

**APPENDIX 4-F  
PRELIMINARY INTERPRETATION OF THE BASAL  
SURFACE OF THE SNOWFIELD LANDSLIDE**

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October 19, 2012  
Project No.: 0638-013-50

Mr. Jim Smolik, Pre-Feasibility Study Manager  
Seabridge Gold Inc.  
108 Front Street East,  
Toronto, Ontario, M5A 1E1

Dear Mr. Smolik,

**Re: Preliminary Interpretation of the Basal Surface of the Snowfield Landslide**

The Snowfield Landslide is a previously documented (Margolis, 1993; BGC, 2010; 2012a; 2012b) large bedrock slope instability located immediately east of the property boundary of Seabridge Gold Inc.'s (Seabridge) KSM Project and directly up-valley from the proposed Mitchell Open Pit. BGC has developed a preliminary three-dimensional (3D) surface of the base of the landslide by:

- Reviewing the available drill holes through and adjacent to the Snowfield Landslide.
- Interpreting the points of intersection between each drill hole and the landslide base.
- Creating a 3D surface using the landslide base intersections and an inverse distance weighting algorithm.

The interpreted surface may be used in ongoing assessments of the Snowfield Landslide and Mitchell Open Pit.

## **1.0 INTRODUCTION**

### **1.1. Background**

The Snowfield Landslide is actively displacing, retrogressive, and complex bedrock slope instability. The landslide has an estimated volume of  $57 \times 10^6 \text{ m}^3$  and approximate deformation rates of between 10 and 50 cm per year. The slope has been deforming for approximately 50 years, possibly in response to the retreat of the Mitchell Glacier.

The background and history of the Snowfield Landslide is discussed in detail in the letter report titled *Preliminary Geotechnical Assessment of the Snowfield Landslide* (BGC, 2012a), submitted to Seabridge in July 2012. Additional geotechnical investigations have been completed (BGC, 2012b) to provide data for ongoing assessments of this landslide.

## 1.2. Scope of Work

A preliminary interpretation of the basal surface of the Snowfield Landslide has been completed in order to estimate the volume of landslide material intersected by the proposed Mitchell Open Pit. The preliminary basal surface may be used to:

1. Estimate the area of the pit slope developed in the disturbed and displaced material of the landslide.
2. Undertake preliminary planning for mitigation of further landslide displacement; potential mitigation includes depressurization of the landslide mass or removal of parts of the landslide.
3. Refine the open pit design and mine plan to allow mining of the landslide from the top down and to locate geotechnical berms at the intersection of the interpreted basal surface and pit wall.

The available drill hole data (Table 1) was compiled, reviewed, and analyzed to develop a preliminary three-dimensional interpretation the basal of the Snowfield Landslide. These data sources are discussed in Section 2.0; the interpretations of the data are discussed in Section 3.0.

## 2.0 DATA SOURCES

Exploration and geotechnical diamond drilling data are available and have been used to interpret the basal surface of the Snowfield Landslide (Table 1). Exploration drilling completed in and around the Snowfield Landslide is summarized as follows:

- Silver Standard Resources Inc. (SSR) has drilled numerous holes to define the Snowfield ore zone. Eleven drill holes from campaigns completed in 2008 and 2009 are used in the current work
- Seabridge has undertaken exploration drilling to the west of the Snowfield Landslide. One drill hole from 2006 is used in the current work.

Geotechnical drilling within and adjacent to the landslide footprint has been undertaken by BGC during three campaigns:

1. Two of nine geotechnical holes completed for Seabridge in 2009 across the area of the proposed Mitchell Open Pit (BGC, 2010) are used in the current evaluations. The geotechnical drill holes used are immediately west of the interpreted limit of the Snowfield Landslide.
2. One of five holes completed for SSR in the area of the Snowfield Landslide during the summer of 2010 (BGC, 2011) is used in the current work. The hole (MZ-095) is located near the center of the landslide.
3. Two holes were completed for Seabridge within the Snowfield Landslide during the summer of 2012 (BGC, 2012b). Data from both drill holes are used in the current work.

