Memo

Date:	February 26, 2016
Project:	Constantine North, Inc. Palmer Exploration Project Environmental Assessment
To:	April Rabuck, BLM and Rick Tankersley, BLM
From:	Darwin Green, Constantine North Inc.
Subject:	**Evaluation of Potential For Acid Rock Drainage**

This memorandum provides written evaluation of ARD potential associated with access road construction, including interpretation of rock sampling and geochemical analysis of bedrock.

GEOLOGY

An analysis of ARD potential first requires an evaluation of the local geology. The reader is directed to Section 6.1 of the Plan of Operations for a thorough review of the local and regional geology. Valley bottoms are filled with Quaternary alluvium and glacial drift (Figure 1; Figure 6.1 in POO). The drift cover is deep, as evidenced by road cuts and incised creek beds. No bedrock was encountered in constructing the 3.6 km long Glacier Creek access road in 2014, and no bedrock is anticipated to be encountered along the valley bottom section of road proposed in the POO.

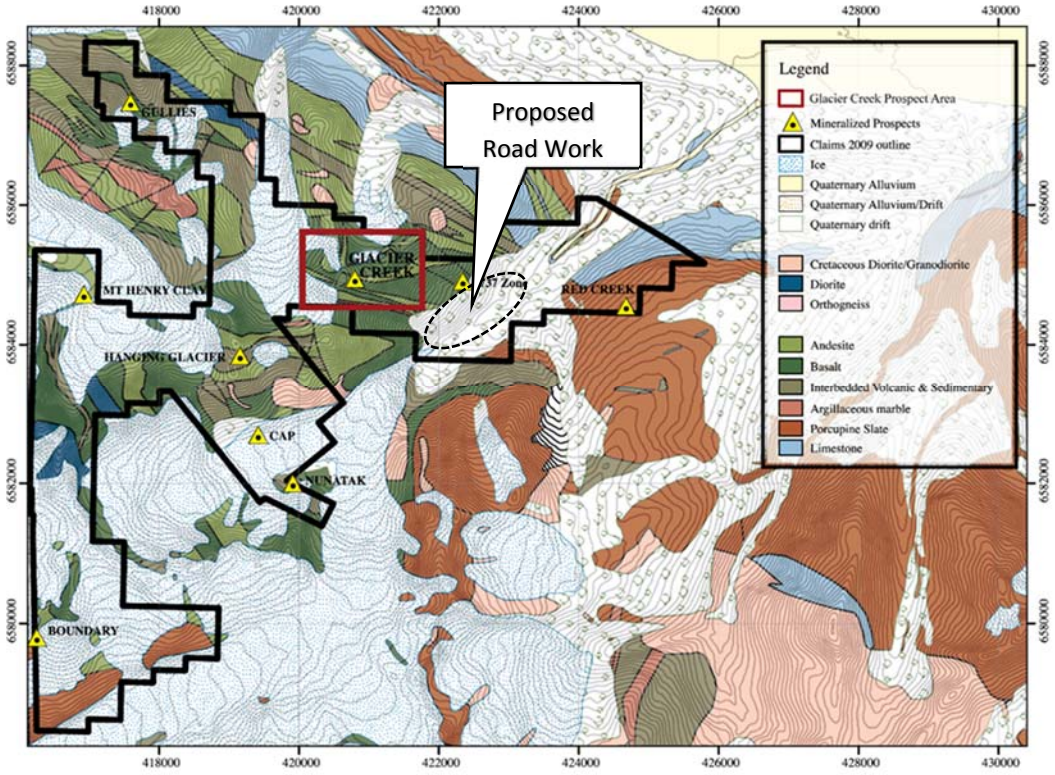

Figure 1. Geology map with both surficial and bedrock geology (modified from Redman et al., 1985)

The potential to disturb bedrock during road construction increases with increased elevation on the steeper switchback portion of the proposed road. This is because the depth of overburden is expected to thin as one moves higher up slope toward areas of mapped bedrock. The switchback road alignment and surrounding area received focused attention for geological mapping and rock sampling for acid base accounting analysis (Figure 2; Figure 6.4 in POO).

