Resolution Copper Mining

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May 6, 2011

Via Certified Mail #
Return Receipt Requested

Arizona Department of Environmental Quality
Groundwater Section
Attn: LTF Application Clerk
1110 W. Washington St.
Mail Code: 5415B-3
Phoenix, AZ 85007

Re: Application for Individual Aquifer Protection Permit: Development Rock Stockpile

Dear Sir/Madam:

Resolution Copper Mining LLC (RCML) submits three copies of the enclosed Aquifer Protection Permit (APP) application and supporting information for the Development Rock Stockpile at RCML's West Plant Site. Also enclosed is a check (12405) in the amount of $1000.00 to cover initial APP application processing fees.

The information included in this document presents a general overview of the West Plant Site and the Development Rock Stockpile that provides supporting information related to the hydrogeology; the design, construction, and operation of the facility; discharge characteristics and other information required to support this application.

The application form and supporting information are bound together as a single submittal package. Please refer to Section 1.1 of enclosed document which provides a description of what is included in the full application package (including reference to the Permit Application Form). The completed application form is bound into the document just behind the cover page.

Please contact me at (520) 689-3254 if you have any questions regarding this application request.

Sincerely,

Casey McKeon, Ph. D.
Environmental Manager

REPORT

AQUIFER PROTECTION PERMIT APPLICATION

Development Rock Stockpile Project, West Plant Site, Superior, Arizona

Submitted To: Resolution Copper Mining LLC
102 Magma Heights
Superior, Arizona 85173

Submitted By: Golder Associates Inc.
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Distribution:
3 Copies – Resolution Copper Mining LLC
3 Copies – Arizona Department of Environmental Quality
2 Copies – Golder Associates Inc.

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List of Acronyms and Abbreviations

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
APP	Aquifer Protection Permit
AQL	Aquifer Quality Limit
ARS	Arizona Revised Statutes
AWQS	Aquifer Water Quality Standards
AZPDES	Arizona Pollutant Discharge Elimination System
BADCT	Best Available Demonstrated Control Technology
cm/sec	centimeters per second
CN	Curve Number
CP	Concentration Point
CPT	Cone Penetration Test
cy	cubic yards
ft-bgs	feet below ground surface
ft/day	feet per day
ft-msl	feet above mean sea level
ft/yr	feet per year
gpm	gallons per minute
GPS	Global Positioning Satellite
in/min	inches per minute
kV	Kilovolt
LEL	lower explosive unit
lin ft	linear feet
mbgs	meters below ground surface
mg/L	milligrams per liter
MSE	Maximum Saturation Event
pcf	pounds per cubic foot
PGA	Peak Ground Acceleration
PMF	Probable Maximum Flood
psf	pounds per square foot
psi	pounds per square inch
SCS	Soil Conservation Service
SPT	Standard Penetration Test
SRP	Salt River Project
VRP	Voluntary Remediation Program
w%	weight percent

1.0 INTRODUCTION

This report provides the necessary background information to support an Individual Aquifer Protection Permit (APP) application for a new Development Rock Stockpile at the Superior Mine, West Plant Site, in Superior, Arizona. The Development Rock Stockpile will receive materials from the development of a new underground mine. The new mine is in the prefeasibility study phase and currently involves excavating a new shaft (No. 10 Shaft) to underground areas not currently accessible from the ground surface. The No. 10 Shaft is located at the East Plant Site approximately six miles from the proposed stockpile location at the West Plant Site. Development rock will be mined at the No. 10 Shaft and brought to the Never Sweat Tunnel, where it will be hauled by underground train to the West Plant Site. The materials will then be loaded into haul trucks at the 500 Yard and placed at the proposed Development Rock Stockpile for permanent storage.

In addition to the information presented on the APP application form that precedes this section, this application will address the following elements:

- Best Available Demonstrated Control Technology (BADCT)
- Discharge characterization
- Hydrogeologic study
- Compliance with Aquifer Water Quality Standards (AWQS)
- Operational monitoring
- Technical capabilities
- Financial capabilities

Additional information regarding the site history and mining operation has been provided in Section 2.0, to provide a foundation for the information presented in the other sections.

1.1 Facility Location, Ownership, and Operation

The following information is provided in accordance with Arizona Administrative Code (AAC) R18-9-A201.A.

Name and Mailing Address of Applicant:

Resolution Copper Mining LLC
102 Magma Heights
P. O. Box 1944
Superior, Arizona 85273

Name and Mailing Address of the Owner of the Facility:

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P. O. Box 1944
Superior, Arizona 85273

Name and Mailing Address of the Operator of the Facility:

Resolution Copper Mining LLC
102 Magma Heights
P. O. Box 1944
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For correspondence concerning this Application, the facility contact is:

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Telephone Number: (520) 689-3254

Permit Technical Consultants:

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Tucson, Arizona 85705
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1.2 Environmental Permit Status

Resolution Copper Mining Limited (RCML) has obtained other environmental permits for facilities at the West Plant Site (Table 1-1). On February 22, 2007, the Arizona Department of Environmental Quality (ADEQ) issued Area-wide APP (No. P-101703) for closure of the historical APP-regulated facilities at the West Plant Site. An amended area-wide APP was issued on November 5, 2010. In addition, ADEQ has issued a Discharge Authorization under a Type 3.02 General APP pursuant to AAC. R18-9-D302 for the sludge-storage impoundments for the new mine dewatering treatment plant. In December 2010, RCML obtained a separate APP (No. P-10J823) for Outfall 002, the pipeline to discharge treated mine water to Queen Creek. Outfall 002 was also included in the renewal of RCML's Arizona Pollutant Discharge Elimination System (AZPDES) permit for Outfall 001, which was finalized in December 2010. On March 3, 2010, RCML and ADEQ met to discuss the transfer of oversight for the smelter-affected soil from the Area-wide APP to the Voluntary Remediation Program (VRP). The VRP accepted RCML's application for the transfer of oversight in May 2010.

1.3 Document Organization

The information required for this submittal is presented on the APP form, in Sections 1.0 through 13.0 of this document, and in the referenced tables, figures, and appendices. The information presented in this submittal is organized as follows:

- **Section 1.0 – Introduction** provides the facility location and ownership, a description of the Application, sources of information used in the Application, and the organization of this report.
- **Section 2.0 – Facility Description** summarizes the site history, provides an overview of the current mining operation, and describes the proposed Development Rock Stockpile and the permitted facilities affected by the project.

- **Section 3.0 – BADCT Demonstration –** presents the designs and BADCT demonstrations for the Development Rock Stockpile, the landfill, and Tailings Pond 7, which will be affected by the project.
- **Section 4.0 – Discharge Characterization** presents discharge estimates for the facilities affected by the Development Rock Stockpile. This section also summarizes the results of chemical characterization of solution that may eventually seep from the Stockpile.
- **Section 5.0 – Hydrogeologic Study** summarizes the geology and hydrogeology in the vicinity of the Development Rock Stockpile, based on information presented in previous studies as part of the Area-Wide APP No. P-101703.
- **Section 6.0 – Demonstration of Compliance with Aquifer Water Quality Standards** presents a demonstration that the Development Rock Stockpile will not cause or contribute to a violation of AWQS at the point of compliance.
- **Section 7.0 – Operational Monitoring** presents the proposed monitoring of the Development Rock Stockpile to demonstrate ongoing compliance with APP requirements.
- **Section 8.0 – Contingency Plan** presents the procedures that will be followed in the event of an unplanned discharge and those response measures that will be undertaken to address the discharge.
- **Section 9.0 – Closure and Post-Closure Strategies** summarizes the general strategies to close the Development Rock Stockpile and the long-term post-closure requirements.
- **Section 10.0 – Demonstration of Technical Capability** describes the technical capabilities of the organizations responsible for preparing the information presented in the Application, and includes a list of project personnel.
- **Section 11.0 – Demonstration of Financial Capability** describes the financial capabilities of RCML to effectively manage the operations of the Development Rock Stockpile and to manage closure/post-closure of the facility.
- **Section 12.0 – References** details all references cited in this Application.

Appendices A through K contain supporting documents for the geotechnical site investigation, engineering design, development rock characterization, discharge characterization, monitoring well inventory, and a demonstration of financial capability.

2.0 FACILITY DESCRIPTION

The RCML Superior Mine, West Plant Site (the site), is located in Pinal County, Arizona, directly north of the Town of Superior. The site boundary is illustrated on Figure 1-1. The site is located in Township 1 South, Range 12 East, Sections 34 and 35, and in Township 2 South, Range 12 East, Sections 3 and 4.

2.1 Site History

Mining of the Magma Vein, a quartz-sulfide ore body, occurred from the late 1800s through the 1940s at the West Plant Site and was followed by the discovery and mining of a carbonate replacement ore body to the east. Underground mining activities conducted from the late 1800s through mid-1996 produced approximately 26-million-tons of ore at the mine, out of which approximately 20-million-tons were tailings. About 6 to 7 million tons of the tailings were used in the underground workings as structural support and the remainder placed at the tailings facilities at the West Plant Site.

Approximately 200 acres of tailings generated from former milling operations are located at the West Plant Site. These facilities include Tailings Ponds 1/2, Tailings Ponds 3/4, Tailings Pond 5; and Tailings Ponds 6/7 (Figure 1-2). Tailings Ponds 1/2 were the original facilities used at the site for the disposal of mill tailings originating from the mining of the sulfide-rich Magma Vein. No information about the duration of active deposition is available; however, it is estimated that Tailings Ponds 1/2 have been inactive for at least 30 years. Because this facility was not operated after 1986, it is considered a closed facility under Arizona Revised Statutes (ARS) §49-102(7), and therefore exempt from APP closure requirements under ARS §49-250(B)(11). Tailings Ponds 3/4 also received tailings from the Magma Vein through the early 1970s, after which operation of that facility ceased. This facility is also exempt from APP closure requirements under ARS 49-250(B)(11). The locations of Tailings Ponds 1/2 and 3/4 are provided on Figure 1-2 for reference. The remainders of the tailings facilities were operated through the 1990s.

2.2 Current Operations

Current operations at the West Plant Site consist of closure of historical facilities (both APP and non-APP) and redevelopment of support facilities for the new mining project at the East Plant Site. Currently closed historical APP facilities include the 500 Yard Waste Rock Facility, Smelter Pond, Depot Pond, Settling Pond 2, and Tailings Pond 5. Currently closed historical non-APP facilities include the former upper basin stockpiles, the mill, and the houses and offices in the upper basin and smelter town.

Redevelopment consists of upgraded roads, water supply, electrical supply, laydown yards, and flood-control structures. The new flood-control structures include the Concentration Point (CP)-6 Berm at the mouth of Magma Wash and downstream channels and the CP-102 Berm just northeast of Tailings Pond 3/4. Redevelopment also includes the recently completed treatment plant for mine dewatering and the associated settling tank, equalization tank, sludge-storage impoundments, and pipeline.

Current operations also include borrow areas associated with closure and redevelopment (i.e., the clay pit, the silt ridge, the TP 3/4 borrow area, and the TP 5 borrow area). RCML is also producing limited quantities of coarse rock for erosion control from the former Rock Quarry at the West Plant Site, although RCML obtains riprap from the offsite Reymert Quarry.

In the future, the West Plant Site will continue to be redeveloped for support facilities for the new mining project at the East Plant Site. Warehouses, offices, rail yards, and similar support facilities may be located at the West Plant Site. However, no new mining will occur at the West Plant Site.

2.3 Development Rock Stockpile Summary

New mine operations are expected to produce both inert and reactive development rock. Currently, inert development rock is being placed in temporary stockpiles until the material is used for road construction or as structural fill at both the East and West Plant Sites. Reactive development rock will be stored in the proposed Intermediate Rock Stockpile and the Development Rock Stockpile, which is designed to have a total storage capacity of approximately 9-million-metrictons (tonnes). A general APP application for the Intermediate Rock Stockpile was submitted to ADEQ in December 2010. At this time, both reactive and inert development rock is anticipated to be placed in the Development Rock Stockpile. It is anticipated that the final distribution of development rock will be acid producing and all analyses presented in this application assume that the entire stockpiles consists of only reactive development rock. Table 2-1 provides a breakdown of reactive and inert rock to be placed in the proposed Stockpile on a yearly basis.

The Development Rock Stockpile will be located within the former Apex Wash drainage, which is now diverted to Silver King Wash by the Apex Wash Berm and Tunnel (Figure 1-2). The Stockpile will overlie both the existing landfill and Tailings Pond 7. The landfill is currently permitted by ADEQ to receive non-municipal solid waste and asbestos. Tailings Pond 7 is currently scheduled for closure as part of the Area-wide APP (No. P-101703). The Individual APP for the Development Rock Stockpile will incorporate both of these facilities. In addition, a Salt River Project (SRP) 115-kilovolt (kV) power line will have to be realigned around the proposed facility. RCML is currently in negotiations to have this power line realigned. At the end of the facility life, the closure of the Stockpile will also incorporate the closure of the landfill and Tailings Pond 7.

2.4 Permitted Facilities Affected by the Development Rock Stockpile

The Development Rock Stockpile will affect two permitted facilities:

- The landfill for non-municipal solid waste and asbestos waste, which is permitted under an individual APP separate from the Area-wide APP for the West Plant Site. This landfill will be buried by the Development Rock Stockpile, which will then serve as closure for the landfill.
- Tailings Pond 6/7, which is two contiguous tailings ponds permitted as a single entity under the Area-wide APP. Tailings Pond 7 (the smaller of the two tailings ponds) will be completely buried by the Development Rock Stockpile, which will then serve as closure

for the facility. Tailings Pond 6 will be affected by the Development Rock Stockpile differently at three stages of its approximately 9-year project life:

- During operation of the Development Rock Stockpile, but before closure of Tailings Pond 6, runoff from the Stockpile will flow to the current stormwater pool on the unclosed Tailings Pond 6. RCML manages this pool of impacted stormwater under an internal operational plan that requires periodic inspections. RCML also inspects it every month under the Area-Wide APP.
- During operation of the Development Rock Stockpile, but after closure of Tailings Pond 6, a small interim pond between the two facilities will receive runoff from the Stockpile. This potentially impacted runoff will not commingle with the unimpacted runoff from the top of the closed Tailings Pond 6.
- During the post-closure period for both the Development Rock Stockpile and Tailings Pond 6, unimpacted runoff from the Stockpile will flow to the closure channels on Tailings Pond 6, where it will commingle with the unimpacted runoff from Tailings Pond 6.

Although not a permitted facility, the Apex Wash Berm and Tunnel on the north side of the Development Rock Stockpile will continue to divert runoff from the Apex Wash watershed to Silver King Wash. RCML will continue to inspect and maintain the berm and tunnel as part of overall site operations.

3.0 BADCT DEMONSTRATION

The APP statutes require that an individual APP facility "be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology", or BADCT (A.R.S. §49-243.B.1). This section presents a BADCT demonstration for the Development Rock Stockpile and describes the geotechnical field investigation of the existing tailings, the laboratory testing results of the tailings, the selection of design parameters, the design of the Development Rock Stockpile, the stormwater controls, the slope stability analyses, and an engineer's cost estimate.

3.1 Geotechnical Field Investigation (Brown & Caldwell, 1999)

The active landfill is located immediately north of the east arm of Tailings Pond 6 and has been in use since approximately 1971. The landfill was characterized in August and September 1998 by Brown and Caldwell (Brown & Caldwell, 1999). Field surveys, comparison of historical and current topographic maps, and seismic refraction technology were used to estimate the landfill volume and define the areal extent and topography. Limited excavations were used to characterize the nature of the landfill materials.

In August 1998, a field survey was conducted to define the areal extent and topography of the landfill for surveying. The contact between native materials and fill materials was visually identified. The landfill surface and perimeter were then surveyed using a sub-meter Trimble Model TDC-1 Global Positioning Satellite (GPS) unit. Data obtained during the survey were plotted on an air-flown digital topography base map provided by RCML and then compared to pre-landfill topographical maps. After comparison of the existing landfill surface with the pre-landfill surface, the thickness of combined waste and cover materials for the active landfill was estimated and contoured.

As a check of the field-survey method used to define the landfill, a seismic survey of the landfill facility was conducted on August 24 and 25, 1998. The survey at the then-active landfill included four east-west lines and one north-south line that intersected all of the east-west lines. The north-south line was used to verify the seismic refraction survey. The results of geophysical survey were used to generate data files of calculated depths to bedrock along each of five seismic lines. The depth-to-bedrock interval is interpreted to include not only the landfill cover and waste materials, but also the alluvium that locally underlies the landfill materials, tailings that are locally intercalated with waste materials in the southern end of the landfill, and weathered bedrock (Gila Conglomerate). These materials constitute a layer exhibiting a similar seismic velocity. By contrast, the underlying unweathered Gila Conglomerate exhibited much higher seismic velocity. Hence, the shallow seismic layer is delineated by this seismic velocity contrast. The difference in thickness between the shallow seismic layer and the waste-cover layer is interpreted to comprise the combined thickness of alluvium, tailings, and weathered Gila Conglomerate that underlies the landfill materials.

Five trenches within and around the landfill were excavated to provide additional information on the types of materials present (Figure 3-1). Trenches ranged in length from approximately 11 feet to 37 feet and in depth from 6 feet to 15 feet. Three of the five trenches (1-1, 1-2, and 1-3) encountered waste materials. In each of these trenches, the bottom of the waste interval was not encountered, so the data could only be used to identify minimum waste thicknesses for these locations. In Trenches 1-1 and 1-2, the waste materials were covered with about 1-foot of sandy gravel. In Trench 1-3, a minimum of 7-feet of waste materials were identified underneath approximately 7 feet of tailings. Trench 1-4 encountered 2.7 feet of tailings extending from Tailings Pond 7, which were underlain by about 10 feet of alluvium that was, in turn, underlain by Gila Conglomerate. Trench 1-5 encountered 5.5-feet of alluvium underlain by Gila Conglomerate. Trenches 1-4 and 1-5 provide a southern limit to the areal extent of the landfill.

The types of waste were similar in all of the trenches that encountered waste. Based on the field observations during trenching, 85 to 90 percent of the waste materials consisted of mine timbers with associated metal straps, cables and wire, and miscellaneous wood and scrap metal. Other materials encountered included plastic pipes, tires, rope, and rubber hoses. Sandy soils and/or minor amounts of tailings were found intercalated with the waste materials. The most recent waste materials placed in the landfill, as observed at the time, consisted mainly of cardboard, paper, concrete, metal scraps, asbestos waste, and branches from trees and shrubs (Brown & Caldwell, 1999).

3.2 Geotechnical Field Investigation (Golder)

A site reconnaissance of the proposed Development Rock Stockpile was completed to evaluate ground conditions at the site and to provide background information for the development of a geotechnical drilling investigation. A geotechnical drilling program was implemented to evaluate the geotechnical properties of the tailings. Because access to Tailings Pond 7 was not possible at the time of the field investigation, the investigation took place Tailings Pond 6. Golder estimates that the materials in both tailings impoundments have the same or similar geotechnical characteristics. Therefore, the material properties obtained from Tailings Pond 6 provide suitable data for use in slope stability analyses.

3.2.1 Site Reconnaissance

A site visit was completed by Michael Grass, P.E., R.G. and Christopher Jester, E.I.T. (Golder) and Ian Edgar (RCML) on September 11, 2008 to evaluate Apex Wash upstream of the Apex Tunnel, Tailings Pond 6, and the area between the tunnel and Tailings Pond 6 (Figure 1-2).

The Apex Wash drainage is located to the north and east of Tailings Pond 6 in steep topography that is underlain by shallow bedrock. The drainage is bounded by the Apex Wash Berm, which routes stormwater through the Apex Tunnel and into a small drainage to the west. This drainage is a tributary to Silver King Wash.

Tailings Pond 6 lies within a north/south oriented drainage that has been filled with tailings. The tailings were discharged into the impoundment from a road located on the west side of the valley. Natural ground

generally consists of Gila Conglomerate bedrock and it is sparsely vegetated. There is a single high-voltage power line that crosses the site; however, the power lines span the valley and are located more than 50 feet above the tailings surface. Water typically ponds within the eastern arm of the facility and the tailings are soft. The area of Tailings Pond 7 was covered in water with no access available for a drill rig. Between Tailings Pond 7 and the Apex Berm is the landfill, which covers the entire bottom of the drainage.

3.2.2 Geotechnical Drilling

Eight boreholes, four Cone P-penetration Tests (CPT), and geotechnical core drilling were advanced at four locations into Tailings Pond 6 to complete the field investigation from July 28 through July 30, 2009. The locations of the boreholes are provided on Figure 3-2. The drilling locations were sited to provide a broad spectrum of information on the geotechnical and pore water conditions of the tailings.

The subsurface field investigation included geotechnical drilling, CPT, and laboratory testing of samples. Yellow Jacket Drilling, under contract to RCML, completed the hollow-stem auger drilling while Gregg Drilling, also under to contract to RCML, completed the CPTs. Golder staff engineer Christopher Jester was on-site to observe drilling and complete the boring logs.

The area is characterized as mine tailings overlying a sedimentary conglomerate. All borings were terminated at or no more than 0.5 feet below the tailings/Gila Conglomerate contact. The Gila Conglomerate is a coarse-grained conglomerate of coalescing and interfingering alluvial fans composed of material shed from the surrounding mountains and hills. The degree of cementation varies within the Gila Conglomerate; the unit is predominantly strongly cemented. This geologic unit was encountered at depths ranging from 47.5 feet below ground surface (ft-bgs) in boring BH-01 to 104 ft-bgs in boring BH-04.

Yellow Jacket Drilling completed the drilling using a CME-85 hollow-stem auger rig with a 4.25-inch drill bit at the four boring locations. Sampling consisted of Standard Penetration Tests (SPT) using a 2-inch split-spoon sampler, brass sleeves in a 3-inch Modified California sampler, and Shelby tubes. Samples were collected at 5-foot intervals.

Tailings deposits encountered in the boreholes were field classified as primarily mixtures of clay and silt. Deposits generally were soft with SPT blow counts between 1 and 7 (averaging 2) per foot and were moist to wet. Color ranged from gray to dark reddish-gray. The geotechnical boring logs are provided in Appendix A.

3.2.3 Cone Penetration Testing

Gregg Drilling completed the CPT drilling at the same four borehole locations, offset approximately 10 to 15 feet from the geotechnical drilling locations.

3.2.3.1 CPT Test Data and Results

The CPT drilling provides a continuous profile of tip resistance, sleeve friction, and pore pressure through the profile of the boring. This method allowed for detailed analysis of piezometric conditions within the investigation area. CPT drilling logs are provided in Appendix B. The CPT data were analyzed by Gregg Drilling and reviewed by Golder. A summary of the estimated undrained shear strength and depth-corrected SPT blow counts $N_{1(60)}$ is provided in Table 3-1.

3.2.3.2 Pore-Water Dissipation Tests

Pore-water dissipation tests were completed at intervals containing saturated tailings or in areas showing high dynamic pore pressure, as measured by the pore-pressure probe during the CPT drilling. The horizontal coefficient of consolidation was calculated from these dissipation tests. Pore-water dissipation graphs and calculations are provided in Appendix B. CPT testing data, like hydraulic conductivity, are also provided in Appendix B. A summary of the analysis is provided in Table 3-2.

3.3 Laboratory Testing Results

Samples collected during the geotechnical drilling included SPT samples stored in Ziploc™ bags for index tests; brass sleeve samples for natural density and moisture content; and Shelby tube samples for index, triaxial, direct shear, and consolidation testing. Golder's soils laboratory in Lakewood, Colorado, performed the geotechnical laboratory testing.

3.3.1 Index Testing

Index testing classified the tailings materials as clay, silty clay, and silt. In-place moisture contents ranged from 24.7 to 84.2 percent. Fines content (material passing through the #200 mesh sieve) ranged from 77 to 100 percent. The majority of the samples contained non- to low-plasticity fines, with samples identified as having plasticity indices between 2 and 15. Ten SPT samples were also tested for specific gravity to determine the phase relationship between water, soil, and air within the tailings and provided results ranging from 3.41 to 3.87. Index testing results are provided in Appendix C.

3.3.2 Natural Moisture Density

Testing of the brass sleeve samples provided in-place dry unit weights of 96.5 to 104.2 pounds per cubic foot (pcf) and moist unit weights of 129.1 to 136.7 pcf. Natural moisture density results are provided in Appendix C.

3.3.3 Triaxial Tests

Consolidated, undrained, triaxial shear tests with pore pressure measurements were completed on three samples extruded from the Shelby tubes. Each sample was consolidated at the effective stress each sample experienced in situ and was saturated with de-aired water. Each sample was sheared at a constant loading rate until approximately 20 percent of strain of the initial sample height was reached. The samples were used to develop the Mohr-Coulomb failure envelope (shear-strength envelope). The

first test was a two-point test using sample BH-01 at 40 feet and sample BH-03 at 25 feet. It provided an effective stress envelope of 33.0 degrees friction and 0.4 pounds per square inch (psi) cohesion. The total stress envelope provided values of 16.1 degrees friction and 1.9 psi cohesion. The second test was a three-point staged test with sample BH-04 at 10 feet, which provided an effective stress envelope of 36.4 degrees friction and 0.0 psi cohesion. The total stress envelope provided values of 17.1 degrees friction and 0.3 psi cohesion. Triaxial test results are provided in Appendix C.

3.3.4 Direct Shear Tests

Three direct shear tests provided shear strength data of the tailings material. The assembly of the tests consisted of extracting a 1-inch high, 2.5-inch diameter sample from the Shelby tube. The sample was then loaded to the specified normal stress and sheared at a rate of 0.04 inches per minute (in/min). Samples were inundated after consolidation and prior to shearing. The first test, sample BH-01 at 40 feet, was completed at normal stresses of 5, 10, and 20 psi. The results provided a peak shear strength of 366 pounds per square foot (psf) adhesion and a friction angle of 28.8 degrees; and a residual shear strength of 450 psf adhesion and a friction angle of 26.4 degrees. The second test, sample BH-03 at 25 feet, was completed at normal stresses of 10, 20, and 40 psi. The results provided a peak shear strength of 500 psf adhesion and a friction angle of 24.1 degrees; and a residual shear strength of 566 psf adhesion and a friction angle of 23.2 degrees. The final test, BH-4 at 10 feet, was completed at normal stresses of 10, 30, and 60 psi. The results provided a peak shear strength of 0.0 psf adhesion and a friction angle of 30.3 degrees; and a residual shear strength of 0.0 psf adhesion and a friction angle of 30.9 degrees. Direct shear test results are provided in Appendix C.

3.3.5 One-Dimensional Consolidation Testing

One-dimensional consolidation tests were completed on two Shelby tube samples to develop data for use in settlement analysis. Analysis of the consolidation test data indicated that the tailings are over-consolidated. Because the tailings are very soft, the overconsolidation ratio could not be accurately calculated from the laboratory test results; however, it was obtained from the CPT Test Data in Appendix B. Table 3-3 summarizes the consolidation properties for the tailings. One-dimensional consolidation test results are provided in Appendix C.

3.4 Stormwater Controls

3.4.1 Apex Wash Berm and Tunnel

The Apex Wash Berm and Tunnel protect the landfill and Tailings Ponds 6 and 7 against flooding from the 358-acre upgradient watershed. Drainages are incised in channels that are geologically controlled either by the competency of the local rock units or along structural controls (i.e. faults). The watershed is largely undisturbed, and runoff is diverted by the Apex Wash Berm into the Apex Tunnel, flowing west into Silver King Wash.

The Apex Wash Berm and Tunnel are needed indefinitely to prevent run-on to the Development Rock Stockpile and Tailings Ponds 6 and 7. Golder completed a geotechnical inspection of the tunnel and found that it is excavated into competent rock without significant rock discontinuities that would lead to roof or wall instability (Golder, 2004a). The Apex Wash Berm is an engineered embankment in good condition.

3.4.1.1 Hydrologic Analysis

The capacity of the Apex Wash Berm and Tunnel to convey runoff from various storms was evaluated with the *Hydrologic Modeling System* (HEC-HMS) software developed by the Hydrologic Engineering Center (US Army Corps of Engineers, 2008). HEC-HMS is a model that simulates the precipitation-runoff process of a watershed system. Input data for the HEC-HMS model consists of the watershed area, time of concentration, hydrologic curve number (CN), and precipitation depths.

The watershed area was delineated using the topographic map for the site. The hydrologic soil group for the site is D, which represents poor drainage conditions and is typical of areas with shallow bedrock. The curve numbers used for estimating hydrographs by Soil Conservation Service (SCS) methods (Natural Resources Conservation Service [NCRS], 1972 and The Mines Group, Inc., 2004) are the following: undisturbed desert brush is 85; disturbed desert brush is 89; and rock outcrop is 90. These CNs were weighted by the areal proportion of each type cover the watershed. The Apex watershed is delineated on Figure 3-3 and the acreage and weighted CN are summarized in Appendix D-1.

The SCS unit hydrograph (UH) model was selected for this study. The UH is a commonly used empirical model of the relationship between direct runoff and excess precipitation. The SCS UH model is a dimensionless UH in which the discharge is expressed by the ratio of discharge (q) to peak discharge (q_p) and by the ratio of time (t) to the time of rise of the UH, (T_p). The SCS UH requires input of lag time (t_{lag}), which may be related to the time of concentration (t_c) as $t_{lag} = 0.6\ t_c$. Calculations are provided in tabular format in Appendix D-1.

The SCS CN loss model was used to compute runoff volumes. The SCS CN model estimates precipitation excess as a function of cumulative precipitation, soil cover, land use, and antecedent moisture. The kinematic wave model was used to route channel flow. Shape and geometry of the channel cross section, length of the reach, slope of the energy grade line, and Manning's roughness coefficient "n" for each channel were required as inputs to the model.

Runoff hydrographs were developed for the following design storms:

- 100-year, 24-hour storm with a precipitation depth of 5.1 inches (The Mines Group, Inc., 2004).
- Maximum Saturation Event (MSE) with a precipitation depth of 8.75 inches, which is defined as successive storm events which have occurred from August 12 through 16,

1990 (Malcolm Pirnie, 1994). These events include a 35-year, 24-hour event (3.8 inches) immediately followed by a 12-year, 24-hour event (2.85 inches).

- ½ Probable Maximum Precipitation (PMP) 6-hour event resulting from 6.95 inches of precipitation. This storm event was developed using the methods described in Hydrometeorological Report No. 49 (National Oceanic and Atmospheric Administration [NOAA], 1984).
- ½ PMP 24-hour event resulting from 11.25 inches of precipitation. This storm event was developed using the methods described in Hydrometeorological Report No. 49 (NOAA, 1984).

The proposed design event for these facilities is the ½ PMF (Probable Maximum Flood) due to the high consequence of failure. High-risk facilities are defined as those of large size and where the failure might cause loss of life (i.e., more than a few); excessive economic loss; or excessive environmental damage. The Development Rock Stockpile, landfill, Tailings Pond 6, and Tailings Pond 7 are in this category. The PMF is the largest flood that can be expected, assuming complete coincidence of all factors that produce the heaviest rainfall and maximum runoff. As such, no return period can be assigned. The ½ PMF is consistent with engineering practice for closed structures of this size and type. The PMP hyetograph was estimated using the methods described in Hydrometeorological Report No. 49 (NOAA, 1984).

3.4.1.2 Hydraulic Analysis

Stage-storage and stage-discharge curves for Apex Tunnel were calculated to estimate freeboard for the different storms and are included in Appendix D-1. The stage-storage curve was developed from available digital topographic maps and covers the base of the tunnel to the crest of the Apex Wash Berm. The stage-discharge curve was developed using the computer program *HY8-Culverts* (HY8) developed by the Federal Highway Administration, Office of Engineering (FHA, 2007). The tunnel was simulated as a long box culvert. The flow area of the tunnel was restricted by approximately 40 percent to simulate partial plugging of the tunnel due to debris buildup either inside the tunnel or at the tunnel inlet. The stage-storage-discharge curve was then used within HEC-HMS to route stormwater through the tunnel and estimate the maximum water-surface elevation on the upstream side of the Apex Wash Berm. The available freeboard was calculated by subtracting the maximum water-surface elevation from the crest elevation of the berm.

The computer results indicate that the critical storm event for flow through the tunnel and freeboard on the berm was the 6-hour ½ PMF as shown on Table 3-4. The Apex Wash Berm did not overtop during the modeled storm events.

3.4.2 Run-on Diversion Channels

Perimeter channels have been designed around the Development Rock Stockpile to divert run-on from areas uphill of the Stockpile. Temporary channels will be cut into native soils and bedrock to collect and convey run-on to either the Apex Wash Berm and Tunnel or to Tailings Pond 6. The channels will not be constructed with riprap and will be erodible, but little erosion is expected because of the cemented Gila

Conglomerate. The perimeter channels will require regular maintenance and will be periodically moved to allow for expansion of the Stockpile to its ultimate footprint. Figure 3-3 provides the hydrologic sub-basins for each perimeter channel. Figure 3-4 provides a typical cross section of the proposed perimeter channels and a table describing the dimensions, excavation volumes, and the required flow capacity of each channel. All of the channels will maintain 1 foot of freeboard while conveying the peak flows resulting from the 100-year, 24-hour design storm event. The channels were designed using similar hydrologic and hydraulic calculations used in the evaluation of the Apex Berm and Tunnel. Detailed calculations are provided in Appendix D-2.

3.4.3 Stormwater Storage

Non-impacted run-on from uphill areas of the Stockpile, except the Apex watershed, as well as non-stormwater that has come into contact with the Stockpile, will be conveyed to Tailings Pond 6 where it will be stored and allowed to evaporate over time. The geotechnical field investigation determined that the tailings in Tailings Pond 6 has a low permeability, in the range of 3.0×10^{-6} to 1.0×10^{-9} centimeters per second (cm/sec), which will limit the infiltration of non-stormwater. During the first few years of operation of the Stockpile, stormwater from a portion of the West Plant Site will also be pumped to Tailings Pond 6 as needed. Once the remaining facilities at the West Plant Site have been closed, stormwater will be released as needed from the Indian Ponds (AZPDES Permit Outfall 001) rather than pumped up to Tailings Pond 6. Only stormwater from areas upgradient of the Stockpile and non-stormwater from the Stockpile will flow into Tailings Pond 6.

A water balance was completed to evaluate the volume of stormwater and non-stormwater that will run into Tailings Pond 6 during average climate conditions. Calculations were completed to estimate both stormwater from upgradient areas and non-stormwater that has come in contact with the Stockpile. Approximately 7,500,000 gallons of water per year (1,300,000 gallons of stormwater and 6,200,000 gallons of non-stormwater) will run into Tailings Pond 6 when the Stockpile reaches its maximum footprint area. Further explanation and detailed calculations are provided in Appendix I.

Tailings Pond 6 currently has a maximum storage capacity of approximately 141,126,000 gallons and will maintain a freeboard of 2 feet. The 100-year, 24-hour design storm event contributes 32,390,000 gallons of water to Tailings Pond 6. This leaves 108,736,000 gallons of capacity below the freeboard elevation for storage of runoff from the Development Rock Stockpile.

3.5 Deformation and Slope Stability Analyses

Finite element numerical analyses were performed to evaluate the Development Rock Stockpile, in terms of constructability and loading rates. The computer software package Geo-Studio 2007 Version 7.15 (GEO-SLOPE, 2009) was used to perform analyses, specifically the tools Seep/W, Sigma/W, and Slope/W.

During the evaluation, the existing soil stress and pore-pressure conditions were approximated on the model using available field and laboratory data from the present and previous studies (Golder, 2004b). Once the initial conditions were modeled, coupled stress-deformation/dissipation analyses were performed for the staged construction of the planned Stockpile using different loading rates at various time steps in order to optimize the stockpile loading rate and lift height without causing failure. Subsequently, limit equilibrium stability analyses were performed for the optimized Stockpile at each construction stage using the finite-element computed stresses.

The critical section, as shown on Figure 3-5, was used as the typical stability profile. It was generated perpendicular to the Stockpile outslope face and extended to cut through the existing Tailings Pond 6 embankment at its highest section. The profile and the results of the stability analyses are presented on Figure 3-6. Detailed outputs of the numerical analyses are provided in Appendix E.

3.5.1 Development of Model

The first step of the analyses was to approximate the initial stress conditions. Thus, a steady-state seepage analysis was performed using Seep/W to estimate the phreatic water surface within the Tailings Pond 6 embankment associated with the water levels measured from installed instrumentation in the embankment and an upstream water surface elevation at 2,950 feet above mean sea level (ft-msl). Once the pore-pressure distribution was estimated, an in-situ stress calculation was performed using Sigma/W to determine the initial soil stress-distribution.

Material properties were developed from available laboratory test data, engineering judgment, and available empirical correlations for similar materials (Fredlund and Xing, 1994; GEO-SLOPE, 2009). Figures 3-7 and 3-8 provide the hydrologic properties of the materials used in the analyses.

3.5.1.1 Deformation and Pore Pressure Dissipation

Once the initial stress and pore pressure conditions were approximated, Sigma/W was used to model the staged construction of the Stockpile. The soil consolidation at each stage was calculated using a fully coupled model, which required that both the stress-deformation and seepage-dissipation equations be solved simultaneously. Sigma/W's coupled consolidation analysis uses the principle of virtual work to find a solution at each finite element using incremental displacement and incremental pore pressure as field variables.

Table 3-5 and Figure 3-9 summarize the different material parameters used in the coupled deformation/dissipation analyses. As shown, all materials were modeled assuming an elastic-plastic behavior except for the tailings, which were modeled using the Modified Cam Clay theory (Atkinson and Bransby, 1978; Britto and Gunn, 1987). In the elastic-plastic model, the stresses are directly proportional to strains until the yield point is reached, beyond which the stress-strain curve is horizontal. The Modified Cam Clay model is a critical state model, as well as a hardening elastic-plastic model, and is better suited for soft compressible materials. It primarily differs from the elastic-plastic model in soil behavior after

yielding. The soil characteristics for the development rock, Gila Conglomerate, and embankment materials were obtained from previous site studies (AGRA, 1997; Dames & Moore, 1979) or estimated using available empirical correlations (Jaky, 1944; Duncan et al., 1980). The deformation and strength parameters for the tailings were obtained from the consolidation and triaxial testing for this application (Section 3.3).

3.5.1.2 Slope Stability

To evaluate slope stability, the finite-element-computed stresses at each stage and time step were imported into a limit equilibrium analysis using Slope/W. Since the stresses (σx), (σy), and (Txy) were known for each element, the normal and mobilized shear stresses were computed at the base mid-point of each slice. With these stresses available, the acting forces were integrated over the length of the slip surface to determine the factor of safety (FOS) for stability.

Minimum design requirements for operating a development rock stockpile at a conceptual level with regard to slope stability under static loading for FOS is 1.3 for short-term conditions and 1.5 for long-term conditions (ADEQ, 1998). Effective stress analysis was used to estimate the mobilized shear stresses of all materials, except for the undrained tailings, for which undrained strength analyses (Ladd, 1991) were used to account for consolidation strengthening of the material. The analyses focused on local and overall failure of the stockpile slope.

Soil characteristics for the development rock, Gila Conglomerate, embankment, and drained tailings materials were obtained from the present and previous site studies (AGRA, 1997; Dames & Moore, 1979) and were modeled using the Mohr-Coulomb failure criterion. Strength parameters for undrained tailings were estimated from the results of field and laboratory testing performed during the present study (Sections 3.2 and 3.3). Figure 3-10 shows the undrained shear-strength variation with respect to effective stress for each CPT location and the assumed undrained shear-strength envelope for the stability analyses. Table 3-6 summarizes the material properties used in the limit equilibrium analyses.

3.5.2 Results

The results of the finite-element analysis of the proposed Development Rock Stockpile are presented below. Appendix E includes the output files and figures from Geo-Studio 2007.

3.5.2.1 Loading Rate

The tailings in the vicinity of the proposed Development Rock Stockpile are soft, sensitive, low-plastic silts and clays based on index and strength testing results. Given that this material will serve as the foundation soil for the Stockpile, the loading rate and lift height will play a major factor in the overall stability during construction, in terms of disturbance level of the tailings due to development rock loading, consolidation, pore-pressure dissipation and stress conditions at each loading stage. Thus, in order to minimize the potential of foundation failure or collapse, the loading rate needs to be optimized.

A simplified model analyzed the loading rate and associated lift height using the proposed schedule shown in Table 2-1. The objective was to optimize the loading rate in terms of maximum ore lift height and number of lifts per year.

A 3-foot lift of development rock or imported fill was required to be placed initially to create a working surface and increase the bearing capacity of the foundation. The estimated maximum rate of rise for the following six lifts was 6 feet per year (ft/yr). Subsequently, the maximum rate of rise can be increased to 18 ft/yr using maximum lift heights of 9 feet. Table 3-7 summarizes the calculated maximum rate of rise of the Stockpile.

The production schedule shown in Table 2-1 will be accommodated according to this maximum loading rate. In the event that the development rock production schedule is modified, the use of smaller maximum lift heights could potentially offset an increase in rate of rise.

3.5.2.2 Overall Stockpile Slope Stability

Golder completed slope stability analyses to evaluate the overall and local stability of the Stockpile. The computer package SLIDE (Version 5.029) was used to conduct the stability analyses (Rocscience, 2008). Kinematically viable failure modes considered for this study include translational block failures and circular failure using the Bishop method (Bishop, 1955). This method is based on the principle of limiting equilibrium (i.e. the method calculates the shear strengths that would be required to just maintain equilibrium and then calculates a FOS by dividing the available shear strength by the shear strength required to maintain the stability). These analyses were used to determine FOS for circular and block failure surfaces under static and seismic loading conditions.

A pseudo-static analysis approach was used for the seismic loading case. With this method, a lateral force is added to a potential failure mass, with magnitude equal to some fraction of the weight of the sliding mass. Arizona Department of Transportation (ADOT) provides a Peak Ground Acceleration (PGA) of approximately 0.13g (where g is the force of gravity) for a 90 percent probability of not being exceeded in 250 years (Euge & Schell, 1992). Therefore, for this project, Golder chose a PGA of 0.13g. The fraction is defined in the form of a pseudo-static coefficient, which is typically assumed to be less than the PGA (0.13g) and is expressed as a percentage of gravity (Frankel, et al., 2002). A typical value for the pseudo-static coefficient is determined by taking two-thirds of the value of the PGA. A conservative value for the pseudo-static coefficient of 0.09g (0.13g × 2/3 = 0.09g) was used to model the earthquake loading.

The stability model consisted of development rock, Gila Conglomerate, alluvium (weathered bedrock), landfill material, and tailings. Each material type was represented by a subsurface distribution with the material properties presented in Table 3-6.

A Mohr-Coulomb failure envelope for the relationship between cohesion and friction angle was used for every material type. The minimum factors of safety obtained are shown in Table 3-8 and shown in detail on Figure 3-6.

The results show that the available shear resistance along all critical slip surfaces will be higher than the applied forces by factors of safety in excess of 1.3 and 1.5 for short- and long-term conditions, respectively.

3.6 Engineer's Cost Estimates

In accordance with AAC R18-9-203A, the engineer's cost estimates consist of the construction, operation and maintenance, closure, and post-closure costs, as detailed in the sections below. Appropriate to a permitting-level design, Golder has added 40 percent to all subtotal costs to cover indirect costs (e.g., mobilization/demobilization, oversight, taxes, etc.) and contingencies (e.g., unforeseen events). Quantities were estimated from the permitting drawings for applicable line items. Unit rates are typical of third party contractors currently working at the site, as compiled in Table 3-9.

3.6.1 Construction Cost Estimate

The construction cost estimate for the implementation of the designs for the Development Rock Stockpile is approximately $176,000, as shown in Table 3-10.

The line items listed in Table 3-10 are based on the following:

1. Excavation of 5,600 linear feet of channel with local disposal of excavated material (no export).
2. Construction of an access road 40 feet wide and 1,000 feet long with local use of excavated material (cut to fill).
3. Drilling, completion, and development of a 4-inch diameter monitoring well for a low-permeability formation (Gila Conglomerate) that requires a second mobilization for completion to allow adequate time for recovery to static conditions (based on Golder's past site experience).

3.6.2 Annual Operation and Maintenance Cost Estimate

The annual cost estimate for operation and maintenance of the Development Rock Stockpile during its nine year project life is approximately $63,000, as shown in Table 3-11.

The line items listed in Table 3-11 are based on the following:

1. One day per week for a foreman and pickup truck to inspect run-on diversion channels, stockpile slopes, water-storage elevations in Tailings Pond 6, condition of the Apex Wash Berm/Tunnel, and monitor stockpile material placement.
2. Five days per year of a two-man labor crew for brush removal and minor maintenance, including a pickup truck and wood chipper.
    2. Five days per year for one motor grader to maintain diversion channels and the access road.

3. One groundwater sampling event per quarter, consisting of one day for a pump rig, operator, and technician, plus laboratory analytical costs.

3.6.3 Closure Cost Estimate

The cost estimate for the implementation of the closure designs for the Development Rock Stockpile is approximately $5,774,000, as shown in Table 3-12.

The line items listed in Table 3-12 are based on the following:

1. Pre-cover grading of 54-acres of top surface, outslopes, and benches with one bulldozer (no ripping, less than 100-feet dozing) to achieve the final configuration; productivity of 2 acres per day; approximate duration of 27 days.
2. Production and placement of a 260,000 cubic yards (cy) of uncompacted vegetative cover (three feet thick), comprised of Gila Conglomerate from a local borrow area (includes drilling and blasting).
   2. Construction of approximately 7,000 linear feet of closure channels consisting (in typical section) of 1-foot of low-permeability material, geotextile, and 1-foot of riprap (low-permeability fill from onsite borrow area; riprap from offsite quarry).
   3. Grading of contour furrows with one bulldozer with ripper as seed bed preparation; productivity of 2 acres per day; approximate duration of 27 days.
   4. Revegetation via hydroseeding with a double application consisting of a desert seed mix and fertilizer followed by tackifier and mulch.

3.6.4 Annual Post-Closure Care Cost Estimate

The annual cost estimate for post-closure care of the Development Rock Stockpile is approximately $38,000, as shown in Table 3-13.

The line items listed in Table 3-13 are based on the following:

1. One day per month for an inspector and pickup truck to inspect run-on diversion channels, stockpile slopes, closure channels, condition of the Apex Wash Berm/Tunnel, cover conditions, and vegetation growth.
   5. Five days per year of a two-man labor crew for brush removal and minor maintenance, including a pickup truck and wood chipper.
   6. Five days per year for one motor grader to maintain channels and the access road.
   7. One groundwater sampling event per quarter, consisting of one day for a pump rig, operator, and technician, plus laboratory analytical costs.

4.0 DISCHARGE CHARACTERIZATION

In accordance with AAC R18-9-A202(A)(4), discharge characterization includes the discharge rate, volume, frequency, and location, as well as the chemical, biological, and physical characteristics of the discharge. This section describes discharge characterization, beginning with a summary of the geochemical characterization of the development rock in Section 4.1. This geochemical characterization data was then used to evaluate expected geochemical characteristics of seepage and discharge, as described in Section 4.2. The rate, volume, and frequency of discharge are then discussed in Section 4.3.

4.1 Development Rock Characterization

RCML started characterizing discharge in 2006 and it has been ongoing since that time. RCML contracted with Geochimica Inc. (Geochimica) in 2006 to characterize selected core samples collected by RCML during advancement of the Shaft No. 10 pilot hole, which is located near Shaft No. 9. The on-going geochemical characterization was based on the Arizona Mining BADCT Guidance Manual (ADEQ, 2008). Ninety-six samples from the Shaft No. 10 pilot hole were submitted for selected ADEQ-defined Tier 1 tests, which included acid base accounting (ABA), synthetic precipitation leach procedure (SPLP), and a Tier 2 test, total metals content. In addition, samples were submitted for net acid-generation (NAG) testing, with analysis of NAG effluent for metal's concentrations.