The data available from the drill holes, useful for the interpretation of the landslide base, depends on original purpose of the drilling. Geotechnical data from the twelve exploration drill holes are limited to total core recovery and rock quality designation (RQD). The five geotechnical drill holes provide a more complete geotechnical dataset with total core recovery, RQD, intact rock strength, fracture spacing, and discontinuity character.

### **3.0 INTERPRETATION OF THE BASAL SURFACE**

Changes in rock mass quality observed in the drill holes within the footprint of the landslide have been used to interpret the location of the landslide base. A total fifteen drill holes within the landslide boundary (Figure 1) were used to estimate the location of the basal surface. Sections of exploration drill holes that were interpreted to be within the landslide mass had:

1. Total core recovery of less than 90%.
2. RQD less than 50%

Sections of geotechnical drill holes interpreted to be within the landslide mass had similar core recovery and RQD values to the exploration drill holes. Rock mass rating (RMR) estimates for sections of the geotechnical drill holes within the landslide mass were less than 55.

Sections of exploration drill holes interpreted to be outside or below the landslide mass had:

1. Total core recovery greater than 95%.
2. RQD greater than 70%.

RMR values of 70 or greater are typical for sections of the geotechnical drill holes outside or below the interpreted base of the Snowfield Landslide.

The identified basal surface point from each drill hole was imported into Gemcom Surpac 6.3. The elevation of each point was compared with the topography to estimate the landslide thickness at each location. The thickness estimates at each point and the outline of the landslide at the ground surface, representing zero landslide thickness, were used to interpolate the complete basal surface of the Snowfield Landslide.

The DTM of the basal surface ("Snowfield Landslide Basal Surface.dxf") was exported to DXF format and provided to Seabridge and Moose Mountain Technical Services Ltd. (MMTS). The Mitchell Open Pit slopes will intersect the landslide during Phase 2 of the pit development (Figure 2). Up to six double benches, representing a pit slope 180 m high in Phase 4 of the open pit development will be composed of landslide material, based on the current plan (Figure 1).

### **4.0 SUMMARY**

BGC has developed a preliminary three-dimensional interpretation of the basal surface of the Snowfield Landslide from drill hole data. The extent of the landslide at depth has been interpreted based on changes in rock mass quality observed in the available drill holes. The

interpretation provided is based on limited data near the edges of the landslide; most data is available within the central area of the slide. The interpreted surface appears to be appropriate for ongoing mine planning and pit optimization at the current stage of study.

The slopes of the Mitchell Open Pit will intersect the landslide mass as the pit is developed. The mine plan in the area of the landslide should:

1. Avoid permanent access or haul ramps in or directly below the benches developed in the landslide mass.
2. Include a geotechnical berm at the bottom-most bench developed in the landslide mass to facilitate dewatering of the landslide mass and the management of seepage from the landslide. This geotechnical berm could also provide catchment for material from the slopes developed in the landslide.

Options for landslide management will be assessed at future stages study. Options to be further explored include flatter slopes for sections of pit wall through the landslide mass, depressurization of the landslide mass, or excavation of parts of the landslide outside of the current limits of the Mitchell Open Pit.

## **5.0 CLOSURE**

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We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

**BGC ENGINEERING INC.**  
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## REFERENCES

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BGC Engineering Inc. 2011. Snowfield-Brucejack 2012 Mine Area Site Investigation Summary – Final. Submitted to Silver Standard Resources Inc., February 14, 2011

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BGC Engineering Inc. 2012b. KSM Project – Snowfield Landslide Site Investigation – Draft. Submitted to Seabridge Gold Inc., September 21, 2012