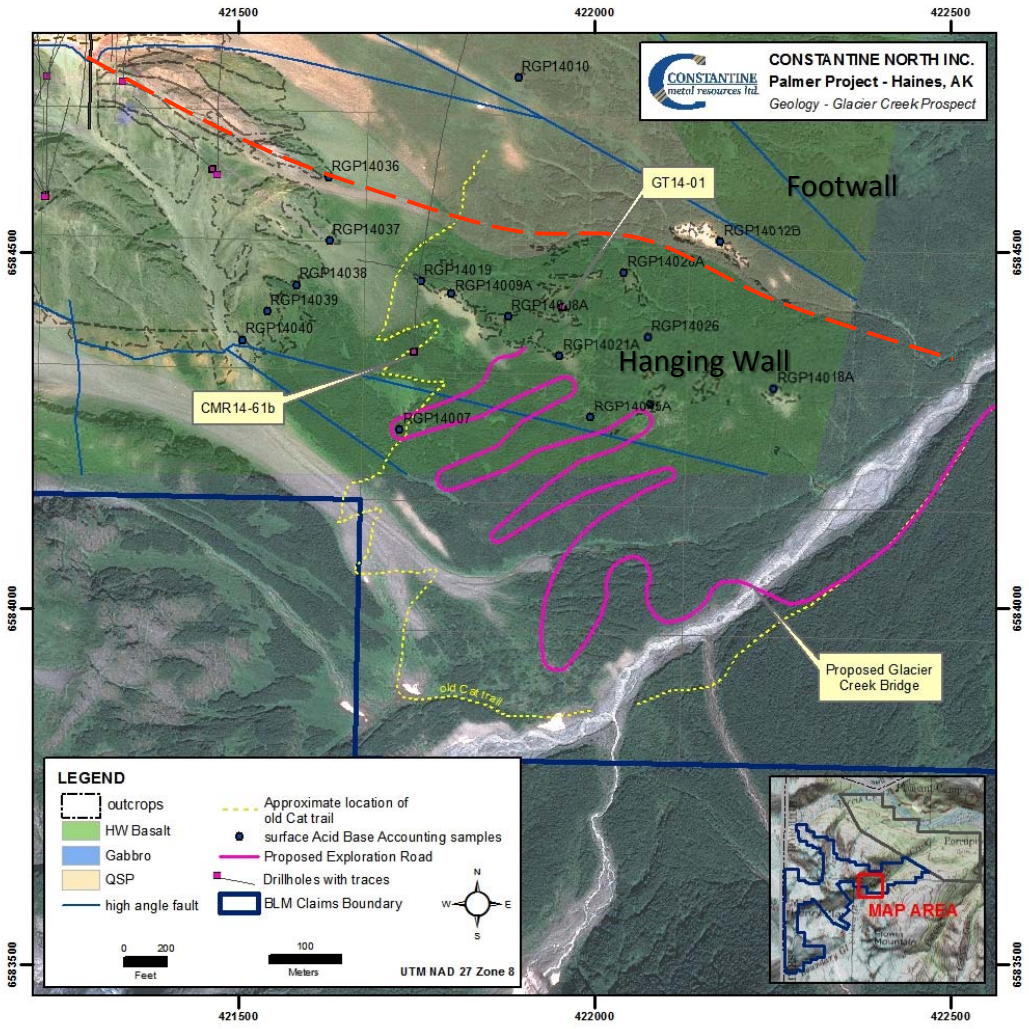

Figure 2. Detailed Geological Map of the Glacier Creek Prospect Area and ABA sample sites. Note the distribution of outcrop (dashed black line) all other areas of road route are overburden covered

The geological setting at the Palmer Project is well constrained by many years of drilling and geological mapping. Palmer is a volcanogenic massive sulphide (VMS) system, which is a type of deposit that forms on the sea floor contemporaneously with the deposition of volcanic and sedimentary strata. Rock units that are stratigraphically younger than the VMS mineral horizon are referred to as the stratigraphic Hanging Wall, and those that are older are referred to as the Footwall. At Palmer ARD potential is controlled by stratigraphy. ARD potential within VMS environments is typically associated the presence of sulphide minerals that form at, or footwall to, the mineralized horizon, whereas rocks deposited after

(stratigraphically above) the mineral horizon are generally not subjected to the same hydrothermal processes that form significant concentrations of sulphides (i.e. generally lower potential for ARD).

The switchback portion of the road is entirely underlain by hanging wall stratigraphy, composed of basalt. The stratigraphic trend of these rock units is roughly east-west, and dips steeply to the south. The structural geology and trends of these units are shown on the geological map and cross section below (figure 3; Figure 6.2 in POO, and figure 4, Figure 6.3 in POO). These figures have been annotated to highlight the key stratigraphic elements – Hanging Wall, Mineralized Horizon, and Footwall.

