TECHNICAL MEMORANDUM

DATE	February 1, 2012	**PROJECT No.**	09-1427-0006/20000/20100
TO	Dave Colbourne DXB Projects / PWGSC	**AECOM DOC. No**.	000-GEN-0-MEM-0007-Rev1_20120201
CC	Rudy Schmidtke, AECOM	**GAL DOC. No.**	156
FROM	Darren Kennard and John Hull	**EMAIL**	dkennard@golder.com; jhull@golder.com

PUBLIC ACCESS CONTROLS ABOVE NON-ARSENIC STOPE 2-01 COMPLEX NEAR A2 OPEN-PIT, GIANT MINE REMEDIATION PROJECT

1.0 NON-ARSENIC STOPE 2-01 COMPLEX CROWN PILLAR STABILITY ASSESSMENT

Golder Associates Ltd. (Golder) is engaged in development of preliminary engineering designs and cost estimating to facilitate closure of the underground portions of the Giant Mine Remediation Project situated north of Yellowknife, NT (see key plan in Figure 1). Golder's scope included a review and update of existing near surface non-arsenic stope stability assessments and the conclusions are outlined in Golder Document 091.

Golder's work included an assessment of the probability of failure of the crown pillar(s) above a series of non-arsenic stopes commonly referred to as the '2-01 stope complex' which are situated north of the A2 open-pit, adjacent to Highway 4, and partly inside the Giant Mine town site boundary (see Figure 2). The stopes in this area underlie or are near to publicly accessible areas (e.g., parking lot) and historical mining equipment pieces associated with the NWT Mining Heritage Society.

The predicted probability of failure of the rock crown pillar over several individual stopes in the 2-01 stope complex area for anticipated typical stope geometry and rock mass quality conditions was: 1% (2-01 NFW stope), 5% (2-01 #3 stope), and 19% (2-01 stope). Worse conditions could prevail due to the inherent variability of the mechanical properties of the rock mass and the complex geometry of the crown pillar and the remnant rock pillars in the stope themselves. Further, there is a significant amount of soil overburden over the rock crowns but the geology of these materials, which may contain significant amounts of fill, is not understood.

The situation is poorly understood today as records from recent underground inspections in the area either do not exist or cannot be located and no geotechnical investigations (e.g., drilling) have been carried out in the area.

2.0 POTENTIAL PUBLIC HAZARDS

The predicted probability of failure of several crown pillars in the 2-01 stope complex area discussed above would be considered relatively low for an active mine site. However, given that public access in the area occurs and is encouraged due to displays of historical buildings and mining equipment, elevated prudence is warranted. Crown pillar failures can occur quickly and there is no monitoring system in place in this area.

Easy, uninformed public access into the area should be dissuaded.

In order to better understand the zone of impact of a potential crown pillar failure, Golder delineated a potential surface subsidence zone by projecting an inverted cone from the top of several stopes in the area to surface using the following cave angles:

- 65° in rock from the top of the stope to surface; or
- 65° from the top of the stope to the rock / overburden contact, and 45° above that contact in soil to surface.

A large bedrock knob dominates the north-western portion of the 2-01 stope complex area and any crown pillar failures under it would likely choke off quickly resulting in minimal surface impact. The area of concern is related to the flat portion of the site southeast of the main 2-01 stope complex area where the crown pillars are the thinnest. Figure 2 shows the zone with the highest potential for surface subsidence due to crown pillar failure with associated lines of decreasing probability of failure away from it. Any crown pillar failure would be expected to manifest itself initially within the highest probability of failure zone with potential gradual progression outwards.

3.0 RECOMMENDATIONS ON SURFACE ACCESS CONTROLS NEAR NON-ARSENIC STOPE 2-01 AREA

Golder recommends that public access to the area above non-arsenic Stope 2-01, 2-01 NFW, and 2-01 #3 near the highest probability of crown pillar failure zone be restricted as soon as practical. A typical solution could include erection of a fence near the outer edge of the zone of highest probability of subsidence to buildings and natural topographic barriers.

