Summary of Stibnite Gold Project Geochemical Characterization Program

1 INTRODUCTION

Midas Gold Idaho, Inc. (Midas Gold or MGII) submitted its Plan of Restoration and Operations (PRO) for the Stibnite Gold Project (Project) to the U.S. Forest Service (USFS) in September 2016. The PRO laid out a proposal to recommence mining at the historic Stibnite Mining District and clean up many of the impacts remaining from historical mining of the site. Under the National Environmental Policy Act (NEPA), the PRO is currently being reviewed by multiple local, state, and federal agencies and MGII is working with these agencies to collect and analyze the data necessary to evaluate the environmental impact of the proposal. In anticipation of this process, Midas Gold contracted SRK Consulting (SRK) in 2011 to conduct a geochemical characterization program for the Project. The purpose of the program is to determine environmental characteristics of different rock types and mining products for environmental impact modeling and project planning. The initial impact modeling results are then used to identify aspects of the Project that could be modified to best protect the public and the environment. Through this public process, MGII continues to refine its understanding of the potential impacts associated with the PRO and anticipates that the draft environmental impact statement (EIS) will include modifications to the PRO that will strengthen the final project design.

This document is meant to summarize the methods and findings of the geochemical baseline study[1] for readers who may not be familiar with geochemical test methods and modeling typically used for minesite geochemical characterization and also to present these results within the context of the PRO and the NEPA process. The characterization program is primarily geared towards predictions of future water quality, specifically the potential for metal leaching and acid rock drainage (ML/ARD) from the proposed Project activities. The geochemical processes that lead to ML/ARD can result from hard rock mining operations under specific geologic and environmental conditions and may have significant environmental impacts if not mitigated appropriately. SRK's test program is aimed at determining whether such potential exists.

The geochemical characterization program for the Project commenced with collection of representative samples of rock, historical mine wastes, and future mine tailings materials. A combined total of 734 samples were submitted for laboratory analysis, including American Society for Testing and Materials (ASTM) and U.S. Environmental Protection Agency (EPA) standard static and kinetic geochemical testing methods.

- Static testing involves a series of short-term screening tests designed to characterize the bulk chemistry of samples and determine their overall potential to generate or neutralize acid and to release metals in contact waters.

[1] *Stibnite Gold Project Baseline Geochemical Characterization Report, SRK Consulting, 2017.*

- Kinetic testing, a longer-term test, is conducted over multiple months to determine rates of acid production (if any) and metal release from samples (if any). The results of these laboratory tests are used to assess the potential for ML/ARD from materials as well as to develop inputs to numerical models that predict changes to water quality associated with proposed mining activities, specifically that of contact water interacting with mined materials, mine tailings and freshly exposed mine benches.

Through this scientific process, regulators, and stakeholders are able to make fact-based decisions, assessing environmental risk and appropriately modifying the Project to ensure protection of the environment.

2 EXISTING CONDITIONS

The Stibnite Mining District has been subject to extensive mining-related activities by prior owners over the past century. Historical mining activities included underground and open pit mining, heap leaching, ore processing in a mill, smelting, tailings disposal, development rock disposal, waterway diversions, hydro dam development (and failure), town and camp sites, haul roads, powerlines, landfills, etc. All of these impacts took place prior to the Midas Gold affiliates' acquisition of their mineral rights in the area and were carefully documented prior to them taking ownership. These human impacts have been compounded by extensive forest fires that have burned approximately 76% of the Project mineral holdings area. Such activities have resulted in widespread impacts on the natural environment including: deforestation; accelerated erosion; increased sedimentation; elevated metals loading in surface water and groundwater; diversion and degradation of natural waterways (including the East Fork of the South Fork of the Salmon River); blockages to anadromous fish passage; impaired water quality; and compromised fish habitat, waterways and wetlands.

As a result of these activities and impacts, as well as the naturally elevated levels of metals and sulfide minerals present in the district bedrock related to the formation of the mineral deposits, groundwater and surface water in the district have elevated levels of metals, particularly arsenic and antimony. These existing conditions have been extensively documented in a synoptic study undertaken by the U.S. Geological Survey and in baseline environmental monitoring reports provided by Midas Gold to the USFS.