Surface overburden, and any bedrock that may be encountered below overburden during road construction and blasting, is all composed of hanging wall rock units. All available data indicates the hanging wall rock units are non-acid generating/non-metals leaching, as detailed in the POO and summarized below. Potential for encountering a different (un-sampled) rock material at depth during road construction and blasting is considered very low.

A new drill hole was completed in 2015 subsequent to preparation and submission of the Plan of Operations. This drill hole (CRM15-76) was collared near the base of the steeper switchback section of road (Figure 5) and drilled toward an azimuth of 360 (north) at an inclination of -45 degrees for a total depth of 455 m. The drill hole confirms that the bedrock geology underlying the entire section of switchback road is composed of Hanging Wall basalt. The basalt contains matrix, amygdule and veinlet calcite and negligible sulphide minerals (i.e. an abundance of acid neutralizing minerals and a general absence of acid forming minerals). ABA sampling of the rock units in hole CMR15-76 are discussed below.

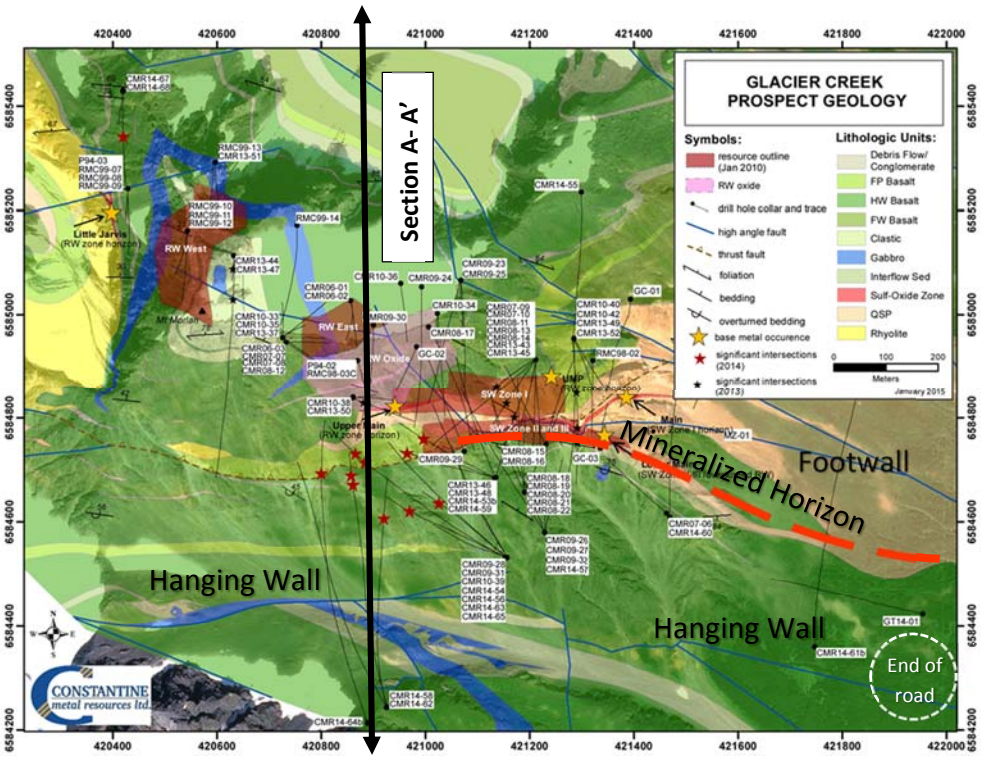

Figure 3. Geological map of the Glacier Creek Prospect Area with drill hole traces and 2010 resource wireframes.