Based on this testing, Geochimica (2007) indicated that material derived below a collar depth of 1,633 meters below ground surface (mbgs) is considered geochemically reactive rock due to the following characteristics:

- Elevated sulfide concentrations, generally greater than one percent by weight (wt%) and ranging to above 20 wt%;
- ABA testing that indicates that the majority of samples are classified as potentially acid generating with negative net neutralization potentials (NNP) and net neutralization potential ratios (NPR) of less than one (Price, 2009);
- NAG test pH values of less than 4.5 standard units (su) for the majority of samples, classifying the samples as acid generating (INAP 2009);
- Elevated total metals content; and
- Leaching of some metals in short-term leaching tests (i.e., SPLP).

Given the considerations above, Geochimica (2007) recommended that materials below 1,633 mbgs be managed under the APP program. On January 5, 2007, Geochimica presented draft results to ADEQ in support of an inertness demonstration for development rock between the surface and 1,633 mbgs; the presentation also included results for the reactive rock below 1,633 mbgs. A report by Geochimica (2007) was submitted to ADEQ on January 31, 2007 and includes the initial Tier 1 and Tier 2 testing data, as described above. ADEQ responded on March 13, 2007, stating that Geochimica's demonstrations appeared adequate to demonstrate that development rock at depths above 1,633 m bgs were inert under

ARS §49-201, but that RCML should manage the development rock from depths greater than 1,633 mbgs under the APP program (ADEQ, 2007).

Following this, RCML contracted Geochimica to initiate kinetic testing, a Tier 2 test, for further evaluation of the geochemically reactive materials. A subset of five samples was submitted for humidity cell testing, four of which are materials from the Shaft No. 10 pilot hole collected below 1,633 m bgs. These tests are currently ongoing. Of these four tests, data were available at the time of this report for three tests through 52 weeks (tests 35, 36, 37) and through 65 weeks for one test (test 34). These initial results from this humidity cell testing are provided in this Application in Appendix G and Golder's preliminary evaluation of humidity cell test data to date is provided below in Section 4.2.2.

4.2 Evaluation of Solution Chemistry

In support of this Application, Golder performed a geochemical evaluation to provide preliminary estimates of water quality for:

- Seepage generated by percolation of meteoric water through the Stockpile and emerging from the toe and base of the Stockpile
- Seepage generated by percolation of meteoric water through the Stockpile and into the underlying Gila Conglomerate hydrostratigraphic unit

The geochemical evaluation included analysis of available laboratory testing data (described above in Section 4.1), supported by geochemical modeling and geoenvironmental models, to predict water quality. This evaluation focused on materials from below 1,633 mbgs, per the conclusions drawn by Geochimica (2007); therefore, only data pertaining to these materials is presented and discussed in this evaluation.

4.2.1 Approach

As described above, geochemically reactive materials from below 1,633 mbgs are expected to be acid generating in the long term, based on ABA and NAG testing. Long-term acidity is expected to be generated based on the sulfide contents and NAG acidity results. Following this, metals leaching is also expected under acidic conditions. Despite these results from the static tests, humidity cell tests on four samples of this material have not generated acidic conditions after 52 and 65 weeks of testing. Depletion calculations performed on the humidity cell tests (described in the following section) indicate that acidic conditions are expected in the future in the humidity cells given the rapid depletion of the neutralization potential (NP) relative to that of sulfur content. However, currently there is sufficient NP present to buffer any acidity generated from sulfide oxidation, resulting in a significant lag time before acidic conditions occur. As such, the humidity cell tests have not yet provided data that can be used to evaluate or estimate water quality expected during the acidic conditions predicted by the ABA, NAG, and depletion calculations. Humidity cell data to date, along with short-term leach data from the SPLP testing, provide an indication as to expected water quality during the lag period, prior to acidic conditions.

Given the lack of final kinetic test data, water-quality data from the NAG effluent testing can be used to evaluate water quality. In the NAG test, the sample is treated with hydrogen peroxide, which results in rapid oxidation and acid generation from available sulfides and subsequent buffering by the available NP. This rapid acid generation also results in the release of metals in the effluent. NAG effluents can then be used as a surrogate for worst-case chemistry or terminal water quality from a humidity cell. While use of the NAG data is not ideal, it provides a basis for conservative estimations of future water quality, given the current neutral humidity cell tests and expected acid-generation potential.

While the NAG test indicates the metals that may be released, actual concentrations released are affected by a number of complex factors, such as the water-to-rock ratio in the test relative to that expected in the field. Scaling from the laboratory test to the field is a challenge inherent to geochemical evaluations, as many scaling techniques often result in unrealistic concentrations. In this case, laboratory NAG concentrations have been scaled based on water-to-rock ratios, but with solubility constraints imposed through geochemical modeling. In addition, scaling has also been constrained using geo-environmental models. As noted by Geochimica (2007), the ore deposit is typical of a copper porphyry; therefore, water-quality data associated with other copper porphyries provide a realistic indication as to the future water quality that may be expected here.

Scaled NAG water qualities were then used to estimate water quality expected as seepage from the Stockpile. Water quality in the underlying Gila Conglomerate Aquifer was then evaluated by modeling the seepage in contact with expected geochemical conditions in the Gila Conglomerate (see Table 4-1). Evaluation of these water qualities is described further in the following Sections 4.2.3 and 4.2.4.

The modeling code used in this study, for both solubility control and mixing with Gila Conglomerate, is PHREEQC (version 2.17; Parkhurst and Appelo, 1999), an equilibrium speciation and mass-transfer code developed by the United States Geological Survey (USGS). This model is appropriate for this application because PHREEQC can be used to simulate mixing of waters, mineral precipitation and dilution, and interaction of waters with mineral surfaces. The MINTEQ (V4) thermodynamic database provided with the program was selected for this project. The MINTEQ database, compiled by the US Environmental Protection Agency (EPA) for the MINTEQ program and adapted for PHREEEQC, is considered by many in the geochemical and regulatory communities to be applicable for this type of application.

4.2.2 Analysis of Humidity Cell Testing

Golder evaluated the available humidity cell test data as a part of this application; however, this evaluation is considered preliminary because the humidity cells have not been terminated and are still generating pertinent data. A complete evaluation of the humidity cell tests is currently beyond the scope of this Application.

Four humidity cell tests are being performed on samples collected from below 1,633 mbgs from the Shaft No. 10 pilot hole. These sampled materials include:

- Test 34 – Cretaceous volcaniclastics (1,717 to 1,720 m bgs);
- Test 35 – Cretaceous detrital sediments/upper skarn developed in Paleozoic carbonates (1,844.1 to 1,846.6 mbgs);
- Test 36 – Annealed fault breccia/Cambrian Bolsa Quartzite (1,979.9 to 1,982.9 mbgs); and
- Test 37 – Precambrian diabase (2,053.8 to 2,056.8 mbgs).

Data for these four humidity cell samples are provided in Appendix G. Following 52 to 65 weeks of testing, effluent from these four humidity cells samples is circum-neutral to alkaline. As of weeks 52 to 65 (depending on the test), sulfate concentrations range from 35 to 263 milligrams per liter (mg/L) in the leachate, indicating that sulfide oxidation is occurring. However, the lack of acidic conditions indicates that sufficient NP is available to buffer the acid generation at this time. While the humidity cell samples are leaching major cations and anions, as well as metals, concentrations are low compared to the NAG effluent results.

Humidity cell tests were analyzed for the future potential for acid generation through depletion calculations. Depletion calculations were performed using effluent chemistry (sulfate, alkalinity, and acidity) compared to sulfur content and NP to determine relative rates of depletion of AGP (for which %S is considered a proxy) and NP. Depletion calculations were based on those presented in Morin and Hutt (2001).

Sulfate production rates were calculated for each cell via:

$$\frac{weekly\ sulfate\ in\ mg/L\ *\ (weekly\ volume\ leachate\ extracted/1000)}{sample\ mass\ in\ kg}$$

The cumulative sulfate loading rate was then calculated and $\%S_{remaining}$ was determined via:

$$\frac{\%S\ from\ ABA\ results - (weekly\ cumulative\ sulfate\ loading * \frac{\frac{32.06}{96.06}}{10{,}000})}{\%S\ from\ ABA\ results} \times 100$$

Similarly, remaining NP was determined empirically via:

$$\frac{NP\ from\ ABA\ results - (\frac{weekly\ cumulative\ open\ system\ NP\ consumption\ @\ \sim neutral\ pH}{1000})}{NP\ from\ ABA\ results} \times 100$$

As shown on Figures G-1 through G-8 (found in Appendix G), depletion rates of NP are clearly higher than those of total sulfur. As a result, it is expected that NP will be depleted in the humidity cells prior to completion of acid generation. When NP is depleted, acidic conditions are expected. Weekly values for pH and the carbonate molar ratio were also graphed for comparison.

4.2.3 Stockpile Toe Seepage

4.2.3.1 NAG Effluent

As noted above, Golder used NAG leachate data as a surrogate for "worst-case" or terminal chemistry from the humidity cell samples. While the NAG leachate data should not be taken as a replacement for the final kinetic testing results, these data may be used as an order-of-magnitude surrogate pending humidity cell results.

NAG testing and analysis of NAG leachate was performed on 39 samples representing five different lithologic units (Tables 4-2 and 4-3) from the Shaft No. 10 pilot hole. These NAG leachate data were combined into a composite NAG leachate based on the relative amount of each lithologic unit expected to be placed into the Development Rock Stockpile. To calculate the weighted average, NAG leachate data for each lithologic unit were averaged. Then the composite NAG leachate chemistry was calculated by weighting each lithologic unit based on the percentage of footage for each lithologic unit from the Shaft No. 10 pilot hole (from 1,633 mbgs downward). The average NAG leachate data for each lithologic unit and the composite NAG leachate data are show in Table 4-3. Copper, nickel, and zinc concentrations were not analyzed in the NAG leachates.

4.2.3.2 Scaling NAG Effluent

While NAG leachates may indicate a worst-case or terminal water quality due to instantaneous oxidation of available sulfides, the actual concentrations in the leachate are affected by the 100:1 water-to-rock ratio in the NAG test. This relatively high water-to-rock ratio is likely unrealistic of field conditions. Therefore, NAG leachate concentrations were scaled to better approximate field conditions using the geochemical model PHREEQC. The composite NAG leachate was speciated in PHREEQC and then scaled by removing water from the speciation, effectively reducing the dilution factor. This resulted in increased concentrations and a decreased pH. During scaling, geochemically credible reactions, particularly mineral precipitation, were allowed to occur, which provides solubility controls on the scaled chemistry. Geochemically credible minerals allowed to participate in the reactions are shown in Table 4-5, and were selected based on Nordstrom and Alpers (1999) and Golder's professional experience with environmentally relevant and credible minerals associated with mining.

The extent to which laboratory data should be scaled is a particular challenge in geochemistry. Actual concentrations and water-to-rock ratios in the field are a consequence of a range of factors, such as the volume of waste rock, waste rock grain size, placement configuration, gas exchange, weathering rates, preferential flow, temperature, and/or amount and timing of precipitation. Scaling of laboratory data frequently results in unrealistic concentrations of constituents, even with solubility controls, simply because laboratory tests cannot possibly replicate all of these conditions. A number of methods or adjustment factors have been applied in similar studies to further adjust scaled concentrations. However, in this case, Golder scaled concentrations to match chemistry associated with porphyry copper deposits as described by geo-environmental models. As noted by Geochimica (2007), the Superior Mine is a

classic porphyry copper deposit and a large body of data is available to evaluate expected water qualities. Plumlee (1999) provides geoenvironmental model data for a number of porphyry copper deposits; these data summarized in Table 4-4.

To obtain an estimated seepage chemistry based on the NAG effluent, the composite NAG leachate was scaled in PHREEQC (i.e., the dilution factor was reduced). Golder selected a scaling equivalent to a water-to-rock ratio of 10:1 because at this level of scaling, concentrations and pH for the estimated seepage were similar to those for the Globe, Arizona, porphyry copper deposit from Plumlee et al. (1999). The Globe, Arizona, sample was selected not only due to the geographic and geologic similarities to the Superior Mine expected, but also because this sample is one of the more conservative porphyry copper samples. The estimated seepage chemistry derived from the scaled composite NAG leachate is shown in Table 4-4, along with the original composite NAG leachate and data from Plumlee (1999). Model input and output files are provided in Appendix H-1.

4.2.4 Seepage into the Underlying Hydrostatic Unit

Advection of stockpile seepage into the subsurface was simulated with the intent of determining the number of pore volumes to exhaustion of acid-neutralization capacity, represented by the calcite content of the Gila Conglomerate. This was accomplished by simulating reactive transport of the estimated seepage through a cell representing the geologic matrix using the advection module of PHREEQC The advection function used in this simulation is one-dimensional ("plug" flow), and assumes no dispersion, diffusion, or other effects due to neighboring cells with immobile water. The geochemical conditions for PHREEQC speciations and advection modeling are provided in Table 4-5. This approach is simplistic, but provides an indication as to the attenuation capacity of the underlying Gila Conglomerate and an order-of-magnitude estimate of expected acidic breakthrough.

The Gila Conglomerate matrix was assumed to contain approximately 18 percent calcite based on an average of x-ray diffraction (XRD) analyses of Gila Conglomerate samples collected during drilling of the new point-of-compliance (POC) and alert wells (Golder, 2007a). Because PHREEQC does not simulate unsaturated flow, this cell was assumed saturated with Gila Conglomerate groundwater. Groundwater chemistry from well MCC-6C (Table 4-6) was used to represent native groundwater. The water-quality sample from this well was collected in March 2007 (Brown & Caldwell, 2007). The analytical data was equilibrated with the assumed aquifer solids content (i.e., Gila Conglomerate calcite content) prior to the advection model.

As the seepage is advected through the cell, it reacts with calcite present in the cell. Geochemical conditions for this modeling, including minerals allowed to precipitate and dissolve during the simulation, are provided in Table 4-5. Due to a lack of iron mineralogy data, and given the simple nature of the model and approach, adsorption onto iron oxides/oxyhydroxides was not modeled and provides a conservative water-quality result. Alkalinity, pH, the saturation indices of selected mineral phases, and

total concentrations of select constituents were tracked with each advection step. Model inputs are provided in Appendix H-2

Upon exhaustion of calcite in the aquifer, seepage from the Stockpile is expected to move without significant neutralization of pH or attenuation of metals. This is consistent with experience at other sites (e.g., Stollenwerk, 1994). The simple advection model used here estimates 73 pore volumes will be required to deplete the calcite, given Gila Conglomerate properties. Beginning with pore volume 74, the model predicts the pH will drop, and will remain below neutral for the extent of the model.

Overall, these results indicate that significant time will be required for discharge of acidic, high-metals seepage from the Stockpile based on two factors. First, a lag time for acidification to occur is expected based on humidity cell testing. Second, geochemical modeling using scaled NAG leachates as a proxy for seepage indicates that over 70-pore volumes would be required to deplete the neutralization and attenuation capacity of the Gila Conglomerate. Given the long travel times predicted in the groundwater model (see Section 5.0) in the Gila Conglomerate at the site, this translates to a significant period of time. Model outputs are provided in Appendix H-3.

4.3 Discharge Rate

To estimate the rate of discharge of non-stormwater from the Development Rock Stockpile, a water-balance model was developed. The water-balance approach was designed to evaluate net monthly loss, or accumulation of water, during average mine and climate conditions. Table 4-7 provides the average monthly precipitation and pan evaporation used for the water-balance model (RMCL, 2010). In addition, if the model calculated a net monthly accumulation of water, then a discharge rate was calculated for the base of the Stockpile. Any surface water runoff was collected and conveyed to Tailings Pond 6. The simulation of the Stockpile water balance was prepared using an Excel™ spreadsheet program. Deterministic analysis was performed on a monthly basis for a typical annual mine operation. All input data used in the water-balance model for the Development Rock Stockpile were based on information provided by RCML (2010), other approved sources, or similar projects performed by Golder in the southern region of Arizona.

The Average Year scenario was evaluated for this project analysis, which includes the average precipitation, the average evaporation, and normal mine operations. The climatic data (precipitation and evaporation) for the project is from RCML (2010). The deterministic water-balance spreadsheet is structured to present annual data on a monthly basis from the following categories: variables used in the water-balance; precipitation and evaporation input data; area and ore loading input data; inflow volume calculation data; outflow volume calculation data; and net water-balance. The variables used in the water-balance model pertain to the design parameters (precipitation and evaporation), loading of ore on the Stockpile, physical geometry of the Stockpile, and ore characteristics.

The water-balance model for the Development Rock Stockpile indicates that, for average production and climate conditions, there will be a net loss of water for each month modeled, with the exception of approximately 206,500 gallons that infiltrates in year five and approximately 51,396 gallons in year nine of operation. The results of the water balance by year are summarized in Table 4-8. A net water loss in the system indicates that either water is captured as runoff in the perimeter channel or is absorbed into the Stockpile without discharging to the aquifer. A net water gain would indicate excess rainfall that infiltrates through the Stockpile and would eventually infiltrate to the aquifer. The detailed water-balance calculations are provided in Appendix I.

5.0 HYDROGEOLOGIC STUDY

A hydrogeologic study of the West Plant Site was completed in 2008, and is described in detail in the amended groundwater modeling report submitted to and approved by ADEQ (Golder, 2008). This section provides a summary of the earlier study, with an emphasis on the hydrogeologic conditions in the vicinity of the proposed Development Rock Stockpile. This section also summarizes groundwater quality in the vicinity of the proposed Development Rock Stockpile, based on groundwater-quality data collected as part of the Area-wide APP for closure.

5.1 Regional Geology

The Superior Mine lies near the eastern edge of an alluvial basin extending west along the Queen Creek Drainage. The eastern edge of the basin is bounded by the Apache Leap, which rises to an elevation of 4,600 feet. Mineralization of the east-striking Magma Fault occurred during the Laramide Orogeny (late Cretaceous through early Tertiary), which created the Magma Vein (MV) discovered in 1875. Replacement orebodies, occurring in Paleozoic limestones east of the MV as mantos, have also been mined (Brown & Caldwell, 1999).

5.1.1 Structural Geology

Numerous northerly and east-west-trending faults are evident in the Precambrian, Cambrian, and Paleozoic rocks in the Superior area (Figure 5-1). The Grand Canyon Disturbance, a deformational event that occurred at the end of the Precambrian, resulted in uplifting and tilting of the crust and widespread intrusion of diabase sills throughout the Superior area (Wilson, 1962). Peterson (1962) identified a north-trending structural belt in the Globe-Miami and Superior mining districts that marks a zone of weakness that is believed to have originated in Precambrian time. Associated with this zone of weakness is the formation of several north- to northwest-trending faults and the eastward tilting of stratified rocks. The major fault expressed in this zone is the Concentrator Fault, which extends for more than 10 miles along the base of the Apache Leap escarpment (Figure 5-1) and has an offset of approximately 1,600 feet near the Superior Mine (Kuhn, 1942).

The Main Fault, a synthetic fault to the east of the Concentrator Fault, exhibits rotational displacement and terminates against the Concentrator Fault in the Queen Creek Drainage (Figure 5-1). Offset on the Main Fault is approximately 900 feet near the mine (Kuhn, 1942). The block between the Concentrator Fault and the Main Fault contains several synthetic and antithetic faults.

The next significant structural event following the Grand Canyon Disturbance was the Laramide Orogeny, which occurred from the Late Mesozoic to Early Cenozoic Eras. The Laramide Orogeny involved regional-scale thrust faulting and folding, producing large northeast-trending vertical block uplifts and associated east-west faulting. The Magma Fault, an east-west-trending fault that hosts the MV, was formed during this event. Approximately four or five of the faults are pervasive along the western edge of the orebody, from the land surface to the 4,400 ft-bgs level. With the exception of the faults along the

western edge of the orebody, the majority of the faults offsetting the MV do not extend more than 100 or 200 feet (Kuhn, 1942).

Finally, the Basin and Range Orogeny (early Miocene to Pleistocene) resulted in extensional faulting that reactivated ancestral north-trending faults, produced several en echelon faults, and resulted in offsets ranging up to several thousands of feet (Wilson, 1962). The Basin and Range Orogeny formed the Basin and Range Province, which is characterized by elongated fault-block mountain ranges trending northwest to southeast separated by broad alluvial basins. Regional uplift and erosion have resulted in the deposition of alluvium and basin-fill deposits seen at the West Plant Site in the basin west of the Concentrator Fault (Brown & Caldwell, 1999).

5.1.2 Stratigraphy

Deposits in the Superior district range from Precambrian metasedimentary deposits to Quaternary alluvium. A generalized stratigraphic column representing the Superior area geology is presented on Figure 5-2. Deposits east of the Concentrator Fault consist of Precambrian schist, diabase, quartzite, basalt, and limestone (Apache Group) overlain by Cambrian and Paleozoic sedimentary rocks, Tertiary Volcanics (Apache Leap Tuff), and Tertiary and Quaternary Alluvium. Deposits west of the Concentrator Fault are Tertiary-Quaternary basin-fill deposits consisting of moderately to well consolidated conglomerates (Gila Conglomerate at the West Plant Site) interbedded with fine-grained silts and sands, lava flows, volcanic ash, and mudstone (interbedded in the Gila Conglomerate at the West Plant Site) (Brown & Caldwell, 1999). The Quaternary Alluvium lies on top of the Gila Conglomerate at the southeastern edge of the West Plant Site and extends to the east beneath Superior. It derives from the bedrock upstream of the Concentrator Fault and was deposited as an unconsolidated alluvial fan (Figure 5-1).

5.1.3 Ore Deposition

Ore deposition in the Superior area was initiated during the latter part of the Laramide Orogeny and ended prior to the Basin and Range Orogeny. The Concentrator Fault is not mineralized, and no mineral deposits are known to exist west of the Concentrator Fault. It is believed that the ancestral Concentrator Fault system controlled the orientation of the Magma orebody and acted as a natural barrier to the westward migration of ore fluids in the Superior area (Hammer, 1989). It was further determined that the permeability and porosity of the formations controlled the deposition of ore fluids east of the Concentrator Fault (Brown & Caldwell, 1999).

5.2 Site Geology

A cross section of the West Plant Site geology with hydrogeologic features is shown on Figure 5-3. The Concentrator Fault forms the northeastern geologic and hydrogeologic boundary of the West Plant Site. Much like the depositional environment of the orebody to its east, the Concentrator Fault likely acts as a barrier to groundwater movement from the northeast.

Three geologic units underlie the site: Gila Conglomerate, mudstone unit, and Quaternary Alluvium. The Gila Conglomerate extends from the Concentrator Fault to the western and southern boundaries of the site. As described by Peterson (1969), the Gila Conglomerate was deposited in a broad alluvial basin and consists of gravel and conglomerate stream deposits derived from older rocks. It contains pebbles, cobbles, and boulders that range from angular to subrounded. The matrix is coarse, poorly sorted arkosic sandstone that varies from well consolidated to poorly consolidated and has crude to well-defined bedding. The Gila Conglomerate is often observed to contain interbedded mudstone, and a mudstone unit lies near the surface in the southwestern portion of the site. Both the Gila Conglomerate and the interbedded mudstone are well consolidated and thus very dense at the West Plant Site. Overlying the Gila Conglomerate along the southeast is the Quaternary Alluvium, which Peterson (1969) described as sand and gravel deposits in partly enclosed basins or along streambeds. The materials are generally unconsolidated. The areal extent of the Quaternary Alluvium is shown on Figure 5-1.

The main hydrogeologic unit at the West Plant Site is primarily Gila Conglomerate. Minor Quaternary Alluvium is present along the washes and along the southern perimeter of the West Plant Site (Golder, 2008).

5.3 Hydrogeologic Setting

Groundwater occurs mainly within the Gila Conglomerate, and, in places, within the Quaternary Alluvium (Golder, 2008). A thick (up to approximately 630 feet) sequence of mudstone (designated the Mudstone Unit) occurs within the Gila Conglomerate. The Mudstone Unit is believed to limit groundwater movement vertically, and also to hydraulically separate the Gila Conglomerate lying below the mudstone from the Gila Conglomerate lying above the mudstone (Golder, 2008). The Mudstone Unit underlies the southern one-half to two-thirds of the site and extends from near the southern edge of Tailings Pond 6 to the southern perimeter of the West Plant Site. The Mudstone Unit rises to near, or at, land surface along the southern perimeter of the West Plant Site, thinning the overlying Gila Conglomerate.

The geology of the West Plant Site was previously subdivided into four hydrostratigraphic units, largely based around the presence of the mudstone (Golder, 2008). The hydrostratigraphic units included:

- Unconfined Gila Unit, defined as the Gila Conglomerate in areas not separated by the mudstone;
- Shallow Unconfined Gila Unit, defined as that portion of saturated Gila Conglomerate that overlies the mudstone;
- Confined Gila Unit, defined as that portion of Gila Conglomerate which is overlain by the mudstone; and
- the Mudstone Unit.

These four hydrostratigraphic units are used below to further describe the nature and occurrence of groundwater at the West Plant Site. The Development Rock Stockpile is located above the unconfined Gila Conglomerate Unit.

5.4 Groundwater Elevations, Flow Direction, and Depths

The modeled groundwater elevations beneath the facility range from approximately 2,940 to 3085 feet amsl. Groundwater monitoring wells located within 1/2 mile of the proposed Stockpile are shown on Figure 5-4, summarized in Table 5-1, and the well construction information is provided in Appendix J. Contours of groundwater from measured data are shown on Figure 5-5. Groundwater beneath the facility is anticipated to flow south-southwest within the Shallow Unconfined Gila Unit. The horizontal hydraulic gradient in the Shallow Unconfined Gila Unit the along Apex Wash is estimated to be approximately 0.023 feet per foot.

Sources and potential sources of groundwater recharge in the vicinity of the facility include infiltration from precipitation and surface water run-on, and from potential seepage from Tailings Pond 7 and the proposed Stockpile. Eventually, groundwater in the Shallow Unconfined Gila Unit is anticipated to discharge to the surface in the lower reaches of Apex Wash, where it is essentially removed from the groundwater system through evapotranspiration (ET). Some of this groundwater probably discharges southward into the alluvium, where it continues to flow to the south/southwest, and is at least partially removed via ET.

Estimates of the West Plant Site water balance based on Darcy Law calculations indicate that very little groundwater is flowing through the system (less than 5 gallons per minute (gpm)) above and below the mudstone (Golder, 2007b). Also, estimates of groundwater and conservative-constituent velocities through the Gila Conglomerate units above and below the mudstone were estimated as slow – on the order of a few feet or less per year. Using the calibrated numerical model developed for the West Plant Site (Golder, 2008), approximately 4 gpm of groundwater is estimated to flow across the site and the property boundary to the south and southwest in the Shallow Unconfined Gila Unit. Groundwater flowing beneath the mudstone across the site to the south is likewise estimated using the model at a rate of 0.25 gpm (Golder, 2008). These updated estimates supersede the estimates presented previously (Golder, 2007b), and indicate that the volume of groundwater leaving the site is notably small.

5.5 Hydraulic Characteristics of Geologic Materials

A major characteristic of the groundwater flow system at the West Plant Site is that the hydraulic conductivities (K) of the hydrostratigraphic units are low, with the exception of the alluvium. Hydraulic conductivities were estimated from aquifer tests and presented in the amended groundwater modeling report (Golder, 2008). The hydraulic conductivity of the alluvium is 9.64 by 10^{-2} feet per day (ft/day) (3.4 by 10^{-5} centimeters per second [cm/sec]). The hydraulic conductivity of the Gila Conglomerate, not including the Mudstone Unit, ranges from 7 by 10^{-2} ft/day (2.5 by 10^{-5} cm/sec) to 9.9 by 10^{-5} ft/day (3.5 by 10^{-8} cm/sec) with a geometric mean of 1.7 by 10^{-3} ft/day (6 by 10^{-7} cm/sec). There are two shallow wells with higher K estimates (MCC-9 and GAI-02-02) compared to the K values of all of the other wells located within the Gila Conglomerate (Golder, 2008). The hydraulic conductivity of the Mudstone Unit has been estimated as 3.7 by 10^{-6} ft/day (1.3 by 10^{-9} cm/sec).

5.6 Numerical Model

A three-dimensional, steady-state, numerical model was constructed to represent the groundwater system of the West Plant Site (Golder, 2008). The purpose of the model was to develop a tool that can be used to assess the current groundwater conditions, including groundwater transit times to wells, and potential long-term groundwater conditions following closure.

The model was created with the processing package Groundwater Vistas™, and simulations were run using MODFLOW-SURFACT, an advanced version of the widely used and accepted modeling software MODFLOW (Environmental Simulations, Inc., 2007; HGL, 2006; and McDonald and Harbaugh, 1988). The advanced properties of MODFLOW-SURFACT, namely the ability to simulate variably-saturated conditions above a fluctuating water table in a continuum manner, coupled with the ability to simulate seepage face conditions anywhere the water table meets land surface, were particularly well-suited to simulate groundwater movement through the low-K hydrostratigraphic units of the West Plant Site, especially the alluvium at the southern portion of the West Plant Site, where groundwater daylights.

The model area extends outward from the West Plant Site to Silver King Wash, Arnett Wash, and the Concentrator Fault (Golder, 2008). The model vertically represents the hydrostratigraphic units from the alluvium through the Gila Conglomerate to the inferred base of the alluvial basin. The model has seven layers to represent the different hydrostratigraphic units and the observed variations in hydraulic conductivity.

Hydraulic stresses simulated in the model included: recharge (regional infiltration and surface water run-on); seepage from the Indian Ponds, Smelter Pond, Settling Ponds 1 and 2, Tailings Pond 6, and Tailings Ponds 1 and 2; ET; discharge to land surface along drainages or topographic lows; and downgradient discharge were included in the model, and are further described in the modeling report (Golder, 2008). Details of the model development and calibration are provided in the modeling report (Golder, 2008).

5.7 Groundwater Quality

The groundwater at the West Plant Site generally meet AWQS, as described in the groundwater assessment and model workplan (Golder, 2007b). Exceptions primarily include arsenic and fluoride from a few of the wells, which Golder believes to be naturally occurring. There are also occasional samples that exceed the AWQS for antimony, cadmium, lead, nickel, selenium, and thallium. None of these exceedances appear to be attributable to mining activities; however, analysis of the major ion chemistry of the groundwater on-site indicates that some of the groundwater, primarily in the Shallow Unconfined Gila Unit downgradient of mine facilities and in the well installed in the alluvium, has been impacted by the oxidation of sulfide/gypsum dissolution, a common occurrence in base metal mining operations.

A geochemical analysis was undertaken to estimate the potential rate and extent of impacted groundwater migration away from the tailings ponds (Golder, 2008). The analysis incorporated the

potential source water chemistry (tailings pore water), the buffering capacity of the geologic media, and the estimated groundwater volumetric flux derived from the numerical groundwater flow model. The analysis indicated that even if the tailings pore water became acidic in the future, the volumetric fluxes within the Gila Conglomerate and its high buffering capacity will effectively arrest expansion of the acidic water within a few to several feet from the Stockpile. Specifically, the analysis indicates that the postulated acidic water could travel between 0.2 to 105 feet after 1,000-years. The results further suggest that post-closure monitoring may not be required, because the theoretical duration of post-closure monitoring would extend in perpetuity, given the exceedingly slow rate of groundwater movement.

6.0 DEMONSTRATION OF COMPLIANCE WITH AQUIFER QUALITY STANDARDS

The APP rules require that an applicant demonstrate that a discharging facility either "will not cause or contribute to a violation of AWQS at the applicable point of compliance" (AAC R18-9-A202.A.8.a) or, if an AWQS has already been exceeded at the time of issuance of the permit, that "no additional degradation of the aquifer will occur as a result of the discharge from the proposed facility" (AAC R18-9-A202.A.8.b). The required components of the AWQS demonstration, including the hydrogeologic study, discharge impact area evaluation, proposed POC, and proposed monitoring requirements are presented in the following sections.

The AWQS demonstration for this Application was performed by comparing the estimated discharge rate from the existing facilities and the proposed Stockpile, and evaluating potential changes in groundwater flow direction or chemistry from the Development Rock Stockpile. The AWQS demonstration is presented below, followed by a discussion of the Pollutant Management Area (PMA) and the POC.

6.1 AWQS Demonstration

The AWQS demonstration is presented below, followed by a discussion of the PMA and the POC. The discussion of the demonstration of compliance with AWQS is organized as follows:

- Material characterization
- Potential for discharge
- Potential flow paths
- A demonstration of compliance with AWQS

To characterize the development rock, 96 samples were collected and analyzed from the Shaft No. 10 pilot hole. All 96 samples underwent ADEQ-defined Tier 1 testing and total metals analysis (Tier 2). Based on this analysis, it was determined that material derived below 1,633 mbgs (i.e., the material planned to be placed on the Stockpile) are geochemically reactive rock that need to be managed under the APP program (Geochimica, 2007). In summary, the characterization indicated that most of the material below 1,633 m bgs:

- have a negative net-neutralization potential (from ABA)
- Total metals concentrations are elevated
- Sulfide concentrations are elevated (>1 wt%)

To assess the potential to discharge, all the reactive rock samples were analyzed using static leaching test (SPLP) and a subset of five representative reactive rock samples are currently being analyzed using kinetic tests (humidity cell tests). Additionally, to simulate anticipated leachate from complete weathering, NAG (net acid generation) testing was performed. In summary, all leaching tests indicate that some metals and metalloids are leachable. NAG testing indicated that the rock will eventually produce acidic

leachate. Ongoing humidity cell testing indicates circum-neutral leachate pHs; however, these are anticipated to become acidic over time. Additional details are available in Section 4.2.2 and Geochimica (2007).

To assess the potential flow path of discharge from the Development Rock Stockpile, the location of the Stockpile in regards to the site hydrogeology was evaluated. The proposed Stockpile predominantly overlies Gila Conglomerate. A portion of the north side of the Stockpile overlies a permitted landfill and a portion of the south side of the facility overlies Tailings Pond 7. These overlie the Gila Conglomerate. Consequently, the Stockpile overlies the Unconfined Gila Conglomerate hydrostratigraphic unit (Golder, 2005 and 2008). Based on contour maps developed from existing monitoring wells and particle tracking performed with the numerical groundwater model approved by ADEQ (Golder, 2008), groundwater flow is generally towards the south-southwest (Figure 5-5).

Material characterization and leachate testing indicate that there is a potential for the development rock to generate acidic leachate with elevated metals concentrations. The primary groundwater flow path is through the Unconfined Gila Conglomerate Unit. The amount of time for groundwater to flow from beneath the Stockpile to the POC monitoring well location (Figure 6-1) is estimated from the model to be approximately 1,400 years.

The proposed closure measures should achieve the greatest degree of pollutant discharge reduction practicable. These measures (as described in Section 9.0) include:

- Run-on controls
- Recontouring
- Cover
- Runoff controls
- Revegetation

Once closed, the mechanism for transporting pollutant discharges will be reduced to the greatest extent practicable. Should releases of acidified solutions from the tailings occur, these solutions will be neutralized and the metals attenuated by the Gila Conglomerate for a significant number of pore volumes (approximately 73), depending on the nature of the acidic solutions generated and the secondary mineral precipitated. Although it is a simplistic approach, the approximate time for constituents to arrive at the proposed POC well location can be estimated by combining the approximate travel time and pore volumes needed before contaminant breakthrough occurs. Using the most conservative values, approximately 103,000 years will be required for the attenuation capacity of the Gila Conglomerate to be fully consumed at the location of the proposed POC well. Given the length of time needed for groundwater to reach the POC well, approximately 50 feet downgradient of the Stockpile, it is highly probable that AWQS will be met.

6.2 Pollutant Management Area and Point of Compliance

The PMA is defined as "the limit projected in the horizontal plane of the area on which pollutants are or will be placed" (Arizona Revised Statutes (ARS) § 49-244.1). This statute further states that, for facilities that contain more than one discharging activity, the PMA "is described by an imaginary line circumscribing the several discharging activities." A proposed PMA boundary based on the areal extent of the Development Rock Stockpile, including the landfill and Tailings Pond 7, is presented on Figure 6-1.

The POC for a hazardous substance is defined in ARS § 49-244.1 as "the limit of the pollutant management area," and is the location at which AWQS must be met. For hazardous substances (such as metals) the POC is the limit of the PMA. The law allows for the establishment of an alternate POC, if it can be demonstrated that it is too costly to monitor at the edge of the PMA, provided that the POC is never further than: 1) the property boundary, 2) any point of an existing or reasonably foreseeable drinking water source, or 3) 750-feet from the edge of the PMA (ARS § 49-244.2).

The numerical groundwater model of the West Plant Site (Golder, 2008) was used to assess groundwater flow paths from the proposed Stockpile location to determine the placement of a POC well. Particles were placed at the north and south ends of the proposed Stockpile and tracked advectively along the model-derived groundwater flow gradients. Particles were placed at the water table, which in the area of the proposed Stockpile is simulated by the model to be in model layer 4. Particle tracking was conducted using the software MODPATH (Pollock, 1989). The results of the particle tracking analysis are shown in Figure 6-1 and indicate that the groundwater flow direction from the proposed Stockpile is to the south. Based on these results, the POC well is proposed to be approximately 50 feet downgradient of the Stockpile footprint, in the center of the flowpaths. For practical reasons, the POC well is proposed on native ground just to the west of Tailings Pond 6, rather than in tailings.

6.3 Discharge Impact Area

For the Discharge Impact Area (DIA), Darcy's Law (Darcy, 1856) was used to calculate groundwater velocity, using the hydraulic gradient from the groundwater elevation contour map (Figure 5-5), and hydraulic conductivity and porosity values obtained from site-specific data. The form of Darcy's Law that was used is as follows:

$$V = Ki/\eta$$

Where:

V = groundwater velocity,
K = hydraulic conductivity,
i = hydraulic gradient, and
η = porosity.

The calculated groundwater velocity was used to estimate the total distance traveled by a fully soluble pollutant in the downgradient direction, based on the location of the discharge. The distance traveled was calculated based on a travel time of 100 years. The travel time is based on the date the discharge began, and the estimated operational life of the discharging facility. Because the Development Rock Stockpile will be in operation for less than 100 years, establishing the travel time at 100 years is a conservative assumption. The equation used to calculate distance traveled is as follows:

$$D = VT$$

Where:

D = distance traveled,
V = groundwater velocity, and
T = travel time.

The DIA was delineated as an area including and extending downgradient from the facility for the calculated distance. This method for delineating the DIA is conservative, because it assumes full advective transport of a pollutant in groundwater, with no allowance made for adsorption, dispersion, or other factors related to the chemistry of the solute or the aquifer materials.

A hydraulic conductivity for Gila Conglomerate with a value of 0.0011 feet per day (ft/d) was used to calculate the DIA. This value is the geometric mean of three hydraulic conductivity values obtained from falling head (“slug”) tests performed on monitoring well MCC-1 completed in the Unconfined Gila Unit. A porosity value of 0.39 for Gila Conglomerate was obtained from the Site Characterization report prepared by Brown and Caldwell (1999), and is also supported by test data. The hydraulic gradient was calculated as 0.0625 using the groundwater elevation contours on Figure 5-5.

The facility is located in the northern part of the Site on Gila Conglomerate. The calculated distance traveled is six feet, and the DIA is within the RCML property boundary as shown on Figure 6-1.

7.0 OPERATIONAL MONITORING

This section presents the proposed activities, frequency, schedule, and reporting requirements of BADCT performance inspections and monitoring, and groundwater monitoring.

7.1 BADCT Performance Inspection and Monitoring

The Stockpile will be regularly monitored to inspect run-on diversion channels, slopes, water-storage elevations in Tailings Pond 6, condition of the Apex Wash Berm/Tunnel, and material placement. Stockpile inspections will be instituted at the time of construction. After construction is complete, the Stockpile will be visually inspected weekly and after major storms. A typical inspection may include the following:

- Visual inspection to evaluate the need for sediment removal in the perimeter channels,
- Visual survey of the channels to evaluate their overall performance,
- Visual survey of the Stockpile slopes to identify any areas of excessive erosion or areas of slope instability,
- Visual survey to estimate storage capacity in Tailings Pond 6,
- Visual survey of the Apex Wash Berm and Tunnel to evaluate the need for sediment or vegetation removal at the tunnel inlet and that the tunnel is open through its entire length, and
- Visual survey of stockpile material placement to evaluate that the placement is made in such a way as to maintain slope stability and limit the potential for excessive erosion.

Until the landfill area is completely covered with a minimum of 3-feet of development rock, the inspection and monitoring of the landfill will be maintained under current standards and will include the following:

- Quarterly non-asbestos landfill inspection
- Annual landfill gas monitoring (gases shouldn't exceed 25 percent of the lower explosive limit (LEL) near structures or property boundary)
- Monitoring in-place controls to prevent uncontrolled public access
- Identifying any wind-blown litter
- Monitor interim cover material

Once a minimum of 3-feet of development rock has been placed over the entire landfill area the monitoring of the landfill will require the following:

- Quarterly non-asbestos inspection for 10-years after closure;
- Illegible or missing signage; and
- Slope erosion or evidence of slope failure.

7.2 Groundwater Monitoring

Upon approval of the POC well location and design, the POC well will be monitored using the same protocols set forth in Area-wide APP No. P-101703 (approved February 22, 2007). In particular, sections of the Area-wide APP that will be followed include:

- Section 2.5 – Monitoring Requirements;
- Section 2.5.3 – Groundwater Monitoring and Sampling Protocols; and
- Section 2.5.3.1 – Ambient Groundwater Monitoring for New Wells and POC Well GAI-02-01.

The monitoring will be performed using the same analytical suite, frequency, and timing as the POC wells included in the Area-wide APP. Upon completion of eight quarters of ambient monitoring, an Ambient Groundwater Monitoring Report will be submitted to ADEQ following the same protocols set forth in Section 2.7.4.2 of the Area-wide APP. Upon completion of the ambient monitoring, routine groundwater monitoring will be initiated (Section 2.5.3.2). Reporting will follow the same schedule set forth in the Areawide APP; however, the results will be submitted separately to ADEQ.

8.0 CONTINGENCY PLAN

A contingency plan is required for an APP by AAC R-18-9-A204. The contingency plan defines the actions to be taken if an unauthorized discharge results in:

- violating a permit condition;
- exceeding an AWQS or Aquifer Quality Limit (AQL);
- exceeding an alert level for groundwater monitoring;
- exceeding a discharge limitation, or
- imminent and substantial endangerment to the public health or the environment.

RCML will maintain a copy of the APP and its contingency and emergency response plans at a location where day-to-day decisions regarding the operations of the Stockpile are made (i.e., the triple-wide trailer housing environmental and maintenance staff).

8.1 Contingency Plan for Violating of a Permit Condition

The contingency plan for violation of a permit condition cannot be prepared until the permit conditions are known. In general, however, this contingency plan will consist of a series of steps with deadlines, in terms of the number of days after RCML first becomes aware of the possible violation. The general steps may include verification, notification, immediate corrective actions, reporting, a workplan for additional corrective actions, and a corrective action completion report.

8.2 Contingency Plan for Exceeding an AWQS or AQL

This contingency plan will consist of a series of steps with deadlines, in terms of number of days after RCML first becomes aware of an exceedance. The general proposed steps are as follows:

- RCML conducts (at their discretion) verification sampling within five days.
- RCML notifies ADEQ in writing within five days of receipt of verification results regarding whether there has been an exceedance or false positive result.
- If an exceedance is confirmed, then
  - RCML undertakes BADCT systems evaluation.
  - RCML increases monitoring frequency to monthly.
- If an exceedance is confirmed, then RCML submits a written report to ADEQ within 30 days, which may include a technical demonstration that the exceedance was not caused or contributed to by the subject APP facility.
- Based on the written report, ADEQ requires no further action, amends the APP, or requires corrective action.
- If exceedance continues for 120 days, then RCML notifies downgradient users.
- If exceedance continues for 180 days, then RCMLs submits to ADEQ a workplan for hydrogeologic investigation to assess whether the exceedance is due to natural or anthropogenic causes, and if mine-related, the nature and extent of the discharge. This investigation would become the basis for adjusting permit conditions and/or designing corrective action, if warranted and feasible.

8.3 Contingency Plan for Exceeding an Alert Level for Groundwater Monitoring

This contingency plan will consist of a series of steps with deadlines, in terms of number of days after RCML first becomes aware of an alert-level exceedance. The general proposed steps are as follows:

- RCML conducts (at their discretion) verification sampling with five days.
- RCML notifies ADEQ in writing within five days of receipt of verification results regarding whether there has been an exceedance or false positive result.
- If an exceedance is confirmed, then
  - RCML undertakes BADCT systems evaluation.
  - RCML increases monitoring frequency to monthly.
- If an exceedance is confirmed, then RCML submits written report to ADEQ within 30 days, which may include a technical demonstration that the exceedance was not caused or contributed to by the subject APP facility.
- Based on the written report, ADEQ requires no further action, amends the APP, or requires corrective action.
- If exceedance continues for 180 days, then RCMLs submits to ADEQ a workplan for hydrogeologic investigation to assess whether the exceedance is due to natural or anthropogenic causes, and if mine-related, the nature and extent of the discharge. This investigation would become the basis for adjusting permit conditions and/or designing corrective action, if warranted and feasible.

8.4 Contingency Plan for Exceeding a Discharge Limitation

The contingency plan for exceeding a discharge limitation is applicable to the failure of a containment structure or unexpected loss of fluid. This contingency plan will consist of a series of steps with deadlines, in terms of number of days after RCML is first aware of possible exceedance of a discharge limitation. The general proposed steps are as follows:

- RCML ceases the discharge as soon as practical
- RCML notifies ADEQ within 24 hours
- RCML collects representative samples of the released fluids and potentially impacted soils within five days
- RCML initiates an investigation into the cause of the release within 15 days and performs immediate corrective actions as practical
- RCML resumes use of the facility only after it has been restored to its proper operating condition
- RCML submits a report to ADEQ within 30 days describing the incident and immediate corrective actions
- RCML submits to ADEQ an assessment of potential impacts to the soil, vadose zone, and groundwater and a corrective action plan with 60 days
- RCML submits to ADEQ a corrective action completion report with 30 days of an approved corrective action plan

8.5 Contingency Plan for Imminent Endangerment

The contingency plan for imminent endangerment is presented below, according to the required items in AAC R18-9-A204(D).

8.5.1 Response Measures

An imminent and substantial endangerment to the public health or environment exists when there is a significant potential that existing environmental conditions may ultimately result in harm to the public or environment. Therefore, if such a condition becomes apparent, by means other than detection of a permit condition violation, AWQS exceedance, alert-level exceedance, or discharge-limitation exceedance, then RCML will, within a reasonable period of time depending on the nature of the condition, notify ADEQ of the condition and submit a proposal for addressing the condition.

8.5.2 Response Coordination

The primary RCML response coordinator and contact information are as follows:

	Primary	**Alternative**
Name	Casey McKeon	James Almaas
Title	Environmental Manager	Project Manager
Work Address	102 Magma Heights Superior, AZ 85173	102 Magma Heights Superior, AZ 85173
Work Phone Number	520-689-3254	520-689-3290
Cell Phone Number	520-827-0322	520-827-0718

8.5.3 Immediate Notification Measures

The response coordinator will orally notify ADEQ within two working days regarding any response measures taken. Written notification (e.g., e-mail or letter) will follow within three working days.