3 DEPOSIT GEOLOGY, MINERALOGY, AND MINING MATERIALS

ML/ARD can be a significant environmental problem for mining and civil engineering projects if metal sulfide minerals are present and if conditions exist for such processes to develop. These processes can occur when sulfide minerals are oxidized as rock is exposed to air and water during mining operations. The potential for oxidation of sulfide minerals and metal leaching depends on a number of site-specific factors, including mineralogy (acid generation and acid neutralization potential), meteoric and climatic conditions, particle size distribution and placement of mined materials with respect to groundwater and surface water.

To understand the geochemical characterization program, it is important to understand the distribution of metals and sulfide minerals within the rock mass in relation to proposed mining activities of the Project. The gold-antimony-silver deposits that comprise the Project are classified as intrusion-related, sulfide-replacement mineral deposits and are hosted in either intrusive or metasedimentary rocks. In these types of mineral deposits, naturally occurring metals and other elements, including gold, have been concentrated in the rock over geologic timespans by the circulation of hydrothermal fluids associated with cooling igneous intrusions. Metals occur principally within metal-sulfide minerals such as pyrite (FeS_2), arsenopyrite (FeAsS), and stibnite (Sb_2S_3). Because microscopic gold occurs within the sulfide minerals, portions of the SGP deposits with low sulfur generally have very low-grade gold mineralization. This is significant because non-gold bearing rock is overall less likely to generate acid and has lower metal content than ore grade rock. Another important geologic factor relevant to ML/ARD is the presence of carbonate minerals in the SGP deposits, which can buffer any acid generated by sulfide oxidation. Carbonate minerals in the SGP mineral deposits that provide acid buffering potential occur within certain carbonate rock formations (limestone and marble) and also within hydrothermally altered igneous intrusive rocks as calcite and dolomite vein fill. Static and kinetic geochemical characterization test methods are used to determine the potential for ML/ARD of these rocks.

Midas Gold's PRO proposes two primary destinations for mined rock; ore will be processed through the mill to extract gold, antimony, and silver while development rock (waste rock) will be placed in engineered development rock storage facilities (DRSFs). The geochemical characterization program included samples of both ore materials and development rock in addition to samples of historical mine wastes and future mine tailings materials produced through metallurgical testing of the metal recovery processes. The development rock is of primary concern for potential ML/ARD because: (1) it is the most significant material by tonnage; (2) sulfide minerals in development rock will not be removed in flotation and oxidized in the pressure oxidation gold extraction circuit as will occur for ore materials; (3) development rock will be placed in unlined DRSFs where it can potentially interact with groundwater as opposed to processed ore being placed a lined tailings storage facility (TSF); and (4) some of this rock will be exposed in pit walls upon cessation of mining.

4 SAMPLE COLLECTION AND REPRESENTATIVENESS

The geochemical characterization program consisted of collecting 734 samples consisting of development rock, ore-grade rock, historical mine tailings, potential future mine tailings and historical mine wastes from both mid- and late 20th century mining operations. Commencing in 2011, SRK geochemists worked with Midas Gold geologists to collect development rock and ore-grade samples representing all the different rock types present in the SGP mineral deposits, as determined from core drilling and geological modeling of the deposits. Initially, 120 samples were collected from drill core and pit wall exposures. In 2015, SRK collected an additional 308 samples to address data gaps identified as a result of additional data and an improved geological understanding of the deposit from the ongoing exploration program. The sample program was designed to be representative both chemically and spatially; samples cover the range of chemical compositions found in Midas Gold's exploration drillhole database as well as being collected from multiple areas, rock types and alteration zones within the proposed open pits (Figure 1).