Figure 2 shows an example fence location that would dissuade casual public access over the area of concern. The southern portion of the fence should start at the northeast corner of the Exploration Shed; then pass west or behind the Heritage Building, and east of and parallel to the tracks holding the historical mine pieces. The fence should finally cross the tracks to intersect the steep bedrock topography at the northern end of the fence indicated in Figure 2. Appropriate signage to inform the public of the undermining hazards beyond the fence should be erected.

The use of a temporary fence (e.g., orange snow fence) and appropriate signage would be considered appropriate for the winter of 2011/2012 but a permanent fence should be installed as soon as practical in the spring of 2012.

4.0 ADDITIONAL WORK

As noted above the geology and underground mine geometry situation/conditions are poorly understood at present. Underground observation of the stope back and pillar conditions, if possible, coupled with a surface drilling investigation that included geotechnical core logging, borehole camera and cavity monitoring work are recommended. Subsequent stability analyses of the situation could lead to a change or an increase in the uncertainty of the probability of failure and a change to the recommendations outlined above. Golder would be pleased to develop a detailed geotechnical investigation plan to execute such work at the request of PWGSC.

5.0 CLOSURE

If you have any questions or concerns regarding this memo please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Darren Kennard, P.Eng.
Associate

ORIGINAL SIGNED

John A. Hull, P.Eng.
Principal

DTK/JAH/rs

Attachments: Figure 1
Figure 2

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REFERENCES

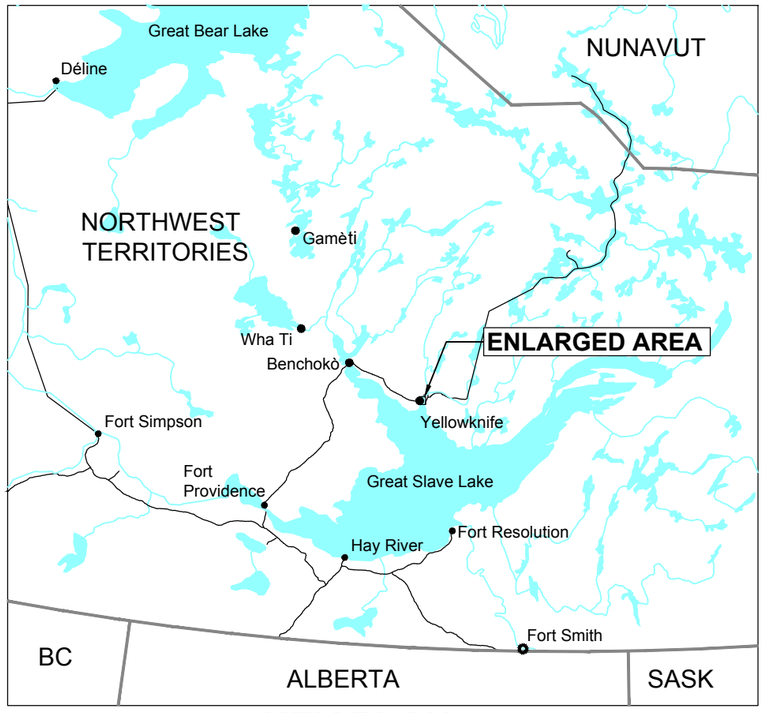
Golder Associates Ltd. 2011. *Review and Update of Arsenic Stope and Chamber Stability Assessments – Giant Mine Remediation Project* (DRAFT). Submitted September 7, 2011. GAL Document 090. AECOM Document 313-UG-13-RPT-0004-Rev2_20110907.

Golder Associates Ltd. 2011. *Underground Preliminary Design Report – Giant Mine Remediation Project* (DRAFT). Submitted November 18, 2011. GAL Document 088. AECOM Document 313-UG-13-PDR-0003-Rev2_20111118.