8.5.4 Persons to be Contacted

The persons to be contacted by the response coordinator (other than the immediate notification to ADEQ) are as follows:

	Town of Superior		**Pinal County**		
Mayor	Name	Michael Ong Hing	**District Supervisor**	Name	Pete Rios
	Address	734 W. Main St. Superior, AZ 85173		Address	P.O. Box 827 Florence, AZ 85132
	Work Phone	520-689-5752		Work Phone	520-866-7830
Police Dept.	Name	Lou Digirolamos, Chief	**County Manager**	Name	Terry Doolittle
	Address	734 W. Main St. Superior, AZ 85173		Address	PO Box 827 Florence, AZ 85132
	Work Phone	520-689-5254		Work Phone	520-866-6248
Fire Dept.	Name	Todd Pryor, Chief	**County Sheriff**	Name	Paul Babeu, Sheriff
	Address	35 S. Magma Ave. Superior, AZ 85173		Address	971 Jason Lopez Circle Building C Florence, AZ 85132
	Work Phone	520-689-5341		Work Phone	1-800-420-8689

8.5.5 General Procedures, Personnel, and Equipment

RMCL has prepared the following standard operating procedures for response measures and has trained the following staff to implement them:

- Stormwater Treatment Procedures – Casey McKeon, Senyssa Manriquez, Tony Martinez, and Dennis Osborn
- Stormwater Alarm Plan – Casey McKeon, Tony Martinez, and Dennis Osborn
- Mine Escape and Evacuation Plan – Steve Gravely, Tony Martinez, and Randy Seppala
- Disaster Recovery Plan – Jon Cherry, Mike Wegleitner, and Melanie Ferreira

RCML has contracted with G4S for security staff that will assist RCML staff during any emergency. They are the first alert on weekends and after normal business hours. G4S maintains one staff member and one vehicle on site during weekends and after hours.

RCML maintains the following equipment and supplies on site:

- trucks, dozers, and graders for earthwork;
- three portable Power Prime pumps (CAT 3126B and two HH-150 S/S) for water pumping; and
- fill material, piping, and spill kits.

RCML has established on-call contracts with the following construction contractors:

- Copper Resource Contracting and/or Albo Guzman respond for earthwork,
- Marcanti Electrical responds for electrical, and
- Rain-for-Rent responds for extra rental pumps and piping.

9.0 CLOSURE AND POST-CLOSURE STRATEGIES

A closure plan for the Development Rock Stockpile, which will include post-closure care, will not be prepared and submitted to ADEQ until after RCML has notified ADEQ that it intends to close the facility, in accordance with AAC R18-8-A209(B). This section describes the proposed general approach for in-place closure of the Development Rock Stockpile, and post-closure care.

9.1 Closure

The overall design elements for in-place closure are listed below:

- **Run-on controls:** Run-on, which is defined as stormwater from upstream areas reporting to a facility, will be diverted to the extent possible to reduce the amount of water crossing a facility, thereby reducing the amount of water available for infiltration and the potential for erosion.
- **Recontouring:** The top surface of the Stockpile will be recontoured to promote runoff, thereby eliminating ponded water and subsequent infiltration. Recontouring of top surfaces will be provided primarily by cut/fill regrading. If needed, outslopes will be flattened to improve stability, to reduce the potential for erosion, and so that cover material can be placed.
- **Cover:** A monolithic (i.e., 3-foot thick, single layer) store and release cover will be placed on the top surfaces and outslopes to reduce infiltration, to provide a rooting layer for vegetation, and to protect the underlying materials from erosion.
- **Runoff controls:** Runoff, which is defined as stormwater generated by the top surfaces and outslopes of a facility, will be controlled by non-erodible channels. Runoff from covered surfaces is presumed to meet applicable water quality standards, and stormwater ponds will be used only to the extent necessary for downstream flood control and sedimentation purposes.
- **Revegetation:** Covered facilities and areas disturbed by closure activities will be revegetated to increase evapotranspiration of infiltrating water and reduce the potential for erosion.

The intent of the closure strategy is to limit infiltration of water into the stockpile. The store and release cover, in conjunction with revegetation of the cover, will limit the volume of water coming into contact with the stockpile material. The runoff controls will also limit infiltration of stormwater into the stockpile.

9.2 Post-Closure

Once closure construction is complete, periodic inspections and maintenance of closed facilities will be required. The following items are proposed for post-closure care:

- **Roads:** Roads will be maintained as needed for access to the Development Rock Stockpile.
- **Channels:** Channels will be inspected monthly and after significant rainfall events. Equipment will be used to replace or reset loose riprap in channels and for stabilization of channel banks. Eroded material from covered surfaces will also be removed from channel bottoms if it compromises flow capacity.

- **Covers:** It is typical that five percent of the revegetated area of the borrow areas and the covered facility surfaces will not revegetate successfully at first and will need touch-up revegetation at least for the first several years.

10.0 TECHNICAL CAPABILITY

This report was prepared for RCML by Golder under the direction of Mr. Michael Grass, P.E., R.G. The technical capabilities of Golder, Mr. Grass, and Golder's project team are provided below.

Golder is the US operating arm of a global consulting firm that specializes in ground engineering and environmental services. Golder is an employee-owned company founded in 1960; the firm's resources consist of approximately 6,000 employees in 160 offices worldwide. In the western US, Golder maintains a staff of more than 200 scientists and engineers with expertise in engineering and water-related environmental permitting. These staff members are located in several offices throughout the west, including Phoenix, Tucson, and Denver. Golder staff that contributed to this Application is based out of the Tucson office.

Michael Grass, P.E., R.G. is a Project Manager in Golder's Tucson office and has 13 years of experience in geological engineering. His responsibilities for this project included the geotechnical evaluation of site conditions, earthworks regrading, surface-water control evaluation, and impoundment-sizing calculations. Mr. Grass has experience in geologic, hydrologic, and hydraulic evaluation for regional mining and civil engineering projects. His technical expertise includes geotechnical site investigations, surface-water hydrology, slope stability, and liquefaction analyses. His responsibilities also include construction quality assurance and computer-aided design and layout. He also has experience in soft-soil site investigations, hard-rock slope stability, and foundation-stability analyses. Mr. Grass is a Registered Professional Engineer (Civil) and a Registered Geologist in Arizona.

Kent Johnejack, P.E. - Mr. Johnejack is an Associate in Golder's Tucson office and has 25-years of experience with a variety of environmental, surface water, and water resource studies. He has worked primarily in the mining sector since 1995, but previously worked in the land development, radioactive waste, and municipal water/sewer sectors. His mining work experience includes due diligence evaluation, surface water/vadose zone/groundwater characterization, mine-waste characterization, spill remediation, smelter-impacted soil remediation, investigation of off-site releases, closure permitting and design, closure cost estimating, and closure completion reports.

Jacob Waples - Mr. Waples is a Senior Project Geochemist from Golder's Denver office with over eight years experience in geochemical investigations and evaluations for the mining industry. He has worked on multidisciplinary projects involving geochemical and hydrologic investigations at copper, gold, molybdenum, iron, coal, and oil shale mines in Arizona, New Mexico, Nevada, Colorado, South Dakota, North Dakota, Montana, Washington, Idaho, Utah, Tennessee, Minnesota, Mexico, Peru, and Chile. Mr. Waples is experienced in geochemical and hydrological aspects of mining including characterization and prediction for acid rock drainage, geochemical fingerprinting, geochemical modeling, Cyanide Code auditing, water and chemical-mass balance modeling, site characterization, and closure analyses for adits, tailings facilities, and waste-rock facilities.

Mr. John Malusa, R.G., is a senior hydrogeologist in Golder's Tucson office with 20-years of experience. His educational background includes geology, hydrology, and geochemistry. He has worked on natural resources, municipal infrastructure, and mining projects. Mr. Malusa has experience in performing aquifer testing and analysis. He specializes in both geochemical and hydrologic groundwater characterization at hard-rock mines. Of particular note, Mr. Malusa has performed feasibility level groundwater dewatering and process-water studies at several mine sites. Additionally, Mr. Malusa has trained junior staff and clients in collecting water-quality samples and aquifer testing techniques.

Ms. Betsy Semmens, R.G., has 12-years of practical experience as a consulting hydrogeologist. Her primary roles have included numerical groundwater flow modeling at mine sites, chemical manufacturing sites, and Superfund sites, data analysis and management, and litigation support. Ms. Semmens specializes in saturated and variably-saturated groundwater flow and reactive chemical transport modeling using MODFLOW, MODFLOW-SURFACT, MT3D, and Groundwater Vistas. She has developed and applied groundwater models for hydrogeologic investigations at mines to obtain a Record of Decision at a Superfund site incorporating Monitored Natural Attenuation, and for water-supply purposes including Aquifer Storage and Recovery pilot and full-scale studies, and Assured Water Supply studies. Ms. Semmens is also experienced with ArcGIS and relational databases.

11.0 FINANCIAL CAPABILITY

RCML has provided a letter of financial capability (Appendix K) in accordance with AAC R18-9-A203.D.1.d to demonstrate their financial capability to construct, operate, and close the Development Rock Stockpile.

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TABLES

Table 1-1: Existing Environmental Permits for the Superior Mine

Type of Permit	Permit Number	Expiration Date	Description
Notice of Disposal	---	Property Transfer	Filed January 9, 1985
National Pollution Discharge Elimination System (NDPES)	AZ0020389	December 6, 2010	Release of storm water at Outfall 001 and Outfall 002
Groundwater Rights and Withdrawal Permits	59-524492	September 20, 2029	Withdrawal of GW not to exceed 5,000 ac-ft/yr
	58-130703	Right	Withdrawal of GW not to exceed 315 ac-ft/yr
	58-117402	Right	Withdrawal of GW not to exceed 1,490 ac-ft/yr
Hazardous Waste/RCRA Identification number	AZD001886654	Facility Life	EPA Hazardous Waste Identification Number for annual reporting
Wastewater Certificates	WW012411	---	Wastewater treatment operations Grade 1 certification
EPA Storm Water Multi-sector General Permits	AZR05A799 current # AZR05B240	October 2005	No. 9 Shaft (East Plant Site)
	AZR05A800 current # AZR05B241	October 2005	West Plant Site
Potable Groundwater (ADEQ) Drinking Water Division	11-078	Unknown	No record of renewal found
Landfill APP	15877.01	Life of Facility	Non-municipal solid waste permitted under separate solid waste permit (transfer from BHP pending)
Landfill Waste Permit	50287800	Unknown	Non-municipal solid waste
General APP	LTF No. 39202; Inventory No. 105727; USAS No. 502878-00	February 8, 2011	3.02 General APP for North and South Sludge Storage Impoundments (SSI)
Area-wide APP	P-101703	Life of Facility	Closure of APP- facilities at the West Plant Site
Individual APP Mine Water Treatment Plant Outfall	P-105823	December 6, 2010	Outfall 002 from Mine Water Treatment Plant
ADWR - Underground Water Storage Permit	73-534489 73-534888		Water Storage at NMIDD Groundwater Savings Facility to a maximum of 20,000 acre feet per annum
Air Quality Control Permit	B30993.000	November 16, 2014	Issued by Pinal County Air Quality Control District
Special Land Use Permit	23-109606-21	February 18, 2011	Issued by Arizona State Land Department for one groundwater monitor well and access
ADEQ Special Waste Facility Generator	302437	Facility Life	Transferred from BHP 4/4/04 (no permit on file)
US Forest Service – Department of Agriculture	MES749	October 31, 2018	Permit to construct water pipeline from WTP to an irrigation canal operated by NMID
FCC	007A058154		Radio License

Table 2-1: Ore Loading Schedule for Reactive and Inert Development Rock

Rock Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Reactive (tonnes)	0.0	0.0	0.0	80.9	127.2	317.4	400.0	1,042	1,961	1,968	948.8	6,845.5
Inert (tonnes)	97.0	109.4	102.5	20.9	20.1	101.7	263.0	323.4	338.9	348.2	92.4	1,817.5
Total (tonnes)	97.0	109.4	102.5	101.8	147.2	419.1	663.0	1,366	2,300	2,316	1,041	8,663

Notes: tonnes = metric tons

Table 3-1: Summary of CPT Analysis

Borehole Identification	Depth of Borehole (feet bgs)	Average Undrained Shear Strength (psf)	Average SPT $N_{1(60)}$ Blow Counts (blows/ft)
BH-01	47.5	1,100	4.0
BH-02	62.5	1,100	3.4
BH-03	60.0	1,200	3.5
BH-04	104.0	1,750	4.4

Notes: CPT = cone penetrometer test
bgs = below ground surface
psf = pounds per square foot
SPT = standard penetration test
blows/ft = number of SPT hammer blows per foot

Table 3-2: Summary of Pore-Water Dissipation Test Results

Borehole Identification	Depth (feet bgs)	Coefficient of Consolidation (cm^2/sec)	Hydraulic Conductivity (ft/sec)
BH-01	11.2	0.036	$1.00x10^{-9}$
BH-01	25.3	0.022	$3.00x10^{-8}$
BH-01	40.2	0.067	$3.00x10^{-8}$
BH-01	47.6	0.060	$3.00x10^{-2}$
BH-02	15.1	0.0048	$1.00x10^{-9}$
BH-02	27.1	0.013	$1.00x10^{-9}$
BH-02	45.1	0.057	$3.00x10^{-8}$
BH-02	62.3	0.010	$3.00x10^{-6}$
BH-03	15.1	0.021	$1.00x10^{-9}$
BH-03	29.4	0.034	$1.00x10^{-9}$
BH-03	45.3	0.061	$1.00x10^{-9}$
BH-03	60.4	0.0085	$3.00x10^{-6}$
BH-04	20.5	0.048	$3.00x10^{-8}$
BH-04	42.2	0.13	$3.00x10^{-6}$
BH-04	62.0	0.072	$1.00x10^{-9}$
BH-04	85.1	0.061	$1.00x10^{-9}$
BH-04	104.0	0.050	$3.00x10^{-4}$

Notes: bgs = below ground surface
cm^2 /sec = square centimeter per second
ft/sec = feet per second

Table 3-3: Summary of Tailings Consolidation Characteristics

Borehole Identification	Depth of Sample (feet bgs)	Overconsolidation Ratio	C_c (Compression Index) (dimensionless)	C_v (Coefficient of Consolidation) (ft^2/day)
BH-01	40	5.5	0.11	2.37
BH-03	25	1.3	0.22	1.40

Notes: bgs = below ground surface
ft^2/day = square feet per day

Table 3-4: Summary of Hydrologic Modeling

Design Storm	Peak Outflow (cfs)	Freeboard on Berm (feet)	Ponding Depth (feet)	Time-to-Drain (hrs)
100-yr, 24-hr	645	11.6	13.7	7
MSE	603	13.2	12.1	99
½ PMF 6-hr	892	0.3	25.0	5
½ PMF 24-hr	805	4.9	20.4	22

Notes: yr = year
hrs = hours
MSE = Maximum saturation event
PMF = Probable Maximum Flood
cfs = cubic feet per second

Table 3-5: Summary of Deformation/Dissipation Analyses Material Properties

Material Type	Material Model	Stiffness Parameters	Unit Weight (pcf)	Poisson's Ratio	Cohesion (psf)	Friction Angle (degrees)	Hydraulic Properties
Development Rock	Elastic-Plastic	Graph 3	125	0.300	0	35	Figures 4-5 and 4-6
Gila Conglomerate	Elastic-Plastic	Graph 3	135	0.277	20,000	38	
Embankment	Elastic-Plastic	Graph 3	125	0.292	100	36	
Drained/Undrained Tailings	Modified Cam Clay	OCR = 1 eo= 1.187 κ = 0.123 λ = 0.016	130	0.312	0	30	

Notes: pcf = pounds per cubic foot
psf = pounds per square foot

Table 3-6: Summary of Limit Equilibrium Analyses Material Properties

Material Type	Dry Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion (psf)	Friction Angle (degrees)	Undrained Shear Strength (psf)
Development Rock	125	130	0	35	n/a
Gila Conglomerate	135	140	20,000	38	n/a
Embankment	125	130	100	36	n/a
Drained Tailings	130	135	100	30	n/a
Undrained Tailings	130	135	n/a	n/a	400 min Su/σv' = 0.3

Notes: pcf = pounds per cubic feet
psf = pounds per square foot
n/a = not applicable

Table 3-7: Estimated Maximum Loading Rate

Lift	Maximum rate of rise (ft/yr)	Maximum lift height (feet)
1	3	3
2-7	6	6
8 and beyond	18	9

Note: ft/yr = feet per year

Table 3-8: Summary of Slope Stability Results

Area	Failure Mode	Factor of Safety	
		Static	Pseudo-static
Stockpile	Circular / Local	1.76	1.38
	Circular / Overall	2.53	1.86
	Block / Local	2.36	1.80
	Block / Overall	2.51	1.86

Table 3-9: Typical Third Party Unit Costs

Item	Unit	Unit Cost
Laborer	Day	$225
Pickup truck for laborers	Day	$150
Bulldozer with ripper	Day	$2,600
Motor grader	Day	$1,200
Wood chipper	Day	$1,300
Pickup truck with foreman	Day	$450
Revegetation	AC	$5,000
Riprap	CY	$50
Geotextile	SY	$4
Rough excavation (no export)	CY	$10
Vegetative cover	CY	$13
Low-permeability fill	CY	$19
Monitoring well	FT	$150

Notes: AC = acres
CY = cubic yards
SY = square yards
FT = feet

Table 3-10: Construction Cost Estimate

Item #	Item	Estimated Quantity	Unit	Unit Price	Total Amount
1	Diversion channels	3,400	CY	$10	$34,000
2	Access road	4,700	CY	$10	$47,000
3	Monitoring well installation	300	FT	$150	$45,000
			Subtotal		**$126,000**
			Indirect Costs and Contingency	40%	$50,400
			TOTAL		**$176,400**

Notes: CY = cubic yard
FT = feet

Table 3-11: Annual Operation and Maintenance Cost Estimate

Item #	Item	Estimated Quantity	Unit	Unit Price	Total Amount
1	Inspections	52	Days	$450	$23,400
2	Brush removal; minor maintenance	5	Days	$1,900	$9,500
3	Channel and road maintenance	5	Days	$1,200	$6,000
4	Groundwater monitoring	4	Event	$1,500	$6,000
			Subtotal		**$44,900**
			Indirect Costs and Contingency	40%	$18,000
			TOTAL		**$62,900**

Table 3-12: Closure Cost Estimate

Item #	Item	Estimated Quantity	Unit	Unit Price	Total Amount
1	Pre-cover grading	27	Days	$2,600	$70,200
2	Vegetative cover	260,000	CY	$13	$3,380,000
3	Closure channels				
3a	Excavation	7,500	CY	$10	$75,000
3b	Low-permeability fill	4,500	CY	$19	$85,500
3c	Geotextile	12,000	SY	$4	$48,000
3d	Riprap	2,500	CY	$50	$125,000
4	Contour furrowing	27	Days	$2,600	$70,200
5	Revegetation	54	AC	$5,000	$270,000
			Subtotal		**$4,123,900**
			Indirect Costs and Contingency	40%	$1,650,000
			TOTAL		**$5,773,900**

Notes: CY = cubic yards
SY = square yards
AC = acres

Table 3-13: Annual Post-Closure Care Cost Estimate

Item #	Item	Estimated Quantity	Unit	Unit Price	Total Amount
1	Inspections	12	Days	$450	$5,400
2	Brush removal; minor maintenance	5	Days	$1,900	$9,500
3	Channel and road maintenance	5	Days	$1,200	$6,000
4	Groundwater monitoring	4	Event	$1,500	$6,000
			Subtotal		**$26,900**
			Indirect Costs and Contingency	40%	$10,800
			TOTAL		**$37,700**

Table 4-1: Grain Size Distribution in Stockpile Materials

Screen Opening (mm)	Percent Retained	Surface Area of this Fraction (assumes r=0.5 opening, in m^2)	Weighted Surface Area (in m^2)
609.6	0	---	---
304.8	0	---	---
152.4	3	0.0730	0.002188981
76.2	12	0.0182	0.002188981
38.1	15	0.0046	0.000684057
25.4	8.953	0.0020	0.000181463
19.05	5.635	0.0011	6.42443E-05
9.525	12.131	0.0003	3.45762E-05
4.75	7.35	0.0001	5.20985E-06
2	5.376	0.000013	6.7557E-07
0.85	3.409	0.000002	7.73777E-08
0.425	2.618	0.000001	1.48559E-08
0.25	2.513	0.00000020	4.93428E-09
0.15	2.933	0.00000007	2.07322E-09
0.075	3.304	0.00000002	5.83866E-10
0.05	10.325	0.00000001	8.10926E-10
		Weighted Surface Area$_{TOTAL}$ (in m^2)	**0.0053**

Notes:
mm = millimeters
m^2 = square meters

Table 4-2: Stockpile Mass Loading Rates

Rock Type	% Contribution of Rock Type to Stockpile Volume	AWQS Constituents											
		Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Fluoride	Lead	Mercury	Nickel	Selenium	Thallium
Average Weekly Mass Load, Steady State Period (mg/m^2/wk)													
Kvs	0.34	0.0148	0.0156	0.1285	0.0778	0.0039	0.3695	3.50	0.0044	0.0074	0.3675	0.0046	0.0039
Skn	0.25	0.0142	0.0153	0.1317	0.0764	0.0036	0.3222	12.44	0.0038	0.0071	0.3835	0.0185	0.0038
Cb & Pcmls	0.13	0.0145	0.0150	0.1281	0.0751	0.0039	0.3473	37.69	0.0039	0.0069	0.3624	0.0323	0.0037
Pcdiab Diab*	0.28	0.0152	0.0164	0.1495	0.0819	0.0040	0.3797	7.42	0.0039	0.0076	0.4206	0.0260	0.0041
Composite, Weighted Average Mass Load Rate		**0.0147**	**0.0157**	**0.1351**	**0.0783**	**0.0038**	**0.3576**	**11.28**	**0.0040**	**0.0073**	**0.3857**	**0.0177**	**0.0039**

Notes:

AWQS = Aquifer Water Quality Standards

mg/m^2/wk = milligrams per square meter per week

Kvs = Cretaceous volcaniclastics

Ks = Cretaceous detrital sediments

Skn = Skarn developed in Paleozoic carbonate rocks

Pcdiab Diab = Precambrian diabase

**Pcdiab Diab* is expected to constitute only 0.11 of stockpile volume. A contiguous rock type (*Pcds Qtzite*, 0.17 of expected stockpile mass and considered extremely reactive) was not subjected to humidity cell testing. The somewhat less reactive diabase was given added weight and may therefore lend a low bias to these estimates. See main text.

Table 4-3: Weighted Average Concentrations in NAG Leachate

Rock Type	% Contribution of >1,633 m bgs Rock Type to Stockpile Volume	Acidity as $CaCO_3$	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bicarbonate as $CaCO_3$	Cadmium	Calcium	Carbonate as $CaCO_3$	Chloride	Chromium	Cobalt	Conductivity @25C	Fluoride	Hydroxide as $CaCO_3$	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	pH	Potassium	Residue Filterable (TDS) @180	Selenium	Silica	Silver	Sodium	Sulfate	Thallium	Total Alkalinity	Uranium	Vanadium
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	umhos/cm	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(SU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Weighted Averages																																			
Kvs & Ks	0.34	541.0	9.20	0.0010	0.0015	0.0943	0.0057	14.00	0.0008	21.86	25.00	3.79	0.0350	0.4050	2023.0	0.7286	1.0000	32.6	0.0035	2.1429	1.9893	0.0001	0.0286	4.56	6.50	280.0	0.0052	23.29	0.0286	2.3571	469.9	0.00025	39.0	0.0013	0.0186
Skn	0.25	31	5.63	0.0010	0.0037	0.0170	0.0055	9	0.2984	121.7	1.0000	5.00	0.0250	0.0250	1207.1	10.10	1.0000	0.05	0.0027	7.85	0.0420	0.00019	0.0385	6.65	6.40	1061.0	0.0403	21.20	0.0250	1.0000	703.0	0.000525	9	0.0143	0.0150
Cb & Pcmls	0.13	56.88	9.04	0.0010	0.0024	0.0195	0.0060	10.50	0.1944	181.7	1.0000	5.0000	0.0275	0.0425	2047.6	9.80	1.0000	11.24	0.0041	7.1500	0.3120	0.00029	0.0490	4.4800	5.1000	1148.9	0.0479	19.45	0.0275	1.0500	977.0	0.000305	10.50	0.0162	0.0160
Pcdiab & Diab	0.11	1322.8	19.23	0.0010	0.0048	0.0463	0.0050	0	0.0018	38.88	0	5.0000	0.0250	0.2975	3775.0	9.5000	0	324.2	0.0280	7.7500	0.6025	0.0002	0.1656	2.0875	7.3750	1856.3	0.0666	28.38	0.0438	1.0000	2170.0	0.00025	0	0.000944	0.0150
Pcds Qtzite	0.17	1692.5	12.61	0.0010	0.0031	0.0425	0.0056	0	0.000581	104.3	0	5.0000	0.0569	0.3275	5247.1	7.63	0	267.2	0.0340	1.1250	0.0813	0.0001	0.0750	2.0625	5.3750	1781.4	0.0738	14.63	0.0281	1.1875	2267.5	0.00025	0	0.0010	0.0163
Expected Concentrations																																			
Hypothetical Stockpile Seepage		628	9.91	0.0010	0.0028	0.0510	0.0056	8.39	0.1007	83.7	8.88	4.58	0.0341	0.2369	2,554	6.37	0.7216	92.4	0.0111	4.64	0.8052	0.0002	0.0560	4.37	6.18	1,012	0.0378	21.3	0.0290	1.50	1,080	0.0003	16.9	0.0064	0.0165

Notes:

m bgs = meters below ground surface

mg/L = milligrams per liter

umhos/cm = micromhos per centimeter

SU = standard units

Kvs = Cretaceous volcaniclastics

Ks = Cretaceous detrital sediments

Skn = Skarn developed in Paleozoic carbonate rocks

Cb & Pcmls = Cambrian Bolsa quartzite and Precambrian quartzite and limestone

Pcdiab Diab = Precambrian diabase

Pcds Qtzite = Precambrian Dripping Springs quartzite

--- non detected or not analyzed

Aitchinson's Method applied to constituents with ≤15% ND. In all other cases (with the possible exception of chloride) the mean was calculated using only those values >DL to represent a worst-case scenario.

Table 4-4: Stockpile Toe Seepage Water Types

Solution	Acidity as $CaCO_3$	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bicarbonate as $CaCO_3$	Cadmium	Calcium	Carbonate as $CaCO_3$	Chloride	Chromium	Cobalt	Conductivity @25 °C	Copper	Fluoride	Hydroxide as $CaCO_3$	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	pH	Potassium	TDS	Selenium	Silica	Silver	Sodium	Sulfate	Thallium	Total Alkalinity	Uranium	Vanadium	Zinc
	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(umhos/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(SU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Aquifer Water Quality Standards	---	---	0.006	0.05	2.00	0.004	---	0.005	---	---	---	0.1	---	---	---	4.00	---	---	0.05	---	---	0.002	---	---	---	---	---	0.05	---	---	---	---	0.002	---	---	---	---
Concentrations Based on NAG Effluent																																					
Hypothetical Stockpile Seepage (100:1 H_2O:Rock)	628	9.91	0.0010	0.0028	0.0510	0.0056	8.39	0.1007	83.7	8.88	4.58	0.0341	0.2369	2,554	---*	6.37	0.7216	92.4	0.0111	4.64	0.8052	0.0002	0.0560	---*	4.37	6.18	1,012	0.0378	21.3	0.0290	1.50	1,080	0.0003	16.9	0.0064	0.0165	---*
Hypothetical Stockpile Seepage (5:1 H_2O:Rock)	---	190.3	---	0.0560	0.0036	0.1120	---	2.01	470	---	91.6	0.6819	4.74	---	---*	127.0	---	1,840	0.2220	92.8	16.10	0.0040	1.1199	---*	3.24	118.0	---	0.7559	49.3	0.5799	30.0	5,556	0.006	---	0.1280	0.3300	---*
Geoenvironmental Model Data from Plumlee et al. 1999 for Porphyry Cu, Cu-Mo with QSP Alteration (Mt. Washington, British Columbia)																																					
MW Weir 3	---	7.2	---	<0.050	---	---	---	---	31.6	---	---	0.1380	---	---	16.8	---	---	9.6000	---	4.40	0.9540	---	---	0.1	3.5	---	---	---	7.07	---	---	226.0	---	---	---	---	0.346
MW Weir 1	---	22.0	---	<0.050	---	---	---	---	156.0	---	---	0.30	---	---	15	---	---	5.60	---	13.0	4.0700	---	---	0.2	3.6	---	---	---	13.5	---	---	696.0	---	---	---	---	0.738
MW BH89-14	---	1.5	---	<0.050	---	---	---	---	5.2	---	---	0.0380	---	---	3.1	---	---	1.2900	---	1.30	0.3680	---	---	<0.02	3.8	---	---	---	3.02	---	---	50.9	---	---	---	---	0.109
MW BH89-4	---	10.7	---	<0.050	---	---	---	---	128.0	---	---	0.48	---	---	9	---	---	45.50	---	19.0	4.7600	---	---	0.3	3.7	---	---	---	14.0	---	---	608.0	---	---	---	---	1.65
MW BH89-3	---	9.3	---	<0.050	---	---	---	---	109.0	---	---	0.3700	---	---	4.2	---	---	26.8000	---	14.00	6.7700	---	---	0.2	4.4	---	---	---	15.80	---	---	445.0	---	---	---	---	1.12
MW BH89-10	---	0.1	---	0.3	---	---	---	---	91.1	---	---	0.16	---	---	0	---	---	53.40	---	11.2	5.0000	---	---	0.1	5.7	---	---	---	11.9	---	---	406.0	---	---	---	---	0.181
MW BH89-8	---	0.9	---	0.3	---	---	---	---	97.8	---	---	0.2050	---	---	1.3	---	---	56.2000	---	13.80	8.4100	---	---	0.0	4.6	---	---	---	9.70	---	---	452.0	---	---	---	---	0.106
Geoenvironmental Model Data from Plumlee et al. 1999 for Porphyry Cu, Cu-Mo with QSP Alteration (Globe, Arizona)																																					
MP1W1, Globe	---	250.0	---	<0.005	---	---	---	0.6	440.0	---	340.0	13.00	---	---	150	0.3	---	2800.00	0.2	390.0	75.0000	---	---	3.1	3.6	---	---	---	na	---	---	8800.0	---	---	---	---	22
Geoenvironmental Model Data from Plumlee et al. 1999 for Porphyry Cu, Cu-Mo with QSP Alteration (Alamosa River Basin, Colorado)																																					
TMT-29	---	66.0	---	0.0	---	---	---	0.01	4.3	---	1.10	0.2000	---	---	1.3	0.9	---	150.0000	0.0	3.00	0.1300	---	---	0.1	2.3	---	---	---	38.00	---	---	407.0	---	---	---	---	0.420
TMT-28	---	70.0	---	0.0	---	---	---	0.0	13.0	---	0.1	0.21	---	---	0	1.8	---	130.00	0.0	11.0	1.7000	---	---	0.1	2.8	---	---	---	41.0	---	---	1010.0	---	---	---	---	0.61
TMT-38	---	390.0	---	0.0	---	---	---	0.03	150.0	---	3.60	0.5300	---	---	2.0	8.4	---	1900.0000	0.0	130.00	45.0000	---	---	0.3	2.3	---	---	---	39.00	---	---	13400.0	---	---	---	---	2.70

Notes:

mg/L = milligrams per liter

°C = degrees celsius

umhos/cm = micromhos per centimeter

SU = standard units

TDS = total dissolved solids

--- not detected, not predicted, or not analyzed

*Cu, Ni and Zn were not detected in NAG effluent. Typical values for these constituents in porphyry copper deposit waters are estimated by Plumlee, et al.

In weighted average, 1/2 the detection limit was substituted for all ND values.

Table 4-5: Geochemical Conditions for PHREEQC Speciations and Advection Modeling

Geochemical Parameter	Value Used in Speciation Models	Value Used in Simple Advection Model	Notes
pe/Eh	6.8 / 400mV	6.8 / 400mV	Transitional environment
P_{CO2}	10^{-2}	$10^{-2.5}$	Appropriate for groundwater
Calcite content	na	3.28 moles / cell	Assumes one liter of solution with the following: -10% of aquifer mass present as calcite - an assumed aquifer porosity of 0.4, -an assumed aquifer density of 1.19 grams per cubic centimeter (gm/cm3)
Temperature	25°C	25°C	
Surface sorption	na	na	Not appropriate at this level of modeling
Equilibrium Phases			
Carbonates	**Sulfates**	**Halides**	**Oxides, Hydroxides, Oxy-hydroxides**
Calcite	Gypsum	Fluorite	Ferrihydrite
Dolomite (disordered)	Barite		$Al(OH)_3$ (amorphous)
Otavite	$Al_4(OH)_{10}SO_4$		$Zn(OH)_2$ (gamma)
Rhodochrosite	$AlOHSO_4$		$Cr(OH)_3$(amorphous)
Siderite	H-Jarosite		$Cr(OH)_3$
Cerrusite	K-Jarosite		$Cu(OH)_2$
Smithsonite	Na-Jarosite		$Ni(OH)_2$
Malachite	Brochantite		SiO_2 (amorphous precipitate)
Azurite	Anglesite		SbO_2
Witherite	Chalcanthite		Manganite
Magnesite			Birnessite

Notes:
mV = Magma Vane
n/a = not applicable
g/cm^3 = grams per cubic centimeter
^{0}C = degrees Celsius

Table 4-6: Native Gila Conglomerate Groundwater Quality

Sample ID	Temp.	Alkalinity	Arsenic	Calcium	Chloride	Fluoride	Magnesium	pH	Potassium	NO_3^-	TDS	Silica	Sodium	Sulfate
	°C	(eq/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(SU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Aquifer Water Quality Standards	---	---	0.05	---	---	4.00	---	---	---		---	---	---	---
Native Groundwater in Contact with the Gila Conglomerate														
MCC-6C*	19.0	200.0	0.0130	25.0	20.0	0.5700	3.60	8.29	1.40	0.1800	520.0	31.0	150.0	160.0

Notes:

°C = degrees Celsius

eq/L = equivalents per liter

mg/L = milligrams per liter

SU = standard units

TDS = total dissolved solids

* Data collected 3/21/2007; presumed "background" and unaffected by mining, from *Groundwater_NS_BrownandCaldwell:Database* (Access 2000).

Table 4-7: Climate Data Used in Water Balance

Variables by Month		Average Precipitation (in)	Average Pan Evaporation (in)
1	January	2.02	2.44
2	February	1.93	3.54
3	March	2.02	5.90
4	April	0.80	8.64
5	May	0.36	11.96
6	June	0.26	14.50
7	July	1.90	14.36
8	August	2.75	12.27
9	September	1.47	10.10
10	October	1.19	6.78
11	November	1.43	3.68
12	December	2.15	2.32
Totals		18.29	96.49
Monthly Average.		1.52	8.04

Note: in = inches

Table 4-8: Summary of Water Balance Results

Year	Total Inflows (gallons)	Total Outflows (gallons)	Net Water (Loss)/Gain (gallons)	Average Annual Discharge (gallons)
1	1,183,964	2,275,302	1,091,339	0
2	2,715,464	3,319,015	651,586	48,035
3	3,564,460	3,667,187	344,092	241,365
4	4,209,297	4,007,983	283,306	484,621
5	4,909,700	5,151,633	528,292	286,359
6	6,770,048	10,730,028	3,959,979	0
7	10,314,390	16,759,195	6,444,804	0
8	14,483,195	30,824,178	16,340,983	0
9	18,605,976	48,749,977	30,144,000	0
10	22,035,738	50,623,794	28,588,055	0
11	23,756,609	51,563,713	27,807,104	0
12	24,213,255	51,813,123	27,599,868	0

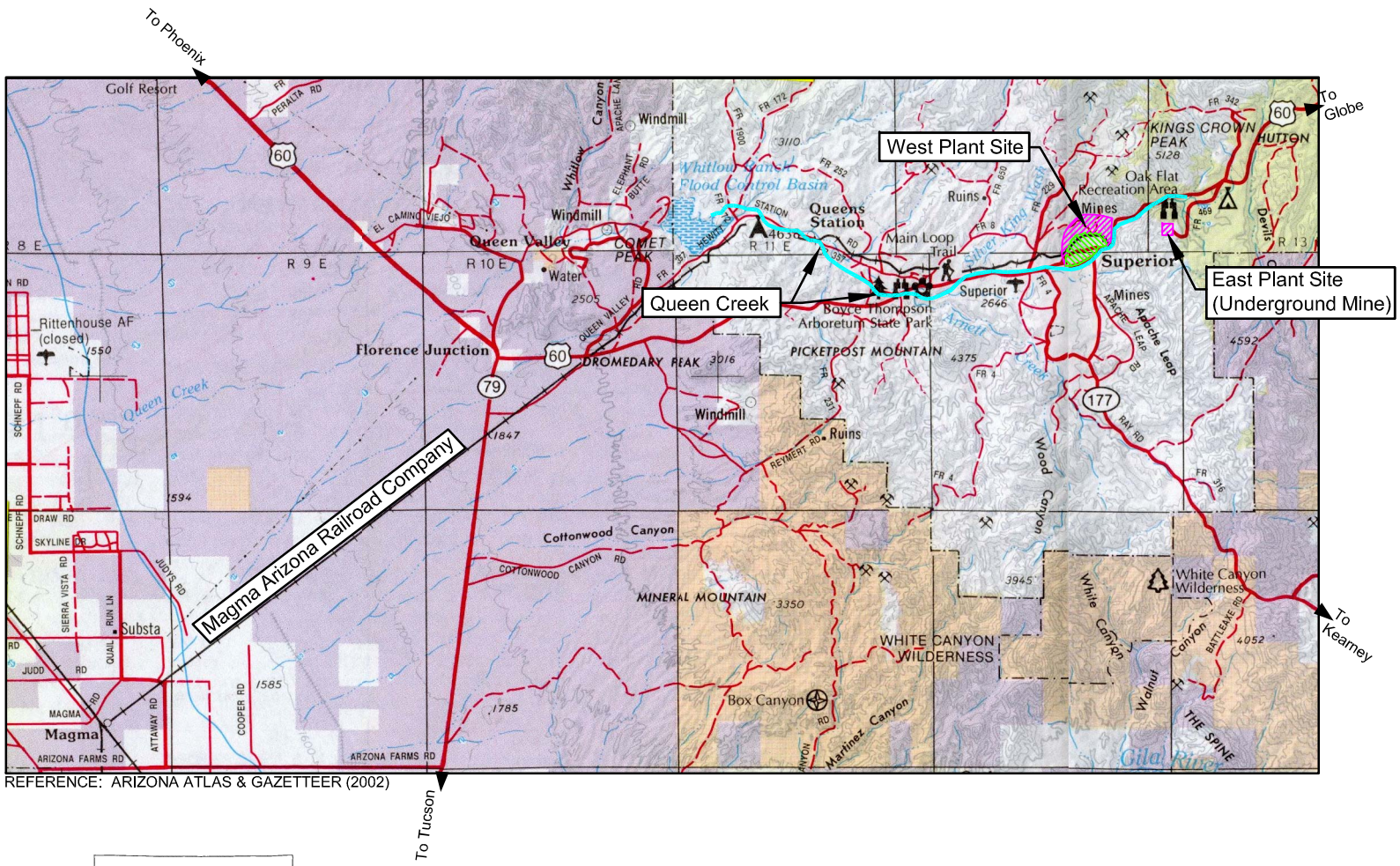
Table 5-1: Well Inventory

Site	Easting*	Northing	Site Type	Well Reg Nbr	Well Depth
Sites with Other Owners					
621501	948,816.96	837,598.52	Production Well	55-621501	100
522271	945,145.15	839,240.82	Cathodic Protection Well	55-522271	120
Resolution Sites					
GAI-02-01	945,370.10	837,325.00	Monitoring Well	55-591860	200
GAI-02-09	945,165.59	837,921.89	Monitoring Well	55-594159	95
MCC-1	944,976.45	838,613.67	Monitoring Well	55-548184	483
MCC-5B	948,047.29	837,355.27	Monitoring Well	55-558207	100
Settling Ponds 1 & 2 Alert Well	948,295.60	837,766.80	Monitoring Well	55-907034	185
SP1&2-Alert-B	948,295.28	837,785.56	Monitoring Well	55-910699	88
Tailings Pond 5 POC Well	947,439.10	837,337.50	Monitoring Well	55-907036	130
TP5-POC-B	947,329.35	837,677.89	Monitoring Well	55-910698	135.5
200644	946,492.86	837,928.63	Borehole	55-200644	0
594157	945,165.59	837,921.89	Borehole	55-594157	0
594162	948,816.96	837,598.52	Borehole	55-594162	0
594164	948,816.96	837,598.52	Borehole	55-594164	0
558204	947,784.24	840,565.40	Corehole	55-558204	0
519005	948,816.96	837,598.52	Mineral Exploration Well	55-519005	0
550403	947,830.90	837,270.17	NOI - no installation documentation	55-550403	0
550407	947,830.90	837,270.17	NOI - no installation documentation	55-550407	0
550412	945,155.20	838,581.19	NOI - no installation documentation	55-550412	0

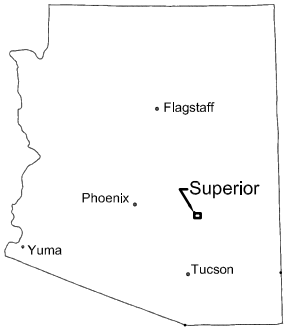
Note: * Well coordinates in NAD 83 State Plane Arizona Central FIPS 0202 ft

FIGURES

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C001.dwg Apr 26, 2011 - 10:09am



REFERENCE: ARIZONA ATLAS & GAZETTEER (2002)



STATE OF ARIZONA

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

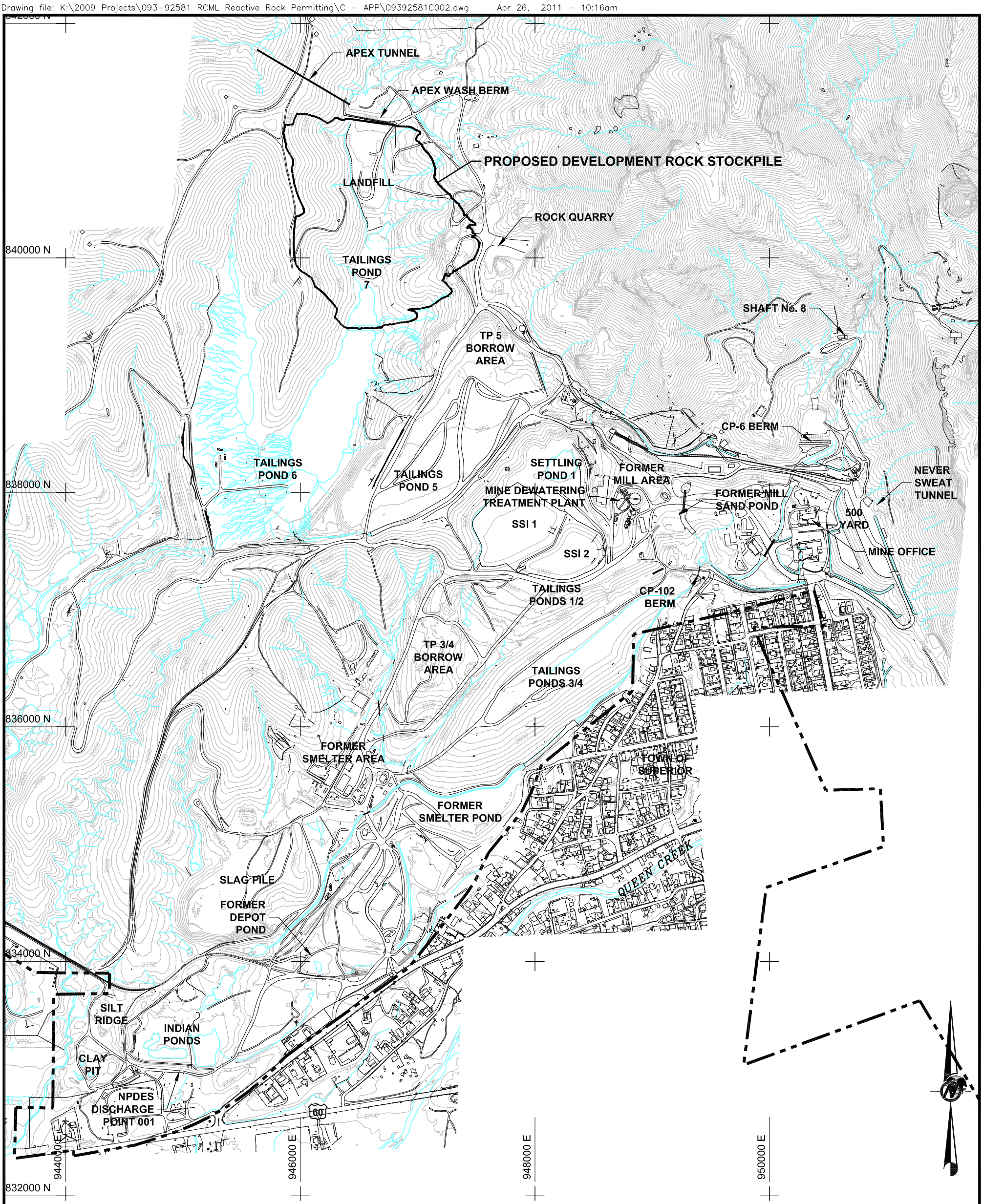
SITE LOCATION MAP

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C001
DESIGN	MJG	07/27/10	SCALE NA	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 1-1

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C002.dwg Apr 26, 2011 - 10:16am



LEGEND

3000	EXISTING SURFACE CONTOURS
	EXISTING ROADS
	EXISTING DRAINAGE
	PROPERTY LINE

800 0 800

Scale: 1" = 800' AZC NAD83
CONTOUR INTERVAL = 10 FT

REFERENCES

1.) 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, FEBRUARY 2009.

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

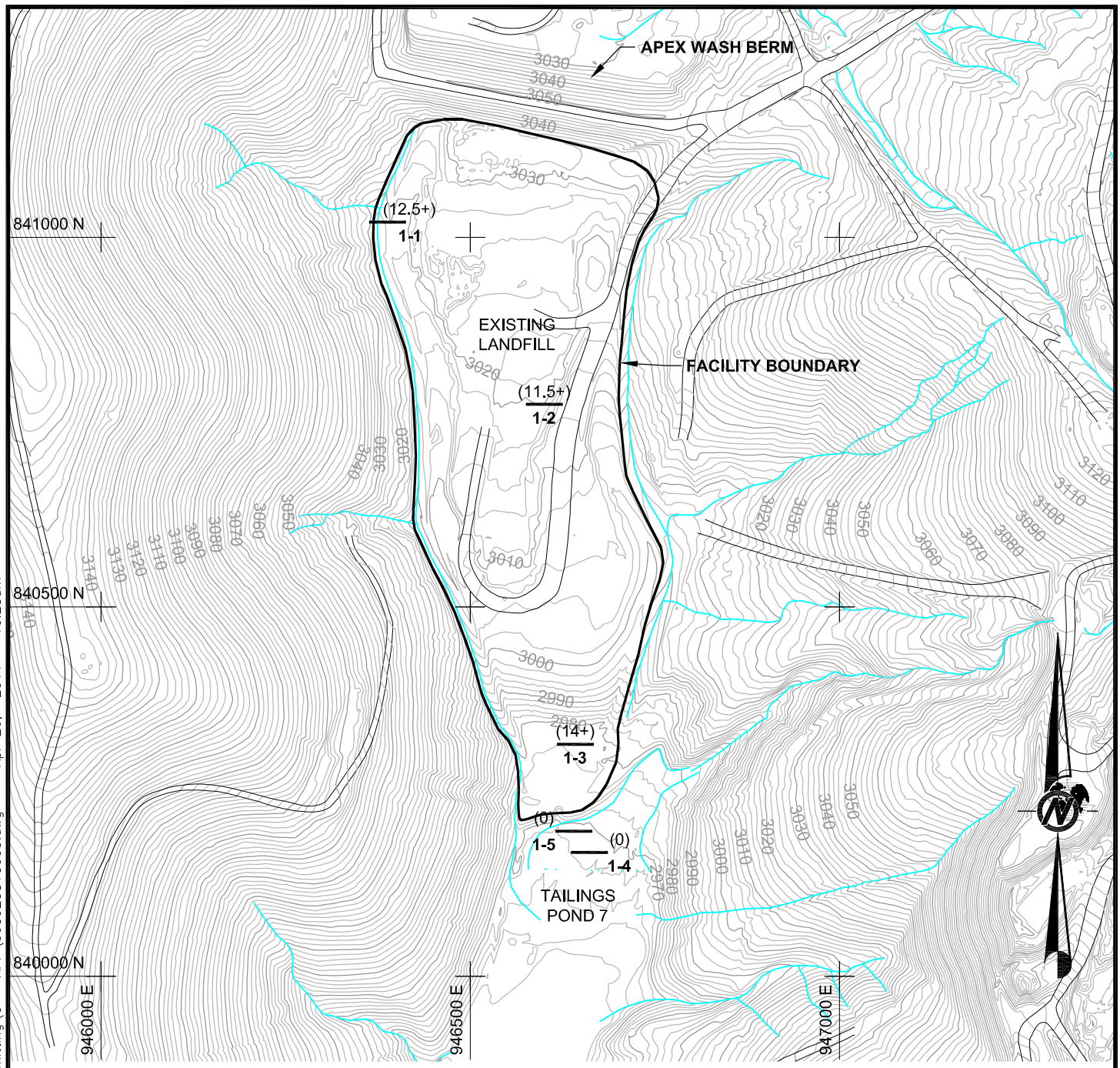
TITLE

SITE TOPOGRAPHY AND FACILITIES MAP

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C002
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 1-2



LEGEND

3000 — EXISTING SURFACE CONTOURS

EXISTING DRAINAGE

EXISTING ROADS

TRENCH LOCATION

(12.5+) — WASTE THICKNESS (FEET)

1-1 — TRENCH ID

200 0 200

SCALE 1" to 200' AZC NAD83

CONTOUR INTERVAL = 2 FT

REFERENCES

1.) 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, FEBRUARY 2009.