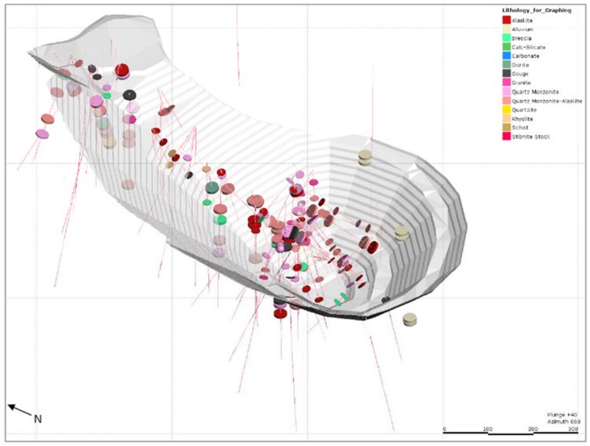


Figure 3-1. Hangar Flats Sample Intervals

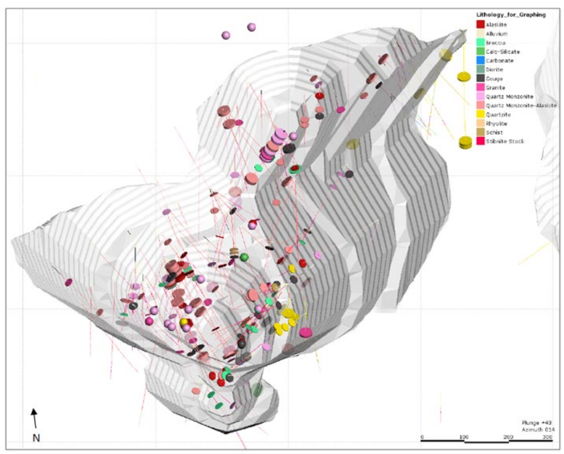


Figure 3-2. Yellow Pine Sample Intervals

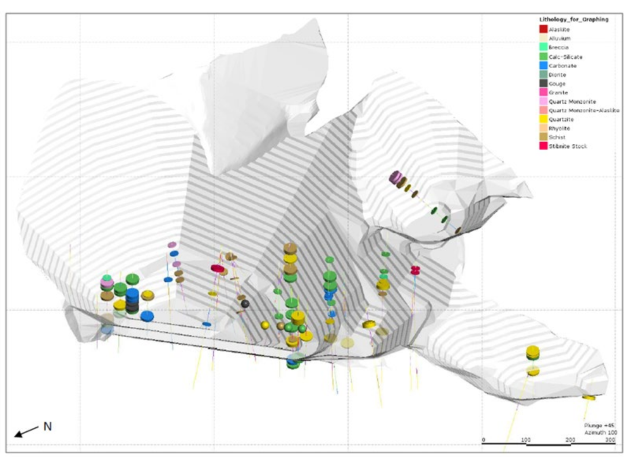


Figure 3-3. West End Sample Intervals

Figure 1: 3D pit shells for Hangar Flats, Yellow Pine and West End deposits depicting geochemistry characterization sample locations. Source: SRK SGP Baseline Geochemical Characterization Report (2017).

Historical mine tailings and previously leached "spent" ore materials were also collected for the geochemical characterization study. In the 1920s-1950s, tailings from the Bradley Mining Company were placed in Meadow Creek valley and were subsequently covered with crushed and leached spent ore by 1980-90s operators. Samples of the tailings and spent ore, as well as other historical mine wastes, were collected in Midas Gold's 2013 through 2015 hollow stem auger drilling programs, which characterized historical mining wastes throughout the site. A total of 295 samples from legacy facilities samples were included in the geochemical characterization program, including 241 samples of spent ore, 24 samples of development rock and 30 samples of historical tailings.

The geochemical characterization program also involved analysis of samples representative of future mill tailings associated with the proposed gold extraction process circuit. As part of Project development, MGII has performed laboratory and pilot scale testing of the gold extraction process at various metallurgical laboratories. The general process separates sulfide minerals from the crushed ore generating a sulfide concentrate and a gangue mineral flotation tailing. The sulfide concentrate goes through a pressure oxidation (POX) vessel to oxidize the sulfides and is then sent to a cyanidation circuit to extract the gold and to be neutralized prior to mixing back in with the flotation tailings. Oxide ores do not require pressure oxidation for gold extraction as they have been naturally oxidized and therefore go straight to cyanide leach. After mixing and cyanide neutralization, the mill tailings would be deposited in a TSF. Eleven samples of potential future mill tailings were analyzed in the geochemical characterization program: six representing POX products; four representing flotation tailings, some of which were subjected to cyanidation; and one representing the final tailings-concentrate mixture as will be stored in the TSF. A second phase of geochemical characterization of the tailings is ongoing concurrent with pilot plant testing and refinements to the metallurgical process flowsheet.