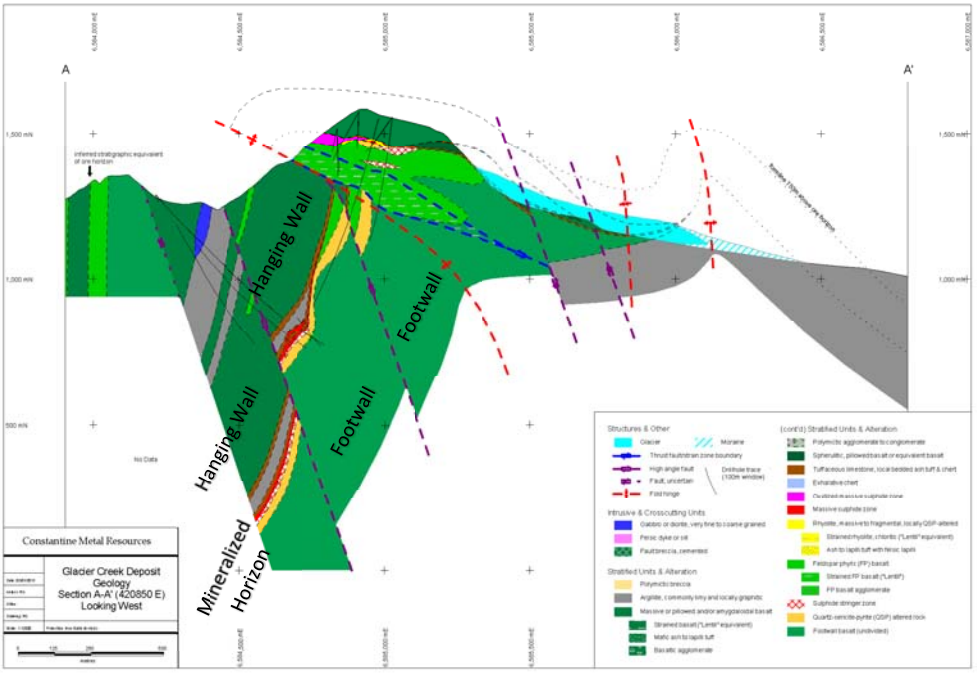

Figure 4. Geological Cross-Section of the Glacier Creek Prospect Area (Looking West) – Note scale

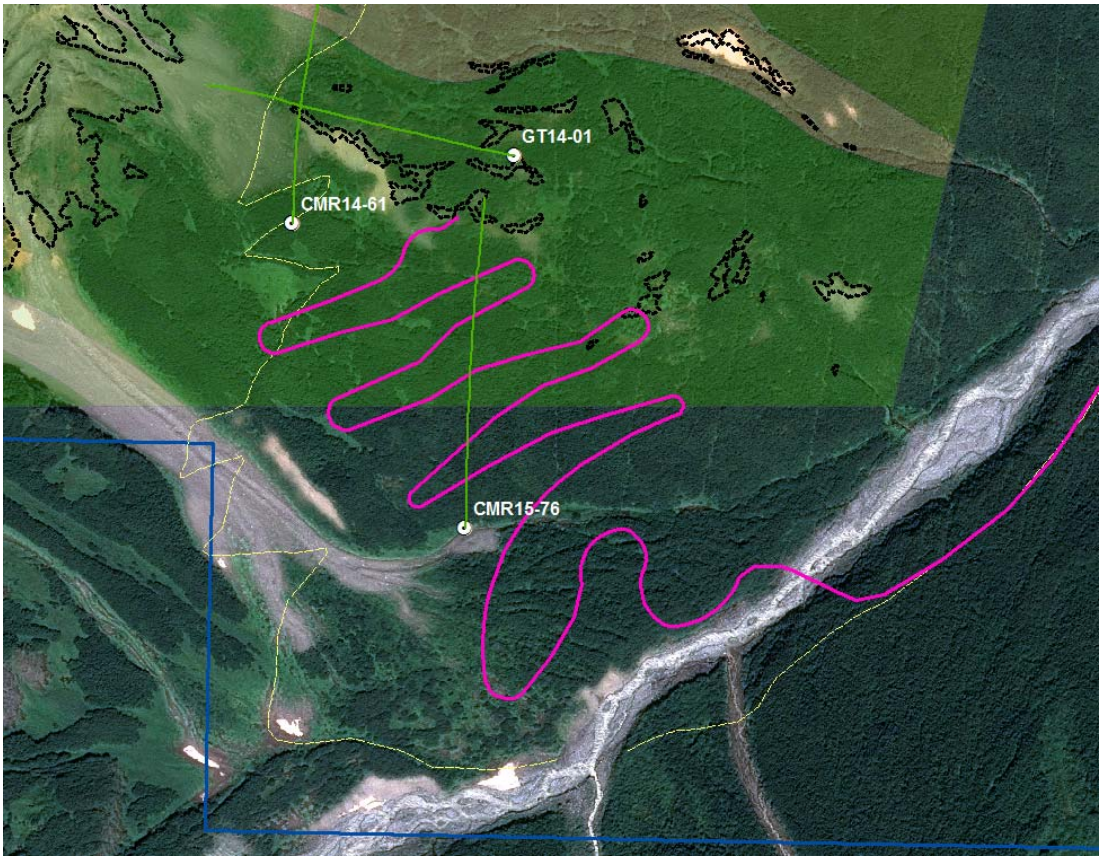

Figure 5. Map depicting showing projected surface trace of drill hole CMR15-76. Drilled at -45 degrees toward 360 azimuth to a depth of 455 m.

