TECHNICAL MEMORANDUM

WATER MANAGEMENT CONSULTANTS

1875 LAWRENCE STREET, SUITE 500
DENVER, COLORADO 80202, USA

TELEPHONE: (303) 297 9005
TELEFAX: (303) 297 9007
www.watermc.com

To: Doug Nicholson (doug.nicholson@novagold.net)

Company: NovaGold Resources Inc.

Project No.: 2573

From: Brent Johnson (bjohnson@watermc.com)
Jennifer Beck (jbeck@watermc.com)

Date: May 26, 2006

Subject: Big Hurrah - Development Rock Handling Plan

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1 INTRODUCTION

This Technical Memorandum presents recommendations for the handling and management of development rock to minimize impacts at the Big Hurrah Project site near Nome, Alaska. This assessment utilizes geochemical test data obtained from development rock samples for the determination of non-acid-generating (NAG) and potentially-acid-generating (PAG) material. Operational sampling of the development rock will confirm the NAG or PAG designation, and the material will be handled accordingly. The NAG material will be handled and stored in the development rock storage area. The PAG material with a NP:AP ratio of 1.0 or less, and up to a volume of 1,305,000 cubic yards (998,000 cubic meters) will be separated, handled, and temporarily stored in the PAG staging area, adjacent to the development rock storage area for later backfilling of the pit. Additional geochemical testing, will be designed and approved by ADEC and ADNR to refine the estimates of PAG at various NP:AP ratios. If it is estimated that the volume of PAG with a minimum NP:AP ratio of 1.0 comprises less than 1,305,000 cubic yards, then the NP:AP ratio used for determining backfill PAG material will be refined and raised to a NP:AP ratio estimated to approximate the volume 1,305,000 cubic yards. By doing so, the storage capacity within the pit is optimized while keeping the PAG material inundated. All remaining PAG material with a NP:AP ratio above the final cutoff ratio will be blended with the NAG material in the development rock storage area and will have a net NAG composition. Upon completion of mining, the segregated PAG material will be placed into the open pit where it will be inundated with water, reducing exposure and mineral oxidation.

2 MINE OPERATION

The final mine design will be determined upon completion of the economic feasibility study, which is currently being developed. However, the working plan for the operation of the mine suggests that operations will begin by 2007 and continue for 3 years, consisting of 3 months of stockpiling per year and hauling up to 12 months per year. The development rock storage facility will be constructed during this time period.

The proposed handling and storage management of development rock is based on rock tonnages and types as summarized in Table 1, with a total of approximately 7 million tons (Mt) of excavated rock mass. Based on percentages provided by NovaGold, the focus of the development rock analysis was on quartz graphite schist (QGS) and the graphite muscovite schist (GMS), which comprise the majority of the development rock. At the time of closure, it is estimated that 5.7 million tons of excavated development rock will need to be managed in a way that minimizes impact to the area surrounding the Big Hurrah site.

Table 1 Big Hurrah Project rock types and tonnages

Description of rock types	Tonnage of ore	Tonnage of development rock	Percent of ore	Percent of development rock
Quartzitic graphite schist (QGS)	696,669	2,985,281	66	52
Quartz-muscovite schist (QMS)	10,556	114,819	1	2
Ore graphite calcareous schist (GCS)	52,778	459,274	5	8
Marble (MBL)	31,667	287,046	3	5
Graphitic Marker Unit (GMU)	10,556	114,819	1	2
Graphitic-muscovite schist (GMS)	242,778	1,779,687	23	31
Ore quartz vein (QVN)	10,556	0	1	0
Totals	1,055,560	5,740,926	100	100

2 CHARACTERIZATION OF DEVELOPMENT ROCK

Development rock properties were characterized based on ABA, bulk chemistry, and depletion calculations estimated from three humidity cell tests (HCTs). Depletion calculations are used for the prediction of long-term weathering behavior of the different development rock types.

Results from depletion time calculations for development rock lithologies in the three HCTs are presented in Table 2. Depletion time estimates were calculated based on sulfate mass generated (for acid depletion) and calcium and magnesium mass generated (for neutralization depletion). Depletion rates were compared to sulfide sulfur (converted to the carbonate equivalent) AP and carbonate NP to estimate whether NP or AP would be depleted first. For cells 1 and 3, NP was predicted to far outlast AP. For Cell 2 (QMS acidic), the sulfate concentrations are very low indicating negligible pyrite oxidation is occurring. With such low rates of pyrite oxidation, it is likely that pyrite is relatively unreactive and/or unavailable for reaction. For this reason, cell 2 was not used in the determination of a site specific NP:AP value.