5 TESTING METHODS

Multiple types of laboratory tests have been employed for geochemical characterization of SGP materials. Testing was conducted by various independent, ISO and EPA accredited and certified laboratories specializing in environmental geochemical testing for the mining industry, primarily located in Reno, Nevada. Geochemical characterization testing included both short-term static tests that assess the potential for acid generation and/or metal leaching and longer-term kinetic tests that assess the rates of acid generation and metal leaching. Static test methods used in the program include multi-element geochemical characterization with inductively-coupled plasma-atomic emission spectrometry/mass spectrometry (ICP-AES/MS), modified Sobek Acid Base Accounting (ABA), and Net Acid Generation (NAG) testing, in addition to Nevada Meteoric Water Mobility Procedure (MWMP) and Synthetic Precipitation Leachate Procedure (SPLP) leach testing. Based on the static test results, some samples were submitted for kinetic testing to determine rates of sample oxidation and potential for acid generation and potential metal release using Humidity Cell Tests (HCTs). The purpose and general methodology of these test methods are summarized below.

The static test methods employed in the program are intended to determine the chemistry, mineralogy, and potential for leaching of acid and constituents from samples into the environment. Multi-element geochemical characterization is conducted as a standard procedure for MGII drill core samples for exploration as well as the characterization program. The weight percent of chemical elements in samples is determined by dissolving rock in a four-acid solution, vaporizing the acid in a plasma flame and analyzing the vapor using atomic emissions (AES) or mass spectroscopy (MS) techniques. This data shows which elements are elevated in the samples above natural background levels and/or could potentially cause environmental problems if they are leached or mobilized from the samples.

ABA and NAG testing is conducted to determine the potential of samples to neutralize acid through dissolution of carbonate minerals or to generate acid through the oxidation of sulfide minerals. Multiple test methods are employed to account for variations in sample mineralogy, including presence of non-sulfide sulfur species (e.g., sulfate) and carbonate minerals other than calcite, such as siderite. Generally, samples are reacted with acids and bases and back titrated to determine acid generation potential and neutralization potential. Sulfide sulfur and total inorganic carbon are also measured to aid in analysis. The ABA results provide a quantitative measure of the potential for a sample to produce acid rock drainage that is expressed in terms of Net Neutralization Potential (NNP, the difference between neutralization potential and acid generation potential) and neutralization potential ratio (NPR, the ratio of the neutralization potential to the acid generation potential). According to Bureau of Land Management (BLM) assessment criteria, samples with NPR values greater than 3 and NNP values greater than 20 kg $CaCO_3$/ton are considered non-acid generating. Samples that do not meet these criteria require additional testing to determine if they are potentially acid generating (PAG) materials. Sample results are presented using NPR and NNP in much of the geochemical characterization reporting.

In addition to ABA, the potential for dissolution and mobility of chemical constituents into the environment is of primary concern for mining projects. The SPLP and MWMP tests are designed to assess the potential for short-term metal leaching. The SPLP test involves agitating the sample with a set volume of leachate water at a specific pH for 18 hours and measuring dissolved constituent concentrations in the resulting leachate. In the MWMP test, a fixed volume of water is slowly added to a column containing crushed rock over a 24-hour period to mimic exposure of mining materials to natural precipitation. The contact water is then analyzed to determine dissolved concentrations of constituents. MWMP results are often presented on Ficklin plots as the sum concentration release of a suite of six base metals plotted against pH to distinguish acid rock drainage from neutral mine drainage.

The SPLP and MWMP tests provide information on the concentrations of constituents that may be released to the environment by short-term meteoric rinsing (i.e., rainfall). However, these tests do not provide information on the dissolution rates as a result of longer-term weathering and oxidation processes. Understanding leaching rates is important for modeling projected changes to water chemistry associated with mining projects under various hydrologic and climatic conditions, and as mined materials are exposed to oxidation and weathering at surface. SRK employed the longer-term HCT to mimic natural weathering processes as samples are exposed to the environment and undergo progressive oxidation. In the HCT, the crushed rock sample is placed in a chamber and exposed to alternating cycles of dry and moist air each week (Figure 2). Leachate from the cell is collected regularly and analyzed for pH, conductivity, and dissolved constituents. HCTs are conducted for a minimum of 20 weeks, and SGP HCTs were run for over 100 weeks. Upon termination of the tests, residual material from the cell is examined petrographically to assess the degree of sulfide oxidation that took place during the test. Together, these testing procedures aid geochemists in prediction of potential environmental impacts associated with materials produced during mining operations.