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

LANDFILL TRENCH LOCATIONS

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C005
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	08/02/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 3-1

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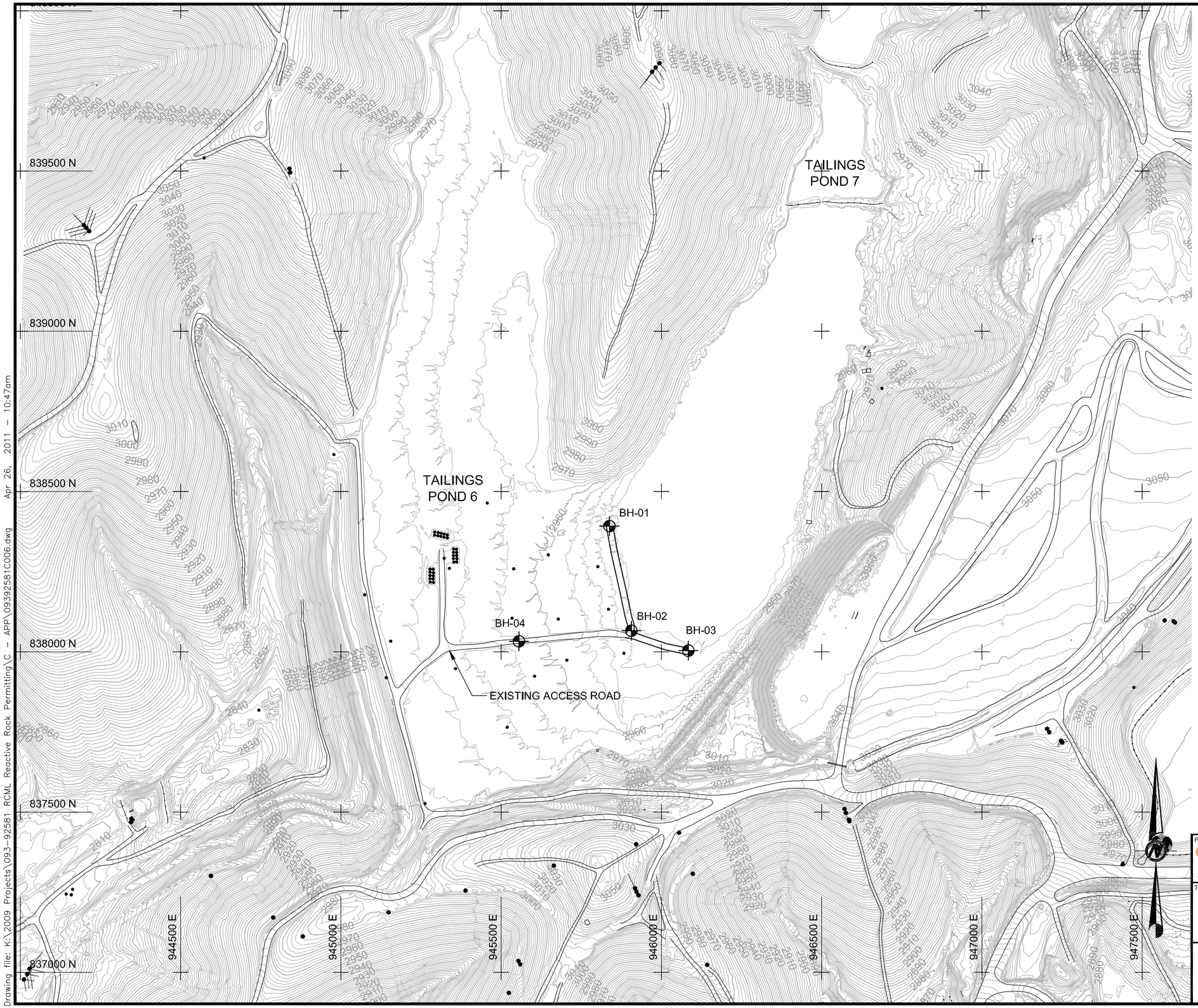

LEGEND

- EXISTING SURFACE CONTOURS (3000)
- EXISTING ROADS
- EXISTING POWERPOLES
- CONSTRUCTED ROAD EXTENSION
- BOREHOLE LOCATION (APPROXIMATE)

REFERENCES

1.) 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, FEBRUARY 2009.

ID	NORTHING	EASTING	ELEVATION
BH-01	838392.22	945837.92	2953.00
BH-02	838065.65	945906.34	2953.00
BH-03	838003.51	946084.05	2952.00
BH-04	838032.93	945555.68	2963.00

300 0 300

SCALE : 1" = 300' AZC NAD83
CONTOUR INTERVAL = 2 FT

PROJECT
Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

TAILINGS POND 6 BOREHOLE LOCATION MAP

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C006
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/28/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 3-2

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C006.dwg Apr 26, 2011 - 10:47am

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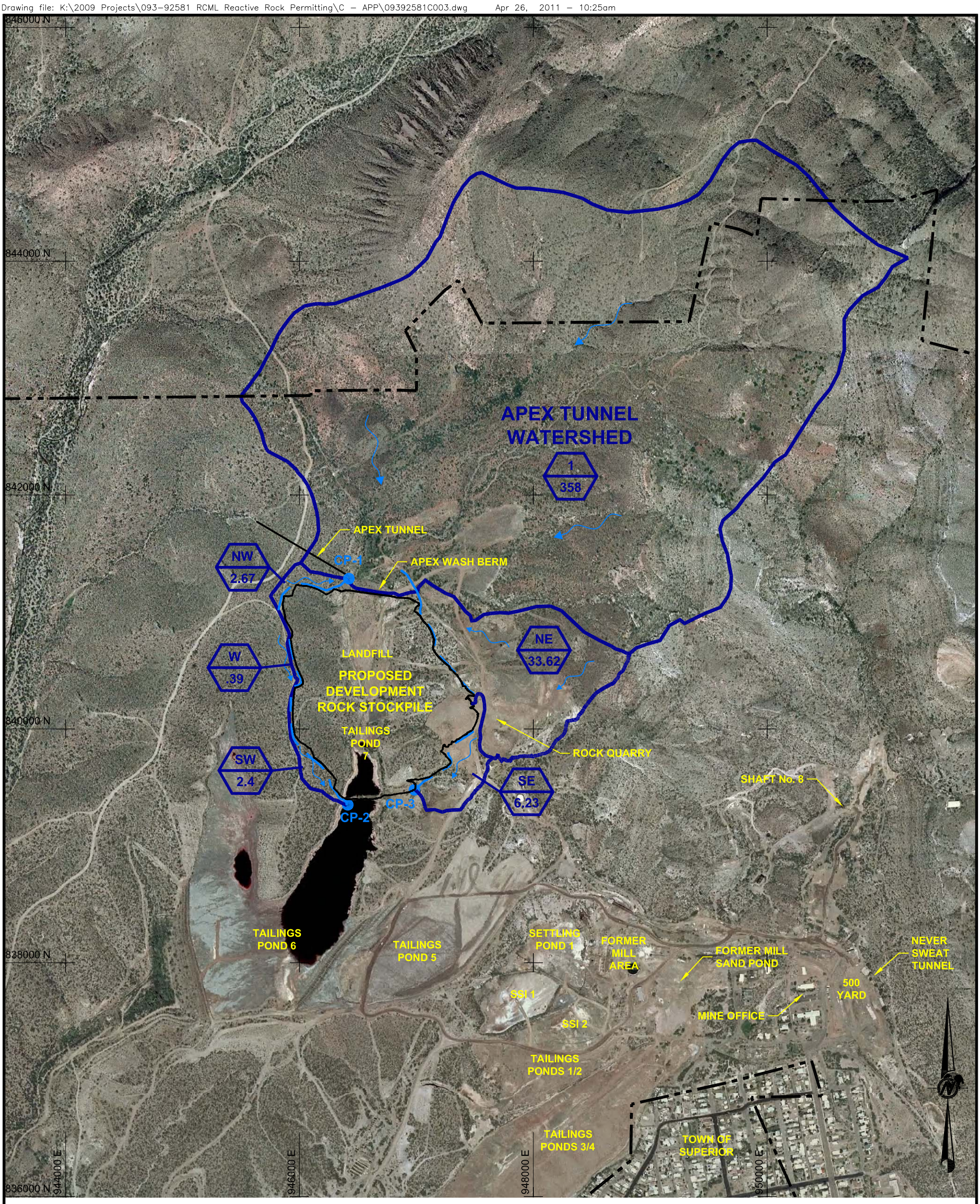


LEGEND

- DIVERSION CHANNEL
- CP — CONCENTRATION POINT
- WATERSHED BOUNDARIES
- DEVELOPMENT ROCK STOCKPILE BOUNDARY
- PROPERTY LINE
- GENERAL FLOW DIRECTION
- 1 / 358 — HYDROLOGIC SUB-BASIN ID / AREA IN ACRES

800 0 800

Scale: 1" = 800' AZC NAD83

REFERENCES

1.) 2005 USGS DOQQs: SUPERIOR, AZ., NW; SUPERIOR, AZ., SW.

PROJECT

Resolution Copper Mining

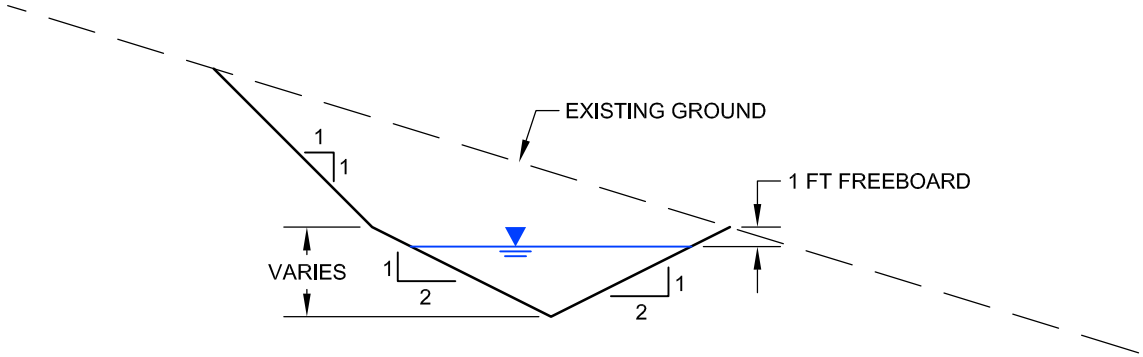
DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

HYDROLOGIC BASIN MAP

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C003
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10	FIGURE 3-3	
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		



TYPICAL DIVERSION CHANNEL DETAIL

CHANNEL DIMENSIONS AND RESPECTIVE EXCAVATION VOLUMES

Sub-Basin ID	Downstream Recipient of Diversion	Channel Slope (ft/ft)	100-yr, 24-hr Peak Outflow (cfs)	Depth of Channel[1] (ft)	Flow Area (ft^2)	Channel Length (ft)	Approximate Excavation Volume (yd^3)
NW	Apex Wash	0.074	30	2.4	11.5	1218	520
NE	Apex Wash	0.052	136	3.5	24.5	2445	2219
SE	Tailings Pond 6	0.204	38	2.2	9.7	647	232
SW	Tailings Pond 6	0.103	26	2.2	9.7	1171	420

1. Includes minimum of one foot of freeboard

ft/ft = feet per feet
cfs = cubic feet per second
ft = feet
ft^2 = square feet
yd^3 = cubic yards

PROJECT
Resolution Copper Mining
DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE
DIVERSION CHANNEL DETAILS

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C004
DESIGN	MJG	07/27/10	SCALE N.T.S.	REV. C
CADD	NIL	07/27/10	**FIGURE 3-4**	
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

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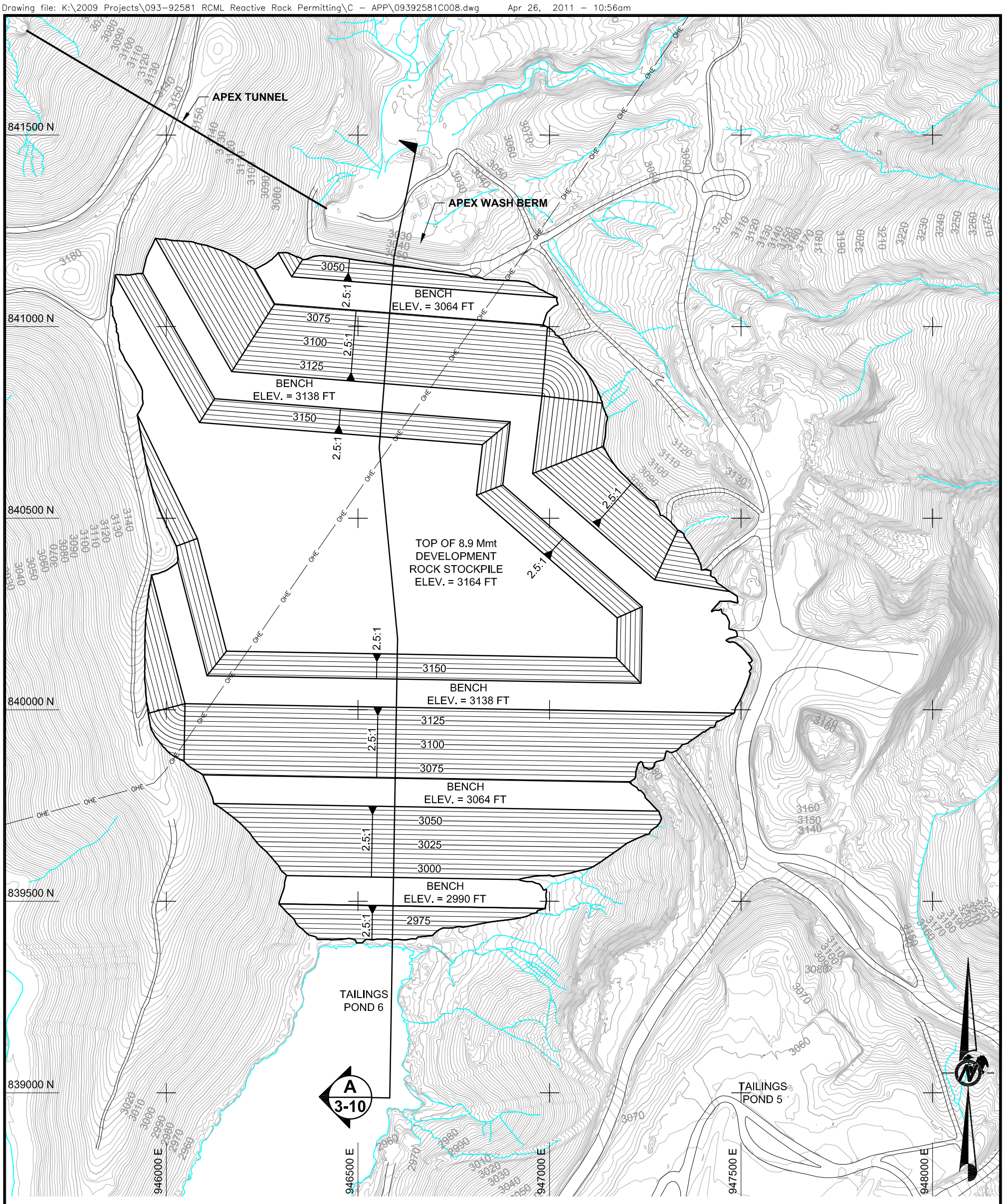


LEGEND

- 3000 — EXISTING SURFACE CONTOURS
- 3000 — PROPOSED STOCKPILE SURFACE CONTOURS
- EXISTING DRAINAGE
- EXISTING ROADS
- EXISTING POWERPOLES/ TRANSISTOR TOWERS
- OHE — EXISTING OVERHEAD POWER LINES

250 0 250

SCALE 1" to 250' AZC NAD83

EXISTING SURFACE CONTOUR INTERVAL = 2 FT

STOCKPILE SURFACE CONTOUR INTERVAL = 5 FT

REFERENCES

1.) 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, FEBRUARY 2009.

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

LOCATION OF CRITICAL STABILITY CROSS-SECTION

Golder Associates

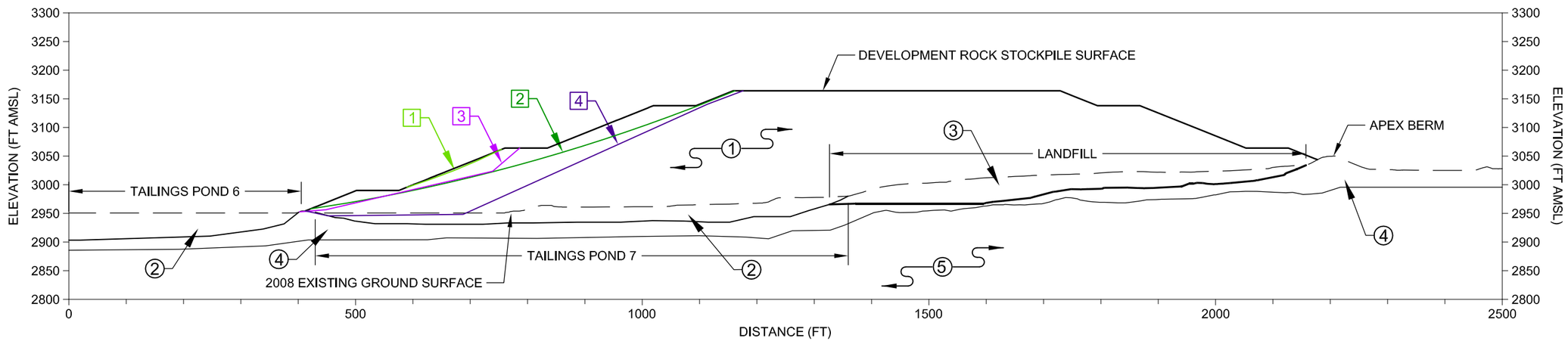
PROJECT No.		093-92581	FILE No.	09392581C008
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/29/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 3-5

MATERIAL PROPERTIES				
TYPE	DESCRIPTION	DRY UNIT WEIGHT (pcf)	COHESION (psf)	FRICTION ANGLE (Degrees)
1	DEVELOPMENT ROCK	125	0	35
2	TAILINGS	130	100	30
3	LANDFILL MATERIAL	100	20	30
4	ALLUVIUM	125	100	36
5	GILA CONGLOMERATE	135	20,000	38

pcf = pounds per cubic foot
psf = pounds per square foot

RESULTS OF ANALYSIS		
FAILURE TYPE	STATIC FACTOR OF SAFETY	PSEUDO-STATIC FACTOR OF SAFETY
1 CIRCULAR / LOCAL	1.76	1.38
2 CIRCULAR / OVERALL	2.53	1.86
3 BLOCK / LOCAL	2.36	1.80
4 BLOCK / OVERALL	2.51	1.86



200 0 200
SCALE 1" to 200' FEET

PROJECT
Resolution Copper Mining
DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

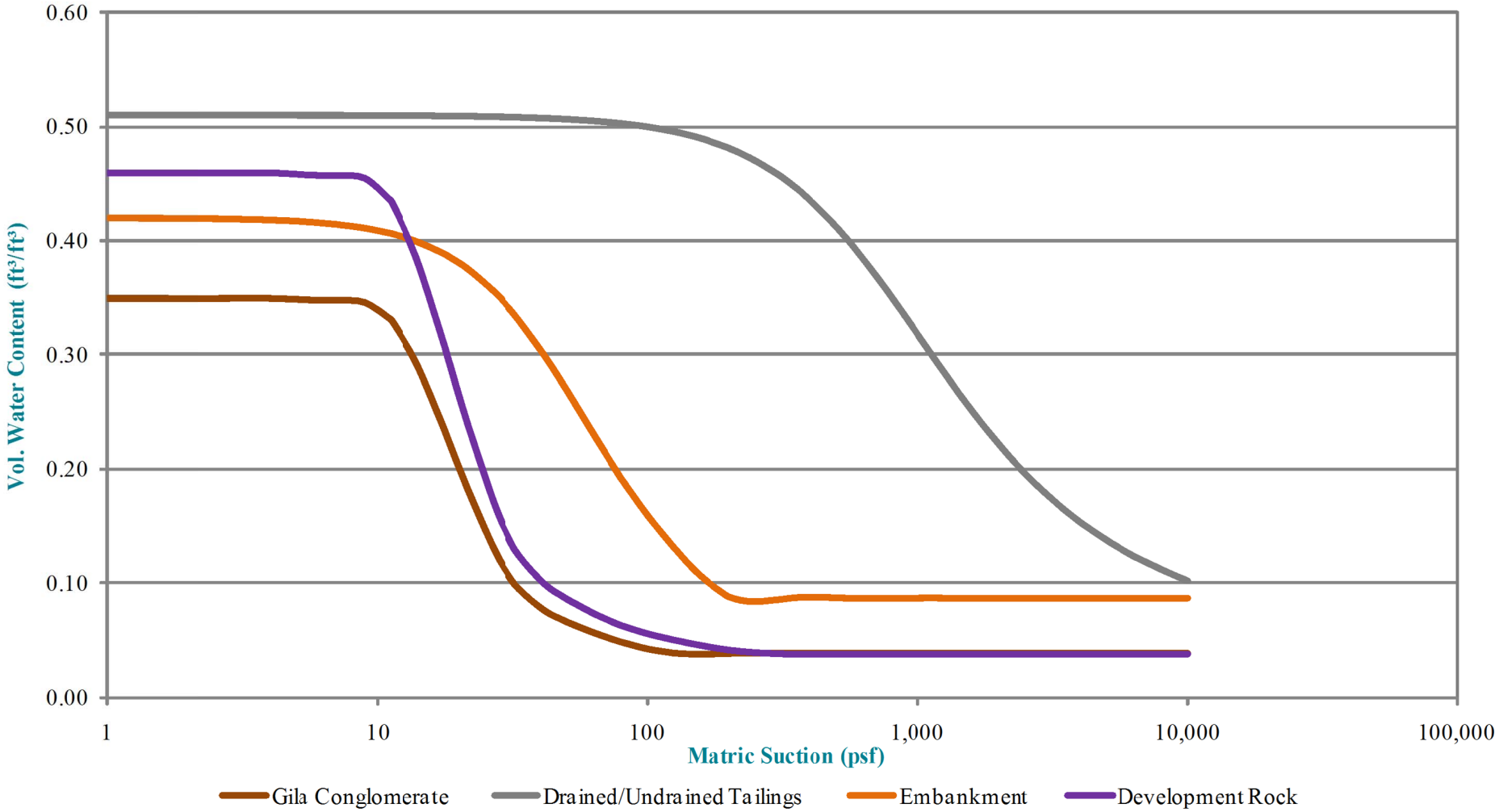
TITLE
CRITICAL STABILITY CROSS-SECTION

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C009
DESIGN	HH	07/24/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/29/10		
CHECK	MJG	08/04/10	**FIGURE 3-6**	
REVIEW	KRJ	02/25/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C009.dwg Apr 26, 2011 - 10:58am

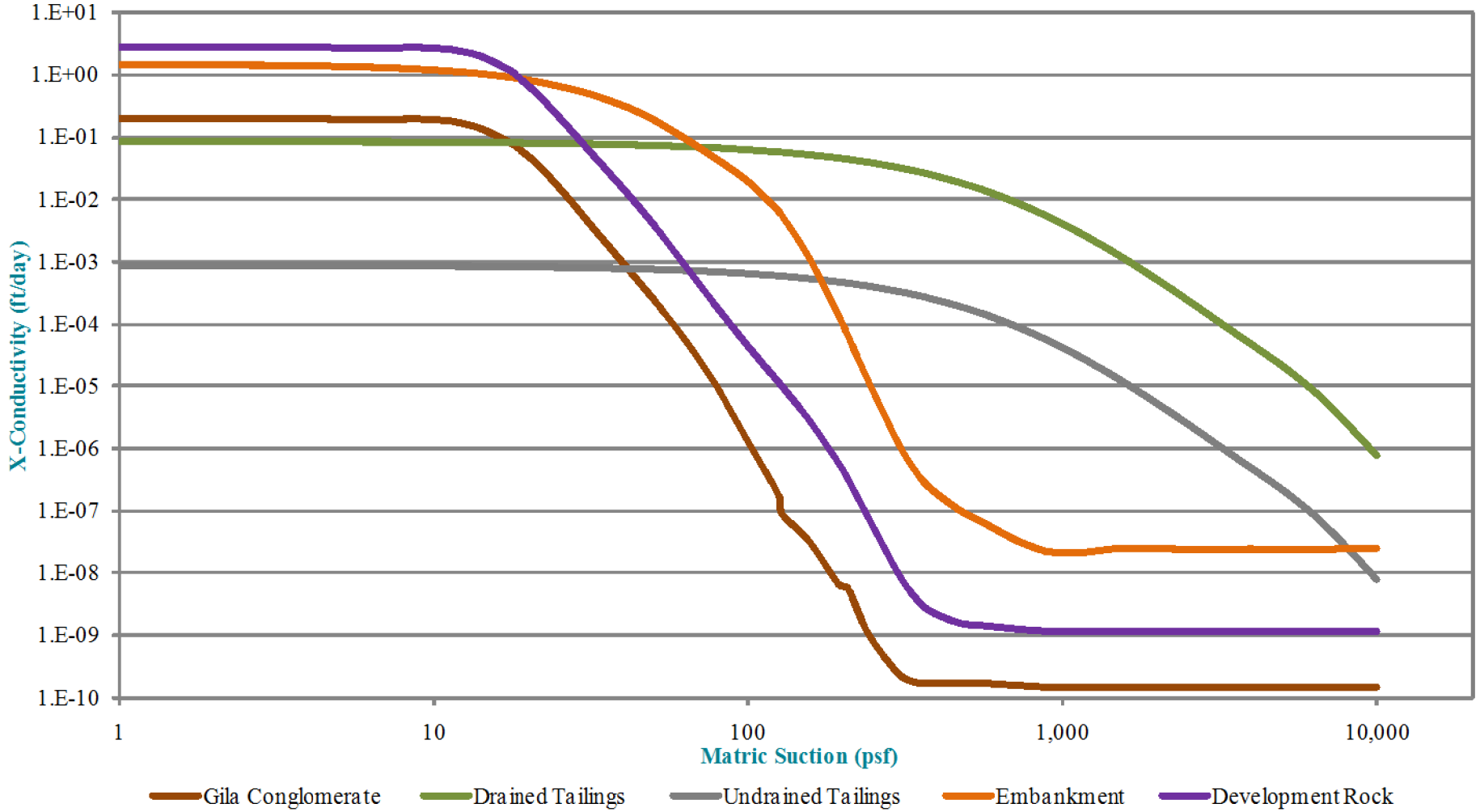
Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C007.dwg Apr 26, 2011 - 10:49am



ft^3/ft^3 = cubic feet per cubic feet
psf = pounds per square foot

PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	VOLUMETRIC WATER CONTENT	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C007	
			DESIGN MJG 07/28/10	SCALE NA	REV. C
			CADD NIL 07/29/10	FIGURE 3-7	
			CHECK MJG 08/04/10		
			REVIEW KRJ 02/25/11		

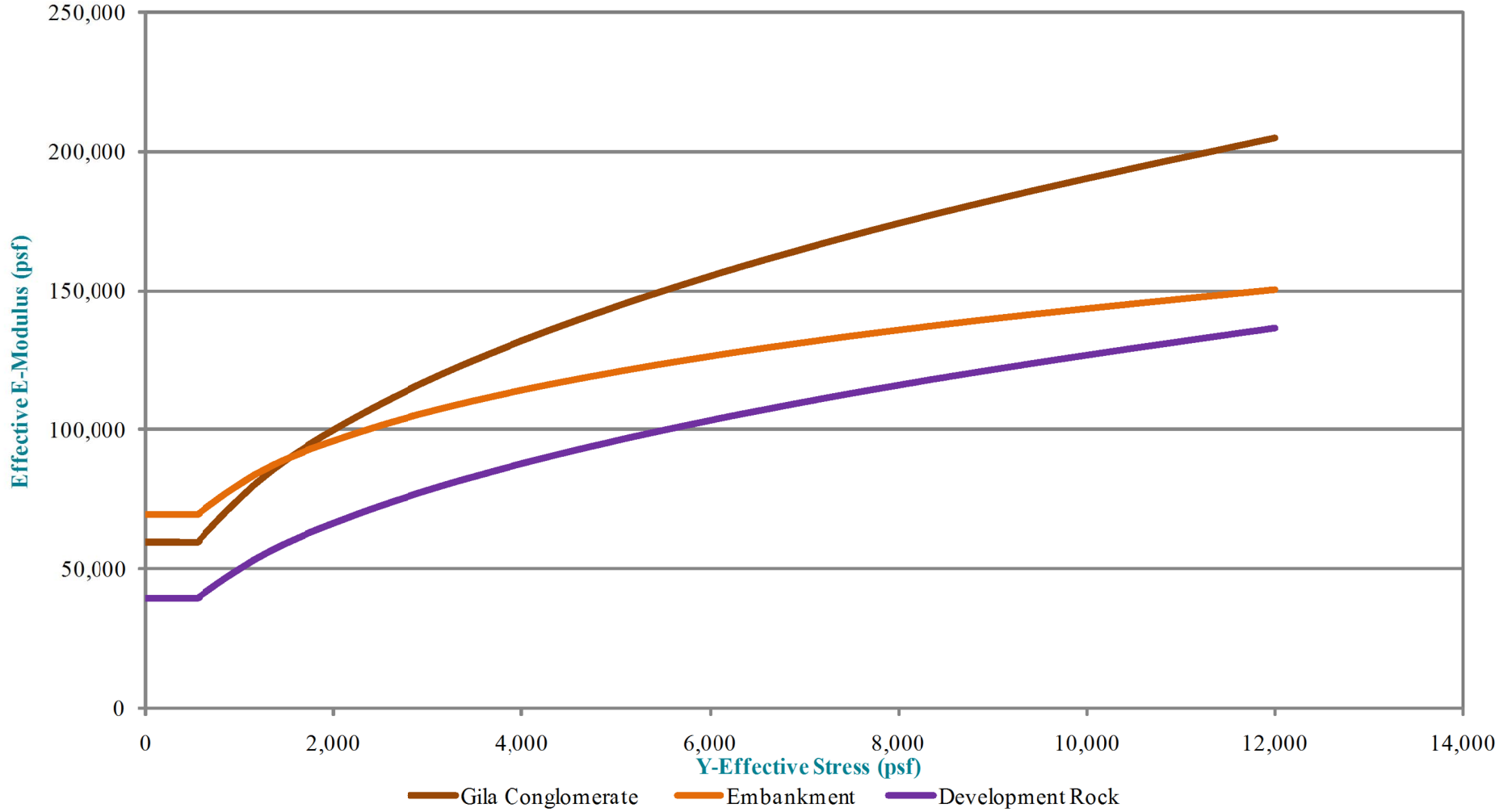
Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C007.dwg Apr 26, 2011 - 10:50am



ft/day = feet per day
psf = pounds per square foot

PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**KX - PERMEABILITY**	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C007	
			DESIGN MJG 07/28/10	SCALE NA REV. C	
			CADD NIL 07/29/10	**FIGURE 3-8**	
			CHECK MJG 08/04/10		
			REVIEW KRJ 02/25/11		

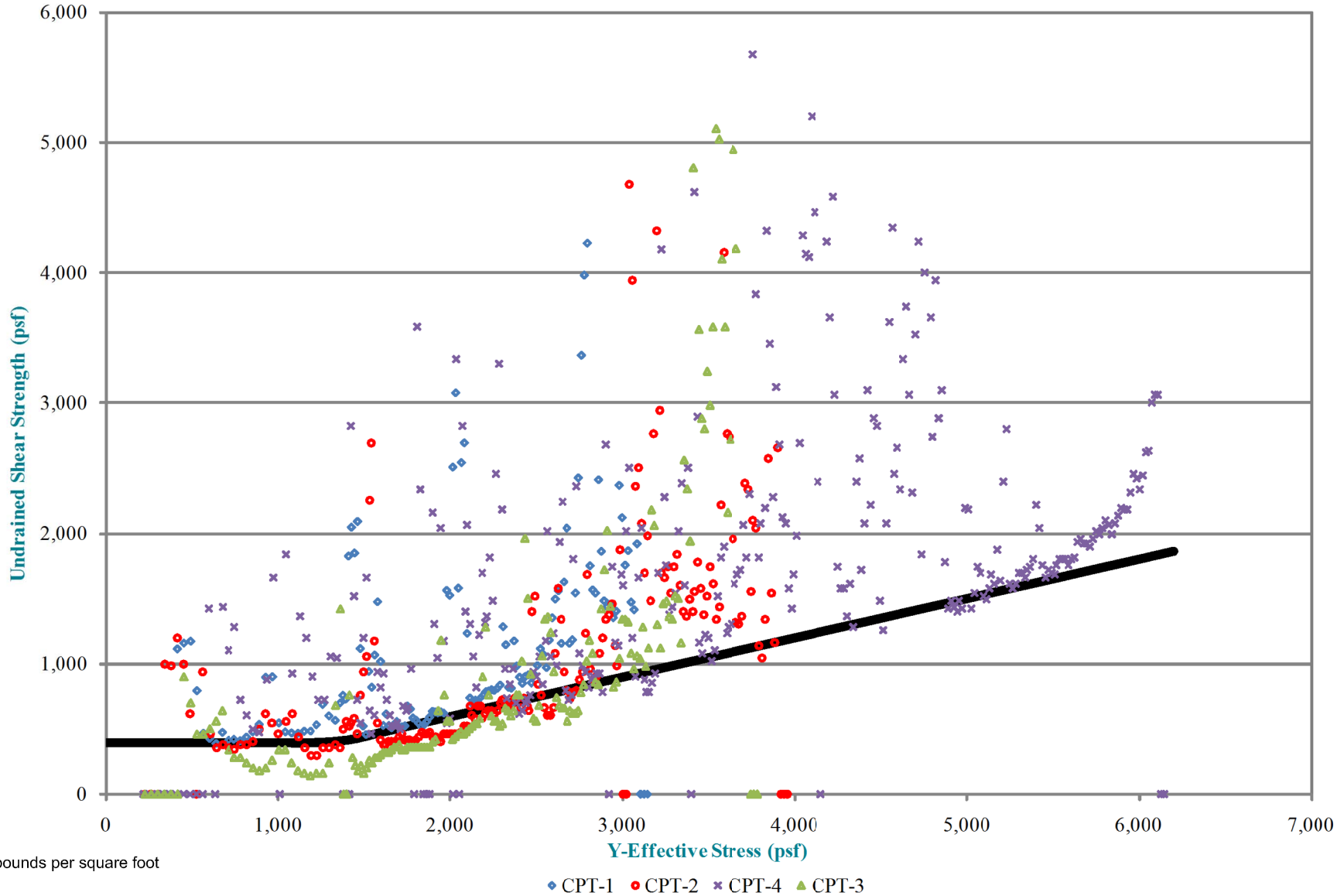
Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C007.dwg Apr 26, 2011 - 10:51am



psf = pounds per square foot

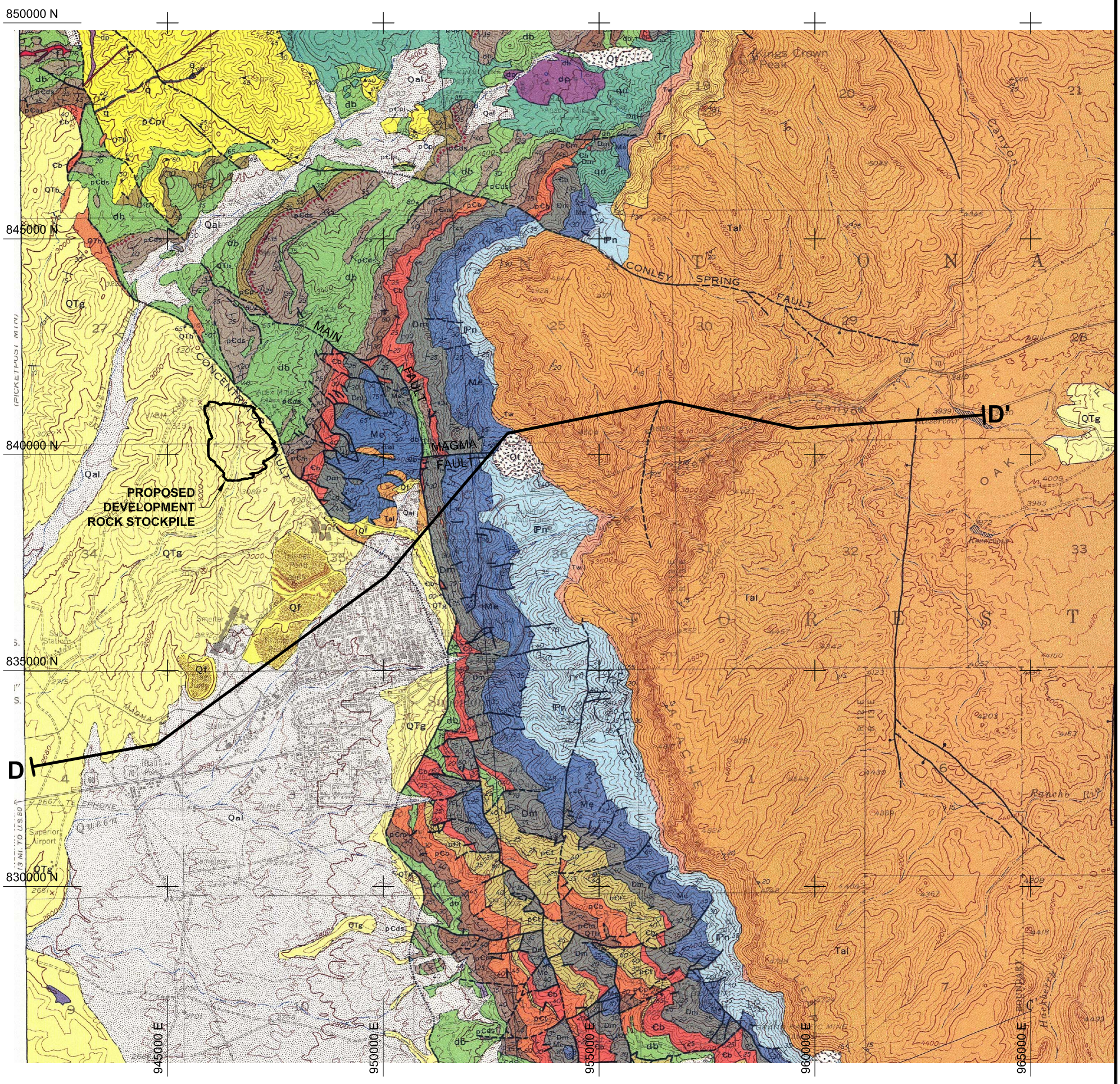
PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	MATERIAL STIFFNESS	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C007	
			DESIGN MJG 07/28/10	SCALE NA REV. C	
			CADD NIL 07/29/10	FIGURE 3-9	
			CHECK MJG 08/04/10		
			REVIEW KRJ 02/25/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C007.dwg Apr 26, 2011 - 10:52am



psf = pounds per square foot

PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**CPT RESULTS**	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C007	
			DESIGN MJG 07/28/10	SCALE NA REV. C	
			CADD NIL 07/29/10	**FIGURE 3-10**	
			CHECK MJG 08/04/10		
			REVIEW KRJ 02/25/11		



LEGEND

CROSS-SECTION LOCATION

NOTES

1.) SEE FIGURE 5-3 FOR CROSS-SECTION.

2500 0 2500

Scale: 1" = 2500' AZC NAD83

REFERENCES

1.) GEOLOGIC BASE FROM USGS GEOLOGIC QUADRANGLE MAP GQ-818 "GEOLOGIC MAP OF THE SUPERIOR QUADRANGLE, PINAL COUNTY, ARIZONA", 1969.

2.) CROSS-SECTION TAKEN FROM FIGURE 2.2, "GEOLOGIC MAP OF THE SUPERIOR SITE, SUPERIOR, ARIZONA", BROWN AND CALDWELL, SITE CHARACTERIZATION REPORT, JUNE 1999.

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

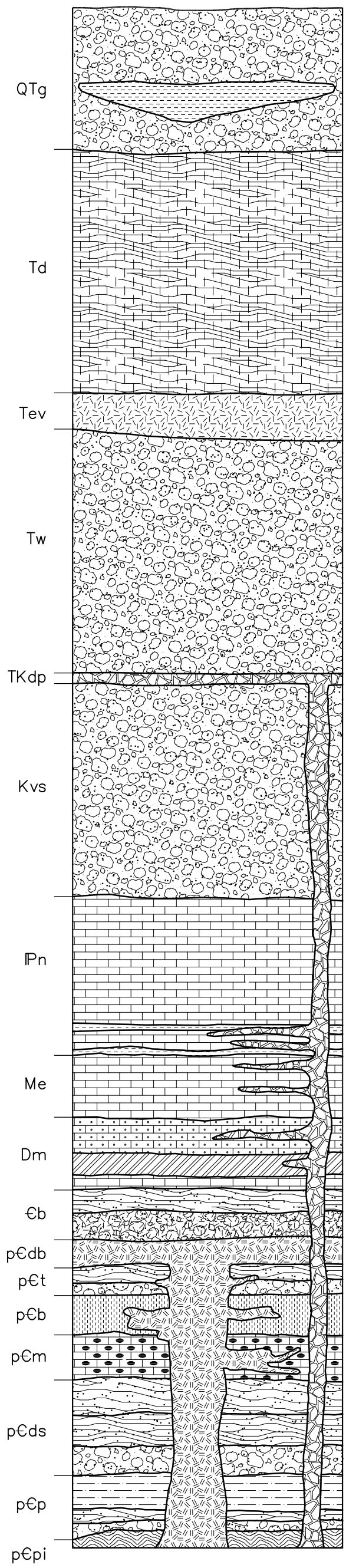
TITLE

GEOLOGIC MAP OF THE LOCAL AREA AND CROSS-SECTION LOCATION

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C010
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 5-1



QTg Quaternary Tertiary Gila Conglomerate (0 to 3,000 Feet)

The Gila Conglomerate poorly sorted, moderately to well-cemented with fine to medium-grained, pale pink to grey dacitic groundmass containing altered biotite. Clasts are sub-rounded to sub-angular, calcareously cemented, ranging in size from granule to boulder, and are composed of micritic limestone, basalt, ash flow tuff, sandstone, mesocratic diabase, quartzite, granodiorite, diabase, calcareous clay nodules, iron-rich mudstone, and dunite. An interbedded mudstone unit is reddish brown, silty to sandy with authigenic carbonate. The unit contains minor angular to sub-rounded, granule- to pebble-sized volcaniclastic clasts.

Td Tertiary Apache Leap Tuff (500 to 2,000 Feet)

The Apache Leap Tuff grades from a non-welded light gray tuff at the base to a densely welded black vitrophyre to a welded tuff with a cryptocrystalline groundmass. The degree of welding in the upper part of the Apache Leap Tuff decreases upward and the color grades from light brown to moderate red to very light gray near the top.

Tev Tertiary Volcanics (300 to 500 Feet)

Composed of basaltic andesite. Locally encountered in subsurface only.

Tw Late Tertiary Whitetail Conglomerate (500 to 4,300 Feet)

This fluvial deposit possesses angular to sub-angular fragments derived from older rocks. Locally, the poorly consolidated sandstone and conglomerate crops out as channel fill.

TKdp Teritiary-Cretaceous Dacite Quartz Andesite Porphyry

This sequence of dikes and sills are co-magmatic, hypabyssal intrusive porphyries. Dikes are abundant among Magma Vein and associated faults. Generally altered to sericite, clay, and calcite. Associated with known ore bodies.

Kvs Cretaceous Sedimentary Rocks (at least 2,700 feet)

Consists of conglomerate and sandstone. The unit does not crop out in the Superior area, but is preserved in a structurally bound block east of the Apache Leap escarpment; the Apache Leaf Tuff. It is completely covered by Whitetail Conglomerate and dacite.

IPn Pennsylvanian Naco Formation (1,400 Feet)

The Naco Formation is a succession of thinly- to medium-bedded limestone with interbedded chert lenses and shale beds.

Me Mississippian Escabrosa Limestone (400 to 500 Feet)

A fine-grained, medium- to thickly-bedded limestone interbedded with permeable shale and chert beds. The unit is fossiliferous containing crinoid stems, brachiopods, and corrals.

Dm Devonian Martin Formation (350 to 450 Feet)

This unit consists of a basal crystalline limestone overlain by thinly-bedded and permeable dolomite. The upper section contains alternating beds of limestone, dolomite, sandstone, and shale.

€b Cambrian Bolsa Quartzite (0 to 430 Feet)

The lower portion of the unit contains pebble conglomerate or arkosic sandstone, graywacke, and wavy-bedded calcareous mudstone. The upper section consists of medium- to thick-bedded, cross-stratified, medium- to fine-grained quartzite.

p€db PreCambrian Diabase (0 to 3,000 Feet)

Sills and dikes have ophitic to sub-ophitic texture and intrude into all Pre-Cambrian rocks, but are truncated by an erosion surface and are underlying Cambrian rocks. Jointing in the sills dips eastward paralleling floating sedimentary blocks and Paleozoic rocks.

p€t PreCambrian Troy Quartzite (0 to 730 Feet)

The upper beds are composed of medium-bedded, fine-grained quartzite. The lower beds are composed of alternating beds of conglomerate, coarse-grained arkose and siltstone.

p€b PreCambrian Basalt (0 to 320 Feet)

Vesicular lava and breccia flows.

p€m PreCambrian Mescal Limestone (350 Feet)

This unit consists of fine-grained limestone with lesser amounts of dolomite. Chert is locally abundant and forms permeable horizons.

p€ds PreCambrian Dripping Spring Quartzite (650 to 800 Feet)

This unit consists of thin-bedded, fine-grained feldspathic quartzite overlying arkose, siltstone, and coarse-grained quartzite. The basal member, the Barnes Conglomerate, is composed of well-rounded pebbles of quartzite, quartz, and jasper in a medium- to coarse-grained arkosic matrix.

p€p PreCambrian Pioneer Formation (400 Feet)

Thinly-bedded shale overlies siltstone, fine-grained arkose and feldspathic quartzite with shale partings. The basal member is composed of rounded quartz and angular schist pebbles in a coarse-grained matrix.

p€pi PreCambrian Pinal Schist

This basement unit is composed of quartz muscovite schist, which is strongly foliated and slightly to strongly contorted. Locally cut by white quartz veins.