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## **TABLES**



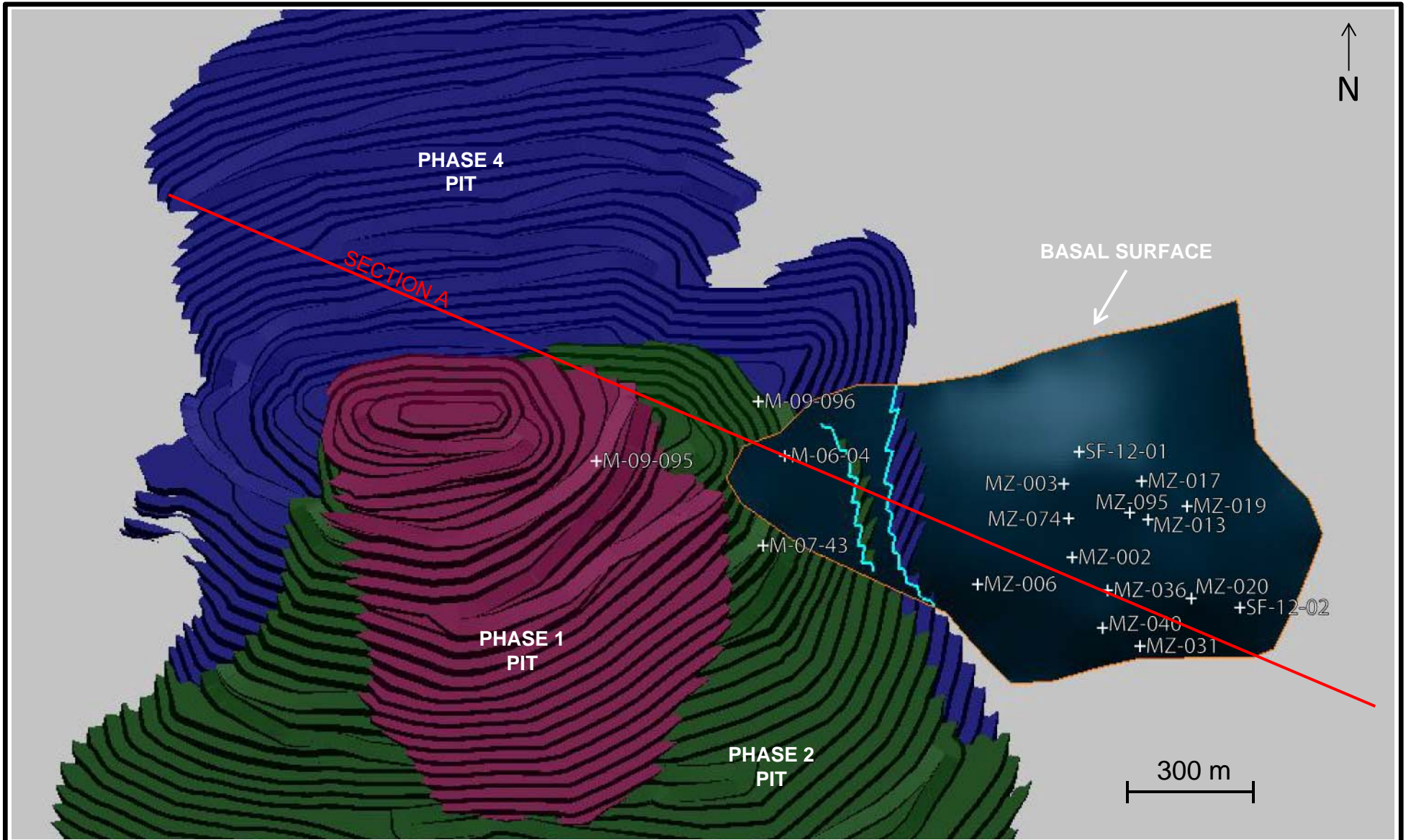
**TABLE 1. DRILL HOLE SUMMARY**

Year Drilled	Drill Hole ID	Trend (°)	Plunge (°)	Collar			Landslide Base				Data Source
				Easting <sup>1</sup>	Northing <sup>1</sup>	Elevation <sup>1</sup>	Depth Along Drill Hole (m)	Easting <sup>1</sup>	Northing <sup>1</sup>	Elevation <sup>1</sup>	
2006	M-06-04	190	-55	423648.3	6265365.2	958.6	36.0	423644.7	6265344.9	929.1	Seabridge: Exploration <sup>3</sup>
2008	MZ-002	177	-51	424320.6	6265186.6	1164.4	133.2	424325.2	6265102.0	1061.6	SSR: Exploration <sup>2</sup>
2008	MZ-003	172	-50	424292.1	6265380.5	1087.9	160.6	424306.6	6265277.2	965.8	SSR: Exploration <sup>3</sup>
2008	MZ-006	173	-55	424094.1	6265090.6	1162.5	94.5	424100.5	6265037.2	1084.7	SSR: Exploration <sup>2</sup>
2008	MZ-013	173	-56	424493.3	6265271.1	1163.8	141.4	424503.2	6265192.7	1046.5	SSR: Exploration <sup>2</sup>
2008	MZ-017	175	-56	424480.2	6265382.3	1134.3	175.3	424488.8	6265283.4	989.9	SSR: Exploration <sup>2</sup>
2008	MZ-019	174	-56	424587.1	6265311.1	1175.5	158.5	424596.8	6265222.8	1044.3	SSR: Exploration <sup>2</sup>
2008	MZ-020	171	-53	424593.6	6265092.7	1264.4	147.5	424608.3	6265005.0	1146.8	SSR: Exploration <sup>2</sup>
2009	MZ-031	175	-55	424483.3	6264905.6	1292.5	68.3	424486.7	6264866.6	1236.6	SSR: Exploration <sup>2</sup>