For the purpose of development rock handling, the percentage of NAG and PAG development rock has been estimated based on a site-specific NP:AP ratio for the Big Hurrah materials. The site-specific NP:AP ratio is calculated from the NP and AP depletion rates measured in the HCTs of NAG waste rock samples once depletion rates have stabilized. This method assumes that the available NP in the samples persists over time, which has been evaluated based on the depletion time calculations which predict that NP will far outlast AP in these samples (Section 3, HCT). The NP:AP ratios are calculated for each HCT and a weighted average was calculated based on the percentage of development rock represented by each HCT. The weighted average was calculated at 1.7, however, a value of 1.9 was selected to provide an additional measure of conservatism.

The depletion calculations indicate that, at the 1.9 cutoff, the NP outlasts the AP by a significant margin. HCT 1 has a ratio of days NP to days AP is 2.2 and for HCT 3 it is 2.9. This indicates that the actual cutoff for the PAG determination is lower than either the 1.7 or the 1.9. The actual cutoff may be refined by further test work, however, at a minimum, the PAG material with a NP:AP ratio of 1.0 or less will be placed into the pit for submergence by the pit lake by at least 5 feet of water. The actual volume of PAG material for submergence will be optimized such that the most acidic material will be submerged and the remaining volume of PAG will be managed by blending with the NAG material in the development rock dump. Data are presented in Table 3.

In order to estimate the approximate percentage of development rock which will be considered PAG material, all of the development rock ABA data are presented in a scatter plot (Figure 1) and compared to the site-specific NP:AP ratio of 1.9. The ABA data presented in Figure 1 are based on siderite-corrected

NP values and sulfide-sulfur AP values. Table 4 presents a comparison of the estimated PAG material using corrections to the NP value, as determined through the confirmatory ABA testing (Big Hurrah Project – Preliminary Materials Geochemical Testing Results (WMC, May 2006)). The estimated percentage of PAG material varies from 37%, based on the standard Sobek determination of NP, to 51%, based on modifying the NP value using both siderite and TIC calculated corrections. For the purpose of planning and development rock handling, the siderite-corrected, TIC NP values are used to estimate PAG material quantity. Approximately 51% (141 samples) of development rock samples plot below the site-specific NP:AP ratio. Therefore, approximately 51% of development rock will be considered PAG material. Actual PAG quantities will be determined by operational sampling and analysis during mining.

Table 2 NP and AP depletion calculation results summary

Rock type	HCT #	Ca (mg/L)	Mg (mg/L)	SO4 (mg/L)	Carbonate molar ratio	Initial AP (Sulfide S) (%)	AP depletion rate (mg SO4/kg/wk)	AP depletion rate (mg CaCO3/kg/wk)	Remaining AP (weeks)	Initial NP (g CaCO3/kg)	NP depletion rate (mg CaCO3/kg/wk)	Remaining NP (weeks)	Prediction of outcome	NP:AP molar ratio
QGS	1	58	4	98	1.58	0.71	43	45	**495**	78	71	**1103**	Non Acid	1.6
QGS	2	10	4.4	7.5	5.51	0.94	3.8	4.0	**7412**	50	22	**2292**	Acid	----
GMS	3	210	6.7	285	1.86	0.35	131	136	**80**	58	254	**229**	Non Acid	1.9

The AP depletion rate is based on the sulfate production rate over the period of stable kinetic data.

Table 3 Big Hurrah site specific NP:AP ratio for development rock

Client ID	**Development Rock Quantity**		**AP depletion rate**	**NP depletion rate**	**NP:AP molar ratio**
	Mass of mined rock (ton)	**Percent of QGS and GMS development rock**	**(mg/kg/wk)**	**(mg/kg/wk)**	
HCT 1 (QGS), 4269, 60-75	2,927,872	51%	45	71	1.6
HCT 3 (GMS), 4269, 50-60	2,813,054	49%	136	254	1.9
Site-specific NP:AP ratio (weighted average value for development rock):					1.9