SOURCES: BROWN AND CALDWELL CORE LOGS, APPENDIX B HAMMER, 1989
LOCKE et al., 1917

REFERENCES

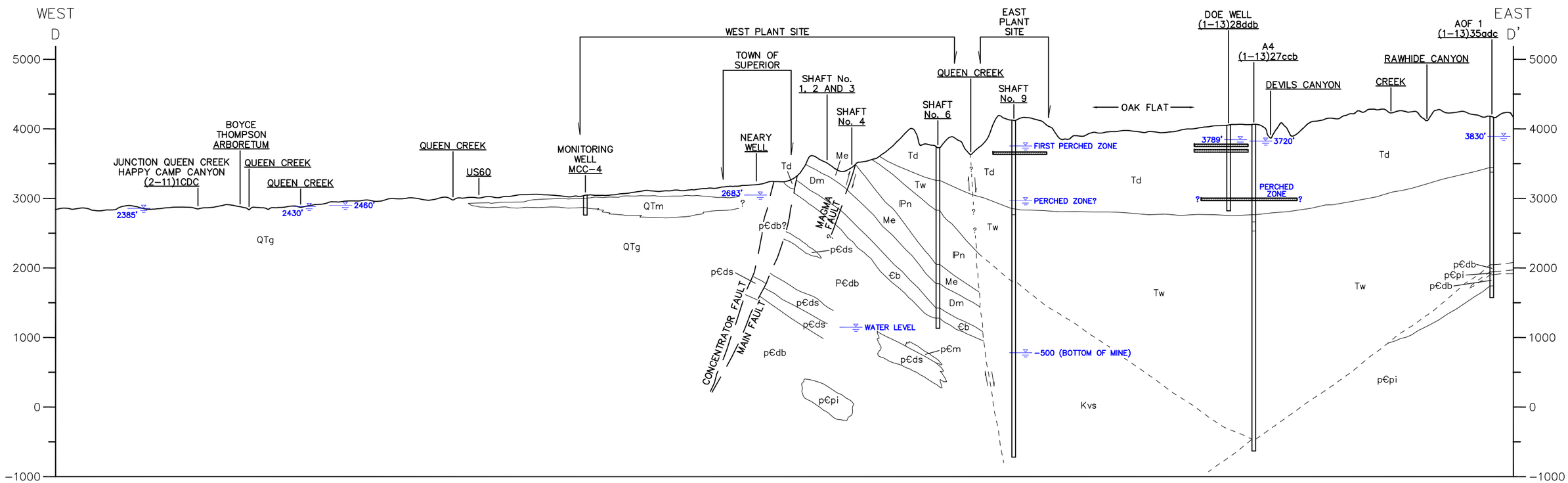
1.) FIGURE 2.3, "GENERALIZED STRATIGRAPHIC COLUMN OF THE SUPERIOR REGION, SUPERIOR, ARIZONA", BROWN AND CALDWELL, SITE CHARACTERIZATION REPORT, JUNE 1999.

PROJECT
Resolution Copper Mining
DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE
GENERALIZED STRATIGRAPHIC COLUMN OF THE LOCAL AREA

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C011
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10	FIGURE 5-2	
REVIEW	KRJ	02/25/11		



SOURCES: U.S. GEOLOGICAL MAP GQ−818, PETERSON, 1969

HAMMER, 1989

BHP MINERALS EXPLORATION, 1978 THROUGH 1999, UNPUBLISHED DATA

CROSS−SECTION A−A' B−B' AND C−C' IN THIS REPORT

EXPLANATION

QTg = QUATERNARY−TERTIARY GILA CONGLOMERATE
QTm = QUATERNARY−TERTIARY GILA CONGLOMERATE/MUDSTONE
Td = TERTIARY DACITE (APACHE LEAP TUFF)
Tw = TERTIARY WHITETAIL CONGLOMERATE
Kvs = CRETACEOUS VOLCANICLASTIC SEQUENCE
IPm = PENNSYLVANIAN NACO FORMATION
Me = MISSISSIPPIAN ESCABROSA LIMESTONE
Dm = DEVONIAN MARTIN FORMATION
€b = CAMBRIAN BOLSA QUARTZITE
p€db = PRECAMBRIAN DIABASE
p€t = PRECAMBRIAN TROY QUARTZITE
p€b = PRECAMBRIAN BASALT
p€m = PRECAMBRIAN MEZCAL LIMESTONE
p€ds = PRECAMBRIAN DRIPPING SPRING QUARTZITE
p€pi = PRECAMBRIAN PINAL SCHIST

SCALE

0 2000 4000
APPROXIMATE HORIZONTAL SCALE IN FEET

0 700 1400
APPROXIMATE VERTICAL SCALE IN FEET

VERTICAL EXAGGERATION 2.86

NOTES

1.) DATES OF WATER LEVELS: 1998 (SECTION 2.0, BROWN AND CALDWELL, SITE CHARACTERIZATION REPORT, JUNE 1999).

REFERENCES

1.) FIGURE 2.15, "GENERALIZED HYDROGEOLOGIC CROSS SECTION D-D', SUPERIOR, ARIZONA", BROWN AND CALDWELL, SITE CHARACTERIZATION REPORT, JUNE 1999.

PROJECT
Resolution Copper Mining
DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE
GENERALIZED HYDROGEOLOGIC CROSS-SECTION D-D'

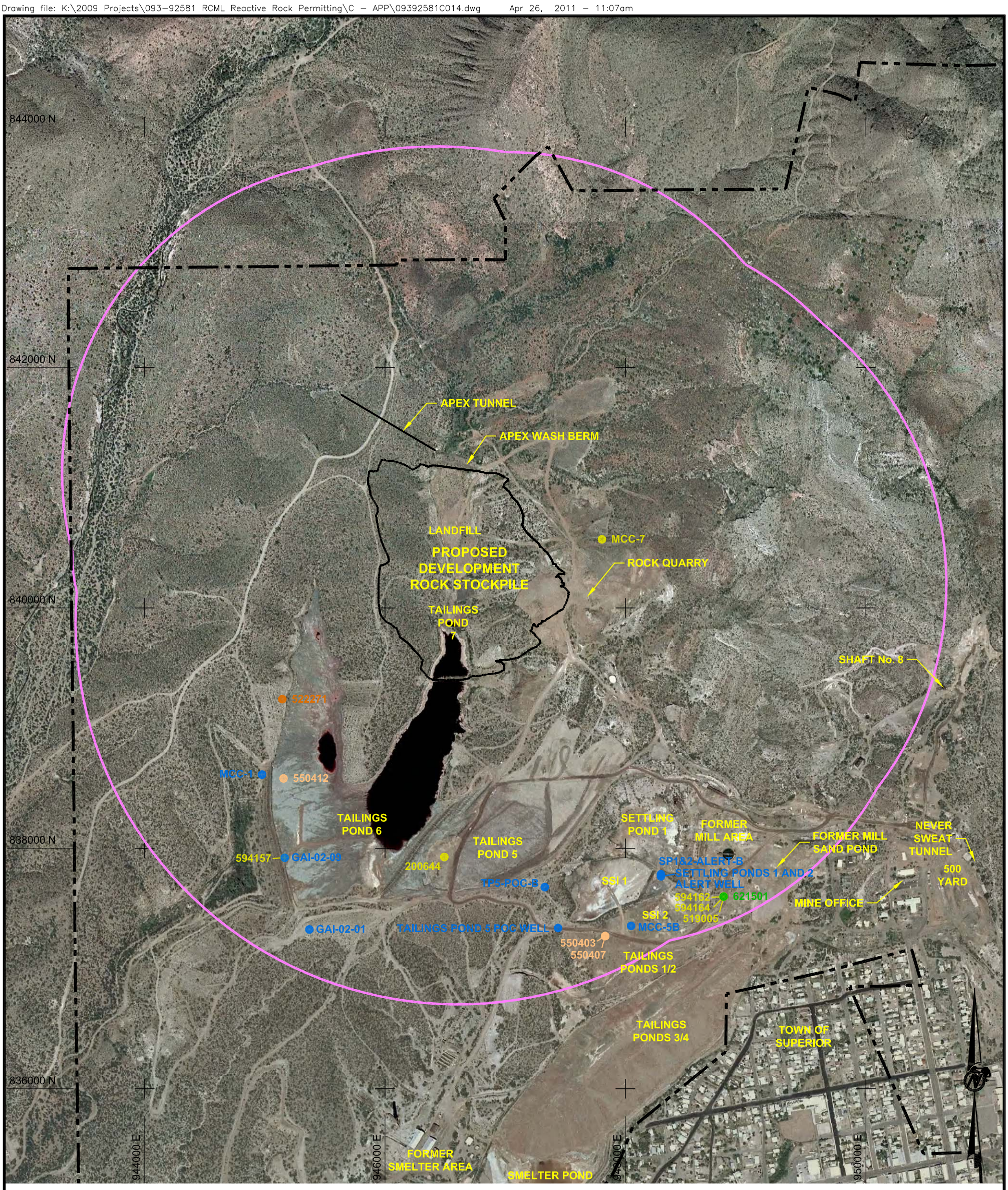
Golder Associates

PROJECT No.		093−92581	FILE No.	09392581C012
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/28/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 5-3

Drawing file: K:\2009 Projects\093−92581 RCML Reactive Rock Permitting\C − APP\09392581C012.dwg Apr 26, 2011 − 11:03am

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C014.dwg Apr 26, 2011 - 11:07am



LEGEND

- DEVELOPMENT ROCK STOCKPILE FOOTPRINT
- AREA WITHIN 1/2 MILE OF FACILITY
- PROPERTY LINE
- MONITORING WELL (RESOLUTION)
- BOREHOLE, COREHOLE, OR MINERAL EXPLORATION HOLE (RESOLUTION)
- NOI - NO INSTALLATION FOUND (RESOLUTION)
- PRODUCTION WELL (OTHER OWNER)
- CATHODIC PROTECTION WELL (OTHER OWNER)

NOTES

1.) ADWR WELLS 55 AND GWSI DATABASES QUERIED AS WELL AS RESOLUTION DATA.

REFERENCES

1.) 2005 USGS DOQQs: SUPERIOR, AZ., NW; SUPERIOR, AZ., SW.

800 0 800

Scale: 1" = 800' AZC NAD83

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

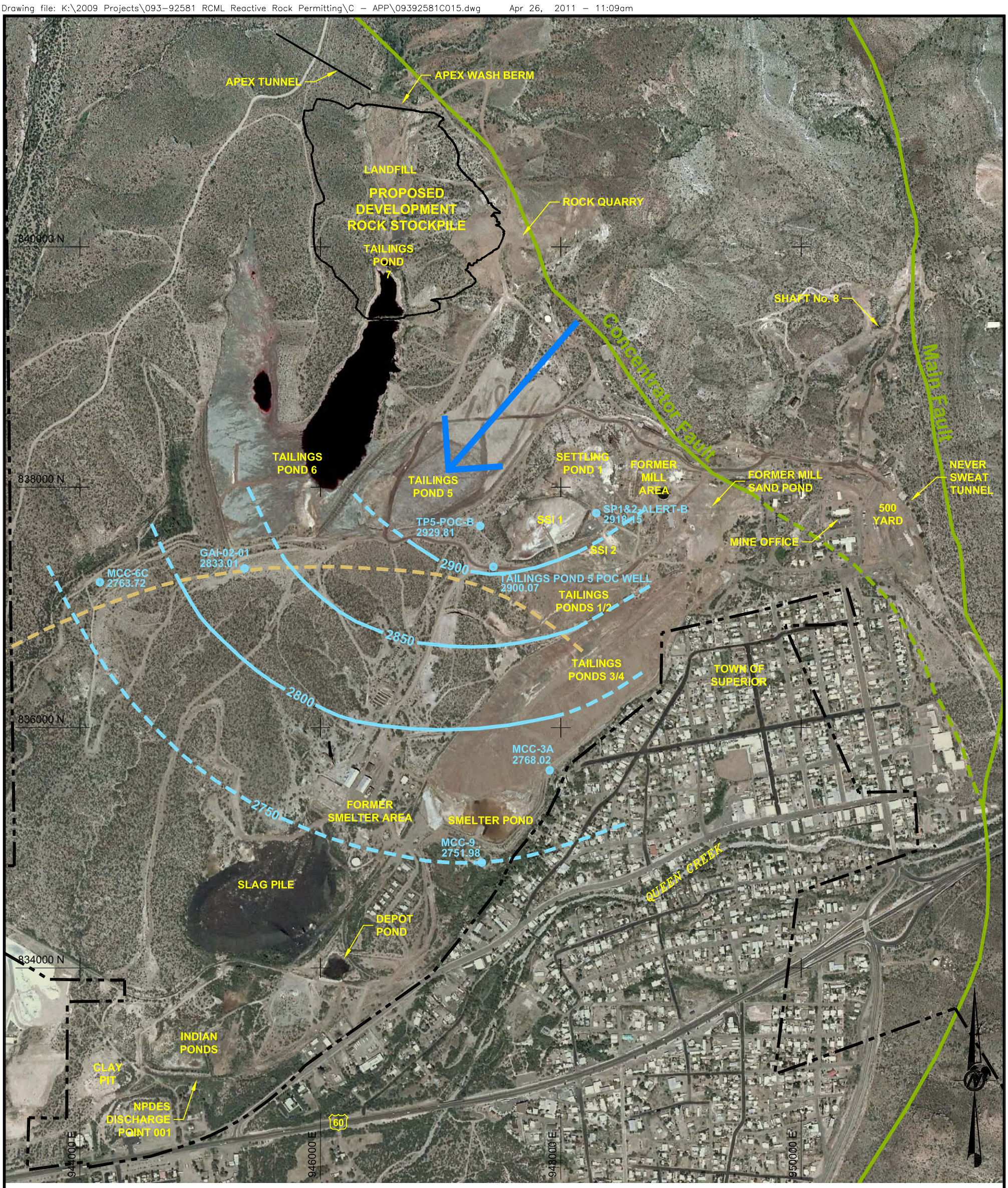
WELL INVENTORY

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C014
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10		
REVIEW	KRJ	02/25/11		

FIGURE 5-4

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C015.dwg Apr 26, 2011 - 11:09am



LEGEND

- 2750 — GROUNDWATER ELEVATION CONTOUR (50 FT) (DASHED WHERE INFERRED)
- MCC-9 2751.98 — WELL WITH SHALLOW GROUNDWATER ELEVATION
- FAULT
- DEVELOPMENT ROCK STOCKPILE FOOTPRINT
- APPROXIMATE NORTHERN EXTENT OF MUDSTONE AQUITARD
- PROPERTY LINE
- APPROXIMATE DIRECTION OF REGIONAL GRADIENT

NOTES

1.) SP1&2-ALERT-B WELL IS COMPLETED IN THE SETTLING PONDS 1 & 2 TAILINGS.

REFERENCES

1.) 2005 USGS DOQQs: SUPERIOR, AZ., NW; SUPERIOR, AZ., SW.

2.) REGIONAL FLOW DIRECTION FROM MONTGOMERY AND ASSOCIATES, 2001. SUMMARY OF HYDROGEOLOGIC DATA FOR THE SUPERIOR AREA, PINAL AND GILA COUNTIES, ARIZONA. NOVEMBER 27, 2001.

800 0 800

Scale: 1" = 800' AZC NAD83

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

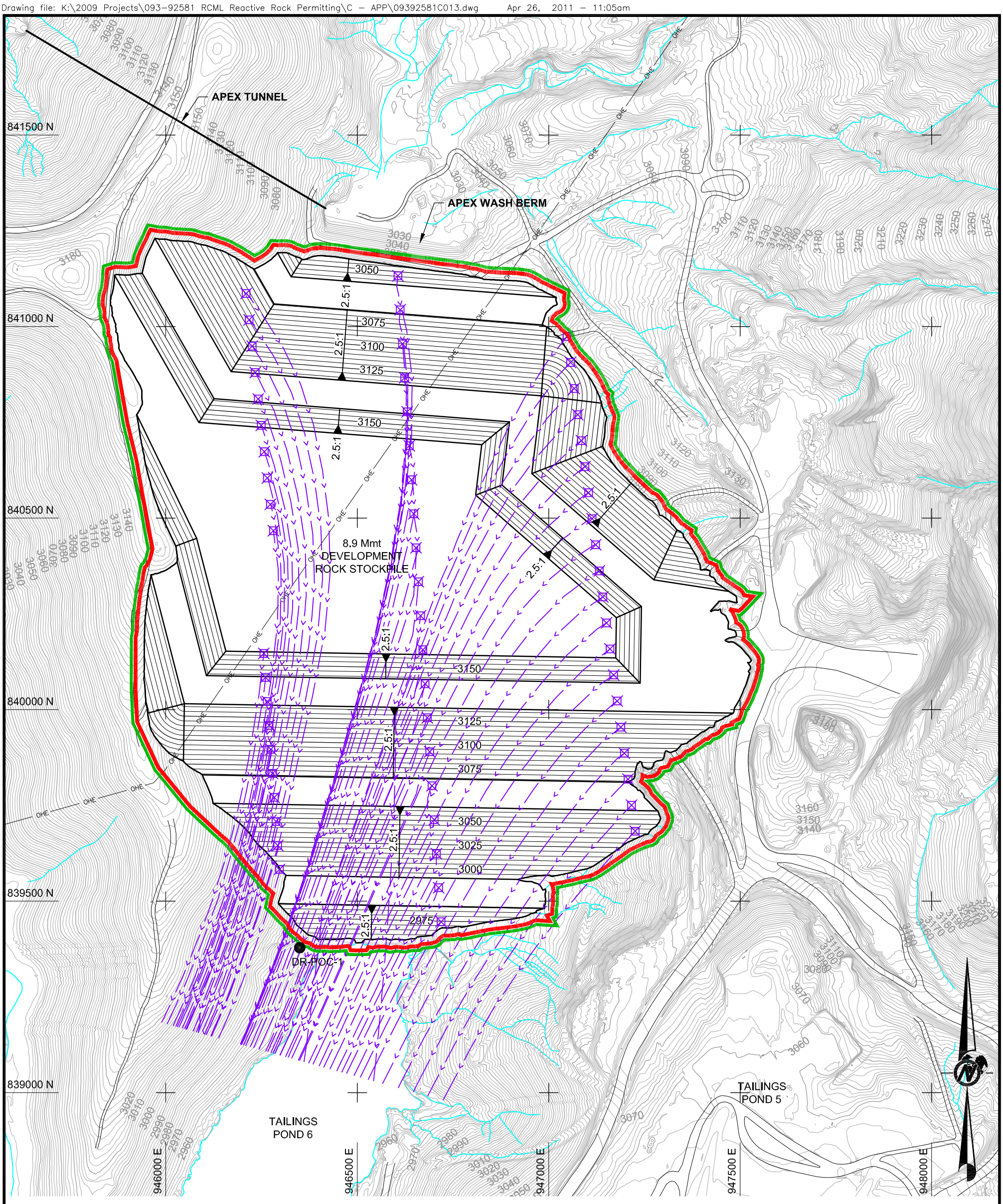
TITLE

WATER TABLE CONTOUR MAP 4TH QUARTER 2010

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C015
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/27/10		
CHECK	MJG	08/04/10	FIGURE 5-5	
REVIEW	KRJ	02/25/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C013.dwg Apr 26, 2011 - 11:05am



LEGEND

- 3000 — EXISTING SURFACE CONTOURS
- EXISTING DRAINAGE
- EXISTING ROADS
- EXISTING POWERPOLES/ TRANSISTOR TOWERS
- OHE — EXISTING OVERHEAD POWERLINES
- 3000 — PROPOSED STOCKPILE SURFACE CONTOURS
- DISCHARGE IMPACT AREA (DIA)
- PROPOSED POLLUTANT MANAGEMENT AREA (PMA)
- DR-POC-1 — APPROXIMATE LOCATION OF PROPOSED POINT OF COMPLIANCE (POC) MONITORING WELL
- PARTICLE TRACE START LOCATION
- PARTICLE TRACE PATH

250 0 250

SCALE 1" to 250' AZC NAD83

EXISTING SURFACE CONTOUR INTERVAL = 2 FT

STOCKPILE SURFACE CONTOUR INTERVAL = 5 FT

REFERENCES

1.) 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, FEBRUARY 2009.

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

PROPOSED POLLUTANT MANAGEMENT AREA, DISCHARGE IMPACT AREA, AND POINT OF COMPLIANCE WELL

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C013
DESIGN	MJG	07/27/10	SCALE AS SHOWN	REV. C
CADD	NIL	07/29/10		
CHECK	MJG	08/04/10		
REVIEW				

FIGURE 6-1

APPENDIX A
GEOTECHNICAL BORING LOGS

REPORT OF BOREHOLE: KEY

Golder Associates

SHEET: 1 OF 1

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0										Material Description Range of Proportion: -trace: 0 - 5% -little: 5 - 12% -some or (y, ey): 12 - 30% -and: 30 - 50%				
										Blows Per Six Inches Number of sample hammer blows required to drive the sampler six inches, or recorded number of blows to drive the sampler the specified distance (e.g. 50/4" = 50 hammer blows to drive the sampler four inches).				
10										Blows Per Foot Number of sample hammer blows required to drive the sampler twelve inches. Resolved using the final twelve inches of the sample or the amount of penetration upon sample refusal (50 blow counts).				
										Sample Down Pressure Maximum down pressure observed from drill-rig hydraulic gauge during sampling (down pressure required to push Shelby Tube into soil). Sampling was discontinued at 1000 psi.				
20										Sample Types				
			1		4 5 6	11	17 / 18			Standard Penetration Test - Full penetration with 17 of 18 inches recovered.				
			2		50/4" - -	50/4"	3 / 4			Standard Penetration Test - Refusal at 4 inches, 3 of 4 inches recovered.				
			4		14 13 9	22	16 / 18			Modified California Samples (Barrel Ring Sampler - (2.5" O.D.))				
30			5				18 / 18			Shelby Tube - Full downward push, by some pressure, with 18 of 18 inches recovered. Maximum down pressure recorded during sampling was 800 psi.				
										Moisture Condition Dry - No moisture. Damp - Moist enough to darken appearance. Moist - Mositure sticks to hand. Wet - Visible water leaves hands wet.				
		▽								Water Level Encountered				
40										Additional Lab Testing AL = Atterberg Limit CO = Consolidation DS = Direct Shear MC = Moisture Content MD = Moisture Density SA = Sieve Analysis SG = Specific Gravity TX = Triaxial				
50														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-01

Golder Associates

SHEET: 1 OF 2

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0										**CLAY with Little Sand, Trace Gravel:** Dark brown, fine gravel, low to medium plasticity, fine to coarse sand, very soft, moist.				
			1		0 1 0	1	18 / 18					51.0		MC AL SG SA
10			2		0 1 0	1	10 / 18							
			3		0 1 0	1	16 / 18		CL		Modified California Sample taken with brass rings.	33.7	98.9	MD
20			4		0 1 0	1	18 / 18			Moist to wet.				
			5		0 1 0	1	18 / 18			Medium plasticity, fine sand, moist.				
30	30.0		6		0 1 0	1	18 / 18			**SILTY CLAY with Little Sand;** Dark brown, low plasticity, fine sand, very soft, moist.		31.5		MC AL SG SA
			7		1 1 1	2	18 / 18		CL-ML	Damp to moist.				
40			8				24 / 24				Full down pressure push @ 200 lbs.	33.5		MC AL SA TX DS CO
	45.0		9		1 3 4	7	18 / 18		CL-CH	**CLAY with Little Sand;** Dark brown, medium to high plasticity, fine sand, firm, damp to moist.				
50														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-01

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
50			10		0 1 3	4	18 / 18		CL-CH	**CLAY with Little Sand;** Dark brown, medium to high plasticity, fine sand, firm, damp to moist. *(continued)*	Modified California Sample taken with brass rings.	34.0	99.9	MD
	52.0									Bottom of Borehole @ Native Ground = 52'. Bottom of Cone Penetration = 47' Water level was encountered = TBD. Borehole backfilled with auger cuttings.				

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-02

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0										**SILT with Little Sand:** Brown to gray, low plasticity, fine to medium sand, very soft, damp.				
			1		0 1 0	1	18 / 18				Modified California Sample taken with brass rings.	60.7	66.3	MD
10			2		0 1 1	2	18 / 18		ML	Blueish green. White 2 inches thick above the brown. Brown during the last 4 inches. Fine sand.		84.2		MC AL SG SA
			3		0 1 0	1	8 / 18							
20	20.0		4		0 1 0	1	16 / 18			**CLAY with Trace Sand:** Dark brown to dark gray, low to medium plasticity, fine to medium sand, very soft, moist to wet.		37.8		MC AL SG SA
			5		0 1 0	1	16 / 18							
30			6		0 1 0	1	17 / 18							
			7		0 1 2	3	17 / 18		CL		Modified California Sample taken with brass rings.	21.0	130.1	MD
40			8		0 1 0	1	18 / 18							
			9		2 3 3	6	18 / 18				Modified California Sample taken with brass rings.	34.6	99.8	MD
50														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-02

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
50			10		0 1 0	1	18 / 18			**CLAY with Trace Sand:** Dark brown to dark gray, low to medium plasticity, fine to medium sand, very soft, moist to wet. *(continued)*				
			11				24 / 24		CL		Full down pressure push @100 lbs.			
	60.0									Bottom of borehole @ Native Ground = 60'. Bottom of cone penetration = 62'. Water level encountered = TBD. Borehole backfilled with auger cuttings.				

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-03

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0										**SILTY CLAY with Little Sand:** Dark brown to green to white to yellow to brown, low to medium plasticity, fine to medium sand, very soft, moist to wet.				
			1		0 1 0	1	18 / 18							
10			2		2 3 1	4	18 / 18		CL-ML	Brown to gray to greenish blue.	Modified California Sample taken with brass rings.	39.7	91.9	MD
			3		0 1 0	1	18 / 18					41.6		MC AL SG SA
20			4		0 1 0	1	18 / 18							
	25.0		5				24 / 24 /			**CLAY with Trace Sand:** Dark brown, medium to high plasticity, fine sand, very soft, moist to wet.	Full down pressure push @ 200 lbs.	45.5		MC AL SA TX DS CO
30			6		0 1 0	1	0 / 18		CL		No recovery. No catcher in sampler.			
	35.0		7		0 1 0	1	18 / 18			**SILTY CLAY** with Little Sand Dark brown to dark gray, low to medium plasticity, fine to coarse sand, very soft, moist to wet.		29.3		MC AL SG SA
40			8		0 1 1	2	18 / 18		CL-ML		Modified California Sample taken with brass rings.	33.4	96.8	MD
			9		1 1 1	2	18 / 18							
50														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-03

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
50			10	X	1 1 5	6	18 / 18							
	51.0									Bottom of Borehole @ Native Ground = 51'. Bottom of cone penetration = 60'. Water level was encountered = TBD. Borehole backfilled with auger cuttings.				

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-04

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
0										**SILT with Little Sand:** Dark brown to dark gray, low plasticity, fine to medium sand, very soft, damp to moist.				
			1		0 1 0	1	18 / 18							
10			2				24 / 24				Full down pressure push @ 300 lbs.	69.4		MC AL SA TX DS CO
			3		0 1 1	2	18 / 18							
20			4		0 1 2	3	18 / 18				Modified California Sample taken with brass rings.	31.1	104.2	MD
			5		0 1 1	2	18 / 18 /		ML			24.7		MC AL SG SA
30			6		0 1 2	3	18 / 18				Modified California Sample taken with brass rings.	36.3	96.5	MD
			7		0 1 0	1	18 / 18							
40			8		0 1 0	1	18 / 18					26.9		MC AL SG SA
			9		0 1 0	1	18 / 18							
50														

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-04

Golder Associates

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
50	50.0		10		0 1 0	1	18 / 18		CL-ML	**SILTY CLAY with Little Sand:** Dark brown to dark gray, low to medium plasticity, fine to medium sand, very soft, damp to moist.				
			11		0 1 0	1	18 / 18					29.1		MC AL SA
60	60.0		12		0 1 0	1	18 / 18		ML	**SILT with Little Sand:** Dark brown to dark gray, low plasticity, fine to medium sand, very soft, damp to moist.				
			13		0 1 0	1	18 / 18					25.9		MC AL SG SA
70			14		2 3 1	4	18 / 18							
			15		0 1 0	1	18 / 18 /					18.3		MC AL SA
80			16		0 1 0	1	18 / 18							
			17		0 1 0	1	18 / 18					27.0		MC AL SG SA
90			18		0 1 0	1	18 / 18							
			19		1 1 0	1	12 / 18							
	99.0									Bottom of Borehole @ Native Ground = 99'.	Borehole backfilled with			

Report of borehole must be read in conjunction with accompanying notes and abbreviations

REPORT OF BOREHOLE: BH-04

PROJECT NO.: 083-92589
CLIENT: RCML
PROJECT: Reactiveive Rock Siting Study
LOGGED: CDJ DATE: 7/28/09
CHECKED: MJG DATE:

LOCATION: West Plant Site-Tailings Pond 6/7
AZ STATE PLANE: N: , E:
ELEVATION: ft. AMSL
INCLINATION: -90

DRILLING CONTRACTOR: Yellow Jacket-PHX
DRILL RIG: CME-85
DRILLING METHOD: HSA 4.25"
SAMPLE HAMMER WEIGHT: 140 lbs
SAMPLE HAMMER DROP: 30 inches

DEPTH feet	LAYER ELEVATION	WATER	SAMPLE NUMBER	SAMPLE TYPE	BLOWS PER SIX INCHES	BLOWS PER FOOT (N)	RECOVERY / ATTEMP (IN.)	GRAPHIC LOG	USCS	Sample Description consistency or density, color, grain size, MAJOR COMPONENT, minor components, moisture.	Comments	MOISTURE (%)	DRY DENSITY (pcf)	ADDITIONAL LAB TESTING
										Bottom of cone penetration = 102'. Water level was encountered = TBD.	auger cuttings.			

Report of borehole must be read in conjunction with accompanying notes and abbreviations

APPENDIX B
CONE PENETRATION TEST RESULTS

GREGG DRILLING & TESTING, INC.
GEOTECHNICAL AND ENVIRONMENTAL INVESTIGATION SERVICES

August 3, 2009

Yellow Jacket Drilling
Attn: Beau Burgess
PO Box. 801
Gilbert, AZ 85299

Subject: CPT Site Investigation
Resolution Copper Mine
Superior, Arizona
GREGG Project Number: 09-0309SH

Dear Mr. Burgess:

The following report presents the results of GREGG Drilling & Testing's Cone Penetration Test investigation for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☒
2	Pore Pressure Dissipation Tests	(PPD)	☒
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	UVOST Laser Induced Fluorescence	(UVOST)	☐
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (562) 427-6899.

Sincerely,
GREGG Drilling & Testing, Inc.

Peter Robertson
Technical Operations

2726 Walnut Ave • Signal Hill, California 90755 • (562) 427-6899 • FAX (562) 427-3314
OTHER OFFICES: SAN FRANCISCO • HOUSTON • SOUTH CAROLINA
www.greggdrilling.com

Cone Penetration Test Sounding Summary

-Table 1-

CPT Sounding Identification	Date	Termination Depth (Feet)	Depth of Groundwater Samples (Feet)	Depth of Soil Samples (Feet)	Depth of Pore Pressure Dissipation Tests (Feet)
CPT-01	7/29/09	47.5	-	-	11.2, 25.3, 40.2, 47.6
CPT-02	7/29/09	62.5	-	-	15.1, 27.1, 45.1, 62.3
CPT-03	7/28/09	60	-	-	15.1, 29.4, 45.3, 60.4
CPT-04	7/30/09	104	-	-	20.5, 42.2, 62.0, 85.1, 104.0

Note: A strong downward gradient was noticed from the pore pressure dissipation tests. An average water table value of 12 feet was used for the interpretation values present in the spreadsheets.

Bibliography

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Roberston, P.K., "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, Vol. 27, 1990 pp. 151-158.

Mayne, P.W., "NHI (2002) Manual on Subsurface Investigations: Geotechnical Site Characterization", available through www.ce.gatech.edu/~geosys/Faculty/Mayne/papers/index.html, Section 5.3, pp. 107-112.

Robertson, P.K., R.G. Campanella, D. Gillespie and A. Rice, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8, 1986 pp. 791-803.

Robertson, P.K., Sully, J., Woeller, D.J., Lunne, T., Powell, J.J.M., and Gillespie, D.J., "Guidelines for Estimating Consolidation Parameters in Soils from Piezocone Tests", Canadian Geotechnical Journal, Vol. 29, No. 4, August 1992, pp. 539-550.

Robertson, P.K., T. Lunne and J.J.M. Powell, "Geo-Environmental Application of Penetration Testing", Geotechnical Site Characterization, Robertson & Mayne (editors), 1998 Balkema, Rotterdam, ISBN 90 5410 939 4 pp 35-47.

Campanella, R.G. and I. Weemees, "Development and Use of An Electrical Resistivity Cone for Groundwater Contamination Studies", Canadian Geotechnical Journal, Vol. 27 No. 5, 1990 pp. 557-567.

DeGroot, D.J. and A.J. Lutenegger, "Reliability of Soil Gas Sampling and Characterization Techniques", International Site Characterization Conference - Atlanta, 1998.

Woeller, D.J., P.K. Robertson, T.J. Boyd and Dave Thomas, "Detection of Polyaromatic Hydrocarbon Contaminants Using the UVIF-CPT", 53rd Canadian Geotechnical Conference Montreal, QC October pp. 733-739, 2000.

Zemo, D.A., T.A. Delfino, J.D. Gallinatti, V.A. Baker and L.R. Hilpert, "Field Comparison of Analytical Results from Discrete-Depth Groundwater Samplers" BAT EnviroProbe and QED HydroPunch, Sixth national Outdoor Action Conference, Las Vegas, Nevada Proceedings, 1992, pp 299-312.

Copies of ASTM Standards are available through www.astm.org

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 10 cm^2 and a friction sleeve area of 150 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and penetration pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored on disk for further analysis and reference. All CPT soundings are performed in accordance with revised (2002) ASTM standards (D 5778-95).

The cone also contains a porous filter element located directly behind the cone tip (u_2), *Figure CPT.* It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain penetration pore pressure as the cone is advanced as well as Pore Pressure Dissipation Tests (PPDT's) during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with silicon oil under vacuum pressure to ensure accurate and fast dissipation.

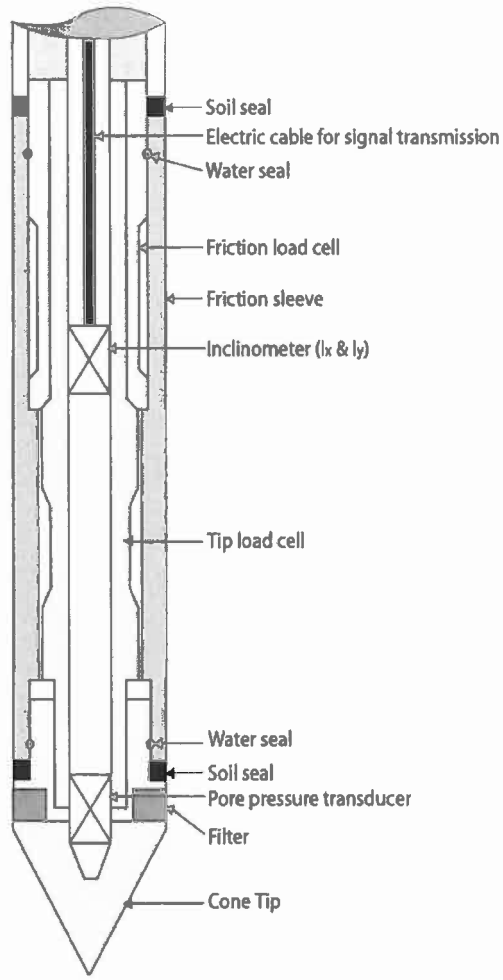


Figure CPT

When the soundings are complete, the test holes are grouted using a Gregg support rig. The grouting procedures generally consist of pushing a hollow CPT rod with a "knock out" plug to the termination depth of the test hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and penetration pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored on disk for further analysis and reference. All CPT soundings are performed in accordance with revised (2002) ASTM standards (D 5778-95).

The cone also contains a porous filter element located directly behind the cone tip (u_2), *Figure CPT.* It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain penetration pore pressure as the cone is advanced as well as Pore Pressure Dissipation Tests (PPDT's) during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with silicon oil under vacuum pressure to ensure accurate and fast dissipation.

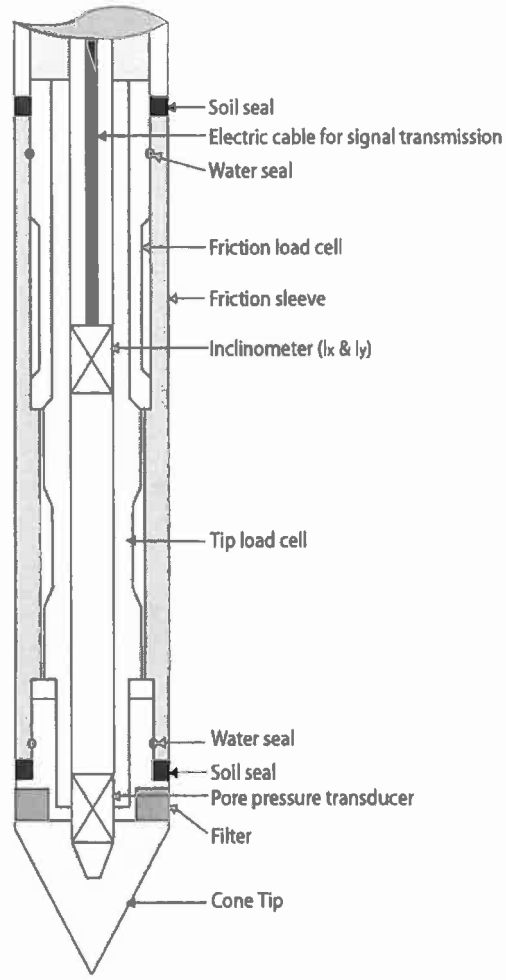


Figure CPT

When the soundings are complete, the test holes are grouted using a Gregg support rig. The grouting procedures generally consist of pushing a hollow CPT rod with a "knock out" plug to the termination depth of the test hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

Pore Pressure Dissipation Tests (PPDT)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals measured hydrostatic water pressures and determined the approximate depth of the ground water table. A PPDT is conducted when the cone is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (u) with time is measured behind the tip of the cone and recorded by a computer system.

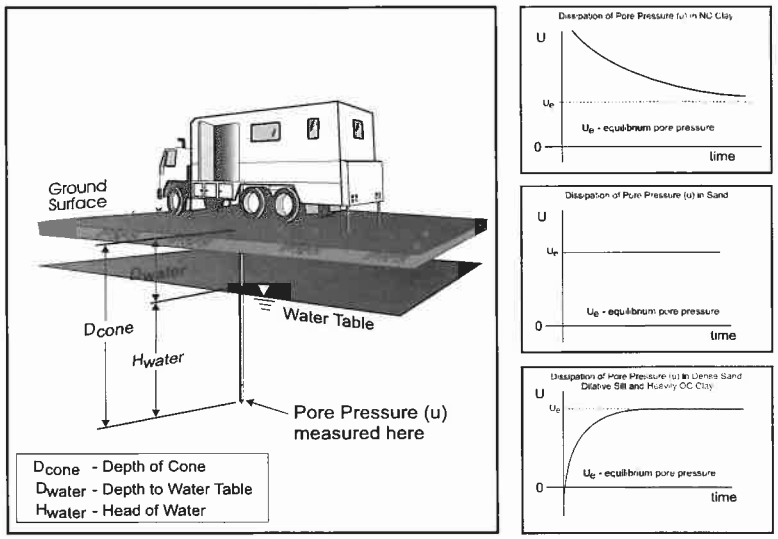
Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until such time as there is no variation in pore pressure with time, *Figure PPDT*. This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992.

A summary of the pore pressure dissipation tests is summarized in Table 1.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

Figure PPDT

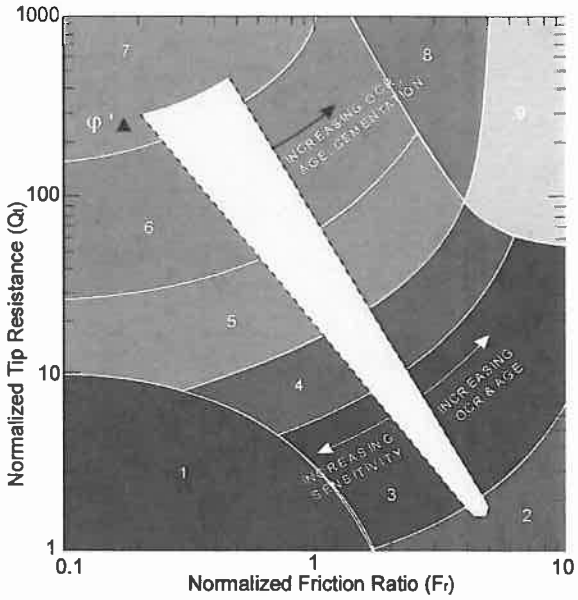
Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected from your site are presented in graphical form in the attached report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings extending greater than 50 feet, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. do not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and do not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on the field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



(After Robertson, 1990)

Zone	Normailzed Soil Behavior Type
1	sensitive fine grained
2	organic material
3	clay to silty clay
4	clayey silt to silty clay
5	silty sand to sandy silt
6	clean sands to silty sands
7	gravelly sand to sand
8	very stiff sand to clayey sand
9	very stiff fine grained

Figure SBTn

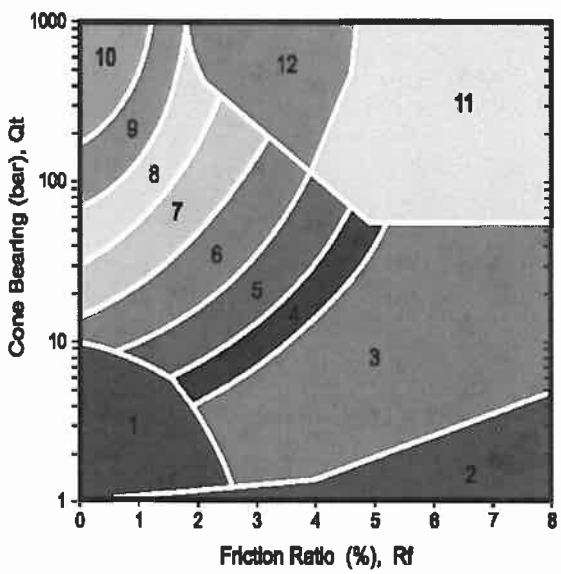
Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected from your site are presented in graphical form in the attached report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings extending greater than 50 feet, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. do not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and do not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



(After Robertson, et al., 1986)

ZONE	SBT
1	Sensitive, fine grained
2	Organic materials
3	Clay
4	Silty clay to clay
5	Clayey silt to silty clay
6	Sandy silt to clayey silt
7	Silty sand to sandy silt
8	Sand to silty sand
9	Sand
10	Gravely sand to sand
11	Very stiff fine grained*
12	Sand to clayey sand*

*over consolidated or cemented

Figure SBT

Cone Penetration Test (CPT) Interpretation

Gregg has recently updated their CPT interpretation and plotting software (2007). The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1. Units for display (Imperial or metric) (atm. pressure, pa = 0.96 tsf or 0.1 MPa)
2. Depth interval to average results,(ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3. Elevation of ground surface (ft or m)
4. Depth to water table, z_w (ft or m) – input required
5. Net area ratio for cone, a (default to 0.80)
6. Relative Density constant, C_{Dr} (default to 350)
7. Young's modulus number for sands, α (default to 5)
8. Small strain shear modulus number
   a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
   b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9. Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10. Over Consolidation ratio number, k_{ocr} (default to 0.3)
11. Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1. Depth, z, (m) – CPT data is collected in meters
2. Depth (ft)
3. Cone resistance, q_c (tsf or MPa)
4. Sleeve friction, f_s (tsf or MPa)
5. Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6. Other – any additional data, if collected, e.g. electrical resistivity or UVIF
7. Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u(1-a)$

6 Estimated permeability, k_{SBT} (based on Normalized SBT_n)
(Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\, C_N$,
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go
a. $G_o = S_G\,(q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*
b. $G_o = C_G\, q_t$ *For SBT_n 1, 2, 3& 4*
Show 'N/A' in zones 8 & 9

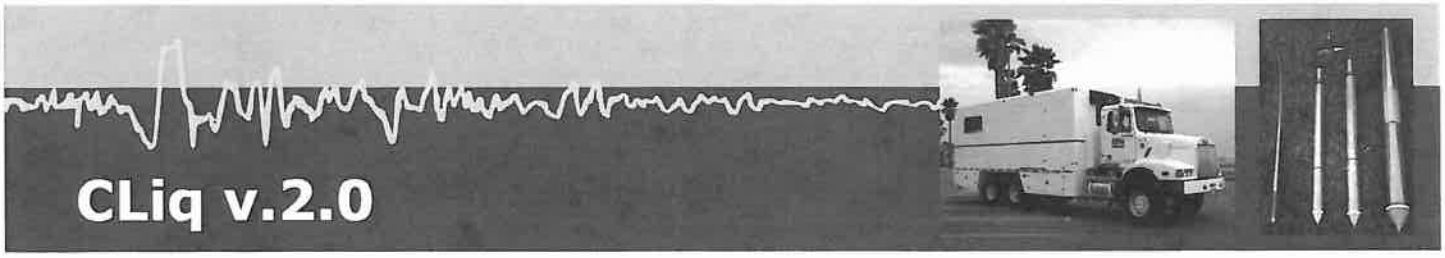
13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\, Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

SBT Zones **SBT_n Zones**

The following updated and simplified SBT descriptions have been used in the software:

1	sensitive fine grained	1	sensitive fine grained
2	organic soil	2	organic soil
3	clay	3	clay
4	clay & silty clay	4	clay & silty clay
5	clay & silty clay		
6	sandy silt & clayey silt		
7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand



Liquefaction of loose saturated cohesionless soils under the effect of strong ground motion, is one of the most complex topics that the Geotechnical Earthquake Engineer can face. CLiq is software for the assessment of soil liquefaction potential based on CPT/CPTU measurements.

"CLiq is an excellent program to perform CPT case history-based liquefaction analyses that is easy to use and provides the user with colourful plots and detailed output. The program includes estimates of post-earthquake vertical settlements, lateral displacements and potential strength loss. It also has the ability to automatically identify and remove transition zones in interlayered deposits for improved analyses. The user can modify a range of key variables to assist in the application of engineering judgment. CLiq is excellent value for money and is highly recommended for anyone that wants to perform liquefaction analyses using the CPT"

- Dr. Peter Robertson

GeoLogismiki CLiq

GeoLogismiki, in collaboration with Gregg Drilling Inc. and Prof. Peter Robertson, is pleased to announce the availability of a new CPT soil liquefaction assessment software, CLiq (pron. 'slick').