2009	MZ-036	175	-53	424402.9	6265080.9	1207.1	96.9	424407.8	6265022.8	1129.7	SSR: Exploration <sup>3</sup>
2009	MZ-040	180	-57	424396.0	6264983.3	1242.1	87.8	424396.4	6264935.0	1168.8	SSR: Exploration <sup>3</sup>
2009	MZ-074	175	-54	424309.6	6265286.5	1140.0	160.0	424317.9	6265193.3	1010.1	SSR: Exploration <sup>3</sup>
2010	MZ-095	223	-87	424468.7	6265214.1	1180.8	153.3	424462.5	6265207.3	1027.7	SSR: Geotechnical <sup>3</sup>
2012	SF-12-01	183	-88	424343.3	6265357.0	1107.0	147.0	424343.1	6265352.7	960.1	Seabridge: Geotechnical <sup>2</sup>
2012	SF-12-02	157	-89	424720.9	6264984.2	1337.8	152.0	424722.5	6264980.5	1185.8	Seabridge: Geotechnical <sup>2</sup>

Notes:

1. All coordinates provided in NAD 83 Zone 9.
2. Collar coordinates surveyed by McElhanney in August 2012
3. Collar coordinates converted from NAD27 to NAD83 using National Resources Canada's Canadian Spatial Reference System NTV2 UTM Transformation (web application located at [http://www.geod.nrcan.gc.ca/apps/ntv2/ntv2\\_utm\\_e.php](http://www.geod.nrcan.gc.ca/apps/ntv2/ntv2_utm_e.php))

## FIGURES



**NOTES:**

1. OPEN PIT PHASES PROVIDED BY MOOSE MOUNTAIN TECHNICAL SERVICES ON OCT. 11, 2012.
2. OPEN PITS ARE CUT TO TOPOGRAPHY (NOT SHOWN).
3. SEE TABLE 1 FOR DRILL HOLE DETAILS.

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CLIENT: SEABRIDGE GOLD INC.