Table 4 PAG development rock estimates based on NP corrections

	NP:AP NP by standard Sobek (AP by sulfide S)		NP:AP NP with siderite correction (AP by sulfide S)		NP:AP NP with siderite/TIC correction (AP by sulfide S)	
	# Samples	**Percent**	**# Samples**	**Percent**	**# Samples**	**Percent**
NP:AP < 1.9	102	37%	120	43%	141	**51%**
NP:AP > 1.9	177	63%	159	57%	138	**49%**
Total	279	100%	279	100%	279	**100%**

3 DEVELOPMENT ROCK STORAGE

Attachment A.1 presents the Big Hurrah mine site plan during operations. This figure illustrates the position and orientation of the development rock stockpile. The development rock stockpile site will serve as the permanent, storage for the 49% (2.8 MT) of development rock that is considered NAG material, which will be blended with the PAG material having an NP:AP ratio that is greater than the final cutoff ratio and will not be used as backfill. The development rock storage area will result in a net NAG composition. The PAG development rock with an NP:AP ratio of 1.0 and up to a volume of 1,305,000 cubic yards (998,000 cubic meters) will be temporarily stored in the PAG staging area adjacent to the main development rock stockpile until mining has been completed. The development rock stockpile area will be graded so that drainage from the PAG staging area will drain towards the pit. Seepage and/or drainage from the development rock stockpiles will be monitored in accordance with the Rock Creek Project Operational and Closure Monitoring Plan.

Attachment A.2 illustrates the Big Hurrah mine site plan upon completion of mining. The development rock stockpile containing only the NAG development rock has been reclaimed. The PAG material has been placed in the pit during the first month of the first spring runoff. Inflowing ground and surface water will inundate the pit, limiting exposure of the PAG material. The pit will fill during the first spring after mine closure. Once the pit is full, surface water drainage will be diverted using pre-existing diversion structures during the summer months. This will allow the suspended solids in the pit lake to settle out. Drainage will be re-directed towards the pit again in the fall, which will flush the upper most layer of the pit lake.

4 OPERATIONAL SAMPLING

Additional sampling and testing will be conducted during operations to confirm NAG or PAG rock designations. One composite sample per 14,000 tons of excavated development rock material is recommended for the maintenance of the handling plan. Each blasthole represents approximately 36 tons of rock (389 blastholes represent 14,000 tons). A 30 g split will be collected from the sample pulp of every tenth blasthole. This will result in a pulp composite weighing approximately 1200 grams. This composite will then be riffle split down to 250 grams for further ABA analysis. Samples will be collected, processed, and analyzed onsite for maximum turn-around times. Samples may alternatively be shipped to an outside laboratory facility for analysis.

Neutralization potential (NP) and acid-generation potential (AP) will be determined by the standard Sobek method. If the analyses are conducted onsite, the standard Sobek method will be used and a correction factor will be applied to the results. If the analyses are shipped off-site, the standard Sobek method will be used and the correction calculation applied. Approximately 10% of the samples, if shipped off-site, will also be analyzed using the siderite correction and TIC methods. NP and AP will subsequently be used to calculate interpretive indices including net neutralization potential (NNP) and NP:AP ratios.

Neutralizing potential (NP)

Values of NP indicate the capacity of rock materials to buffer acidity produced by sulfide oxidation or other proton-generating reactions. The standard Sobek method along with the siderite-corrected Sobek method will be used for the determination and comparison of NP values.

The standard Sobek method (Sobek, et al., 1978) will be applied to a mixture containing 1-2 grams of crushed rock sample, and a volume of hydrochloric acid (HCl). The solution is heated for two hours in order to expel any dissolved carbon dioxide (CO_2) and bring the reaction to completion. A neutralizing potential (NP) will then be calculated based upon the normality of the acid and base applied and the mass of the sample.

An alternate method that will be used to determine NP values is the peroxide siderite correction for the standard Sobek method (Skousen, et al., 1997). This method will address potential erroneously high NP calculations from the above described standard Sobek method. For this method, a 2 gram sample is boiled in HCl for 5 minutes, and then filtered. The filtrate is then added to a 30% peroxide solution and boiled for 5 minutes to drive the oxidation of ferrous to ferric iron. The solution is then titrated to determine the calcium carbonate equivalent for the acid consumed during the test.

For these methods described above, the results will be normalized to a conventional unit of tons $CaCO_3$ (equivalent) per 1,000 tons of rock. The reported results will not necessarily imply that calcite ($CaCO_3$) is present.