CLiq is more advanced than the CPT section of the current LiqIT software and provides users an easy to use graphical environment specifically tailored for CPT and CPTU data. The new software addresses advanced issues such as cyclic softening in clay-like soils and thin-layer/layer-transition zone detection. CLiq provides results and plots for each calculation step, starting with the basic CPT data interpretation through to final plots of factor of safety, liquefaction potential index and post-earthquake displacements, both vertical settlement and lateral displacements. CLiq provides consistent output results by applying the state-of-the-art NCEER method (Youd et al, 2001) along with the calibrated procedures for post-earthquake displacements by Zhang et al (2002 & 2004).

A unique 2D feature provides a means of creating colorful contour maps of the overall liquefaction potential index (LPI) and post-earthquake vertical settlements in plan view thus allowing the user to visualize the spatial variation of liquefaction potential and settlements across a site. The variations of calculated post-earthquake settlements across a site allow estimates of differential settlements for a given site and design earthquake.

A parametric analysis feature allows the user to vary both the earthquake magnitude and surface acceleration to evaluate the sensitivity of both the overall liquefaction potential index and post-earthquake settlements as a function of earthquake loading and results are presented in a 3D graphical form. As with all of our software, all input and output data can be exported to a Microsoft® Excel file type for further manipulation.

Requirements

CLiq will run on Windows© 2000 or XP operating system. GDI+ library should also be present (included in XP). For better performance a 17" monitor running on 1280 x 1024 resolution is needed

Key features

- Field data input from CPT/CPTU measurments
- Liquefaction analysis based on Youd et al (2001) proposed CPT method
- Consistent results for vertical and lateral displacements calculations
- Estimation of vertical settlements and lateral displacements
- Overall liquefaction potential according to Iwasaki
- Tabular results for every calculation step (interpretation and liquefaction analysis
- Support for the SI or Imperial unit system
- 2D plain view map creation tool for the spatial distibution for LPI or vertical displacements
- Analytic reports

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Email: info@greggdrilling.com

GEOLOGISMIKI
Geotechnical Software

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GREECE
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Fax: + 30 23210 39800
URL: http://www.geologismiki.gr
Email: info@geologismiki.gr

CPeT-IT v.1.60

The piezocone (CPTU) test is one of the most versatile tools for soil exploration in existence today. The piezocone and associated pushing equipment provide continuous measurements, excellent repeatability and is cost-effective.

Throughout the last few decades, considerable knowledge regarding the use and interpretation of the CPTU has accumulated in the geotechnical community. CPeT-IT makes use of this knowledge and provides a fast, easy to use tool for Geotechnical Engineers to interpret and plot CPTU data.

"GeoLogismiki have produced an excellent CPTU interpretation software package that is easy to use and provides the user with colourful plots and detailed output of a wide range of geotechnical parameters. CPeT-IT is excellent value for money and is highly recommended for anyone that is using CPTU results."

- Dr. Peter Robertson

GeoLogismiki
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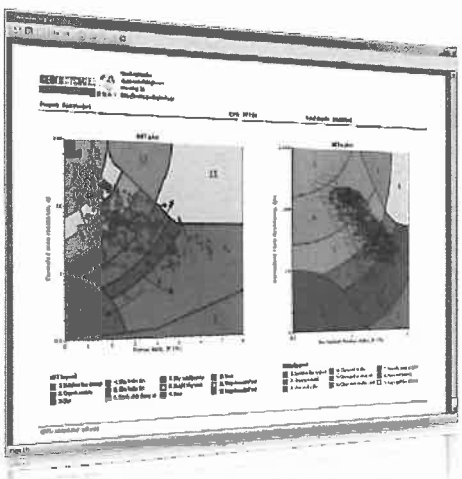
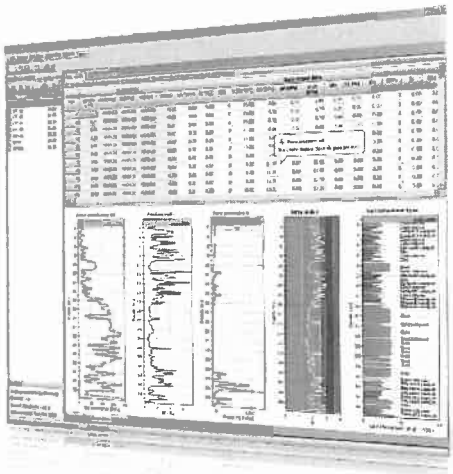
Email: info@geologismiki.gr

GeoLogismiki CPeT-IT

CPeT-IT is an easy to use yet detailed software package for the interpretation of CPTU data. CPeT-IT is the result of a collaborative effort with Gregg Drilling Inc., a leading company in geotechnical site investigation and cone penetration testing (CPT) and Professor Peter Robertson, co-author of the comprehensive text book on the CPT.

CPeT-IT takes CPT data and performs basic interpretation in terms of Soil Behaviour Type (SBT) and various other geotechnical parameters using the current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson.





Key features

- Imports raw CPTU data from any ASCII text file
- Supports input and output in both the SI and Imperial unit systems
- Interpretations based on the comprehensive review by Lunne, Robertson and Powell (1997) as well as on latest Robertson (2009) recommendations
- Tabular presentation of all interpretation results
- Graphical presentation of all interpretation results
- Analytic reports for every level of interpretation
- Overlay report for selected CPTU files
- Single pile bearing capacity calculation module
- Dissipation test interpretation module
- Typical geotechnical section creation module

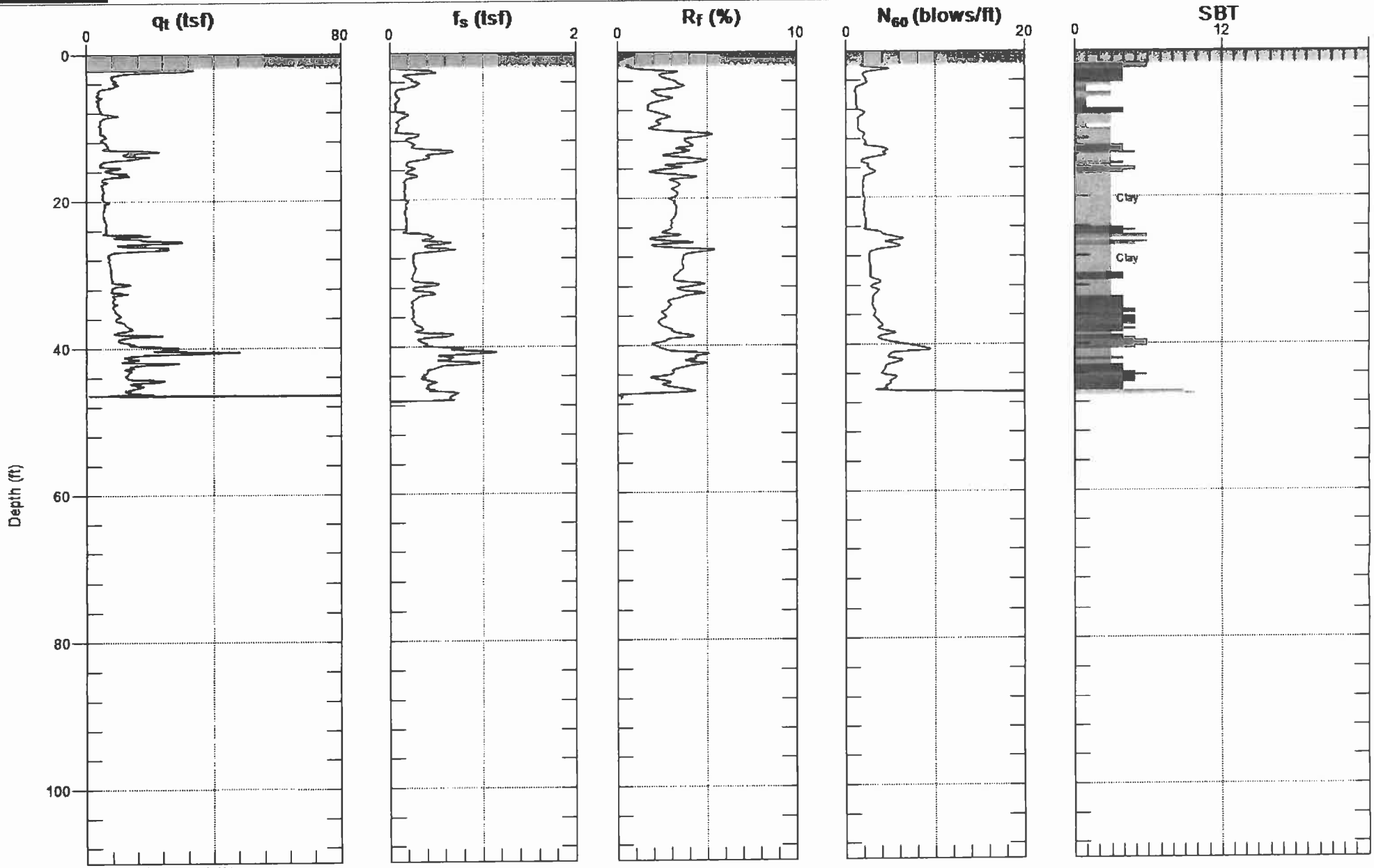
Requirements

CPeT-IT will run on Windows© 2000 or XP operating systems. GDI+ library should also be present (included in XP). A 17" monitor is highly recommended for better performance.

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT–01

Engineer: B.BURGESS
Date: 7/29/2009 06:50



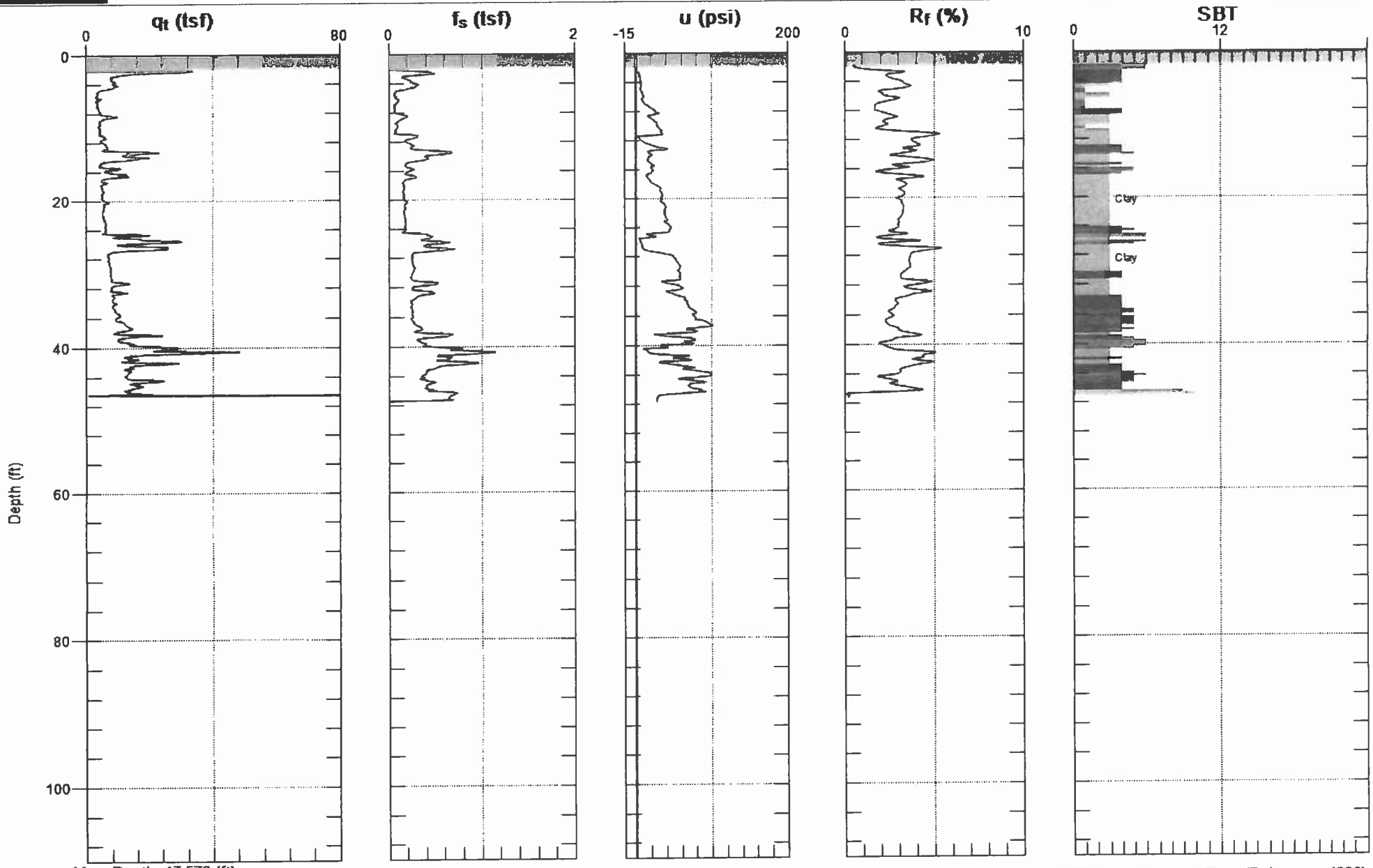
Max. Depth: 47.572 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT–01

Engineer: B.BURGESS
Date: 7/29/2009 06:50



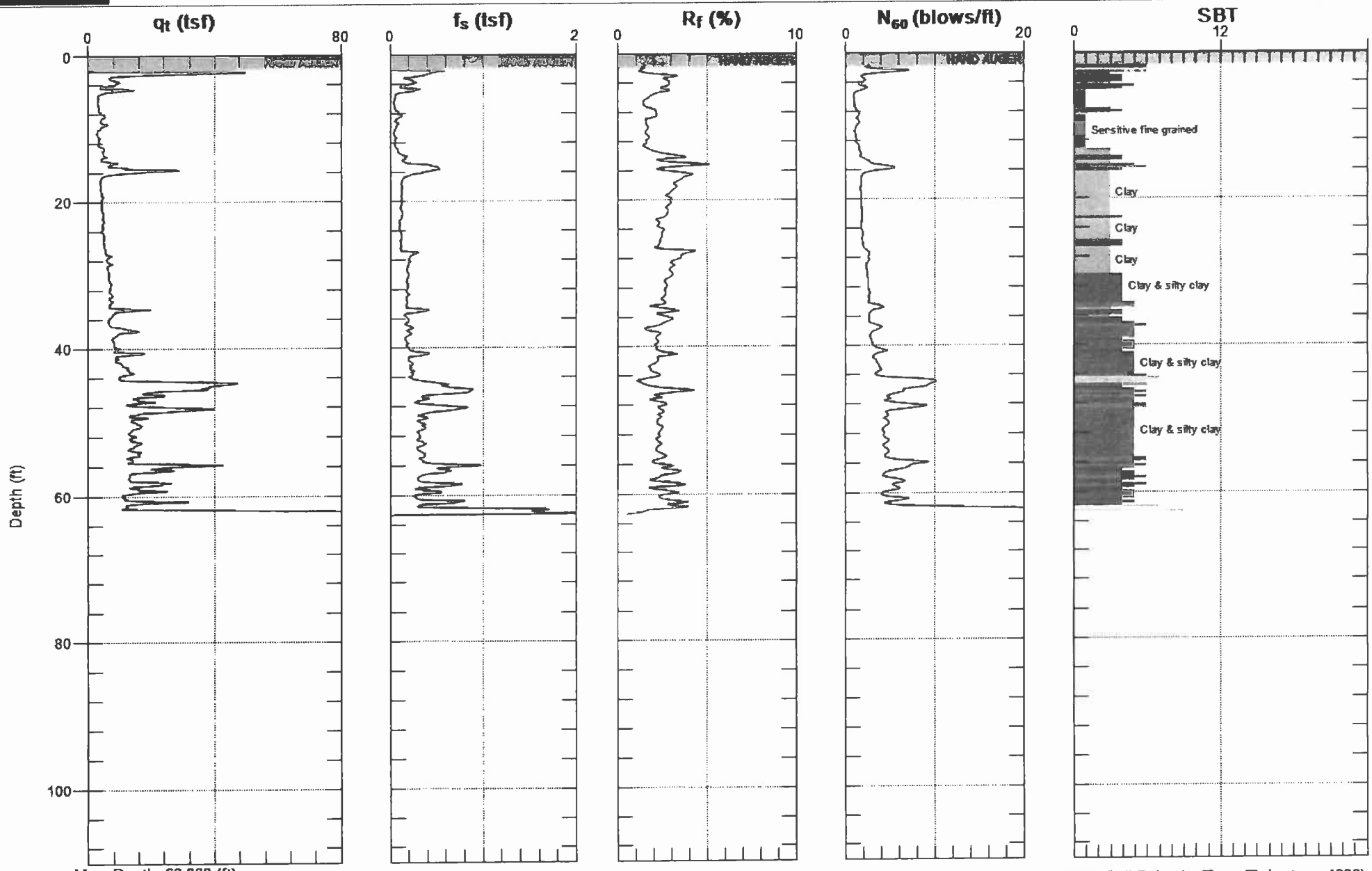
Max. Depth: 47.572 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT–02

Engineer: B.BURGESS
Date: 7/29/2009 11:10



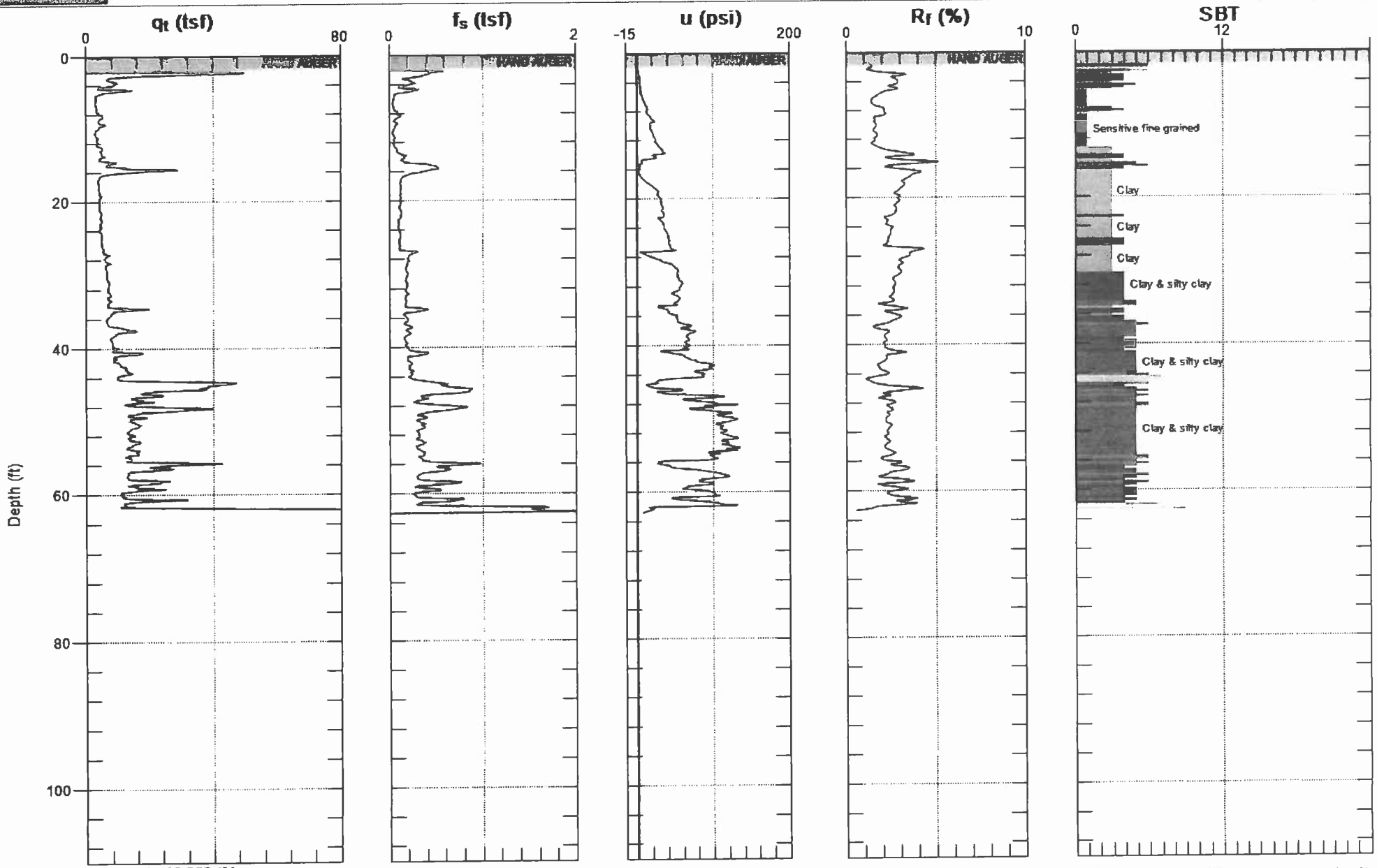
Max. Depth: 62.828 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT–02

Engineer: B.BURGESS
Date: 7/29/2009 11:10



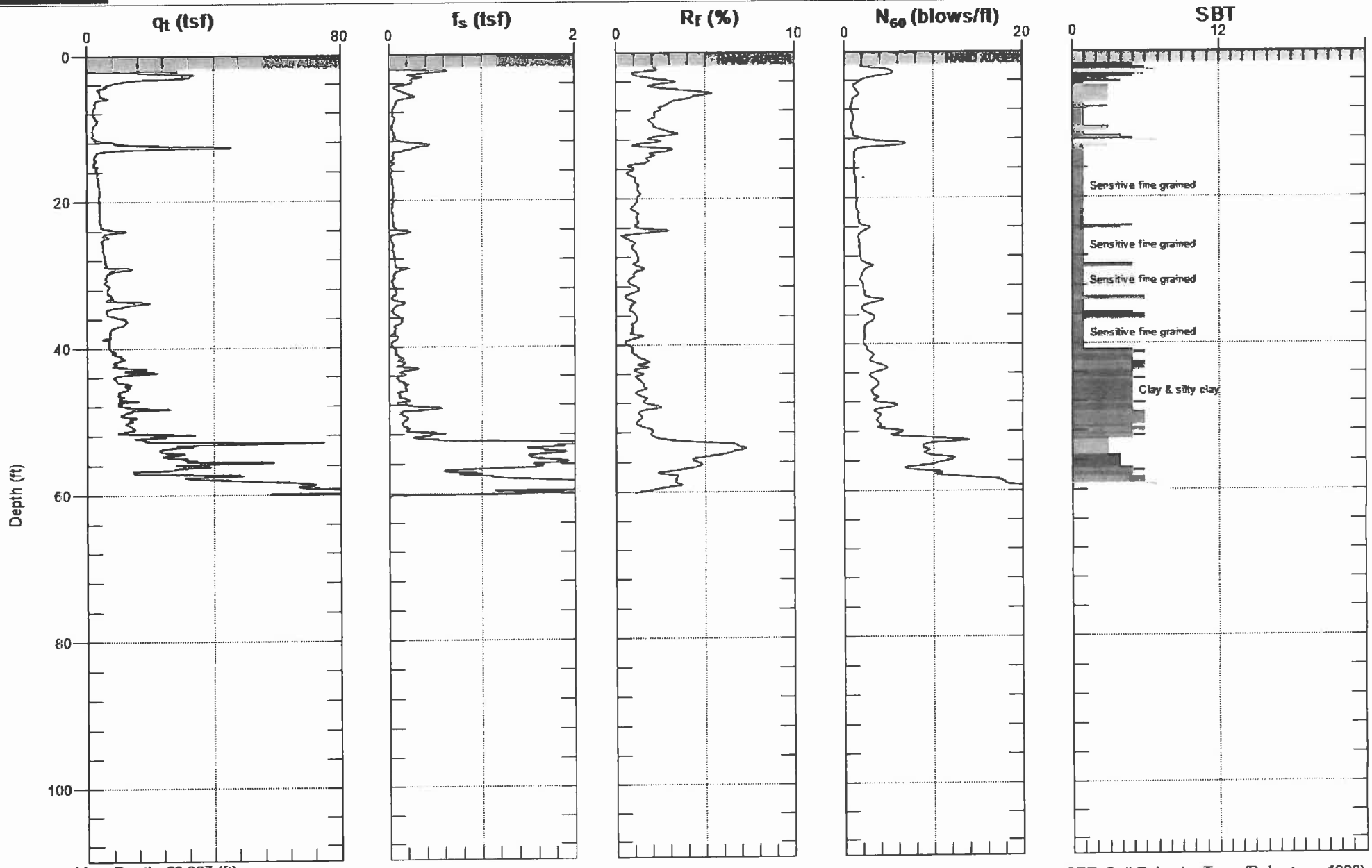
Max. Depth: 62.828 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT-03

Engineer: B.BURGESS
Date: 7/28/2009 09:16



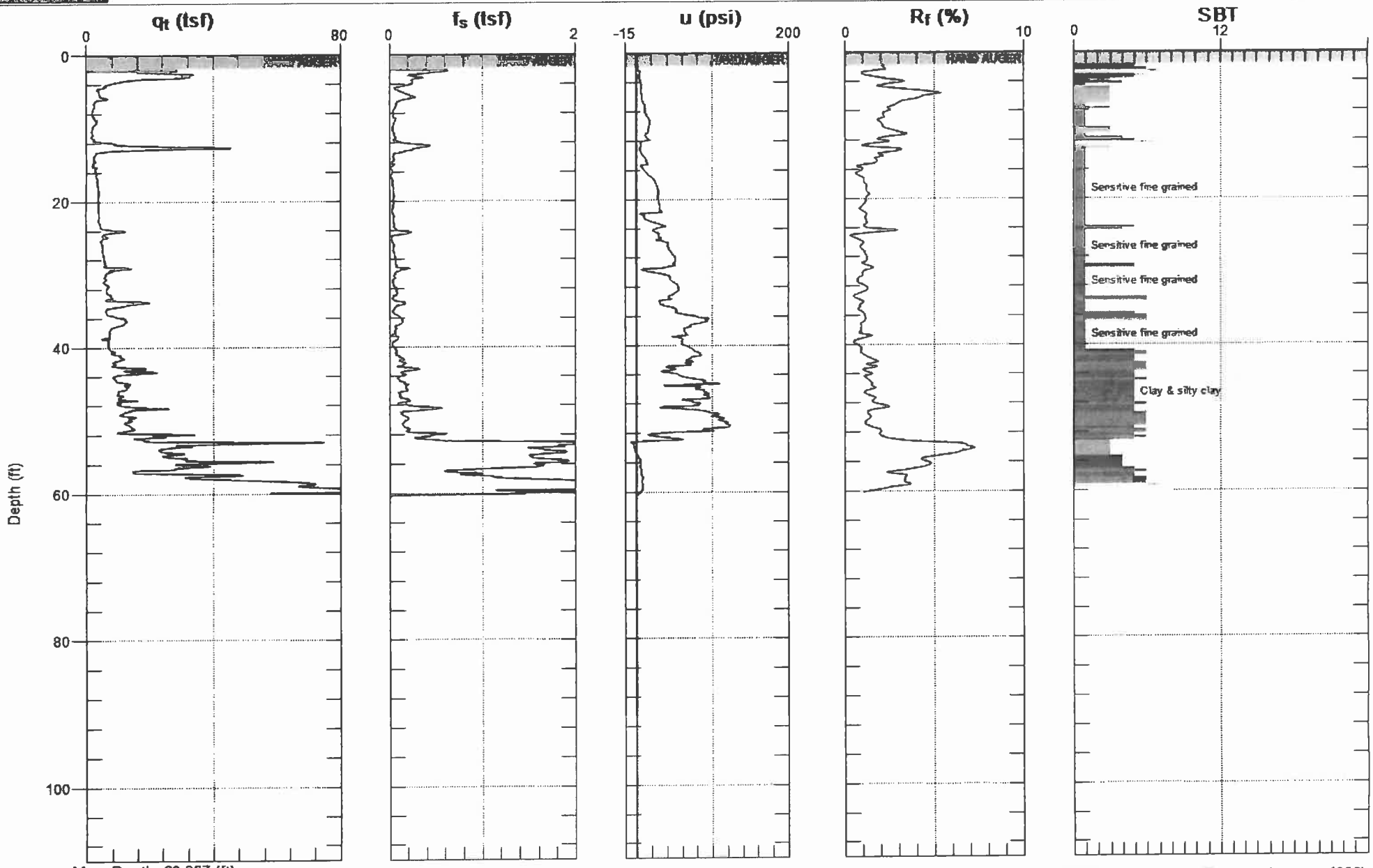
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT-03

Engineer: B.BURGESS
Date: 7/28/2009 09:16



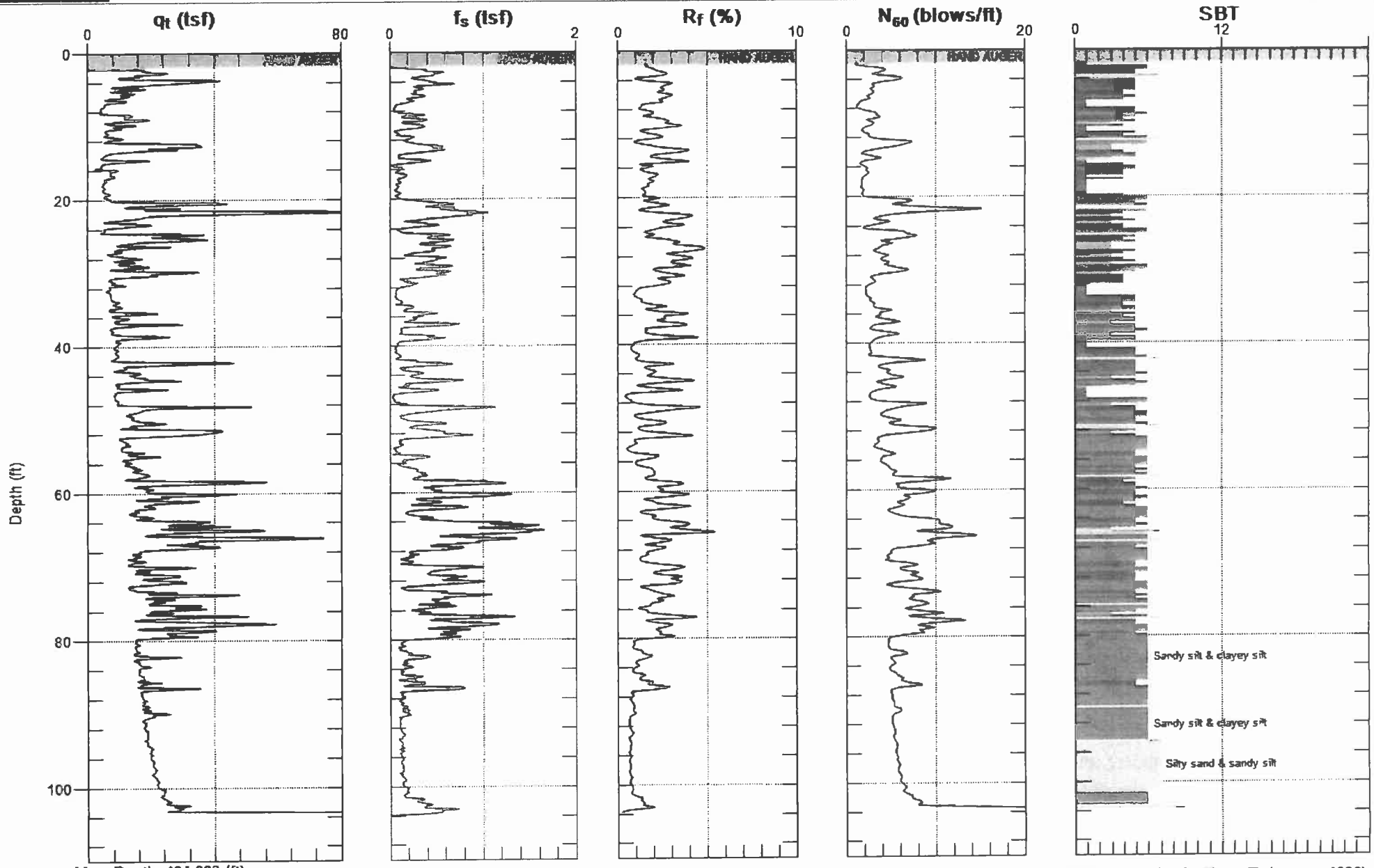
Max. Depth: 60.367 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT-04

Engineer: B.BURGESS
Date: 7/30/2009 06:44



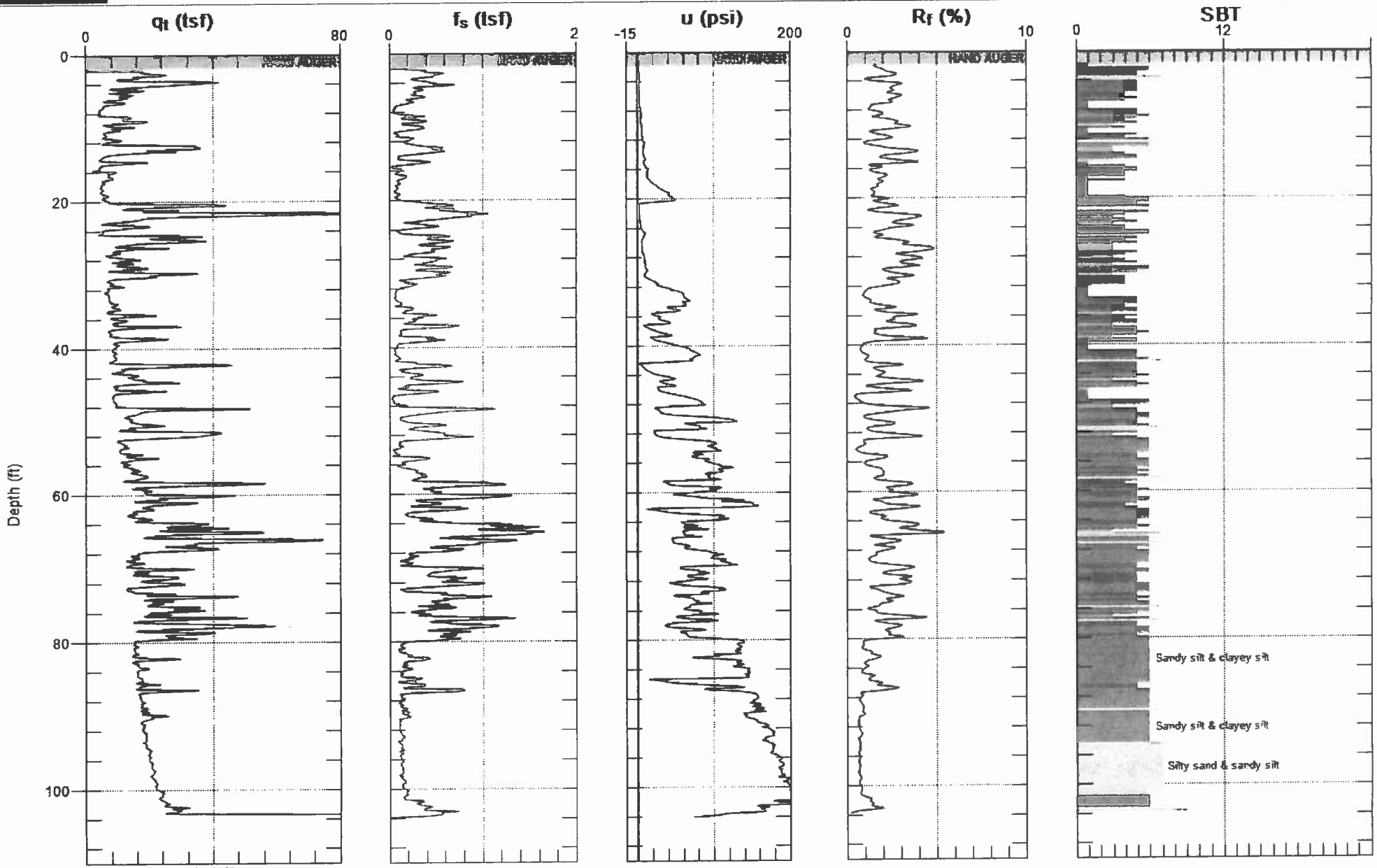
Max. Depth: 104.003 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

YELLOW JACKET DRILLING

Site: RESOLUTION MINE
Sounding: CPT–04

Engineer: B.BURGESS
Date: 7/30/2009 06:44



Max. Depth: 104.003 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Sounding:	CPT--01
Site:	RESOLUTION MINE	Date:	7/29/2009
Engineer:	B.BURGESS	Time:	6:50 AM

Col 1 Depth (m)	Col 2 Depth (ft)	Col 3 q_c (tsf)	Col 4 f_s (tsf)	Col 5 u (psi)	Col 6 Other	Col 7 q_t (tsf)	Col 8 R_f (%)
0.050	0.164	0.000	0.000	0.000			
0.100	0.328	0.000	0.000	0.000			
0.150	0.492	0.000	0.000	0.000			
0.200	0.656	0.000	0.000	0.000			
0.250	0.820	0.000	0.000	0.000			
0.300	0.984	0.000	0.000	0.000			
0.350	1.148	0.000	0.000	0.000			
0.400	1.312	0.000	0.000	0.000			
0.450	1.476	0.000	0.000	0.000			
0.500	1.640	0.000	0.000	0.000			
0.550	1.804	0.000	0.000	0.000			
0.600	1.969	0.000	0.000	0.000			
0.650	2.133	31.666	0.173	0.999		31.68	0.55
0.700	2.297	28.580	0.414	0.075		28.58	1.45
0.750	2.461	16.118	0.458	1.036		16.13	2.84
0.800	2.625	11.504	0.487	4.221		11.56	4.21
0.850	2.789	9.467	0.288	4.466		9.53	3.02
0.900	2.953	7.639	0.153	4.654		7.71	1.99
0.950	3.117	7.849	0.156	5.031		7.92	1.97
1.000	3.281	7.669	0.184	5.390		7.75	2.38
1.050	3.445	8.059	0.222	5.747		8.14	2.73
1.100	3.609	9.137	0.241	6.068		9.22	2.61
1.150	3.773	8.268	0.236	6.294		8.36	2.82
1.200	3.937	8.358	0.302	6.596		8.45	3.57
1.250	4.101	9.886	0.320	7.104		9.99	3.20
1.300	4.265	8.838	0.291	7.085		8.94	3.26
1.350	4.429	8.149	0.287	7.255		8.25	3.48
1.400	4.593	5.992	0.217	6.878		6.09	3.56
1.450	4.757	4.254	0.182	5.785		4.34	4.20
1.500	4.921	3.565	0.093	6.369		3.66	2.54
1.550	5.085	3.295	0.076	6.954		3.40	2.24
1.600	5.249	3.595	0.066	7.764		3.71	1.78
1.650	5.413	3.295	0.060	8.461		3.42	1.76
1.700	5.577	3.026	0.061	9.008		3.16	1.93
1.750	5.741	2.996	0.080	9.818		3.14	2.55
1.800	5.906	4.404	0.071	11.099		4.56	1.56
1.850	6.070	3.834	0.106	9.498		3.97	2.67
1.900	6.234	2.876	0.105	8.160		2.99	3.51
1.950	6.398	3.295	0.102	8.442		3.42	2.99

2.000	6.562	3.565	0.090	9.498	3.70	2.43
2.050	6.726	3.325	0.078	10.515	3.48	2.24
2.100	6.890	3.265	0.058	12.117	3.44	1.69
2.150	7.054	3.295	0.064	14.039	3.50	1.83
2.200	7.218	3.535	0.058	16.677	3.78	1.54
2.250	7.382	3.565	0.064	18.863	3.84	1.67
2.300	7.546	3.715	0.070	21.238	4.02	1.74
2.350	7.710	3.865	0.068	23.838	4.21	1.62
2.400	7.874	4.164	0.062	25.365	4.53	1.37
2.450	8.038	4.284	0.092	26.100	4.66	1.97
2.500	8.202	6.711	0.162	30.490	7.15	2.27
2.550	8.366	9.437	0.199	23.989	9.78	2.03
2.600	8.530	6.531	0.192	15.999	6.76	2.84
2.650	8.694	4.943	0.160	17.262	5.19	3.08
2.700	8.858	4.284	0.130	19.881	4.57	2.84
2.750	9.022	3.745	0.110	21.860	4.06	2.71
2.800	9.186	3.805	0.100	24.555	4.16	2.40
2.850	9.350	3.745	0.074	25.120	4.11	1.80
2.900	9.514	3.984	0.088	27.796	4.38	2.01
2.950	9.678	3.295	0.098	27.588	3.69	2.65
3.000	9.843	3.955	0.096	28.003	4.36	2.20
3.050	10.007	3.745	0.096	28.455	4.15	2.31
3.100	10.171	3.745	0.080	30.151	4.18	1.91
3.150	10.335	3.805	0.072	31.659	4.26	1.69
3.200	10.499	3.715	0.075	33.110	4.19	1.79
3.250	10.663	3.745	0.078	33.807	4.23	1.84
3.300	10.827	3.595	0.075	32.865	4.07	1.84
3.350	10.991	5.033	0.293	34.768	5.53	5.29
3.400	11.155	5.303	0.313	32.940	5.78	5.42
3.450	11.319	6.022	0.298	3.316	6.07	4.91
3.500	11.483	4.853	0.250	3.976	4.91	5.09
3.550	11.647	4.434	0.187	4.824	4.50	4.15
3.600	11.811	4.674	0.175	5.955	4.76	3.68
3.650	11.975	5.393	0.196	7.821	5.51	3.56
3.700	12.139	6.051	0.227	10.459	6.20	3.66
3.750	12.303	5.902	0.245	13.229	6.09	4.02
3.800	12.467	6.141	0.269	17.544	6.39	4.21
3.850	12.631	6.381	0.253	23.122	6.71	3.77
3.900	12.795	5.962	0.234	26.759	6.35	3.69
3.950	12.959	5.033	0.285	34.391	5.53	5.16
4.000	13.123	14.470	0.473	41.025	15.06	3.14
4.050	13.287	22.469	0.645	21.671	22.78	2.83
4.100	13.451	13.961	0.678	16.131	14.19	4.78
4.150	13.615	11.204	0.607	16.885	11.45	5.30
4.200	13.780	12.523	0.427	19.862	12.81	3.33
4.250	13.944	19.473	0.395	21.332	19.78	2.00
4.300	14.108	15.608	0.420	17.507	15.86	2.65
4.350	14.272	13.631	0.430	16.960	13.88	3.10
4.400	14.436	8.179	0.383	15.660	8.40	4.56
4.450	14.600	5.123	0.293	15.339	5.34	5.48
4.500	14.764	4.404	0.216	16.244	4.64	4.66
4.550	14.928	4.014	0.188	17.676	4.27	4.40

4.600	15.092	3.924	0.182	19.617	4.21	4.33
4.650	15.256	4.074	0.182	22.048	4.39	4.14
4.700	15.420	10.066	0.201	24.762	10.42	1.93
4.750	15.584	8.718	0.250	19.862	9.00	2.78
4.800	15.748	5.692	0.272	20.767	5.99	4.54
4.850	15.912	5.842	0.229	22.161	6.16	3.72
4.900	16.076	7.849	0.198	22.274	8.17	2.42
4.950	16.240	12.133	0.180	20.672	12.43	1.45
5.000	16.404	10.066	0.188	20.051	10.35	1.82
5.050	16.568	13.032	0.270	14.963	13.25	2.04
5.100	16.732	7.070	0.300	13.964	7.27	4.13
5.150	16.896	5.033	0.279	14.717	5.24	5.32
5.200	17.060	4.494	0.195	15.698	4.72	4.13
5.250	17.224	4.554	0.175	17.054	4.80	3.65
5.300	17.388	6.201	0.164	18.826	6.47	2.53
5.350	17.552	5.273	0.152	19.240	5.55	2.74
5.400	17.717	4.344	0.159	20.635	4.64	3.43
5.450	17.881	4.344	0.166	23.574	4.68	3.54
5.500	18.045	4.494	0.168	26.533	4.88	3.45
5.550	18.209	4.554	0.166	29.171	4.97	3.34
5.600	18.373	4.554	0.171	31.376	5.01	3.42
5.650	18.537	4.763	0.164	32.884	5.24	3.13
5.700	18.701	5.063	0.156	32.300	5.53	2.82
5.750	18.865	4.554	0.154	31.998	5.01	3.07
5.800	19.029	4.404	0.162	32.865	4.88	3.32
5.850	19.193	4.464	0.162	33.996	4.95	3.27
5.900	19.357	4.584	0.170	35.032	5.09	3.34
5.950	19.521	4.374	0.163	34.844	4.88	3.34
6.000	19.685	4.494	0.158	34.561	4.99	3.17
6.050	19.849	4.793	0.166	32.620	5.26	3.15
6.100	20.013	5.782	0.172	34.938	6.29	2.74
6.150	20.177	6.591	0.194	32.921	7.07	2.75
6.200	20.341	5.153	0.201	32.903	5.63	3.57
6.250	20.505	4.973	0.179	34.768	5.47	3.27
6.300	20.669	5.153	0.170	37.275	5.69	2.99
6.350	20.833	4.943	0.173	38.669	5.50	3.15
6.400	20.997	4.853	0.178	39.008	5.41	3.29
6.450	21.161	4.883	0.180	39.348	5.45	3.30
6.500	21.325	4.703	0.173	38.933	5.26	3.29
6.550	21.490	4.584	0.164	38.047	5.13	3.20
6.600	21.654	4.584	0.166	38.179	5.13	3.23
6.650	21.818	4.554	0.166	38.179	5.10	3.25
6.700	21.982	4.643	0.170	38.122	5.19	3.27
6.750	22.146	4.853	0.171	38.066	5.40	3.17
6.800	22.310	4.823	0.174	38.367	5.38	3.24
6.850	22.474	4.973	0.175	39.008	5.53	3.16
6.900	22.638	5.093	0.181	39.894	5.67	3.19
6.950	22.802	5.303	0.174	41.534	5.90	2.95
7.000	22.966	5.512	0.182	41.232	6.11	2.98
7.050	23.130	5.662	0.183	37.067	6.20	2.95
7.100	23.294	5.452	0.185	39.969	6.03	3.07
7.150	23.458	5.303	0.178	42.419	5.91	3.01

7.200	23.622	5.393	0.177	43.606	6.02	2.94
7.250	23.786	5.452	0.176	45.547	6.11	2.88
7.300	23.950	5.422	0.188	46.358	6.09	3.09
7.350	24.114	5.393	0.181	45.510	6.05	2.99
7.400	24.278	5.422	0.158	43.493	6.05	2.61
7.450	24.442	5.362	0.162	44.247	6.00	2.70
7.500	24.606	19.263	0.398	39.592	19.83	2.01
7.550	24.770	13.332	0.412	15.867	13.56	3.04
7.600	24.934	8.268	0.467	17.205	8.52	5.48
7.650	25.098	16.147	0.456	25.930	16.52	2.76
7.700	25.262	17.495	0.427	24.347	17.85	2.39
7.750	25.427	26.363	0.347	5.672	26.44	1.31
7.800	25.591	29.629	0.437	5.823	29.71	1.47
7.850	25.755	17.406	0.650	5.559	17.49	3.72
7.900	25.919	10.036	0.594	6.219	10.13	5.87
7.950	26.083	12.283	0.428	7.161	12.39	3.46
8.000	26.247	24.865	0.381	8.066	24.98	1.53
8.050	26.411	24.266	0.405	8.122	24.38	1.66
8.100	26.575	25.195	0.557	8.480	25.32	2.20
8.150	26.739	15.399	0.703	8.706	15.52	4.53
8.200	26.903	8.927	0.576	10.101	9.07	6.35
8.250	27.067	7.549	0.435	13.323	7.74	5.62
8.300	27.231	6.531	0.278	20.032	6.82	4.08
8.350	27.395	6.261	0.263	28.700	6.67	3.94
8.400	27.559	6.141	0.255	37.312	6.68	3.82
8.450	27.723	6.261	0.252	44.963	6.91	3.65
8.500	27.887	6.471	0.260	48.864	7.17	3.62
8.550	28.051	6.141	0.253	50.032	6.86	3.69
8.600	28.215	6.171	0.250	50.937	6.90	3.62
8.650	28.379	6.381	0.251	52.539	7.14	3.52
8.700	28.543	6.411	0.256	53.161	7.18	3.57
8.750	28.707	6.411	0.260	54.197	7.19	3.62
8.800	28.871	6.591	0.260	55.403	7.39	3.52
8.850	29.035	6.591	0.265	56.854	7.41	3.58
8.900	29.199	6.801	0.276	58.098	7.64	3.61
8.950	29.364	6.770	0.281	57.966	7.60	3.70
9.000	29.528	6.770	0.272	57.363	7.60	3.58
9.050	29.692	6.770	0.275	57.419	7.60	3.62
9.100	29.856	7.070	0.262	54.630	7.86	3.33
9.150	30.020	6.831	0.258	55.799	7.63	3.38
9.200	30.184	6.801	0.250	58.625	7.65	3.27
9.250	30.348	6.890	0.248	58.192	7.73	3.21
9.300	30.512	6.831	0.243	58.475	7.67	3.17
9.350	30.676	7.190	0.239	57.043	8.01	2.98
9.400	30.840	6.980	0.247	58.023	7.82	3.16
9.450	31.004	7.399	0.265	58.475	8.24	3.22
9.500	31.168	11.834	0.347	56.326	12.65	2.74
9.550	31.332	12.822	0.514	35.107	13.33	3.86
9.600	31.496	9.107	0.525	37.520	9.65	5.44
9.650	31.660	7.520	0.457	45.001	8.17	5.59
9.700	31.824	6.980	0.295	54.649	7.77	3.80
9.750	31.988	7.070	0.259	58.192	7.91	3.28