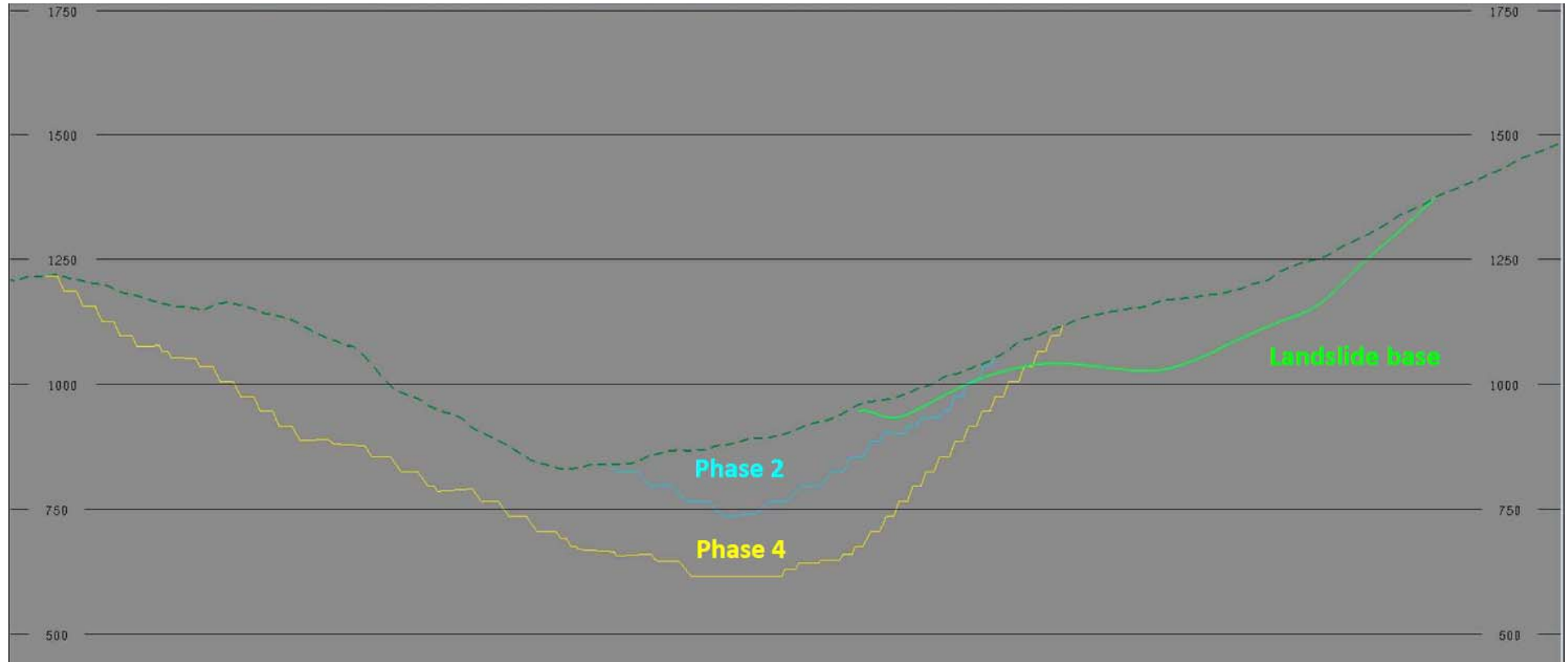
REPORT TITLE:  
PRELIMINARY INTERPRETATION OF THE BASAL SURFACE OF THE SNOWFIELD LANDSLIDE

FIGURE TITLE:  
INTERSECTION OF THE INTERPRETED BASAL SURFACE AND SELECT PHASES OF THE MITCHELL OPEN PIT

PROJECT No.:  
0638-013-50


FIGURE No.:  
1

# SECTION A



**NOTES:**

1. SEE FIGURE 1 FOR LOCATION OF SECTION A.
2. CROSS SECTION PROVIDED BY MOOSE MOUNTAIN TECHNICAL SERVICES.

 <b>BGC ENGINEERING INC.</b> AN APPLIED EARTH SCIENCES COMPANY	REPORT TITLE: PRELIMINARY INTERPRETATION OF THE BASAL SURFACE OF THE SNOWFIELD LANDSLIDE	
	FIGURE TITLE: SECTION A	
CLIENT: SEABRIDGE GOLD INC.	PROJECT No.: 0638-013-50	FIGURE No.: 2