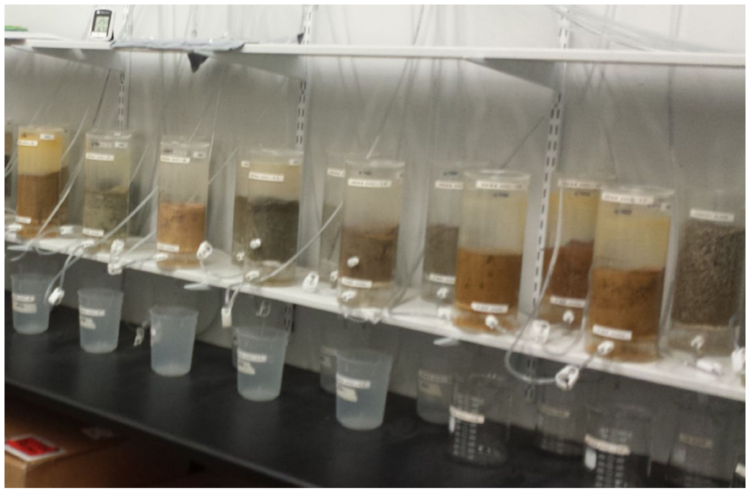


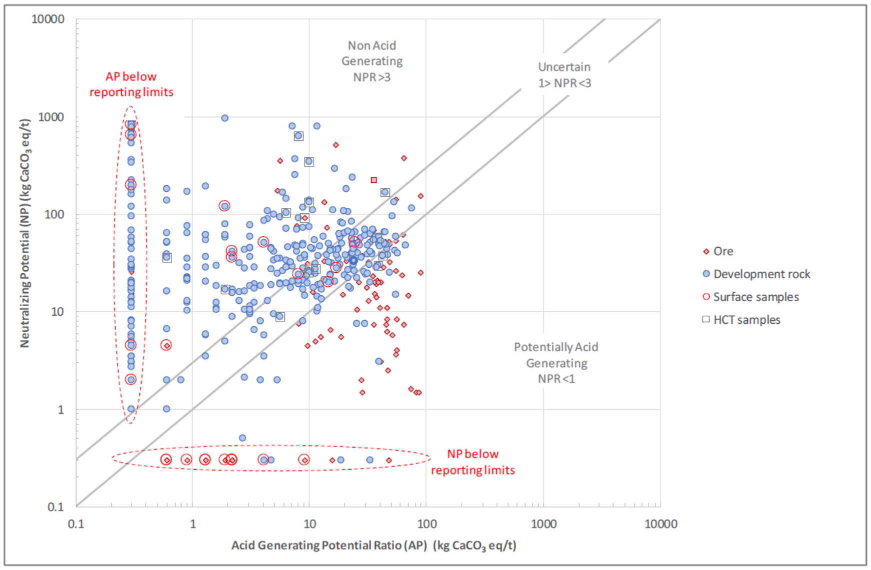
Figure 2: SGP Humidity cells at McClelland Lab, Reno, NV.

6 RESULTS

Based on the geochemical testing completed for the SGP geochemical characterization program, SRK has concluded that, without additional measures, the potential for acid rock drainage from the Project materials is generally low. The potential for metal leaching is also low with some exceptions, principally that arsenic and antimony may be leached from some materials at elevated concentrations, especially materials with ore-grade gold concentrations. These results should only be considered in the context of the broader mine plan and hydrologic framework, as discussed below. Overall, development rock has a low potential to generate acid, and less than 10% of the samples from Hangar Flats and Yellow Pine are classified as potentially acid generating (Figure 3), and only one of the West End samples (1%) was classed as potentially acid generating. Ore grade materials from Yellow Pine and Hangar Flats deposits show a higher potential for acid generation than development rock (these materials have higher sulfur contents); however, the objective would be to remove as much these sulfides as possible from these ore materials since the sulfides contain the economic value of the Project. Acid generation is not associated with carbonate host rock that occurs in the West End deposit. None of the HCTs included in the SGP geochemical characterization program developed acidic conditions and samples retained much of their initial neutralizing potential during the test as demonstrated by the termination tests (Figure 4), even after running those cells for up to seven times as long as the minimum testwork period required. Some constituents were leached under the neutral conditions including arsenic, antimony, aluminum, manganese, selenium, and sulfate. Of these constituents, SRK considers arsenic and antimony to be of principal concern as these are elevated in development rock; other metals are more benign or occur at less significant concentrations. These results are consistent with minimal development of acidic conditions onsite associated with legacy mining activities in similar rock units. These historical materials have been exposed to oxidation and weathering processes at surface for several decades but show minimal evidence of acid generation. Furthermore, existing surface water and groundwater in the Project area is neutral to alkaline and shows no evidence of acid generation from past mining operations. The geochemical characterization testwork results show that future mine materials are likely to behave in a similar manner and will primarily be non-acid generating.