The NP of the material may also be calculated based on the total inorganic carbon (TIC) content of the sample. TIC content is determined in the laboratory as the difference between the total carbon content and the total organic carbon (TOC) content. Total carbon is measured using the standard LECO furnace method. For TOC determination, inorganic carbon must be removed from the samples by bathing the samples in 2N HCl for 24 hours, followed by rinsing and centrifuging. The sample is then analyzed for TOC using the LECO furnace method. The difference between total carbon and TOC is the TIC content of the material. The NP is calculated based on the TIC, and converted to standard units (i.e., TIC, as percent carbon, is multiplied by a factor of 83.3 to convert to NP, as tons $CaCO_3$ per 1,000 tons of rock).

Acid generation potential (AP)

Numerous procedures exist for the determination of AP. All include the analytical derivation of the various forms of sulfur, including total and sulfide-sulfur. For all Big Hurrah samples, total sulfur will be determined using a LECO induction furnace (EPA method 600). Sulfur speciation will be assessed following the US-EPA method 600 sequential leach procedure, in which sulfate-sulfur and sulfide-sulfur are differentiated on the basis of their respective solubilities in HCl and HNO_3.

The potential proton yield will then be calculated in accordance with the stoichiometry of pyrite oxidation. Options for the derivation of AP using an appropriate sulfur value include:

- the assignment of total sulfur within a sample to stoichiometric pyrite;
- the analytical differentiation of sulfide-sulfur from other sulfur species, and assignment of the former to stoichiometric pyrite; and
- the mineralogical determination of pyrite sulfur.

The Sobek (1978) method, involving the use of sulfide-sulfur for AP calculation, is most-widely deployed worldwide and is most appropriate for determination of AP for unweathered rock samples. This procedure may be considered conservative for samples containing a significant component of sulfide-sulfur in non-pyrite phases. For this evaluation, values of AP will be calculated for samples using both (a) total sulfur and (b) sulfide-sulfur data. All results will be converted to ton equivalents of $CaCO_3$ per 1,000 tons of material, using a conventional multiplier of 31.25 (moles of calcite required to neutralize protons liberated by 1 mole of oxidized pyrite).

5 DATA MANAGEMENT

Data obtained from the operational sampling will be used for real-time input for the characterization of development rock. The data will also be incorporated into a database for ongoing analyses and closure support. Corrections to the handling plan will be updated as warranted by the data.