Golder Associates Ltd. 2011. *Preliminary Design Report - Open Pit Closures (*DRAFT). Submitted December 6, 2011. GAL Document 051. AECOM Document 311-Open Pit-16-PDR-0003-Rev2-20111206.

Golder Associates Ltd. 2012. *Review and Update of Near Surface Non-Arsenic Stope Stability Assessment* (DRAFT). Submitted February 2012. GAL Document 091. AECOM Document 313-UG-13-ROT-0005-Rev0_20120210

INAC (Indian and Northern Affairs Canada). 2011. *Risk Management Report Detailed*. Submitted January 28, 2011.



KEY PLAN
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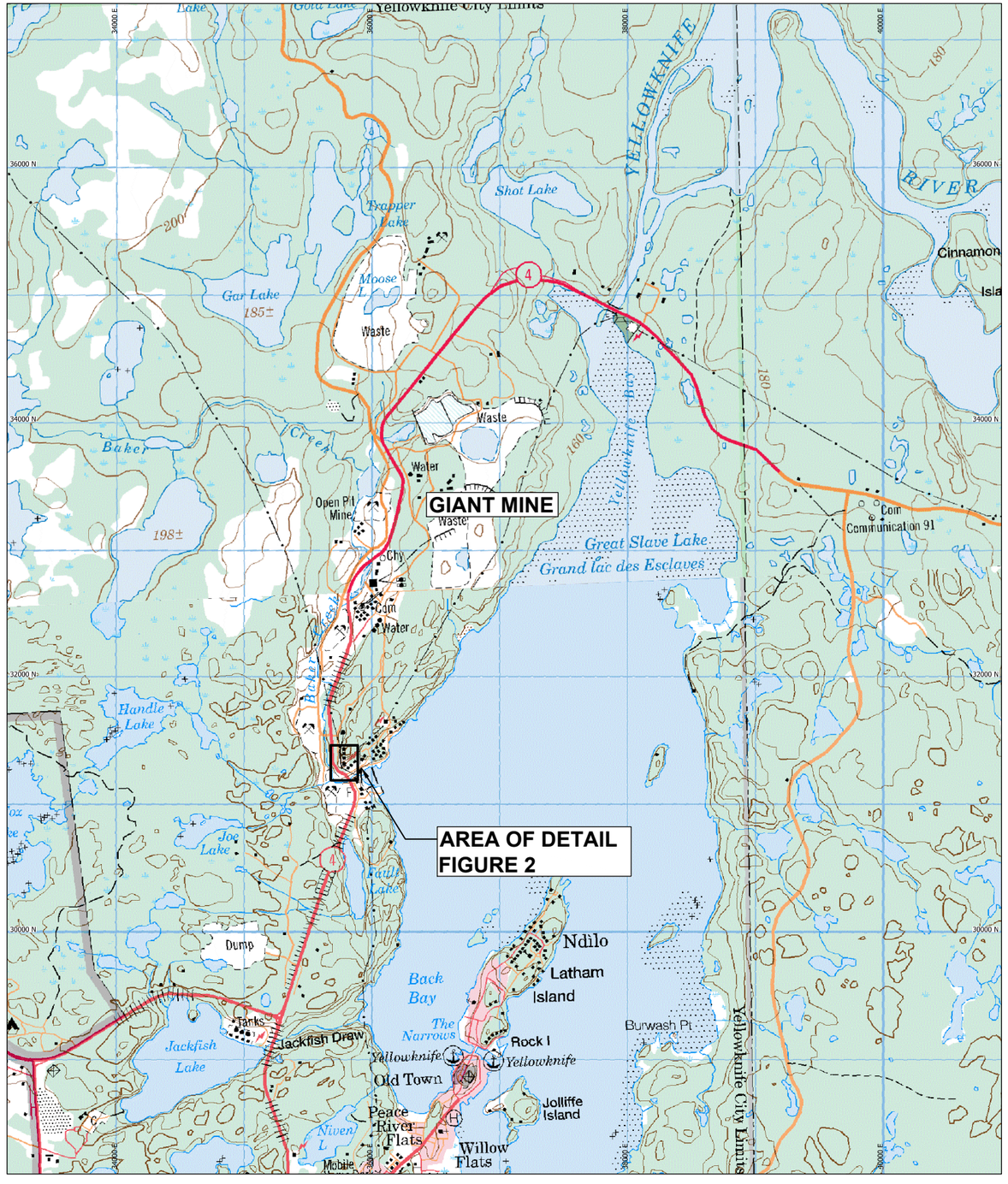