Ore grade materials from Yellow Pine and Hangar Flats deposits have higher sulfur content and show a higher potential for acid generation than development rock. The ore grade material from the West End deposit is associated with carbonate host rocks and has a lower potential for acid generation in comparison to Yellow Pine and Hangar Flats. These ore grade materials will be removed, processed in the mill (where the sulfides will be removed and therefore substantially reduce the potential for acid generation and metal leaching), and deposited in the lined TSF.

The historical spent ore material from the SODA area is not expected to generate acid but may leach arsenic, antimony, and residual weak acid dissociable (WAD) cyanide remaining from prior operators. Similarly, the historical tailings are not expected to generate acid but have the potential to leach arsenic, antimony, manganese, selenium, and thallium. These materials will also be reprocessed in the mill to remove as much as possible of the contained metals before placement in the lined TSF, thereby largely eliminating this as a concern. The future mill tailings, post-metal recovery, that will be produced by the Project will be deposited in a fully-lined TSF. These tailings are predicted to be net acid neutralizing, but arsenic and antimony may still be mobilized under circum-neutral conditions expected in the TSF. Additional testing of this material is ongoing.



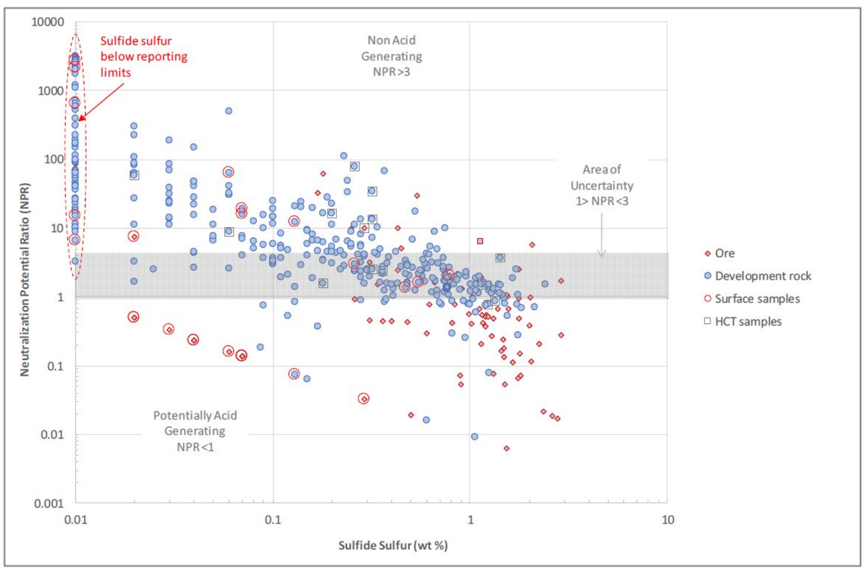


Figure 3: NPR vs AGP and Sulfide Sulfur for development rock and ore samples classified by gold content. Source: SRK SGP Baseline Geochemical Characterization Report (2017).