9.800	32.152	6.860	0.261	60.058	7.72	3.38
9.850	32.316	7.190	0.265	61.320	8.07	3.28
9.900	32.480	12.073	0.441	54.517	12.86	3.43
9.950	32.644	10.455	0.467	40.365	11.04	4.23
10.000	32.808	7.478	0.491	42.796	8.09	6.07
10.050	32.972	7.849	0.375	48.657	8.55	4.39
10.100	33.136	8.059	0.319	51.728	8.80	3.62
10.150	33.301	7.639	0.305	56.590	8.45	3.61
10.200	33.465	7.250	0.285	64.128	8.17	3.49
10.250	33.629	7.250	0.262	64.109	8.17	3.21
10.300	33.793	7.460	0.243	64.166	8.38	2.90
10.350	33.957	8.538	0.242	66.032	9.49	2.55
10.400	34.121	7.789	0.252	67.709	8.76	2.88
10.450	34.285	7.190	0.251	66.540	8.15	3.08
10.500	34.449	7.340	0.249	68.707	8.33	2.99
10.550	34.613	7.579	0.239	68.236	8.56	2.79
10.600	34.777	7.939	0.252	69.405	8.94	2.82
10.650	34.941	7.969	0.252	70.950	8.99	2.80
10.700	35.105	8.179	0.257	74.172	9.25	2.78
10.750	35.269	8.808	0.255	76.528	9.91	2.57
10.800	35.433	9.197	0.249	78.695	10.33	2.41
10.850	35.597	9.736	0.253	79.430	10.88	2.33
10.900	35.761	8.927	0.259	74.436	10.00	2.59
10.950	35.925	8.208	0.263	76.151	9.30	2.83
11.000	36.089	8.089	0.243	77.489	9.20	2.64
11.050	36.253	8.298	0.248	79.279	9.44	2.63
11.100	36.417	10.396	0.254	77.960	11.52	2.21
11.150	36.581	10.575	0.273	88.589	11.85	2.30
11.200	36.745	10.905	0.270	92.414	12.24	2.21
11.250	36.909	11.234	0.283	95.316	12.61	2.24
11.300	37.073	11.773	0.303	96.767	13.17	2.30
11.350	37.238	12.762	0.342	101.045	14.22	2.41
11.400	37.402	13.152	0.349	94.242	14.51	2.41
11.450	37.566	11.624	0.364	77.809	12.74	2.86
11.500	37.730	9.437	0.330	66.163	10.39	3.18
11.550	37.894	8.239	0.277	74.248	9.31	2.98
11.600	38.058	8.748	0.361	80.090	9.90	3.65
11.650	38.222	22.948	0.667	67.030	23.91	2.79
11.700	38.386	15.878	0.658	26.495	16.26	4.05
11.750	38.550	11.863	0.626	31.301	12.31	5.08
11.800	38.714	9.646	0.427	45.774	10.31	4.14
11.850	38.878	8.987	0.322	69.160	9.98	3.23
11.900	39.042	9.317	0.307	74.945	10.40	2.95
11.950	39.206	11.804	0.334	78.054	12.93	2.58
12.000	39.370	13.871	0.353	64.712	14.80	2.38
12.050	39.534	12.732	0.398	68.387	13.72	2.90
12.100	39.698	18.694	0.401	74.285	19.76	2.03
12.150	39.862	27.382	0.375	36.068	27.90	1.34
12.200	40.026	28.071	0.619	34.919	28.57	2.17
12.250	40.190	25.524	0.791	41.138	26.12	3.03
12.300	40.354	22.079	0.671	10.892	22.24	3.02
12.350	40.518	47.933	0.925	15.264	48.15	1.92

12.400	40.682	33.793	1.149	14.925	34.01	3.38
12.450	40.846	19.683	1.017	16.696	19.92	5.10
12.500	41.011	14.170	0.782	20.842	14.47	5.40
12.550	41.175	11.504	0.529	36.182	12.03	4.40
12.600	41.339	12.822	0.675	70.045	13.83	4.88
12.650	41.503	15.698	0.654	52.991	16.46	3.97
12.700	41.667	12.492	0.641	50.127	13.21	4.85
12.750	41.831	11.144	0.521	69.009	12.14	4.29
12.800	41.995	28.041	0.828	70.026	29.05	2.85
12.850	42.159	19.802	0.968	32.375	20.27	4.78
12.900	42.323	14.590	0.828	36.558	15.12	5.48
12.950	42.487	13.092	0.602	45.830	13.75	4.38
13.000	42.651	13.990	0.544	59.361	14.84	3.66
13.050	42.815	11.054	0.509	68.802	12.04	4.23
13.100	42.979	12.702	0.469	77.338	13.82	3.39
13.150	43.143	12.942	0.408	61.848	13.83	2.95
13.200	43.307	12.193	0.418	75.944	13.29	3.15
13.250	43.471	11.804	0.401	86.195	13.05	3.07
13.300	43.635	11.144	0.406	97.276	12.54	3.24
13.350	43.799	10.875	0.373	98.388	12.29	3.03
13.400	43.963	11.354	0.354	99.254	12.78	2.77
13.450	44.127	12.642	0.387	93.676	13.99	2.77
13.500	44.291	21.660	0.338	77.018	22.77	1.48
13.550	44.455	23.308	0.384	55.837	24.11	1.59
13.600	44.619	16.327	0.454	67.482	17.30	2.62
13.650	44.783	12.762	0.503	81.390	13.93	3.61
13.700	44.948	14.080	0.460	91.114	15.39	2.99
13.750	45.112	16.807	0.414	73.814	17.87	2.32
13.800	45.276	15.998	0.411	71.025	17.02	2.41
13.850	45.440	13.871	0.413	69.084	14.87	2.78
13.900	45.604	12.822	0.396	71.704	13.85	2.86
13.950	45.768	11.144	0.473	74.342	12.21	3.87
14.000	45.932	12.403	0.428	84.970	13.63	3.14
14.050	46.096	12.613	0.638	83.199	13.81	4.62
14.100	46.260	19.503	0.740	91.509	20.82	3.55
14.150	46.424	15.489	0.710	70.385	16.50	4.30
14.200	46.588	247.726	0.684	46.584	248.40	0.28
14.250	46.752	289.818	0.656	30.792	290.26	0.23
14.300	46.916	294.461	0.652	29.228	294.88	0.22
14.350	47.080	288.170	0.650	28.342	288.58	0.23
14.400	47.244	284.095	0.648	27.928	284.50	0.23
14.450	47.408	281.249	0.010	27.833	281.65	0.00
14.500	47.572	278.523	0.010	27.739	278.92	0.00

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Units:	Imperial
Site:	RESOLUTION MINE	Data averaging interval:	0.100 meters
Engineer:	B.BURGESS	Assumed depth of water:	12.003 feet
		Net area ratio of cone:	0.80
		Unit weight of water:	62.4 lb/ft^3
		Relative density constant, C_{DR}:	350
Sounding:	CPT--01	Young's modulus for sands, α:	4
Date:	7/29/2009	Small strain shear modulus number, S_G (sands):	180
Time:	6:50 AM	Small strain shear modulus number, C_G (clays):	50
		N_{kt} for clays:	15
		OCR number, k_{ocr}:	0.3

Interpretation based on Lunne, Robertson and Powell, 1997

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
0.100	0.328	0.000	0.000	0.000							0.000																	
0.200	0.656	0.000	0.000	0.000							0.000																	
0.300	0.984	0.000	0.000	0.000							0.000																	
0.400	1.312	0.000	0.000	0.000							0.000																	
0.500	1.640	0.000	0.000	0.000							0.000																	
0.600	1.969	10.555	0.058	0.333		10.56	0.55	6	115	0.113	0.000	0.113	92.63	0.55	0.00	6	1.78	33.33	3.00E-4	1.9	5.9	31	40	42	194			
0.700	2.297	25.455	0.348	0.703		25.46	1.37	6	115	0.132	0.000	0.132	192.53	1.38	0.00	6	1.80	75.18	3.00E-4	4.7	13.2	46	44	102	274			
0.800	2.625	12.363	0.411	3.241		12.41	3.31	4	115	0.150	0.000	0.150	81.52	3.35	0.02	5	2.34	46.30	3.00E-6	2.8	7.4	36	39	50	226			
0.900	2.953	8.318	0.199	4.717		8.39	2.37	4	115	0.169	0.000	0.169	48.57	2.42	0.04	5	2.40	29.48	3.00E-6	1.9	4.8	29	36	34	206			
1.000	3.281	7.859	0.187	5.389		7.94	2.36	4	115	0.188	0.000	0.188	41.22	2.42	0.05	5	2.45	26.47	3.00E-6	1.9	4.4	27	35	32	210			
1.100	3.609	8.488	0.233	6.036		8.57	2.72	4	115	0.207	0.000	0.207	40.47	2.78	0.05	4	2.50	27.24	3.00E-8	2.1	4.7				429	0.56	2.70	12.1
1.200	3.937	8.837	0.286	6.665		8.93	3.20	4	115	0.226	0.000	0.226	38.60	3.28	0.06	4	2.56	27.33	3.00E-8	2.2	4.8				447	0.58	2.57	11.6
1.300	4.265	8.958	0.299	7.148		9.06	3.30	4	115	0.244	0.000	0.244	36.08	3.40	0.06	4	2.59	26.36	3.00E-8	2.3	4.8				453	0.59	2.41	10.8
1.400	4.593	6.132	0.229	6.639		6.23	3.67	3	111	0.263	0.000	0.263	22.71	3.83	0.08	4	2.78	18.21	3.00E-8	1.7	3.5				311	0.40	1.51	6.8
1.500	4.921	3.705	0.117	6.369		3.80	3.08	3	111	0.281	0.000	0.281	12.51	3.33	0.13	3	2.94	10.83	1.00E-9	1.1	2.2				190	0.23	0.83	3.8
1.600	5.249	3.395	0.067	7.726		3.51	1.92	1	111	0.299	0.000	0.299	10.72	2.10	0.17	4	2.89	9.14	3.00E-8	1.0	1.9				175	0.21	0.71	3.2
1.700	5.577	3.106	0.067	9.096		3.24	2.07	1	111	0.317	0.000	0.317	9.20	2.30	0.22	3	2.96	8.12	1.00E-9	1.0	1.8				162	0.19	0.61	2.8
1.800	5.906	3.745	0.086	10.138		3.89	2.20	3	111	0.336	0.000	0.336	10.59	2.41	0.21	3	2.92	9.28	1.00E-9	1.1	2.0				195	0.24	0.71	3.2
1.900	6.234	3.335	0.104	8.700		3.46	3.02	3	111	0.354	0.000	0.354	8.77	3.36	0.20	3	3.07	8.12	1.00E-9	1.1	1.9				173	0.21	0.58	2.6
2.000	6.562	3.395	0.090	9.485		3.53	2.55	3	111	0.372	0.000	0.372	8.49	2.85	0.22	3	3.04	7.81	1.00E-9	1.1	1.9				177	0.21	0.57	2.5
2.100	6.890	3.295	0.067	12.224		3.47	1.92	1	111	0.391	0.000	0.391	7.89	2.16	0.29	3	3.01	7.21	1.00E-9	1.1	1.7				174	0.21	0.53	2.4
2.200	7.218	3.465	0.062	16.526		3.70	1.67	1	111	0.409	0.000	0.409	8.06	1.88	0.36	3	2.97	7.31	1.00E-9	1.1	1.7				185	0.22	0.54	2.4
2.300	7.546	3.715	0.067	21.313		4.02	1.67	1	111	0.427	0.000	0.427	8.42	1.87	0.43	3	2.95	7.64	1.00E-9	1.2	1.8				201	0.24	0.56	2.5
2.400	7.874	4.104	0.074	25.101		4.47	1.66	1	111	0.445	0.000	0.445	9.03	1.84	0.45	4	2.92	8.17	3.00E-8	1.2	1.9				223	0.27	0.60	2.7
2.500	8.202	6.811	0.151	26.860		7.20	2.10	4	115	0.464	0.000	0.464	14.51	2.24	0.29	4	2.79	12.77	3.00E-8	1.9	2.9				360	0.45	0.97	4.4
2.600	8.530	6.970	0.184	19.083		7.25	2.54	4	115	0.483	0.000	0.483	14.00	2.72	0.20	4	2.85	12.58	3.00E-8	2.0	3.0				362	0.45	0.93	4.2
2.700	8.858	4.324	0.133	19.668		4.61	2.89	3	111	0.501	0.000	0.501	8.19	3.25	0.34	3	3.09	7.80	1.00E-9	1.5	2.1				230	0.27	0.55	2.5
2.800	9.186	3.765	0.095	23.845		4.11	2.30	3	111	0.520	0.000	0.520	6.91	2.64	0.48	3	3.10	6.61	1.00E-9	1.3	1.8				205	0.24	0.46	2.1
2.900	9.514	3.675	0.087	26.835		4.06	2.13	3	111	0.538	0.000	0.538	6.55	2.46	0.55	3	3.10	6.29	1.00E-9	1.3	1.8				203	0.23	0.44	2.0
3.000	9.843	3.665	0.097	28.015		4.07	2.38	3	111	0.556	0.000	0.556	6.32	2.75	0.57	3	3.14	6.12	1.00E-9	1.3	1.8				203	0.23	0.42	1.9
3.100	10.171	3.765	0.083	30.088		4.20	1.97	3	111	0.574	0.000	0.574	6.31	2.28	0.60	3	3.10	6.08	1.00E-9	1.3	1.7				210	0.24	0.42	1.9
3.200	10.499	3.755	0.075	32.859		4.23	1.77	1	111	0.593	0.000	0.593	6.13	2.06	0.65	3	3.09	5.91	1.00E-9	1.3	1.7				211	0.24	0.41	1.8
3.300	10.827	4.124	0.149	33.813		4.61	3.22	3	111	0.611	0.000	0.611	6.55	3.72	0.61	3	3.20	6.44	1.00E-9	1.5	2.0				231	0.27	0.44	2.0
3.400	11.155	5.453	0.301	23.675		5.79	5.20	3	111	0.629	0.000	0.629	8.21	5.83	0.33	3	3.24	8.12	1.00E-9	2.0	2.7				290	0.34	0.55	2.5
3.500	11.483	5.103	0.245	4.039		5.16	4.75	3	111	0.647	0.000	0.647	6.97	5.43	0.06	3	3.27	6.94	1.00E-9	2.0	2.5				258	0.30	0.46	2.1
3.600	11.811	4.834	0.186	6.200		4.92	3.78	3	111	0.666	0.000	0.666	6.39	4.37	0.10	3	3.25	6.34	1.00E-9	1.8	2.3				246	0.28	0.43	1.9
3.700	12.139	5.782	0.223	10.503		5.93	3.75	3	111	0.684	0.004	0.680	7.72	4.24	0.14	3	3.18	7.59	1.00E-9	2.1	2.6				297	0.35	0.51	2.3
3.800	12.467	6.141	0.256	17.965		6.40	3.99	3	111	0.702	0.014	0.688	8.28	4.49	0.22	3	3.16	8.13	1.00E-9	2.2	2.7				320	0.38	0.55	2.5
3.900	12.795	5.792	0.257	28.091		6.20	4.15	3	111	0.721	0.025	0.696	7.87	4.70	0.36	3	3.19	7.76	1.00E-9	2.1	2.6				310	0.37	0.52	2.4
4.000	13.123	13.991	0.468	32.362		14.46	3.23	4	115	0.739	0.035	0.704	19.47	3.41	0.17	4	2.80	18.30	3.00E-8	4.0	4.9				723	0.91	1.30	5.8
4.100	13.451	15.878	0.643	18.229		16.14	3.99	4	115	0.758	0.045	0.713	21.58	4.18	0.08	3	2.82	20.37	1.00E-9	4.6	5.6				807	1.03	1.44	6.5
4.200	13.780	14.400	0.476	19.360		14.68	3.25	4	115	0.777	0.055	0.722	19.27	3.43	0.10	4	2.80	18.18	3.00E-8	4.1	5.0				734	0.93	1.28	5.8
4.300	14.108	16.237	0.415	18.600		16.51	2.51	5	115	0.796	0.066	0.730	21.52	2.64	0.08	4	2.70	20.10	3.00E-8	4.4	5.2				825	1.05	1.43	6.5
4.400	14.436	8.978	0.369	15.986		9.21	4.00	3	111	0.814	0.076	0.738	11.37	4.39	0.13	3	3.05	11.06	1.00E-9	3.0	3.5				460	0.56	0.76	3.4
4.500	14.764	4.514	0.232	16.420		4.75	4.89	3	111	0.832	0.086	0.746	5.25	5.93	0.28	3	3.40	5.25	1.00E-9	1.9	2.3				238	0.26	0.35	1.6
4.600	15.092	4.004	0.184	19.780		4.29	4.29	3	111	0.851	0.096	0.754	4.56	5.35	0.39	3	3.42	4.56	1.00E-9	1.7	2.1				214	0.23	0.30	1.4
4.700	15.420	7.619	0.211	22.224		7.94	2.66	4	115	0.869	0.107	0.763	9.27	2.98	0.21	3	3.02	9.01	1.00E-9	2.5	2.9				397	0.47	0.62	2.8
4.800	15.748	6.751	0.250	20.930		7.05	3.55	3	111	0.888	0.117	0.771	8.00	4.06	0.23	3	3.15	7.88	1.00E-9	2.4	2.8				353	0.41	0.53	2.4
4.900	16.076	8.608	0.202	21.702		8.92	2.27	5	115	0.906	0.127	0.779	10.28	2.52	0.18	3	2.94	9.95	1.00E-9	2.7	3.1				446	0.53	0.69	3.1
5.000	16.404	11.744	0.213	18.562		12.01	1.77	5	115	0.925	0.137	0.788	14.07	1.92	0.11	4	2.77	13.41	3.00E-8	3.3	3.8				601	0.74	0.94	4.2
5.100	16.732	8.378	0.283	14.548		8.59	3.30	4	115	0.944	0.148	0.796	9.60	3.70	0.12	3	3.06	9.40	1.00E-9	2.8	3.2				429	0.51	0.64	2.9
5.200	17.060	4.694	0.216	15.823		4.92	4.40	3	111	0.962	0.158	0.805	4.92	5.46	0.25	3	3.40	4.92	1.00E-9	2.0	2.3				246	0.26	0.33	1.5
5.300	17.388	5.343	0.164	18.373		5.61	2.92	3	111	0.981	0.168	0.813	5.69	3.54	0.25	3	3.24	5.66	1.00E-9	2.0	2.3				280	0.31	0.38	1.7
5.400	17.717	4.654	0.159	21.150		4.96	3.21	3	111	0.999	0.178	0.821	4.83	4.02	0.34	3	3.33	4.83	1.00E-9	1.9	2.1				248	0.26	0.32	1.4
5.500	18.045	4.464	0.167	26.426		4.84	3.44	3	111	1.017	0.188	0.829	4.62	4.35	0.45	3	3.37	4.62	1.00E-9	1.8	2.1				242	0.26	0.31	1.4
5.600	18.373	4.624	0.167	31.144		5.07	3.29	3	111	1.035	0.199	0.837	4.82	4.14	0.51	3	3.34	4.82	1.00E-9	1.9	2.1				254	0.27	0.32	1.4
5.700	18.701	4.793	0.158	32.394		5.26	3.00	3	111	1.054	0.209	0.845	4.98	3.76	0.50	3	3.30	4.98	1.00E-9	1.9	2.1				263	0.28	0.33	1.5
5.800	19.029	4.474	0.159	32.953		4.95	3.22	3	111	1.072	0.219	0.853	4.55	4.11	0.56	3	3.36	4.55	1.00E-9	1.8	2.1				247	0.26	0.30	1.4
5.900	19.357	4.474	0.165	34.624		4.97	3.32	3	111	1.090	0.229	0.861	4.51	4.25	0.58	3	3.37	4.51	1.00E-9	1.9	2.1				249	0.26	0.30	1.4
6.000	19.685	4.554	0.162	34.008		5.04	3.22	3	111	1.108	0.240	0.869	4.53	4.13	0.56	3	3.36	4.53	1.00E-9	1.9	2.1				252	0.26	0.30	1.4
6.100	20.013	5.722	0.177	33.493		6.20	2.86	3	111	1.127	0.250	0.877	5.79	3.49	0.43	3	3.23	5.77	1.00E-9	2.1	2.3				310	0.34	0.39	1.7
6.200	20.341	5.572	0.191	33.531		6.06	3.16	3	111	1.145	0.260	0.885	5.55	3.90	0.44	3	3.27	5.54	1.00E-9	2.1	2.3				303	0.33	0.37	1.7
6.300	20.669	5.023	0.174	36.904		5.55	3.13	3	111	1.163	0.270	0.893	4.92	3.96	0.54	3	3.32	4.92	1.00E-9	2.0	2.2				278	0.29	0.33	1.5
6.400	20.997	4.893	0.177	39.008		5.45	3.24	3	111	1.182	0.281	0.901	4.74	4.14	0.59	3	3.34	4.74	1.00E-9	2.0	2.2				273	0.28	0.32	1.4
6.500	21.325	4.723	0.172	38.776		5.28	3.26	3	111	1.200	0.291	0.909	4.49	4.22	0.61	3	3.37	4.49	1.00E-9	2.0	2.1				264	0.27	0.30	1.3
6.600	21.654	4.574	0.165	38.135		5.12	3.23	3	111	1.218	0.301	0.917	4.26	4.23	0.63	3	3.39	4.26	1.00E-9	1.9	2.1				256	0.26	0.28	1.3
6.700	21.982	4.683	0.169	38.122		5.23	3.23	3	111	1.236	0.311	0.925	4.32	4.23	0.61	3	3.38	4.32	1.00E-9	2.0	2.1				262	0.27	0.29	1.3
6.800	22.310	4.883	0.173	38.480		5.44	3.19	3	111	1.255	0.322	0.933	4.48	4.14	0.59	3	3.36	4.48	1.00E-9	2.0	2.2				272	0.28	0.30	1.3
6.900	22.638	5.123	0.177	40.145		5.70	3.10	3	111	1.273	0.332	0.941	4.70	3.99	0.58	3	3.34	4.70	1.00E-9	2.1	2.2				285	0.30	0.31	1.4
7.000	22.966	5.492	0.180	39.944		6.07	2.96	3	111	1.291	0.342	0.949	5.03	3.76	0.53	3	3.30	5.03	1.00E-9	2.2	2.3				303	0.32	0.34	1.5

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
7.100	23.294	5.472	0.182	39.818		6.05	3.01	3	111	1.310	0.352	0.957	4.95	3.84	0.53	3	3.31	4.95	1.00E-9	2.2	2.3				302	0.32	0.33	1.5
7.200	23.622	5.383	0.177	43.857		6.01	2.94	3	111	1.328	0.363	0.965	4.85	3.78	0.60	3	3.31	4.85	1.00E-9	2.1	2.2				301	0.31	0.32	1.5
7.300	23.950	5.422	0.182	45.805		6.08	2.99	3	111	1.346	0.373	0.973	4.87	3.84	0.62	3	3.32	4.87	1.00E-9	2.2	2.3				304	0.32	0.32	1.5
7.400	24.278	5.392	0.167	44.417		6.03	2.77	4	115	1.365	0.383	0.982	4.75	3.58	0.60	3	3.31	4.75	1.00E-9	2.1	2.2				302	0.31	0.32	1.4
7.500	24.606	12.652	0.324	33.235		13.13	2.47	5	115	1.384	0.393	0.990	11.86	2.76	0.17	3	2.92	11.77	1.00E-9	3.8	4.0				657	0.78	0.79	3.6
7.600	24.934	12.582	0.445	19.667		12.87	3.46	4	115	1.402	0.403	0.999	11.47	3.88	0.09	3	3.01	11.42	1.00E-9	4.1	4.2				643	0.76	0.76	3.4
7.700	25.262	20.002	0.410	18.650		20.27	2.02	6	115	1.421	0.414	1.008	18.71	2.18	0.05	4	2.69	18.54	3.00E-8	5.4	5.5				1014	1.26	1.25	5.6
7.800	25.591	24.466	0.478	5.685		24.55	1.95	6	115	1.440	0.424	1.016	22.74	2.07	0.00	4	2.61	22.55	3.00E-8	6.3	6.4				1227	1.54	1.52	6.8
7.900	25.919	13.242	0.557	6.313		13.33	4.18	3	111	1.458	0.434	1.024	11.59	4.69	0.00	3	3.06	11.57	1.00E-9	4.4	4.5				667	0.79	0.77	3.5
8.000	26.247	20.471	0.405	7.783		20.58	1.97	6	115	1.477	0.444	1.033	18.50	2.12	0.01	4	2.69	18.42	3.00E-8	5.5	5.6				1029	1.27	1.23	5.6
8.100	26.575	21.620	0.555	8.436		21.74	2.55	5	115	1.496	0.455	1.041	19.44	2.74	0.01	4	2.74	19.39	3.00E-8	5.9	6.0				1087	1.35	1.30	5.8
8.200	26.903	10.625	0.571	10.710		10.78	5.30	3	111	1.514	0.465	1.049	8.83	6.17	0.03	3	3.23	8.83	1.00E-9	4.0	4.0				539	0.62	0.59	2.6
8.300	27.231	6.780	0.325	20.685		7.08	4.60	3	111	1.532	0.475	1.057	5.24	5.87	0.18	3	3.39	5.24	1.00E-9	2.9	2.9				354	0.37	0.35	1.6
8.400	27.559	6.221	0.257	36.992		6.75	3.80	3	111	1.551	0.485	1.065	4.88	4.93	0.42	3	3.38	4.88	1.00E-9	2.6	2.6				338	0.35	0.33	1.5
8.500	27.887	6.291	0.255	47.953		6.98	3.65	3	111	1.569	0.496	1.073	5.04	4.71	0.55	3	3.35	5.04	1.00E-9	2.6	2.6				349	0.36	0.34	1.5
8.600	28.215	6.231	0.251	51.169		6.97	3.61	3	111	1.587	0.506	1.081	4.98	4.67	0.59	3	3.36	4.98	1.00E-9	2.6	2.5				348	0.36	0.33	1.5
8.700	28.543	6.401	0.256	53.299		7.17	3.57	3	111	1.606	0.516	1.090	5.11	4.60	0.60	3	3.34	5.11	1.00E-9	2.6	2.6				358	0.37	0.34	1.5
8.800	28.871	6.531	0.262	55.485		7.33	3.57	3	111	1.624	0.526	1.098	5.20	4.59	0.61	3	3.34	5.20	1.00E-9	2.6	2.6				366	0.38	0.35	1.6
8.900	29.199	6.721	0.274	57.639		7.55	3.63	3	111	1.642	0.537	1.106	5.34	4.64	0.61	3	3.33	5.34	1.00E-9	2.7	2.6				378	0.39	0.36	1.6
9.000	29.528	6.770	0.276	57.583		7.60	3.63	3	111	1.660	0.547	1.114	5.33	4.65	0.61	3	3.33	5.33	1.00E-9	2.7	2.7				380	0.40	0.36	1.6
9.100	29.856	6.890	0.265	55.949		7.70	3.44	3	111	1.679	0.557	1.122	5.36	4.40	0.58	3	3.31	5.36	1.00E-9	2.7	2.7				385	0.40	0.36	1.6
9.200	30.184	6.841	0.252	57.539		7.67	3.29	3	111	1.697	0.567	1.130	5.29	4.22	0.60	3	3.31	5.29	1.00E-9	2.7	2.6				383	0.40	0.35	1.6
9.300	30.512	6.970	0.243	57.903		7.80	3.12	4	115	1.716	0.577	1.138	5.35	4.00	0.59	3	3.29	5.35	1.00E-9	2.7	2.6				390	0.41	0.36	1.6
9.400	30.840	7.190	0.250	57.847		8.02	3.12	4	115	1.735	0.588	1.147	5.48	3.98	0.57	3	3.28	5.49	1.00E-9	2.8	2.7				401	0.42	0.37	1.6
9.500	31.168	10.685	0.375	49.969		11.40	3.29	4	115	1.753	0.598	1.155	8.35	3.89	0.31	3	3.13	8.39	1.00E-9	3.7	3.5				570	0.64	0.56	2.5
9.600	31.496	9.816	0.499	39.209		10.38	4.80	3	111	1.772	0.608	1.163	7.40	5.79	0.26	3	3.27	7.41	1.00E-9	3.8	3.6				519	0.57	0.49	2.2
9.700	31.824	7.190	0.337	52.614		7.95	4.24	3	111	1.790	0.618	1.171	5.26	5.47	0.51	3	3.38	5.26	1.00E-9	3.0	2.9				397	0.41	0.35	1.6
9.800	32.152	7.040	0.262	59.857		7.90	3.31	3	111	1.808	0.629	1.180	5.17	4.29	0.60	3	3.32	5.17	1.00E-9	2.8	2.7				395	0.41	0.34	1.5
9.900	32.480	9.906	0.391	52.067		10.66	3.67	3	111	1.826	0.639	1.188	7.43	4.43	0.35	3	3.20	7.46	1.00E-9	3.6	3.4				533	0.59	0.50	2.2
10.000	32.808	8.594	0.444	43.939		9.23	4.82	3	111	1.845	0.649	1.196	6.17	6.02	0.34	3	3.34	6.17	1.00E-9	3.5	3.3				461	0.49	0.41	1.9
10.100	33.136	7.849	0.333	52.325		8.60	3.87	3	111	1.863	0.659	1.204	5.60	4.94	0.46	3	3.33	5.60	1.00E-9	3.2	3.0				430	0.45	0.37	1.7
10.200	33.465	7.380	0.284	61.609		8.27	3.44	3	111	1.881	0.670	1.212	5.27	4.45	0.59	3	3.32	5.27	1.00E-9	3.0	2.8				413	0.43	0.35	1.6
10.300	33.793	7.749	0.249	64.769		8.68	2.87	4	115	1.900	0.680	1.220	5.56	3.67	0.59	3	3.26	5.57	1.00E-9	3.0	2.7				434	0.45	0.37	1.7
10.400	34.121	7.839	0.248	66.760		8.80	2.82	4	115	1.919	0.690	1.229	5.60	3.61	0.60	3	3.25	5.61	1.00E-9	3.0	2.8				440	0.46	0.37	1.7
10.500	34.449	7.370	0.246	67.828		8.35	2.95	4	115	1.938	0.700	1.237	5.18	3.84	0.65	3	3.29	5.18	1.00E-9	2.9	2.7				417	0.43	0.35	1.6
10.600	34.777	7.829	0.248	69.530		8.83	2.80	4	115	1.956	0.711	1.246	5.52	3.60	0.62	3	3.26	5.53	1.00E-9	3.0	2.7				442	0.46	0.37	1.7
10.700	35.105	8.319	0.255	73.883		9.38	2.71	4	115	1.975	0.721	1.254	5.90	3.44	0.62	3	3.22	5.93	1.00E-9	3.1	2.8				469	0.49	0.39	1.8
10.800	35.433	9.247	0.252	78.218		10.37	2.43	5	115	1.994	0.731	1.263	6.63	3.01	0.58	3	3.15	6.69	1.00E-9	3.3	3.0				519	0.56	0.44	2.0
10.900	35.761	8.957	0.258	76.672		10.06	2.57	5	115	2.013	0.741	1.272	6.33	3.21	0.59	3	3.18	6.37	1.00E-9	3.2	2.9				503	0.54	0.42	1.9
11.000	36.089	8.198	0.251	77.640		9.32	2.70	4	115	2.032	0.751	1.280	5.69	3.45	0.66	3	3.23	5.71	1.00E-9	3.1	2.8				466	0.49	0.38	1.7
11.100	36.417	9.756	0.258	81.943		10.94	2.36	5	115	2.050	0.762	1.289	6.90	2.91	0.58	3	3.12	6.97	1.00E-9	3.4	3.1				547	0.59	0.46	2.1
11.200	36.745	10.905	0.275	92.106		12.23	2.25	5	115	2.069	0.772	1.297	7.83	2.71	0.58	3	3.06	7.95	1.00E-9	3.6	3.3				612	0.68	0.52	2.3
11.300	37.073	11.923	0.309	97.709		13.33	2.32	5	115	2.088	0.782	1.306	8.61	2.75	0.56	3	3.03	8.76	1.00E-9	3.9	3.5				667	0.75	0.57	2.6
11.400	37.402	12.513	0.352	91.032		13.82	2.54	5	115	2.107	0.792	1.314	8.91	3.00	0.49	3	3.04	9.07	1.00E-9	4.1	3.7				691	0.78	0.59	2.7
11.500	37.730	9.767	0.324	72.740		10.81	2.99	4	115	2.126	0.803	1.323	6.57	3.73	0.51	3	3.20	6.61	1.00E-9	3.6	3.2				541	0.58	0.44	2.0
11.600	38.058	13.312	0.435	73.789		14.37	3.03	5	115	2.144	0.813	1.332	9.18	3.56	0.37	3	3.07	9.34	1.00E-9	4.4	4.0				719	0.82	0.61	2.8
11.700	38.386	16.896	0.650	41.609		17.50	3.72	4	115	2.163	0.823	1.340	11.44	4.24	0.14	3	3.04	11.66	1.00E-9	5.5	4.9				875	1.02	0.76	3.4
11.800	38.714	10.165	0.458	48.745		10.87	4.22	3	111	2.181	0.833	1.348	6.44	5.28	0.31	3	3.29	6.45	1.00E-9	4.0	3.5				543	0.58	0.43	1.9
11.900	39.042	10.036	0.321	74.053		11.10	2.89	4	115	2.200	0.844	1.357	6.56	3.61	0.50	3	3.19	6.62	1.00E-9	3.6	3.2				555	0.59	0.44	2.0
12.000	39.370	12.802	0.362	70.384		13.82	2.62	5	115	2.219	0.854	1.365	8.49	3.12	0.36	3	3.06	8.65	1.00E-9	4.3	3.8				691	0.77	0.57	2.5
12.100	39.698	19.603	0.391	59.580		20.46	1.91	6	115	2.238	0.864	1.374	13.26	2.15	0.19	4	2.81	13.79	3.00E-8	5.6	4.9				1023	1.21	0.88	4.0
12.200	40.026	26.992	0.595	37.375		27.53	2.16	6	115	2.257	0.874	1.382	18.28	2.35	0.07	4	2.72	19.16	3.00E-8	7.4	6.4				1377	1.68	1.22	5.5
12.300	40.354	31.845	0.796	22.431		32.17	2.47	6	115	2.275	0.885	1.391	21.49	2.66	0.02	4	2.70	22.59	3.00E-8	8.6	7.5				1608	1.99	1.43	6.4
12.400	40.682	33.803	1.030	15.628		34.03	3.03	5	115	2.294	0.895	1.399	22.68	3.25	0.01	4	2.73	23.79	3.00E-8	9.3	8.1				1701	2.12	1.51	6.8
12.500	41.011	15.119	0.776	24.573		15.47	5.02	3	111	2.313	0.905	1.408	9.35	5.90	0.07	3	3.20	9.44	1.00E-9	5.5	4.8				774	0.88	0.62	2.8
12.600	41.339	13.341	0.619	53.073		14.11	4.39	3	111	2.331	0.915	1.416	8.32	5.26	0.25	3	3.20	8.39	1.00E-9	4.9	4.2				705	0.78	0.55	2.5
12.700	41.667	13.111	0.605	57.376		13.94	4.34	3	111	2.349	0.926	1.424	8.14	5.22	0.28	3	3.21	8.21	1.00E-9	4.8	4.2				697	0.77	0.54	2.4
12.800	41.995	19.662	0.772	57.137		20.49	3.77	4	115	2.368	0.936	1.432	12.65	4.26	0.18	3	3.00	13.00	1.00E-9	6.3	5.4				1024	1.21	0.84	3.8
12.900	42.323	15.828	0.799	38.254		16.38	4.88	3	111	2.386	0.946	1.440	9.72	5.71	0.13	3	3.17	9.84	1.00E-9	5.7	4.9				819	0.93	0.65	2.9
13.000	42.651	12.712	0.552	57.998		13.55	4.07	3	111	2.404	0.956	1.448	7.69	4.95	0.29	3	3.22	7.76	1.00E-9	4.7	4.0				677	0.74	0.51	2.3
13.100	42.979	12.233	0.462	69.329		13.23	3.49	4	115	2.423	0.966	1.457	7.42	4.27	0.37	3	3.19	7.50	1.00E-9	4.4	3.8				662	0.72	0.49	2.2
13.200	43.307	12.313	0.409	74.662		13.39	3.05	4	115	2.442	0.977	1.465	7.47	3.74	0.40	3	3.16	7.58	1.00E-9	4.4	3.7				669	0.73	0.50	2.2
13.300	43.635	11.274	0.393	93.953		12.63	3.11	4	115	2.461	0.987	1.474	6.90	3.87	0.57	3	3.19	6.98	1.00E-9	4.1	3.5				631	0.68	0.46	2.1
13.400	43.963	11.624	0.371	97.106		13.02	2.85	5	115	2.480	0.997	1.482	7.11	3.52	0.57	3	3.16	7.22	1.00E-9	4.1	3.5				651	0.70	0.47	2.1
13.500	44.291	19.203	0.370	75.510		20.29	1.82	6	115	2.498	1.007	1.491	11.93	2.08	0.25	4	2.84	12.51	3.00E-8	5.6	4.7				1015	1.19	0.80	3.6
13.600	44.619	17.466	0.447	68.236		18.45	2.42	5	115	2.517	1.018	1.500	10.62	2.81	0.24	3	2.96	11.02	1.00E-9	5.4	4.6				922	1.06	0.71	3.2
13.700	44.948	14.550	0.459	82.106		15.73	2.92	5	115	2.536	1.028	1.508	8.75	3.48	0.37	3	3.08	8.96	1.00E-9	4.9	4.1				787	0.88	0.58	2.6
13.800	45.276	15.559	0.413	71.308		16.59	2.49	5	115	2.555	1.038	1.517	9.25	2.94	0.29	3	3.02	9.54	1.00E-9	5.0	4.2				829	0.94	0.62	2.8
13.900	45.604	12.612	0.427	71.710		13.64	3.13	4	115	2.574	1.048	1.525	7.26	3.86	0.37	3	3.17	7.37	1.00E-9	4.5	3.8				682	0.74	0.48	2.2
14.000	45.932	12.053	0.513	80.837		13.22	3.88	4	115	2.592	1.059	1.534	6.93	4.83	0.45	3	3.25	6.97	1.00E-9	4.6	3.8				661	0.71	0.46	2.1
14.100	46.260	15.868	0.696	81.698		17.04	4.08	4	115	2.611	1.069	1.542	9.36	4.82	0.33	3	3.14	9.53	1.00E-9	5.6	4.6				852	0.96	0.62	2.8
14.200	46.588	184.344	0.683	49.254		185.05	0.37	9	124	2.632	1.079	1.553	117.50	0.37	0.01	6	1.61	142.33	3.00E-4	31.5	26.0	64	41	740	1210			
14.300	46.916	290.816	0.653	29.454		291.24	0.22	10	127	2.652	1.089	1.563	184.62	0.23	0.00	7	1.33	224.39	3.00E-2	45.5	37.5	80	44	1165	1411			
14.400	47.244	284.505	0.436	28.034		284.91	0.15	10	127	2.673	1.100	1.574	179.33	0.15	0.00	7	1.28	218.71	3.00E-2	43.9	36.0	79	44	1140	1404			

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Sounding:	CPT--02
Site:	RESOLUTION MINE	Date:	7/29/2009
Engineer:	B.BURGESS	Time:	11:10 AM

Col 1 Depth (m)	Col 2 Depth (ft)	Col 3 q_c (tsf)	Col 4 f_s (tsf)	Col 5 u (psi)	Col 6 Other	Col 7 q_t (tsf)	Col 8 R_f (%)
0.050	0.164	0.000	0.000	0.000			
0.100	0.328	0.000	0.000	0.000			
0.150	0.492	0.000	0.000	0.000			
0.200	0.656	0.000	0.000	0.000			
0.250	0.820	0.000	0.000	0.000			
0.300	0.984	0.000	0.000	0.000			
0.350	1.148	0.000	0.000	0.000			
0.400	1.312	0.000	0.000	0.000			
0.450	1.476	0.000	0.000	0.000			
0.500	1.640	0.000	0.000	0.000			
0.550	1.804	0.000	0.000	0.000			
0.600	1.969	0.000	0.000	0.000			
0.650	2.133	40.804	0.564	1.206		40.82	1.38
0.700	2.297	49.282	0.443	1.847		49.31	0.90
0.750	2.461	33.014	0.437	2.544		33.05	1.32
0.800	2.625	18.814	0.390	2.676		18.85	2.07
0.850	2.789	9.497	0.346	2.563		9.53	3.63
0.900	2.953	6.741	0.255	2.789		6.78	3.76
0.950	3.117	6.561	0.151	3.166		6.61	2.29
1.000	3.281	7.100	0.188	3.562		7.15	2.63
1.050	3.445	8.898	0.237	3.712		8.95	2.65
1.100	3.609	9.707	0.249	3.882		9.76	2.55
1.150	3.773	8.748	0.281	4.052		8.81	3.19
1.200	3.937	8.389	0.209	4.202		8.45	2.47
1.250	4.101	5.812	0.169	4.165		5.87	2.88
1.300	4.265	4.045	0.115	4.202		4.11	2.80
1.350	4.429	4.703	0.128	4.334		4.77	2.69
1.400	4.593	14.140	0.312	4.636		14.21	2.20
1.450	4.757	11.085	0.270	4.692		11.15	2.42
1.500	4.921	5.962	0.237	4.673		6.03	3.93
1.550	5.085	4.703	0.120	4.711		4.77	2.52
1.600	5.249	3.565	0.072	4.862		3.64	1.98
1.650	5.413	2.966	0.059	5.050		3.04	1.94
1.700	5.577	2.966	0.055	5.371		3.04	1.81
1.750	5.741	3.086	0.058	6.803		3.18	1.82
1.800	5.906	2.876	0.052	7.330		2.98	1.74
1.850	6.070	3.086	0.048	7.444		3.19	1.50
1.900	6.234	2.786	0.043	7.971		2.90	1.48
1.950	6.398	2.756	0.041	8.687		2.88	1.42

2.000	6.562	2.876	0.040	9.366	3.01	1.33
2.050	6.726	2.876	0.042	10.101	3.02	1.39
2.100	6.890	3.116	0.046	10.911	3.27	1.41
2.150	7.054	3.146	0.048	11.646	3.31	1.45
2.200	7.218	3.176	0.053	12.419	3.35	1.58
2.250	7.382	2.996	0.055	13.135	3.19	1.73
2.300	7.546	3.086	0.061	13.719	3.28	1.86
2.350	7.710	3.715	0.095	13.851	3.91	2.43
2.400	7.874	3.595	0.091	11.985	3.77	2.42
2.450	8.038	4.943	0.083	12.588	5.12	1.62
2.500	8.202	4.913	0.126	13.003	5.10	2.47
2.550	8.366	5.063	0.123	15.283	5.28	2.33
2.600	8.530	4.164	0.095	16.734	4.40	2.16
2.650	8.694	3.715	0.071	17.601	3.97	1.79
2.700	8.858	3.685	0.059	18.486	3.95	1.49
2.750	9.022	3.595	0.052	19.542	3.88	1.34
2.800	9.186	3.955	0.073	21.633	4.27	1.71
2.850	9.350	5.662	0.098	22.745	5.99	1.64
2.900	9.514	5.183	0.074	17.582	5.44	1.36
2.950	9.678	3.775	0.066	16.715	4.02	1.64
3.000	9.843	3.715	0.069	17.714	3.97	1.74
3.050	10.007	3.535	0.059	17.902	3.79	1.56
3.100	10.171	2.696	0.053	16.734	2.94	1.80
3.150	10.335	2.667	0.046	17.563	2.92	1.58
3.200	10.499	2.457	0.040	18.449	2.72	1.47
3.250	10.663	2.427	0.042	19.372	2.71	1.55
3.300	10.827	2.546	0.039	20.220	2.84	1.37
3.350	10.991	2.846	0.050	21.049	3.15	1.59
3.400	11.155	3.265	0.057	21.596	3.58	1.59
3.450	11.319	3.146	0.065	20.993	3.45	1.88
3.500	11.483	3.026	0.056	22.331	3.35	1.67
3.550	11.647	2.936	0.052	23.273	3.27	1.59
3.600	11.811	3.265	0.057	24.611	3.62	1.57
3.650	11.975	3.116	0.053	24.347	3.47	1.53
3.700	12.139	2.816	0.051	23.386	3.15	1.62
3.750	12.303	3.026	0.055	25.252	3.39	1.62
3.800	12.467	4.314	0.055	26.967	4.70	1.17
3.850	12.631	4.674	0.071	27.362	5.07	1.40
3.900	12.795	4.674	0.080	28.813	5.09	1.57
3.950	12.959	4.164	0.084	29.887	4.59	1.83
4.000	13.123	4.224	0.087	31.772	4.68	1.86
4.050	13.287	4.224	0.091	32.940	4.70	1.94
4.100	13.451	4.284	0.111	33.656	4.77	2.33
4.150	13.615	4.524	0.137	34.844	5.03	2.73
4.200	13.780	5.213	0.183	36.313	5.74	3.19
4.250	13.944	4.134	0.166	21.068	4.44	3.74
4.300	14.108	3.865	0.168	23.650	4.21	3.99
4.350	14.272	3.685	0.142	25.157	4.05	3.51
4.400	14.436	5.872	0.128	23.424	6.21	2.06
4.450	14.600	9.317	0.161	10.628	9.47	1.70
4.500	14.764	6.861	0.183	5.898	6.95	2.63
4.550	14.928	7.250	0.381	6.219	7.34	5.19