PLAN
SCALE: 1:40000

0 400 800 1200 1600 2000
SCALE IN METRES

NOTES
COORDINATES SHOWN ARE IN METRES GMRP GRID.

REFERENCE
TOPOGRAPHIC MAPS 85J08 AND 85J09 © 2002 HER MAJESTY THE QUEEN IN RIGHT OF CANADA. DEPARTMENT OF NATURAL RESOURCES. ALL RIGHTS RESERVED. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD83 COORDINATE SYSTEM: UTM ZONE 11.

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

PRELIMINARY
NOT FOR CONSTRUCTION

Golder Associates

DO NOT SCALE DRAWINGS

Revision/ Revision	Description/Description	Date/Date
0	ISSUED WITH MEM-0007	20120201

Client/client

PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

GIANT MINE REMEDIATION PROJECT YELLOWKNIFE, N.W.T.

END LAND USE TASK NO. 20

Approved by/Approuvé par
JAH

Designed by/Concept par
DTK

Drawn by/Dessiné par
MSH

PWGSC Project Manager/Administrateur de Projets TPSGC
PWGSC

PWGSC, Architectural and Engineering Resources Manager/ Ressources Architectural et de Directeur d'ingénierie, TPSGC

Client/client
PWGSC

Drawing title/Titre du dessin
KEY PLAN

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R-014204-320	FIGURE 1 OF 2	0