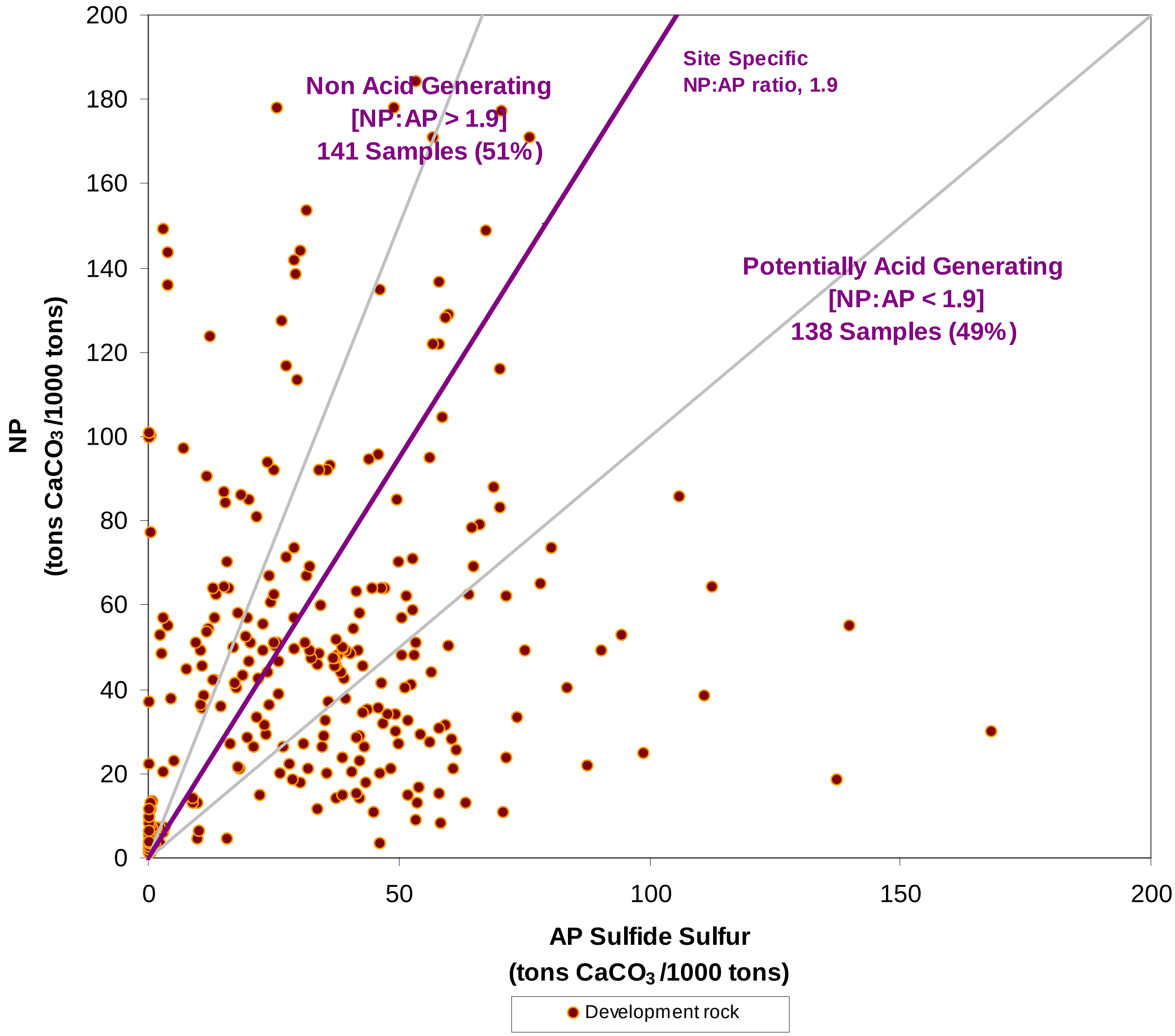
6 REFERENCES

EPA, 1999. EPA and Hardrock Mining: A Sourcebook for Industry in the Northwest and Alaska. Draft Guidance Document from EPA Region 10; EPA-10-R-99-016.

Skousen, J., Renton, J., Brown, H., Evans, P., Leavitt, B., Brady, K., Cohen, L. and P. Ziemkiewicz, 1997. Neutralization Potential of Overburden Samples containing Siderite. Journal of Environmental Quality, v26, n3, p673-681.

Sobek, A.A., W.A. Schuller, J.R. Freeman, and R.M. Smith, 1978. Field and laboratory methods applicable to overburden and minesoils. U.S. E.P.A. Report EPA-600/2-78-054.