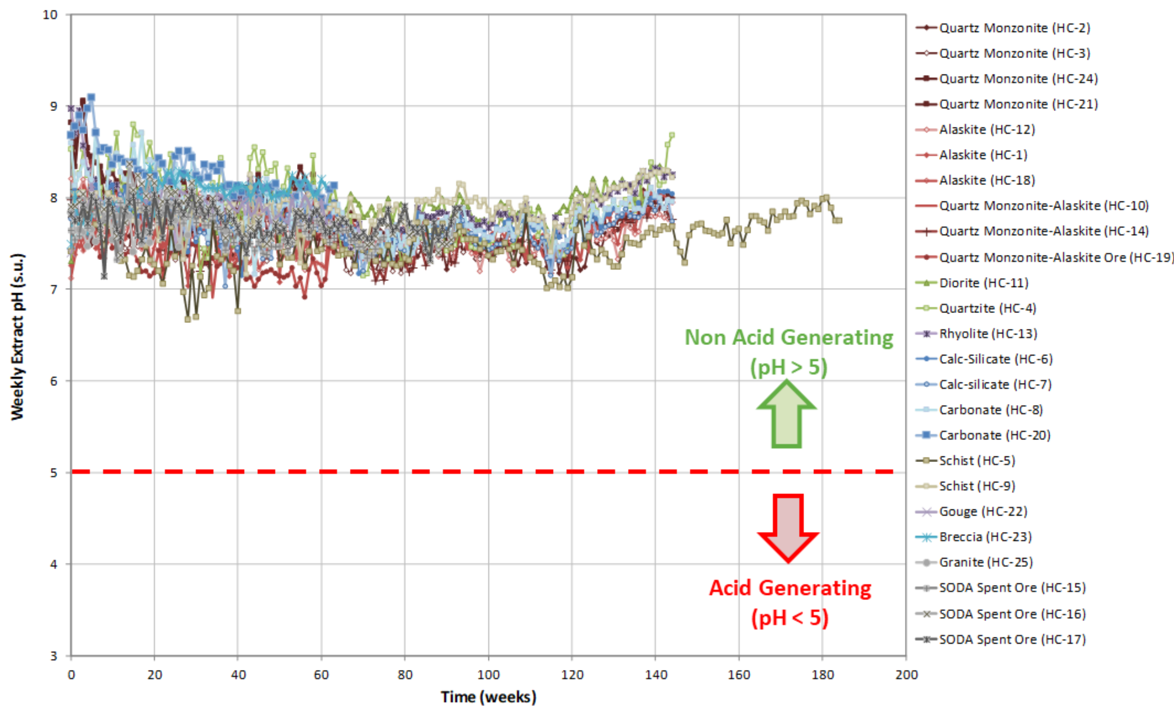


Figure 4: HCT pH results for development rock, ore and spent ore samples. Source: SRK SGP Baseline Geochemical Characterization Report (2017) and SRK SGP Phase 2 Humidity Cell Testing Update Report (2018)

7 WATER CHEMISTRY MODELING

The results of the geochemical characterization program and the baseline water quality monitoring data have been integrated with the hydrologic model, site-wide water balance model, SGP mine plan, and geological model to make predictions of water quality at various locations under existing conditions and associated with the Proposed Action. This modeling is the subject of the site-wide water chemistry (SWWC) existing conditions and Proposed Action reports; the latter is currently under review with the USFS NEPA team. Baseline water quality data are summarized in Brown and Caldwell's 2017 Water Resources Summary Report (WRSR). Generally, the potential metal leaching rates of different Project materials, as determined by the HCT program, were scaled from lab-to-field conditions based on tonnages of those materials estimated from the geology models and mine plan to determine overall metal leaching concentrations from various mine facilities under different hydrologic conditions, as simulated in the hydrologic model. Predictions of metal leaching from exposed pit walls were also made by scaling material surface areas exposed within each pit based on the geological model. Geochemical thermodynamic modeling software developed by the U.S. Geological Survey (PHREEQC) was used to model precipitation and adsorption reactions occurring between mineral phases in the contact waters. The resulting input (or "source term") from each proposed facility was then incorporated into the SWWC model according to the hydrologic model, site-wide water balance model, and seasonal adjustment factors to allow monthly predictions of water quality at multiple surface water locations throughout the Project area.

8 CONCLUSION

The SGP geochemical characterization program was designed to determine environmental characteristics of different rock types and mining products for environmental impact modeling and Project planning, and to compare and contrast with existing conditions. Exhaustive representative sampling of future and historical mining materials was performed by qualified consultants according to industry best practices. Analytical testing by certified laboratories following prescribed methodologies was conducted to assess potential for ML/ARD of Project materials. Test results have been incorporated into numerical models to predict changes to water quality associated with the Project. These water quality predictions are an important tool for regulators in the NEPA process. Not only does water chemistry modeling allow for the quantitative assessment of environmental impacts associated with the Proposed Action, but models also provide a means to objectively assess alternative design strategies should additional mitigation measures be implemented and to compare and contrast with the existing conditions in the area. This multiphase scientific process is fundamental to the success of NEPA in protecting the environment for future generations.