ROCK GEOCHEMISTRY

An environmental-geochemistry rock sampling program was included in Constantine's 2015 work program. The objective of the program was to provide additional data for understanding acid rock drainage/metals leaching potential from broken rock generated from road construction (particularly if blasting is required).

The 2015 program builds upon results from the previous programs during which a total of 17 surface rock samples and 15 drill core samples were collected and analyzed (as detailed in POO). A total of 14 drill core samples were collected and analyzed in 2015, bringing the total number of samples submitted for ABA analysis to 46. Core samples were collected over the length of drill hole CMR15-76. Samples of cut core were collected at a nominal spacing of approximately one sample every 30 meters, with individual samples typically measuring 20-50 centimeters in length. Samples were submitted to ALS Laboratories for the ABA-PKG05 analysis package. Samples were also analyzed for the standard ICP and whole rock characterization. Analysis methodology was selected following past consultation and recommendations by various third party consultants and Alaska State Department of Natural Resources.

Results from the 2015 program support the findings of previous work reported in the POO; that is, rock units within the Hanging Wall package have large positive net neutralizing potential (NNP). NNP values from the 2015 sampling range from 27 to 192 (Table 2). Net neutralizing potential is equal to the

neutralizing potential (NP) minus the maximum potential acidity (MPA). MPA is calculated by multiplying the total sulphur value by the constant 31.25. NP was determined using the Modified Sobek method.

The neutralizing potential ratio (NP/MPA) values also demonstrate a large excess of neutralizing capacity, with NP/MPA ratios ranging from a low of 6.3 to a high of 844.8. The data are consistent with observations of core and surface outcrop that record very low sulphide content (typically trace to 1% disseminated pyrite within the hanging wall basalt), and abundant groundmass, veinlet and amygdule calcite.

The ABA sample data continue to indicate ARD is not a concern for the proposed road construction.

New 2015 Drill core ABA sample results (not previously included in PoO)

From (m)	To (m)	Sample #	Rocktype	MPA	FIZZ RATING	NNP	NP	pH	NP/MPA	S_pct_IR08	S_pct_GRA06	S_pct_GRA06a	S_pct_CAL06	C_pct_GAS05	CO2_pct_GAS05
66.7	67.0	S037434	Basalt	5	3	192	197	8.5	39.4	0.16	0.01	0.03	0.16	2.46	9
90.3	90.5	S037435	Dyke	5	2	27	32	9.2	6.4	0.16	0.01	0.01	0.16	0.32	1.2
122.0	122.4	S037436	Basalt	17.5	3	94	111	9.4	6.34	0.56	0.01	0.02	0.55	1.22	4.5
152.0	152.4	S037437	Fault	10.3	3	167	177	8.6	17.16	0.33	0.01	0.02	0.33	2.23	8.2
169.0	169.4	S037438	Basalt	7.8	2	40	48	9.4	6.14	0.25	0.01	0.03	0.25	0.45	1.7
187.1	187.5	S037439	Basalt	0.9	3	84	85	9.5	90.67	0.03	0.01	0.01	0.03	0.89	3.2
218.9	219.3	S037441	Basalt	0.3	3	132	132	9.5	844.8	0.01	0.01	0.01	0.01	1.49	5.5
249.2	249.6	S037442	Basalt	0.3	2	35	35	9.1	112	0.01	0.01	0.01	0.01	0.3	1.1
275.2	275.7	S037443	Basalt	6.6	2	54	61	9.2	9.3	0.21	0.01	0.02	0.21	0.62	2.3
310.4	310.8	S037444	Basalt	5	3	145	150	8.8	30	0.16	0.01	0.03	0.16	1.74	6.4
330.9	331.3	S037445	Basalt	2.5	3	128	130	8.8	52	0.08	0.01	0.01	0.08	1.42	5.2
344.7	345.0	S037447	Basalt	15	3	180	195	8.7	13	0.48	0.01	0.01	0.48	3.07	11.3
367.7	368.2	S037449	Fault	5.6	3	183	189	9.3	33.6	0.18	0.03	0.01	0.15	3.73	13.7
428.3	428.7	S037452	Basalt	4.7	3	115	120	8.6	25.6	0.15	0.01	0.03	0.15	1.42	5.2