FIGURE

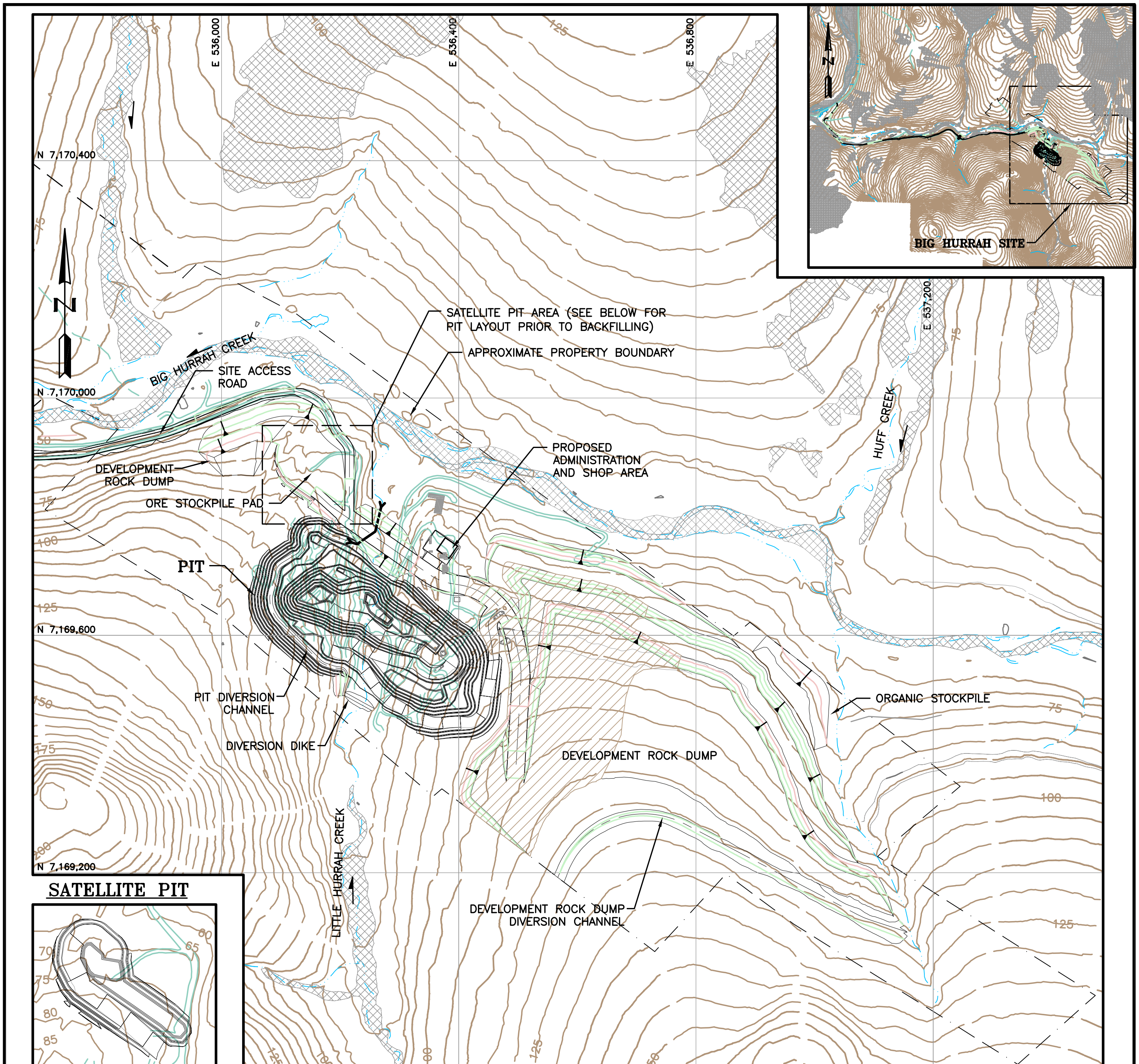


AP is calculated based on sulfide-sulfur.
NP is based on siderite-corrected values.

WATER MANAGEMENT CONSULTANTS Denver, CO	PAG DEVELOPMENT ROCK BASED ON SITE SPECIFIC NP:AP RATIO			
	CLIENT: NovaGold RESORCES, INC.		PROJECT: BIG HURRAH	
	JOB: 2509	FILE: FIGURE-1.DWG	DRAWN: RN	CHECKED: PR
	DATE: MAY 2006		FIGURE: 1	

F:\2573 - BIG HURRAH\GEOCHEMISTRY\DEVELOPMENT ROCK HANDLING PLAN\FIGURES DRAWINGS\FIGURE-1.DWG

ATTACHMENT A.1



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LEGEND:

- EXISTING GROUND SURFACE CONTOUR AND EL, METERS
- PROPOSED GROUND SURFACE CONTOUR AND EL, METERS
- EXISTING ROAD
- EXISTING STREAM
- EXISTING DITCH
- EXISTING POND/WATER
- EXISTING STRUCTURE
- WETLANDS
- APPROXIMATE LIMITS OF PAG DEVELOPMENT ROCK STAGING AREA
- PROPOSED CULVERT