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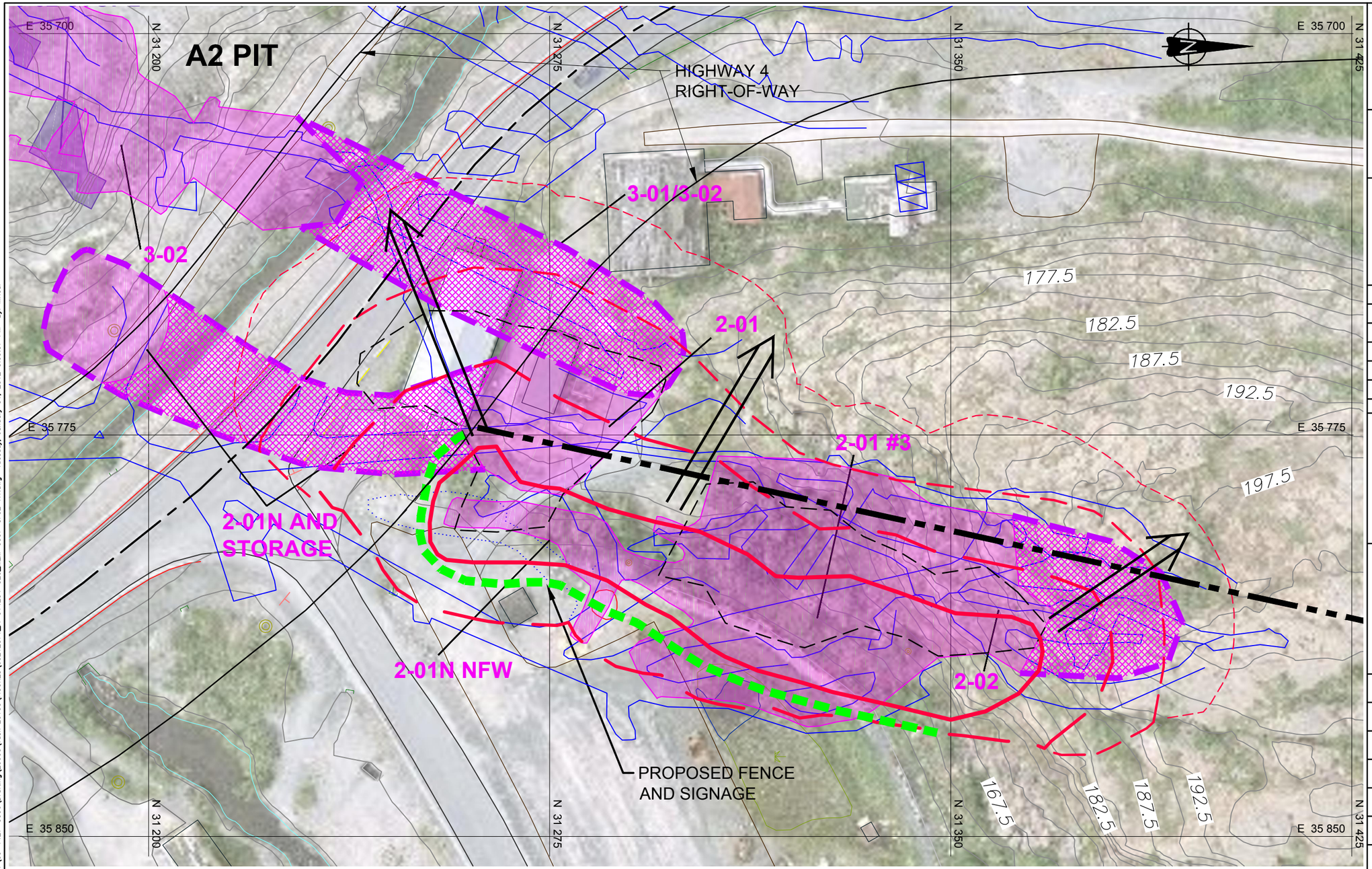

LEGEND

- NEAR SURFACE NON-ARSENIC STOPES (POSITION APPROXIMATE)
- NON-ARSENIC STOPES > 30 m DEEP (POSITION APPROXIMATE)
- UNDERGROUND STOPE BREAKTHROUGH TO OPEN-PIT, MAY BE BACKFILLED WITH UNKNOWN FILL (POSITION APPROXIMATE)
- PROPOSED FENCE AND SIGNAGE
- TOP OF STOPE
- TOWNSITE LEASE LIMITS (APPROXIMATE)
- HIGHWAY CENTERLINE, ROW
- LEVEL 100 U.G. DEVELOPMENT

NOTES

TOPOGRAPHIC CONTOUR INTERVAL IS 2.5m

PROBABILITY OF SURFACE SUBSIDENCE
DUE TO CROWN PILLAR FAILURE
NEAR 2-01 STOPE COMPLEX

HIGHEST

LOWEST

0 7.5 15 22.5 30 37.5

SCALE IN METRES (SCALE 1:750)

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Western Region
SERVICES IMMOBILIERS
Région de l'ouest

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1	ISSUED WITH MEM-0007	20120201
0	ISSUED WITH MEM-0007	20120120
Revision/ Revision	Description/Description	Date/Date

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PUBLIC WORKS GOVERNMENT SERVICES CANADA

Project title/Titre du projet

**GIANT MINE
REMEDIATION PROJECT
YELLOWKNIFE, N.W.T.**

**END LAND USE
TASK NO. 20**

Approved by/Approuve par
JAH

Designed by/Concept par
DTK

Drawn by/Dessine par
JD

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
PWGSC

Drawing title/Titre du dessin

**POTENTIAL SURFACE SUBSIDENCE
2-01 STOPE AREA, A2 PIT,
RECOMMENDATION FOR FENCE
TO ADDRESS PUBLIC HAZARD**

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R-014204-320	FIGURE 2 OF 2	1

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