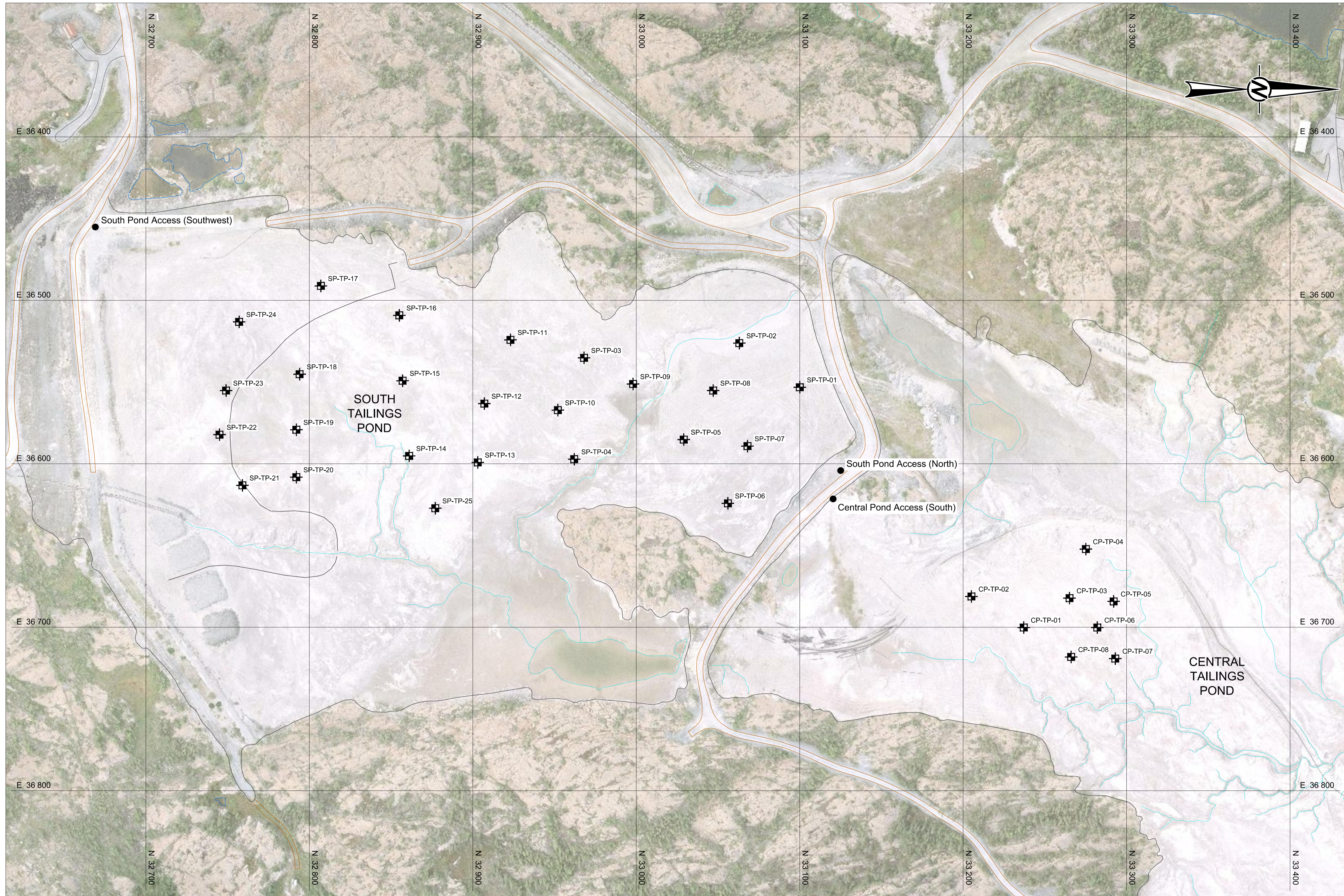
Attachment: Figure 1: South and Central Pond Test Pit Locations

ORIGINAL SIGNED

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PRELIMINARY
NOT FOR CONSTRUCTION



PLAN VIEW
SCALE A

- LEGEND**
- ✦ TEST PIT LOCATION (GOLDER 2013)
 - ACCESS POINT

NOTES
ALL UNITS ARE IN METRES UNLESS OTHERWISE NOTED. COORDINATE SYSTEM IS THE GMRP COORDINATE SYSTEM.

REFERENCES
AERIAL PHOTO DATED 2009, PROVIDED BY PUBLIC WORKS GOVERNMENT SERVICES CANADA

Revision/Revision	Description/Description	Date/Date
0	ISSUED WITH DOC. #013 REV 0	2014-01-24

Client/client
PUBLIC WORKS GOVERNMENT SERVICES CANADA

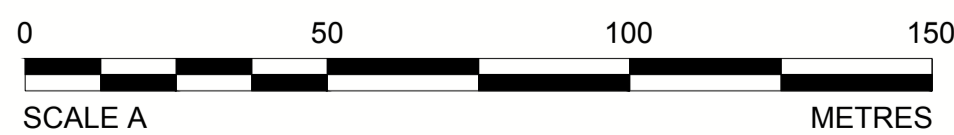
Project title/Titre du projet
**GIANT MINE
REMEDATION PROJECT
YELLOWKNIFE, N.W.T.**

Approved by/Approuvé par
JH
Designed by/Concept par
DC
Drawn by/Dessiné par
JK
PWGSC Project Manager/Administrateur de Projets TPSGC
DAVE COLBOURNE

PWGSC, Architectural and Engineering Resources Manager/Ressources Architectural et de Directeur d'ingénierie, TPSGC
Client/client
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Drawing title/Titre du dessin
**SOUTH AND CENTRAL PONDS
TEST PIT LOCATIONS**

Project No./No. du projet 13-1426-0010 DOC. #013	Sheet/Fauille FIGURE 1 OF 1	Revision no./Le Révision no. 0
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