DEVELOPMENT ROCK HANDLING PLAN

CLIENT: ALASKA GOLD COMPANY

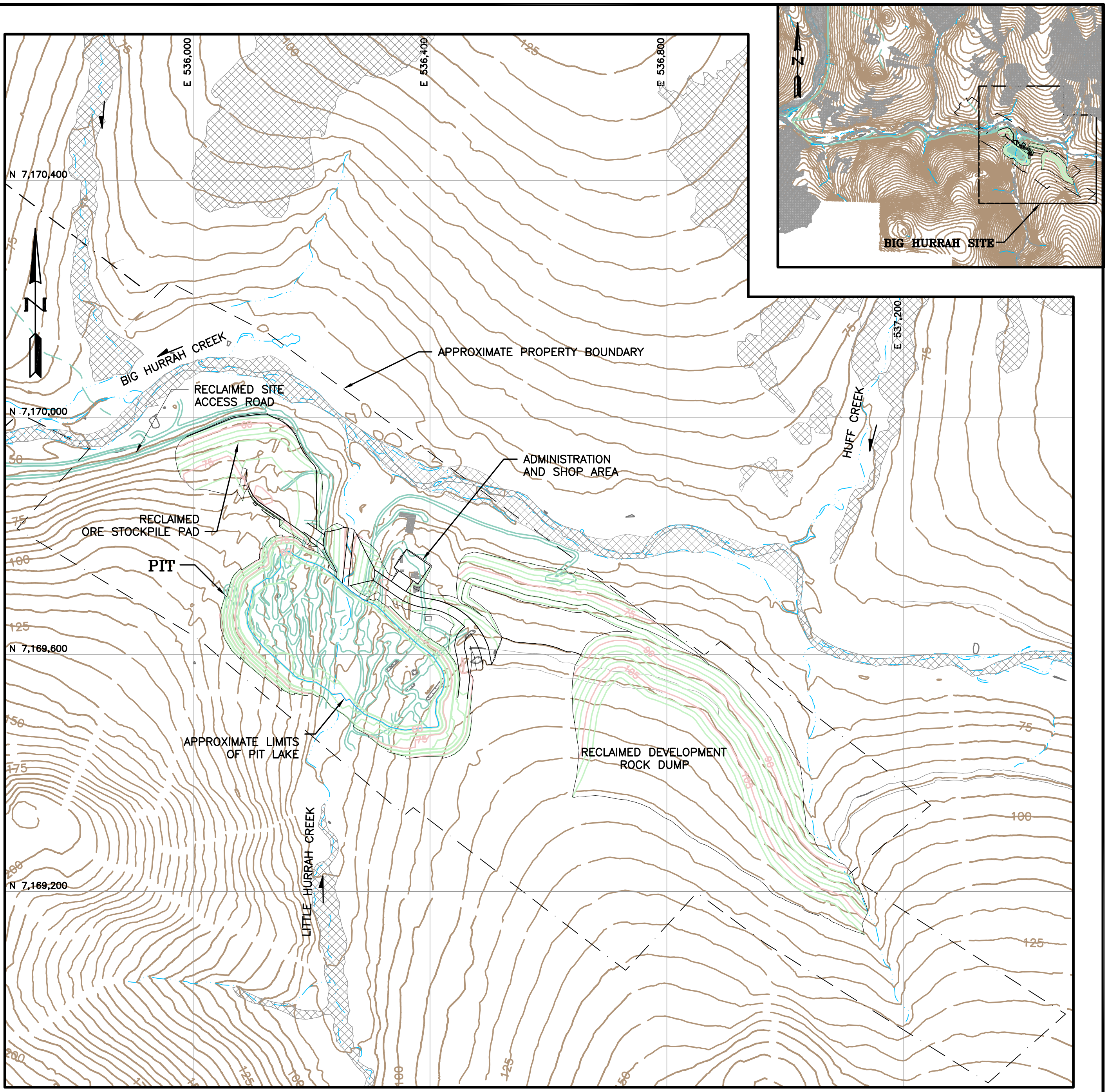
PROJECT: ROCK CREEK PROJECT

TITLE: BIG HURRAH MINE SITE PLAN

SWC
SMITH WILLIAMS CONSULTANTS, INC.
304 Inverness Way South, Suite 490, Englewood, Colorado 80112
Phone: 303-433-0262 Fax: 303-433-0362

DESIGNED BY	JNM	CHECKED BY	RTB	DATE
DRAWN BY	JNM	APPROVED BY	RTB	4/27/06
FILENAME			FIGURE No.	REV.
1011F212			A.1	B

ATTACHMENT A.2



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LEGEND:

- EXISTING GROUND SURFACE CONTOUR AND EL, METERS
- PROPOSED GROUND SURFACE CONTOUR AND EL, METERS
- EXISTING ROAD
- EXISTING STREAM
- EXISTING DITCH
- EXISTING POND/WATER
- EXISTING STRUCTURE
- WETLANDS

DEVELOPMENT ROCK HANDLING PLAN

CLIENT

ALASKA GOLD COMPANY

PROJECT

ROCK CREEK PROJECT

TITLE

RECLAIMED BIG HURRAH MINE SITE PLAN

SWC
SMITH WILLIAMS CONSULTANTS, INC.
304 Inverness Way South, Suite 490, Englewood, Colorado 80112
Phone: 303-433-0262 Fax: 303-433-0362

DESIGNED BY	RTB	CHECKED BY	RTB	DATE
DRAWN BY	JNM	APPROVED BY	RTB	4/27/06
FILENAME			FIGURE No.	REV.
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