4.600	15.092	6.471	0.441	6.520	6.56	6.72
4.650	15.256	12.223	0.507	3.241	12.27	4.13
4.700	15.420	12.426	0.521	3.524	12.48	4.18
4.750	15.584	28.461	0.533	3.486	28.51	1.87
4.800	15.748	20.701	0.454	2.996	20.74	2.19
4.850	15.912	14.201	0.385	2.469	14.24	2.70
4.900	16.076	8.988	0.332	2.356	9.02	3.68
4.950	16.240	5.970	0.242	2.393	6.00	4.03
5.000	16.404	4.554	0.209	2.733	4.59	4.55
5.050	16.568	4.254	0.168	3.317	4.30	3.91
5.100	16.732	4.074	0.146	4.052	4.13	3.53
5.150	16.896	3.715	0.138	5.069	3.79	3.64
5.200	17.060	3.655	0.131	6.313	3.75	3.50
5.250	17.224	3.655	0.131	7.726	3.77	3.48
5.300	17.388	3.625	0.128	9.366	3.76	3.40
5.350	17.552	3.745	0.117	11.175	3.91	3.00
5.400	17.717	3.805	0.121	13.097	3.99	3.03
5.450	17.881	3.745	0.128	15.227	3.96	3.23
5.500	18.045	3.715	0.131	17.450	3.97	3.30
5.550	18.209	3.685	0.130	19.617	3.97	3.28
5.600	18.373	3.625	0.124	21.539	3.94	3.15
5.650	18.537	3.685	0.123	23.575	4.02	3.06
5.700	18.701	3.745	0.121	25.459	4.11	2.94
5.750	18.865	3.745	0.123	27.061	4.13	2.97
5.800	19.029	3.715	0.131	28.192	4.12	3.18
5.850	19.193	4.344	0.117	27.362	4.74	2.47
5.900	19.357	4.314	0.118	25.798	4.69	2.52
5.950	19.521	3.895	0.130	26.835	4.28	3.04
6.000	19.685	3.745	0.123	28.437	4.15	2.96
6.050	19.849	3.835	0.123	29.812	4.26	2.88
6.100	20.013	3.895	0.124	30.547	4.33	2.86
6.150	20.177	3.865	0.125	31.301	4.32	2.90
6.200	20.341	3.715	0.122	31.602	4.17	2.93
6.250	20.505	3.715	0.126	32.111	4.18	3.02
6.300	20.669	3.565	0.115	31.791	4.02	2.86
6.350	20.833	3.805	0.111	31.979	4.27	2.60
6.400	20.997	3.745	0.113	33.280	4.22	2.68
6.450	21.161	3.865	0.119	33.845	4.35	2.73
6.500	21.325	3.955	0.131	33.883	4.44	2.95
6.550	21.490	4.404	0.130	32.375	4.87	2.67
6.600	21.654	4.194	0.136	32.827	4.67	2.91
6.650	21.818	4.254	0.128	34.599	4.75	2.69
6.700	21.982	4.134	0.127	34.900	4.64	2.74
6.750	22.146	4.074	0.126	35.409	4.58	2.75
6.800	22.310	4.015	0.124	35.352	4.52	2.74
6.850	22.474	4.434	0.108	34.052	4.92	2.19
6.900	22.638	4.554	0.098	27.833	4.95	1.98
6.950	22.802	4.374	0.104	30.246	4.81	2.16
7.000	22.966	3.955	0.100	31.546	4.41	2.27
7.050	23.130	4.015	0.108	33.355	4.50	2.40
7.100	23.294	4.134	0.104	34.863	4.64	2.24
7.150	23.458	4.105	0.099	34.467	4.60	2.15

7.200	23.622	4.134	0.096	35.824	4.65	2.06
7.250	23.786	3.745	0.105	35.824	4.26	2.46
7.300	23.950	3.355	0.111	35.541	3.87	2.87
7.350	24.114	4.164	0.113	36.257	4.69	2.41
7.400	24.278	4.194	0.119	37.294	4.73	2.52
7.450	24.442	4.254	0.119	38.481	4.81	2.47
7.500	24.606	4.374	0.119	39.234	4.94	2.41
7.550	24.770	4.344	0.120	39.951	4.92	2.44
7.600	24.934	4.344	0.123	40.648	4.93	2.50
7.650	25.098	4.314	0.118	40.572	4.90	2.41
7.700	25.262	4.224	0.113	40.798	4.81	2.35
7.750	25.427	4.224	0.112	41.364	4.82	2.32
7.800	25.591	4.224	0.117	42.155	4.83	2.42
7.850	25.755	4.344	0.112	42.155	4.95	2.26
7.900	25.919	4.314	0.115	42.155	4.92	2.34
7.950	26.083	4.434	0.116	41.307	5.03	2.31
8.000	26.247	4.434	0.114	42.231	5.04	2.26
8.050	26.411	4.734	0.114	43.361	5.36	2.13
8.100	26.575	4.883	0.116	43.588	5.51	2.11
8.150	26.739	4.614	0.121	44.775	5.26	2.30
8.200	26.903	4.824	0.293	46.772	5.50	5.33
8.250	27.067	4.973	0.279	47.583	5.66	4.93
8.300	27.231	7.370	0.244	6.558	7.46	3.27
8.350	27.395	6.471	0.222	8.292	6.59	3.37
8.400	27.559	5.872	0.211	10.873	6.03	3.50
8.450	27.723	5.512	0.209	14.171	5.72	3.66
8.500	27.887	5.572	0.197	17.921	5.83	3.38
8.550	28.051	5.662	0.209	21.992	5.98	3.50
8.600	28.215	6.231	0.216	26.590	6.61	3.27
8.650	28.379	7.100	0.199	30.528	7.54	2.64
8.700	28.543	5.962	0.194	32.677	6.43	3.02
8.750	28.707	5.393	0.192	38.123	5.94	3.23
8.800	28.871	5.333	0.190	43.814	5.96	3.19
8.850	29.035	5.393	0.182	47.112	6.07	3.00
8.900	29.199	5.512	0.182	49.166	6.22	2.93
8.950	29.364	5.632	0.180	50.089	6.35	2.83
9.000	29.528	5.692	0.185	52.501	6.45	2.87
9.050	29.692	5.692	0.189	53.990	6.47	2.92
9.100	29.856	5.722	0.201	53.745	6.50	3.09
9.150	30.020	5.692	0.197	52.727	6.45	3.05
9.200	30.184	5.632	0.194	52.162	6.38	3.04
9.250	30.348	5.602	0.190	53.443	6.37	2.98
9.300	30.512	5.752	0.180	53.198	6.52	2.76
9.350	30.676	5.932	0.187	53.180	6.70	2.79
9.400	30.840	6.112	0.178	54.725	6.90	2.58
9.450	31.004	6.531	0.182	54.159	7.31	2.49
9.500	31.168	6.351	0.189	57.193	7.17	2.63
9.550	31.332	6.201	0.188	58.889	7.05	2.67
9.600	31.496	6.082	0.192	59.945	6.95	2.76
9.650	31.660	6.112	0.190	58.513	6.95	2.73
9.700	31.824	6.082	0.188	56.986	6.90	2.72
9.750	31.988	6.082	0.183	56.534	6.90	2.65

9.800	32.152	5.752	0.171	55.573	6.55	2.61
9.850	32.316	6.291	0.181	55.799	7.09	2.55
9.900	32.480	6.651	0.191	53.255	7.42	2.57
9.950	32.644	7.040	0.213	49.052	7.75	2.75
10.000	32.808	6.951	0.192	45.698	7.61	2.52
10.050	32.972	6.022	0.177	47.375	6.70	2.64
10.100	33.136	5.962	0.175	51.917	6.71	2.61
10.150	33.301	6.112	0.168	54.084	6.89	2.44
10.200	33.465	7.100	0.180	55.931	7.91	2.28
10.250	33.629	6.681	0.189	56.157	7.49	2.52
10.300	33.793	6.201	0.180	53.632	6.97	2.58
10.350	33.957	5.962	0.181	53.066	6.73	2.69
10.400	34.121	6.022	0.168	49.712	6.74	2.49
10.450	34.285	6.082	0.176	48.845	6.79	2.59
10.500	34.449	10.396	0.179	51.691	11.14	1.61
10.550	34.613	19.143	0.310	29.416	19.57	1.58
10.600	34.777	11.534	0.418	28.738	11.95	3.50
10.650	34.941	8.029	0.366	35.428	8.54	4.29
10.700	35.105	8.089	0.299	39.932	8.66	3.45
10.750	35.269	7.190	0.181	40.704	7.78	2.33
10.800	35.433	7.100	0.155	40.686	7.69	2.02
10.850	35.597	6.801	0.160	42.155	7.41	2.16
10.900	35.761	6.082	0.182	47.846	6.77	2.69
10.950	35.925	5.752	0.194	53.142	6.52	2.98
11.000	36.089	5.722	0.197	50.749	6.45	3.05
11.050	36.253	5.662	0.201	52.652	6.42	3.13
11.100	36.417	5.812	0.190	52.784	6.57	2.89
11.150	36.581	5.902	0.168	52.746	6.66	2.52
11.200	36.745	6.172	0.166	53.255	6.94	2.39
11.250	36.909	6.771	0.199	58.399	7.61	2.61
11.300	37.073	9.767	0.229	62.639	10.67	2.15
11.350	37.238	11.145	0.248	70.479	12.16	2.04
11.400	37.402	12.942	0.208	68.180	13.92	1.49
11.450	37.566	14.979	0.180	57.420	15.81	1.14
11.500	37.730	10.485	0.202	61.735	11.37	1.78
11.550	37.894	8.448	0.220	73.438	9.51	2.31
11.600	38.058	8.299	0.229	76.095	9.39	2.44
11.650	38.222	7.699	0.200	70.158	8.71	2.30
11.700	38.386	7.040	0.181	66.333	8.00	2.26
11.750	38.550	6.711	0.164	65.994	7.66	2.14
11.800	38.714	6.711	0.157	64.562	7.64	2.05
11.850	38.878	6.981	0.166	66.088	7.93	2.09
11.900	39.042	7.130	0.175	66.785	8.09	2.16
11.950	39.206	7.250	0.181	68.331	8.23	2.20
12.000	39.370	7.160	0.195	63.469	8.07	2.42
12.050	39.534	7.340	0.179	63.299	8.25	2.17
12.100	39.698	7.400	0.178	64.373	8.33	2.14
12.150	39.862	8.963	0.186	67.860	9.94	1.87
12.200	40.026	8.029	0.200	67.558	9.00	2.22
12.250	40.190	8.149	0.212	61.471	9.03	2.35
12.300	40.354	7.610	0.227	64.580	8.54	2.66
12.350	40.518	16.328	0.305	65.843	17.28	1.77

12.400	40.682	15.728	0.411	32.337	16.19	2.54
12.450	40.846	10.546	0.396	38.349	11.10	3.57
12.500	41.011	8.358	0.335	46.264	9.02	3.71
12.550	41.175	7.759	0.214	57.608	8.59	2.49
12.600	41.339	8.658	0.196	61.923	9.55	2.05
12.650	41.503	7.729	0.200	62.545	8.63	2.32
12.700	41.667	7.580	0.197	67.106	8.55	2.31
12.750	41.831	9.108	0.217	69.028	10.10	2.15
12.800	41.995	9.377	0.235	78.280	10.50	2.24
12.850	42.159	9.767	0.242	77.621	10.88	2.22
12.900	42.323	9.527	0.233	89.813	10.82	2.15
12.950	42.487	11.235	0.209	98.011	12.65	1.65
13.000	42.651	11.025	0.227	100.951	12.48	1.82
13.050	42.815	11.055	0.209	94.298	12.41	1.68
13.100	42.979	11.714	0.227	95.523	13.09	1.73
13.150	43.143	11.534	0.259	97.050	12.93	2.00
13.200	43.307	13.242	0.230	83.350	14.44	1.59
13.250	43.471	11.534	0.250	75.284	12.62	1.98
13.300	43.635	9.257	0.244	81.277	10.43	2.34
13.350	43.799	8.508	0.237	88.004	9.78	2.42
13.400	43.963	8.568	0.207	85.215	9.80	2.11
13.450	44.127	8.628	0.237	86.139	9.87	2.40
13.500	44.291	11.684	0.251	83.689	12.89	1.95
13.550	44.455	26.424	0.330	49.448	27.14	1.22
13.600	44.619	44.788	0.431	32.356	45.25	0.95
13.650	44.783	46.016	0.516	26.571	46.40	1.11
13.700	44.948	41.942	0.626	25.572	42.31	1.48
13.750	45.112	38.137	0.552	26.194	38.51	1.43
13.800	45.276	38.347	0.605	12.268	38.52	1.57
13.850	45.440	35.711	0.693	14.435	35.92	1.93
13.900	45.604	36.909	0.881	18.242	37.17	2.37
13.950	45.768	23.008	0.876	27.626	23.41	3.74
14.000	45.932	19.173	0.858	55.497	19.97	4.30
14.050	46.096	16.537	0.836	56.477	17.35	4.82
14.100	46.260	22.649	0.663	26.646	23.03	2.88
14.150	46.424	23.158	0.429	34.015	23.65	1.81
14.200	46.588	16.268	0.349	45.453	16.92	2.06
14.250	46.752	12.703	0.353	97.615	14.11	2.50
14.300	46.916	14.080	0.417	114.236	15.72	2.65
14.350	47.080	14.920	0.360	98.840	16.34	2.20
14.400	47.244	20.372	0.298	63.035	21.28	1.40
14.450	47.408	13.991	0.264	63.525	14.91	1.77
14.500	47.572	10.995	0.307	80.052	12.15	2.53
14.550	47.736	12.703	0.445	98.708	14.12	3.15
14.600	47.900	20.312	0.626	101.930	21.78	2.87
14.650	48.064	32.505	0.824	131.328	34.40	2.40
14.700	48.228	38.317	0.811	88.852	39.60	2.05
14.750	48.392	29.809	0.710	98.444	31.23	2.27
14.800	48.556	24.806	0.618	68.953	25.80	2.40
14.850	48.720	16.417	0.472	76.811	17.52	2.69
14.900	48.885	14.320	0.388	97.954	15.73	2.47
14.950	49.049	11.534	0.338	110.580	13.13	2.57

15.000	49.213	11.923	0.305	123.658	13.70	2.23
15.050	49.377	17.496	0.387	107.150	19.04	2.03
15.100	49.541	12.703	0.404	106.133	14.23	2.84
15.150	49.705	12.463	0.346	116.384	14.14	2.45
15.200	49.869	11.774	0.291	128.237	13.62	2.14
15.250	50.033	13.421	0.317	130.800	15.30	2.07
15.300	50.197	13.601	0.336	124.544	15.39	2.18
15.350	50.361	15.219	0.383	117.967	16.92	2.26
15.400	50.525	15.129	0.346	107.791	16.68	2.07
15.450	50.689	14.889	0.377	103.137	16.37	2.30
15.500	50.853	12.852	0.380	112.031	14.47	2.63
15.550	51.017	12.373	0.364	110.109	13.96	2.61
15.600	51.181	11.864	0.318	109.732	13.44	2.37
15.650	51.345	11.354	0.294	109.148	12.93	2.27
15.700	51.509	11.145	0.304	115.291	12.81	2.37
15.750	51.673	11.923	0.313	117.157	13.61	2.30
15.800	51.837	13.751	0.323	110.128	15.34	2.11
15.850	52.001	12.223	0.321	111.428	13.83	2.32
15.900	52.165	11.384	0.327	116.441	13.06	2.50
15.950	52.329	11.894	0.301	122.170	13.65	2.20
16.000	52.493	11.923	0.291	126.655	13.75	2.12
16.050	52.657	14.710	0.344	132.176	16.61	2.07
16.100	52.822	15.129	0.358	114.500	16.78	2.13
16.150	52.986	13.871	0.383	110.580	15.46	2.48
16.200	53.150	12.882	0.365	118.646	14.59	2.50
16.250	53.314	12.703	0.325	119.060	14.42	2.25
16.300	53.478	11.594	0.284	111.503	13.20	2.15
16.350	53.642	10.785	0.297	122.019	12.54	2.37
16.400	53.806	12.433	0.299	125.580	14.24	2.10
16.450	53.970	14.800	0.328	134.174	16.73	1.96
16.500	54.134	14.170	0.348	116.573	15.85	2.20
16.550	54.298	14.111	0.379	130.574	15.99	2.37
16.600	54.462	14.800	0.366	105.907	16.33	2.24
16.650	54.626	11.984	0.382	92.885	13.32	2.87
16.700	54.790	10.785	0.362	108.130	12.34	2.93
16.750	54.954	12.343	0.317	95.391	13.72	2.31
16.800	55.118	12.732	0.337	98.105	14.14	2.38
16.850	55.282	12.433	0.357	101.139	13.89	2.57
16.900	55.446	12.253	0.356	105.191	13.77	2.59
16.950	55.610	30.558	0.439	95.128	31.93	1.37
17.000	55.774	42.032	0.720	33.393	42.51	1.69
17.050	55.938	28.371	0.975	31.904	28.83	3.38
17.100	56.102	22.409	0.707	26.684	22.79	3.10
17.150	56.266	19.623	0.510	34.147	20.11	2.54
17.200	56.430	26.334	0.568	42.268	26.94	2.11
17.250	56.594	23.398	0.654	43.927	24.03	2.72
17.300	56.759	15.698	0.628	53.500	16.47	3.81
17.350	56.923	12.163	0.558	74.323	13.23	4.22
17.400	57.087	11.804	0.399	85.913	13.04	3.06
17.450	57.251	11.864	0.340	99.198	13.29	2.56
17.500	57.415	11.384	0.321	104.795	12.89	2.49
17.550	57.579	10.995	0.299	112.634	12.62	2.37

17.600	57.743	11.684	0.298	116.705	13.36	2.23
17.650	57.907	12.523	0.300	120.021	14.25	2.11
17.700	58.071	24.356	0.343	105.323	25.87	1.33
17.750	58.235	22.050	0.497	89.116	23.33	2.13
17.800	58.399	21.840	0.761	82.313	23.03	3.31
17.850	58.563	14.920	0.722	81.465	16.09	4.49
17.900	58.727	11.804	0.570	94.657	13.17	4.33
17.950	58.891	14.380	0.366	99.518	15.81	2.31
18.000	59.055	15.339	0.272	85.008	16.56	1.64
18.050	59.219	23.847	0.366	67.294	24.82	1.47
18.100	59.383	16.537	0.521	65.089	17.47	2.98
18.150	59.547	13.002	0.547	59.775	13.86	3.95
18.200	59.711	10.066	0.387	78.733	11.20	3.46
18.250	59.875	9.617	0.282	92.150	10.94	2.58
18.300	60.039	9.467	0.255	97.822	10.88	2.34
18.350	60.203	10.246	0.276	101.120	11.70	2.36
18.400	60.367	10.246	0.290	101.459	11.71	2.48
18.450	60.531	15.698	0.365	105.813	17.22	2.12
18.500	60.696	30.798	0.781	59.606	31.66	2.47
18.550	60.860	18.634	0.733	45.397	19.29	3.80
18.600	61.024	12.942	0.660	55.252	13.74	4.80
18.650	61.188	10.935	0.365	75.002	12.02	3.04
18.700	61.352	10.575	0.320	95.316	11.95	2.68
18.750	61.516	11.145	0.330	106.133	12.67	2.60
18.800	61.680	11.384	0.746	111.164	12.98	5.75
18.850	61.844	42.990	1.661	126.183	44.81	3.71
18.900	62.008	75.346	1.575	23.292	75.68	2.08
18.950	62.172	124.417	1.531	22.142	124.74	1.23
19.000	62.336	126.574	1.661	21.125	126.88	1.31
19.050	62.500	120.553	1.907	15.811	120.78	1.58
19.100	62.664	122.590	0.010	10.742	122.74	0.01
19.150	62.828	119.025	0.010	8.028	119.14	0.01

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING		
Site:	RESOLUTION MINE		
Engineer:	B.BURGESS		
Sounding:	CPT--02		
Date:	7/29/2009		
Time:	11:10 AM		

Units:	Imperial	
Data averaging interval:	0.100	meters
Assumed depth of water:	12.003	feet
Net area ratio of cone:	0.80	
Unit weight of water:	62.4	lb/ft^3
Relative density constant, C_{DR}:	350	
Young's modulus for sands, α:	4	
Small strain shear modulus number, S_G (sands):	180	
Small strain shear modulus number, C_G (clays):	50	
N_{kt} for clays:	15	
OCR number, k_{ocr}:	0.3	

Interpretation based on Lunne, Robertson and Powell, 1997

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
0.100	0.328	0.000	0.000	0.000							0.000																	
0.200	0.656	0.000	0.000	0.000							0.000																	
0.300	0.984	0.000	0.000	0.000							0.000																	
0.400	1.312	0.000	0.000	0.000							0.000																	
0.500	1.640	0.000	0.000	0.000							0.000																	
0.600	1.969	13.601	0.188	0.402		13.61	1.38	6	115	0.113	0.000	0.113	119.65	1.39	0.00	6	1.95	48.07	3.00E-4	2.6	8.0	37	42	54	212			
0.700	2.297	41.033	0.481	1.866		41.06	1.17	7	118	0.132	0.000	0.132	309.82	1.18	0.00	6	1.62	109.47	3.00E-4	7.0	19.9	56	46	164	322			
0.800	2.625	20.442	0.391	2.594		20.48	1.91	6	115	0.151	0.000	0.151	134.71	1.92	0.01	6	2.01	63.33	3.00E-4	4.0	10.7	43	42	82	267			
0.900	2.953	7.600	0.251	2.839		7.64	3.28	3	111	0.169	0.000	0.169	44.16	3.36	0.03	4	2.53	28.74	3.00E-8	1.9	4.7				382	0.50	2.94	13.2
1.000	3.281	7.520	0.192	3.480		7.57	2.54	4	115	0.188	0.000	0.188	39.27	2.60	0.03	4	2.49	25.70	3.00E-8	1.8	4.3				378	0.49	2.62	11.8
1.100	3.609	9.118	0.256	3.882		9.17	2.79	4	115	0.207	0.000	0.207	43.37	2.85	0.03	4	2.48	28.97	3.00E-8	2.2	5.0				459	0.60	2.89	13.0
1.200	3.937	7.650	0.220	4.140		7.71	2.85	4	115	0.226	0.000	0.226	33.18	2.94	0.04	4	2.58	23.67	3.00E-8	1.9	4.2				385	0.50	2.21	10.0
1.300	4.265	4.853	0.137	4.234		4.91	2.79	3	111	0.244	0.000	0.244	19.15	2.94	0.07	4	2.76	15.08	3.00E-8	1.4	2.8				246	0.31	1.28	5.7
1.400	4.593	9.976	0.237	4.554		10.04	2.36	5	115	0.263	0.000	0.263	37.23	2.42	0.03	5	2.49	26.42	3.00E-6	2.4	4.8	27	35	40	253			
1.500	4.921	7.250	0.209	4.692		7.32	2.86	4	115	0.281	0.000	0.281	25.00	2.97	0.05	4	2.68	19.46	3.00E-8	1.9	3.7				366	0.47	1.67	7.5
1.600	5.249	3.745	0.084	4.874		3.81	2.19	3	111	0.300	0.000	0.300	11.73	2.38	0.10	4	2.88	9.99	3.00E-8	1.1	2.1				191	0.23	0.78	3.5
1.700	5.577	3.006	0.057	5.741		3.09	1.86	1	111	0.318	0.000	0.318	8.71	2.07	0.15	3	2.96	7.69	1.00E-9	0.9	1.7				154	0.18	0.58	2.6
1.800	5.906	3.016	0.053	7.192		3.12	1.69	1	111	0.336	0.000	0.336	8.28	1.89	0.19	3	2.96	7.34	1.00E-9	0.9	1.7				156	0.19	0.55	2.5
1.900	6.234	2.876	0.044	8.034		2.99	1.47	1	111	0.355	0.000	0.355	7.44	1.67	0.22	3	2.97	6.66	1.00E-9	0.9	1.6				150	0.18	0.50	2.2
2.000	6.562	2.836	0.041	9.385		2.97	1.38	1	111	0.373	0.000	0.373	6.97	1.58	0.26	3	2.99	6.30	1.00E-9	0.9	1.5				149	0.17	0.46	2.1
2.100	6.890	3.046	0.045	10.886		3.20	1.42	1	111	0.391	0.000	0.391	7.19	1.61	0.28	3	2.98	6.52	1.00E-9	1.0	1.6				160	0.19	0.48	2.2
2.200	7.218	3.106	0.052	12.400		3.28	1.58	1	111	0.409	0.000	0.409	7.02	1.81	0.31	3	3.01	6.46	1.00E-9	1.0	1.6				164	0.19	0.47	2.1
2.300	7.546	3.266	0.070	13.568		3.46	2.03	1	111	0.428	0.000	0.428	7.09	2.32	0.32	3	3.06	6.64	1.00E-9	1.1	1.7				173	0.20	0.47	2.1
2.400	7.874	4.084	0.090	12.808		4.27	2.10	3	111	0.446	0.000	0.446	8.57	2.35	0.24	3	2.99	7.91	1.00E-9	1.3	2.0				213	0.25	0.57	2.6
2.500	8.202	4.973	0.111	13.625		5.17	2.14	4	115	0.465	0.000	0.465	10.12	2.35	0.21	3	2.93	9.23	1.00E-9	1.5	2.3				258	0.31	0.67	3.0
2.600	8.530	4.314	0.096	16.539		4.55	2.12	3	111	0.483	0.000	0.483	8.43	2.37	0.29	3	3.00	7.84	1.00E-9	1.4	2.0				228	0.27	0.56	2.5
2.700	8.858	3.665	0.061	18.543		3.93	1.54	1	111	0.501	0.000	0.501	6.84	1.77	0.39	3	3.02	6.41	1.00E-9	1.2	1.7				197	0.23	0.46	2.1
2.800	9.186	4.404	0.074	21.307		4.71	1.58	1	111	0.520	0.000	0.520	8.07	1.77	0.37	3	2.95	7.48	1.00E-9	1.4	2.0				236	0.28	0.54	2.4
2.900	9.514	4.873	0.079	19.014		5.15	1.54	1	111	0.538	0.000	0.538	8.57	1.72	0.30	4	2.93	7.93	3.00E-8	1.5	2.1				257	0.31	0.57	2.6
3.000	9.843	3.675	0.065	17.444		3.93	1.65	1	111	0.556	0.000	0.556	6.06	1.92	0.37	3	3.08	5.80	1.00E-9	1.2	1.7				196	0.22	0.40	1.8
3.100	10.171	2.966	0.053	17.400		3.22	1.64	1	111	0.574	0.000	0.574	4.60	1.99	0.47	3	3.19	4.50	1.00E-9	1.1	1.5				161	0.18	0.31	1.4
3.200	10.499	2.517	0.043	18.461		2.78	1.53	1	111	0.593	0.000	0.593	3.70	1.95	0.61	3	3.27	3.67	1.00E-9	1.0	1.3				139	0.15	0.25	1.1
3.300	10.827	2.606	0.044	20.214		2.90	1.51	1	111	0.611	0.000	0.611	3.74	1.91	0.64	3	3.26	3.72	1.00E-9	1.0	1.3				145	0.15	0.25	1.1
3.400	11.155	3.086	0.057	21.213		3.39	1.69	1	111	0.629	0.000	0.629	4.39	2.08	0.55	3	3.22	4.33	1.00E-9	1.1	1.5				170	0.18	0.29	1.3
3.500	11.483	3.036	0.058	22.199		3.36	1.72	1	111	0.647	0.000	0.647	4.18	2.13	0.59	3	3.24	4.14	1.00E-9	1.1	1.5				168	0.18	0.28	1.3
3.600	11.811	3.106	0.054	24.077		3.45	1.56	1	111	0.666	0.000	0.666	4.19	1.94	0.62	3	3.22	4.14	1.00E-9	1.2	1.5				173	0.19	0.28	1.3
3.700	12.139	2.986	0.053	24.328		3.34	1.59	1	111	0.684	0.004	0.680	3.90	2.00	0.66	3	3.26	3.88	1.00E-9	1.1	1.4				167	0.18	0.26	1.2
3.800	12.467	4.005	0.060	26.527		4.39	1.38	1	111	0.702	0.014	0.688	5.36	1.64	0.51	3	3.09	5.21	1.00E-9	1.4	1.7				219	0.25	0.36	1.6
3.900	12.795	4.504	0.078	28.687		4.92	1.59	1	111	0.721	0.025	0.696	6.03	1.87	0.49	3	3.08	5.86	1.00E-9	1.5	1.9				246	0.28	0.40	1.8
4.000	13.123	4.204	0.087	31.533		4.66	1.87	1	111	0.739	0.035	0.704	5.57	2.23	0.57	3	3.14	5.46	1.00E-9	1.5	1.8				233	0.26	0.37	1.7
4.100	13.451	4.344	0.113	33.813		4.83	2.34	3	111	0.757	0.045	0.712	5.72	2.77	0.59	3	3.18	5.64	1.00E-9	1.6	1.9				242	0.27	0.38	1.7
4.200	13.780	4.624	0.162	30.742		5.07	3.20	3	111	0.775	0.055	0.720	5.96	3.78	0.50	3	3.24	5.91	1.00E-9	1.7	2.1				253	0.29	0.40	1.8
4.300	14.108	3.895	0.159	23.292		4.23	3.75	3	111	0.794	0.066	0.728	4.72	4.62	0.47	3	3.37	4.72	1.00E-9	1.6	2.0				212	0.23	0.31	1.4
4.400	14.436	6.291	0.144	19.736		6.58	2.18	4	115	0.812	0.076	0.737	7.82	2.49	0.23	3	3.04	7.60	1.00E-9	2.1	2.5				329	0.38	0.52	2.3
4.500	14.764	7.809	0.242	7.582		7.92	3.05	4	115	0.831	0.086	0.745	9.51	3.41	0.06	3	3.05	9.25	1.00E-9	2.6	3.1				396	0.47	0.63	2.9
4.600	15.092	8.648	0.443	5.327		8.72	5.08	3	111	0.850	0.096	0.753	10.46	5.63	0.04	3	3.14	10.28	1.00E-9	3.0	3.6				436	0.53	0.70	3.1
4.700	15.420	17.703	0.520	3.417		17.75	2.93	5	115	0.868	0.107	0.762	22.17	3.08	0.01	4	2.73	20.93	3.00E-8	4.8	5.7				888	1.13	1.48	6.6
4.800	15.748	21.121	0.457	2.984		21.16	2.16	6	115	0.887	0.117	0.770	26.32	2.26	0.00	4	2.58	24.57	3.00E-8	5.4	6.3				1058	1.35	1.75	7.9
4.900	16.076	9.720	0.320	2.406		9.75	3.28	4	115	0.906	0.127	0.779	11.36	3.61	0.01	3	3.00	11.04	1.00E-9	3.1	3.6				488	0.59	0.76	3.4
5.000	16.404	4.926	0.206	2.814		4.97	4.15	3	111	0.924	0.137	0.787	5.14	5.10	0.02	3	3.37	5.14	1.00E-9	2.0	2.4				248	0.27	0.34	1.5
5.100	16.732	4.014	0.151	4.146		4.07	3.70	3	111	0.942	0.148	0.795	3.94	4.81	0.05	3	3.45	3.94	1.00E-9	1.8	2.1				204	0.21	0.26	1.2
5.200	17.060	3.675	0.133	6.369		3.77	3.54	3	111	0.961	0.158	0.803	3.49	4.75	0.11	3	3.49	3.49	1.00E-9	1.7	1.9				188	0.19	0.23	1.0
5.300	17.388	3.675	0.125	9.422		3.81	3.29	3	111	0.979	0.168	0.811	3.49	4.43	0.18	3	3.47	3.49	1.00E-9	1.7	1.9				191	0.19	0.23	1.0
5.400	17.717	3.765	0.122	13.166		3.95	3.09	3	111	0.997	0.178	0.819	3.61	4.13	0.26	3	3.44	3.61	1.00E-9	1.7	1.9				198	0.20	0.24	1.1
5.500	18.045	3.715	0.130	17.431		3.97	3.27	3	111	1.016	0.188	0.827	3.57	4.39	0.36	3	3.46	3.57	1.00E-9	1.7	1.9				198	0.20	0.24	1.1
5.600	18.373	3.665	0.126	21.577		3.98	3.16	3	111	1.034	0.199	0.835	3.52	4.27	0.46	3	3.46	3.52	1.00E-9	1.6	1.9				199	0.20	0.23	1.1
5.700	18.701	3.725	0.122	25.365		4.09	2.99	3	111	1.052	0.209	0.843	3.60	4.03	0.53	3	3.44	3.60	1.00E-9	1.6	1.8				205	0.20	0.24	1.1
5.800	19.029	3.935	0.124	27.538		4.33	2.86	3	111	1.070	0.219	0.851	3.83	3.79	0.54	3	3.40	3.83	1.00E-9	1.7	1.9				217	0.22	0.26	1.1
5.900	19.357	4.184	0.122	26.665		4.57	2.66	3	111	1.089	0.229	0.859	4.05	3.50	0.49	3	3.36	4.05	1.00E-9	1.7	1.9				228	0.23	0.27	1.2
6.000	19.685	3.825	0.125	28.361		4.23	2.96	3	111	1.107	0.240	0.867	3.61	4.01	0.58	3	3.44	3.61	1.00E-9	1.7	1.9				212	0.21	0.24	1.1
6.100	20.013	3.865	0.124	30.553		4.30	2.88	3	111	1.125	0.250	0.875	3.63	3.90	0.61	3	3.43	3.63	1.00E-9	1.7	1.9				215	0.21	0.24	1.1
6.200	20.341	3.765	0.124	31.671		4.22	2.95	3	111	1.143	0.260	0.883	3.48	4.04	0.66	3	3.45	3.48	1.00E-9	1.7	1.8				211	0.21	0.23	1.0
6.300	20.669	3.695	0.117	31.960		4.16	2.82	3	111	1.162	0.270	0.891	3.36	3.92	0.68	3	3.46	3.36	1.00E-9	1.7	1.8				208	0.20	0.22	1.0
6.400	20.997	3.805	0.114	33.035		4.28	2.67	3	111	1.180	0.281	0.899	3.45	3.69	0.68	3	3.43	3.45	1.00E-9	1.7	1.8				214	0.21	0.23	1.0
6.500	21.325	4.075	0.127	33.368		4.56	2.78	3	111	1.198	0.291	0.907	3.70	3.77	0.63	3	3.41	3.70	1.00E-9	1.8	1.9				228	0.22	0.25	1.1
6.600	21.654	4.284	0.131	33.267		4.76	2.76	3	111	1.217	0.301	0.915	3.87	3.70	0.59	3	3.39	3.87	1.00E-9	1.8	1.9				238	0.24	0.26	1.2
6.700	21.982	4.154	0.127	34.969		4.66	2.73	3	111	1.235	0.311	0.924	3.71	3.71	0.64	3	3.41	3.71	1.00E-9	1.8	1.9				233	0.23	0.25	1.1
6.800	22.310	4.174	0.119	34.938		4.68	2.55	3	111	1.253	0.322	0.932	3.68	3.48	0.64	3	3.40	3.68	1.00E-9	1.8	1.9				234	0.23	0.25	1.1
6.900	22.638	4.454	0.103	30.710		4.90	2.11	4	115	1.272	0.332	0.940	3.86	2.85	0.52	3	3.34	3.86	1.00E-9	1.8	1.9				245	0.24	0.26	1.2
7.000	22.966	4.115	0.104	31.716		4.57	2.28	3	111	1.290	0.342	0.948	3.46	3.17	0.59	3	3.40	3.46	1.00E-9	1.8	1.9				229	0.22	0.23	1.0

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
7.100	23.294	4.085	0.104	34.228		4.58	2.26	3	111	1.308	0.352	0.956	3.42	3.17	0.65	3	3.40	3.42	1.00E-9	1.7	1.8				229	0.22	0.23	1.0
7.200	23.622	3.995	0.100	35.372		4.50	2.22	3	111	1.327	0.363	0.964	3.30	3.15	0.69	3	3.42	3.30	1.00E-9	1.7	1.8				225	0.21	0.22	1.0
7.300	23.950	3.755	0.110	35.874		4.27	2.57	3	111	1.345	0.373	0.972	3.01	3.75	0.76	3	3.49	3.01	1.00E-9	1.7	1.8				214	0.20	0.20	0.9
7.400	24.278	4.204	0.117	37.344		4.74	2.47	3	111	1.363	0.383	0.980	3.45	3.46	0.68	3	3.42	3.45	1.00E-9	1.8	1.9				237	0.23	0.23	1.0
7.500	24.606	4.324	0.119	39.222		4.89	2.44	3	111	1.382	0.393	0.988	3.55	3.40	0.69	3	3.41	3.55	1.00E-9	1.9	1.9				244	0.23	0.24	1.1
7.600	24.934	4.334	0.120	40.390		4.92	2.45	3	111	1.400	0.403	0.996	3.53	3.42	0.71	3	3.41	3.53	1.00E-9	1.9	1.9				246	0.23	0.24	1.1
7.700	25.262	4.254	0.114	40.911		4.84	2.36	3	111	1.418	0.414	1.004	3.41	3.34	0.74	3	3.42	3.41	1.00E-9	1.8	1.9				242	0.23	0.23	1.0
7.800	25.591	4.264	0.114	41.891		4.87	2.34	3	111	1.436	0.424	1.012	3.39	3.31	0.76	3	3.42	3.39	1.00E-9	1.8	1.9				243	0.23	0.23	1.0
7.900	25.919	4.364	0.114	41.872		4.97	2.30	4	115	1.455	0.434	1.021	3.44	3.26	0.73	3	3.41	3.44	1.00E-9	1.9	1.9				248	0.23	0.23	1.0
8.000	26.247	4.534	0.115	42.300		5.14	2.23	4	115	1.474	0.444	1.030	3.56	3.13	0.71	3	3.38	3.56	1.00E-9	1.9	1.9				257	0.24	0.24	1.1
8.100	26.575	4.744	0.117	43.908		5.38	2.18	4	115	1.493	0.455	1.038	3.74	3.01	0.70	3	3.36	3.74	1.00E-9	2.0	2.0				269	0.26	0.25	1.1
8.200	26.903	4.804	0.231	46.377		5.47	4.22	3	111	1.511	0.465	1.046	3.79	5.83	0.73	3	3.51	3.79	1.00E-9	2.3	2.3				274	0.26	0.25	1.1
8.300	27.231	6.271	0.248	20.811		6.57	3.78	3	111	1.529	0.475	1.054	4.78	4.93	0.20	3	3.38	4.78	1.00E-9	2.6	2.6				329	0.34	0.32	1.4
8.400	27.559	5.952	0.214	11.112		6.11	3.50	3	111	1.548	0.485	1.062	4.30	4.69	0.07	3	3.41	4.30	1.00E-9	2.6	2.6				306	0.30	0.29	1.3
8.500	27.887	5.582	0.205	18.028		5.84	3.51	3	111	1.566	0.496	1.070	3.99	4.79	0.19	3	3.44	3.99	1.00E-9	2.5	2.4				292	0.29	0.27	1.2
8.600	28.215	6.331	0.208	26.370		6.71	3.10	3	111	1.584	0.506	1.078	4.75	4.06	0.27	3	3.34	4.75	1.00E-9	2.6	2.5				336	0.34	0.32	1.4
8.700	28.543	6.152	0.195	33.776		6.64	2.94	3	111	1.602	0.516	1.086	4.64	3.87	0.38	3	3.34	4.64	1.00E-9	2.5	2.5				332	0.34	0.31	1.4
8.800	28.871	5.373	0.188	43.016		5.99	3.14	3	111	1.621	0.526	1.094	3.99	4.30	0.59	3	3.42	3.99	1.00E-9	2.3	2.3				300	0.29	0.27	1.2
8.900	29.199	5.512	0.181	48.789		6.21	2.92	3	111	1.639	0.537	1.102	4.15	3.96	0.65	3	3.38	4.15	1.00E-9	2.3	2.3				311	0.31	0.28	1.2
9.000	29.528	5.672	0.185	52.193		6.42	2.87	3	111	1.657	0.547	1.111	4.29	3.87	0.67	3	3.36	4.29	1.00E-9	2.3	2.3				321	0.32	0.29	1.3
9.100	29.856	5.702	0.196	53.487		6.47	3.02	3	111	1.676	0.557	1.119	4.29	4.08	0.69	3	3.38	4.29	1.00E-9	2.4	2.3				324	0.32	0.29	1.3
9.200	30.184	5.642	0.194	52.777		6.40	3.03	3	111	1.694	0.567	1.127	4.18	4.11	0.69	3	3.39	4.18	1.00E-9	2.4	2.3				320	0.31	0.28	1.3
9.300	30.512	5.762	0.186	53.274		6.53	2.84	4	115	1.713	0.577	1.135	4.24	3.85	0.68	3	3.37	4.24	1.00E-9	2.4	2.3				326	0.32	0.28	1.3
9.400	30.840	6.192	0.182	54.021		6.97	2.62	4	115	1.731	0.588	1.144	4.58	3.48	0.63	3	3.32	4.58	1.00E-9	2.5	2.4				348	0.35	0.31	1.4
9.500	31.168	6.361	0.186	56.747		7.18	2.60	4	115	1.750	0.598	1.152	4.71	3.43	0.64	3	3.30	4.71	1.00E-9	2.5	2.4				359	0.36	0.31	1.4
9.600	31.496	6.132	0.190	59.116		6.98	2.72	4	115	1.769	0.608	1.161	4.49	3.64	0.70	3	3.33	4.49	1.00E-9	2.5	2.4				349	0.35	0.30	1.3
9.700	31.824	6.092	0.187	57.344		6.92	2.70	4	115	1.788	0.618	1.169	4.39	3.65	0.68	3	3.34	4.39	1.00E-9	2.5	2.4				346	0.34	0.29	1.3
9.800	32.152	6.042	0.178	55.969		6.85	2.60	4	115	1.807	0.629	1.178	4.28	3.54	0.67	3	3.34	4.28	1.00E-9	2.5	2.3				342	0.34	0.29	1.3
9.900	32.480	6.661	0.195	52.702		7.42	2.63	4	115	1.825	0.639	1.187	4.71	3.49	0.56	3	3.31	4.71	1.00E-9	2.6	2.5				371	0.37	0.31	1.4
10.000	32.808	6.671	0.194	47.375		7.35	2.64	4	115	1.844	0.649	1.195	4.61	3.52	0.50	3	3.32	4.61	1.00E-9	2.7	2.5				368	0.37	0.31	1.4
10.100	33.136	6.032	0.173	51.125		6.77	2.56	4	115	1.863	0.659	1.204	4.08	3.53	0.62	3	3.36	4.08	1.00E-9	2.5	2.3				338	0.33	0.27	1.2
10.200	33.465	6.631	0.179	55.391		7.43	2.41	4	115	1.882	0.670	1.212	4.58	3.23	0.60	3	3.30	4.58	1.00E-9	2.6	2.4				371	0.37	0.31	1.4
10.300	33.793	6.281	0.183	54.285		7.06	2.60	4	115	1.901	0.680	1.221	4.23	3.55	0.63	3	3.35	4.23	1.00E-9	2.6	2.4				353	0.34	0.28	1.3
10.400	34.121	6.022	0.175	50.541		6.75	2.59	4	115	1.919	0.690	1.229	3.93	3.62	0.61	3	3.38	3.93	1.00E-9	2.5	2.3				337	0.32	0.26	1.2
10.500	34.449	11.874	0.222	43.317		12.50	1.77	5	115	1.938	0.700	1.238	8.53	2.10	0.23	3	2.97	8.67	1.00E-9	3.7	3.4				625	0.70	0.57	2.6
10.600	34.777	12.902	0.365	31.194		13.35	2.73	5	115	1.957	0.711	1.246	9.14	3.20	0.13	3	3.04	9.26	1.00E-9	4.2	3.9				668	0.76	0.61	2.7
10.700	35.105	7.769	0.282	38.688		8.33	3.39	3	111	1.975	0.721	1.254	5.06	4.44	0.33	3	3.34	5.06	1.00E-9	3.1	2.9				416	0.42	0.34	1.5
10.800	35.433	7.030	0.165	41.182		7.62	2.17	4	115	1.994	0.731	1.263	4.46	2.94	0.40	3	3.29	4.46	1.00E-9	2.7	2.5				381	0.38	0.30	1.3
10.900	35.761	6.212	0.179	47.714		6.90	2.59	4	115	2.013	0.741	1.272	3.84	3.66	0.55	3	3.39	3.84	1.00E-9	2.6	2.4				345	0.33	0.26	1.2
11.000	36.089	5.712	0.197	52.181		6.46	3.05	3	111	2.031	0.751	1.280	3.46	4.45	0.68	3	3.48	3.46	1.00E-9	2.6	2.4				323	0.30	0.23	1.0
11.100	36.417	5.792	0.186	52.727		6.55	2.84	4	115	2.050	0.762	1.288	3.49	4.14	0.67	3	3.46	3.49	1.00E-9	2.6	2.3				328	0.30	0.23	1.0
11.200	36.745	6.282	0.178	54.800		7.07	2.51	4	115	2.069	0.772	1.297	3.86	3.55	0.63	3	3.38	3.86	1.00E-9	2.6	2.4				354	0.33	0.26	1.2
11.300	37.073	9.228	0.225	63.839		10.15	2.22	5	115	2.088	0.782	1.305	6.17	2.80	0.47	3	3.16	6.23	1.00E-9	3.3	2.9				507	0.54	0.41	1.9
11.400	37.402	13.022	0.212	65.360		13.96	1.52	6	115	2.106	0.792	1.314	9.02	1.79	0.33	4	2.91	9.26	3.00E-8	4.0	3.5				698	0.79	0.60	2.7
11.500	37.730	11.304	0.201	64.198		12.23	1.64	5	115	2.125	0.803	1.322	7.64	1.99	0.38	3	3.00	7.80	1.00E-9	3.6	3.2				611	0.67	0.51	2.3
11.600	38.058	8.149	0.216	73.230		9.20	2.35	5	115	2.144	0.813	1.331	5.30	3.06	0.63	3	3.23	5.33	1.00E-9	3.0	2.7				460	0.47	0.35	1.6
11.700	38.386	7.150	0.182	67.495		8.12	2.24	5	115	2.163	0.823	1.340	4.45	3.05	0.68	3	3.30	4.45	1.00E-9	2.8	2.5				406	0.40	0.30	1.3
11.800	38.714	6.801	0.162	65.548		7.74	2.10	5	115	2.181	0.833	1.348	4.13	2.92	0.70	3	3.31	4.13	1.00E-9	2.7	2.4				387	0.37	0.28	1.2
11.900	39.042	7.120	0.174	67.068		8.09	2.15	5	115	2.200	0.844	1.357	4.34	2.96	0.68	3	3.30	4.34	1.00E-9	2.8	2.5				404	0.39	0.29	1.3
12.000	39.370	7.250	0.185	65.033		8.19	2.26	4	115	2.219	0.854	1.365	4.37	3.10	0.64	3	3.31	4.37	1.00E-9	2.9	2.5				409	0.40	0.29	1.3
12.100	39.698	7.901	0.181	65.177		8.84	2.05	5	115	2.238	0.864	1.374	4.81	2.74	0.58	3	3.24	4.83	1.00E-9	3.0	2.6				442	0.44	0.32	1.4
12.200	40.026	8.380	0.199	65.630		9.33	2.14	5	115	2.257	0.874	1.382	5.11	2.82	0.54	3	3.23	5.15	1.00E-9	3.1	2.7				466	0.47	0.34	1.5
12.300	40.354	10.696	0.248	63.965		11.62	2.13	5	115	2.275	0.885	1.391	6.72	2.65	0.40	3	3.11	6.82	1.00E-9	3.7	3.2				581	0.62	0.45	2.0
12.400	40.682	14.201	0.371	45.510		14.86	2.50	5	115	2.294	0.895	1.399	8.98	2.95	0.19	3	3.03	9.19	1.00E-9	4.6	4.0				743	0.84	0.60	2.7
12.500	41.011	8.888	0.315	47.407		9.57	3.29	4	115	2.313	0.905	1.408	5.15	4.34	0.35	3	3.33	5.15	1.00E-9	3.6	3.1				479	0.48	0.34	1.5
12.600	41.339	8.049	0.203	60.692		8.92	2.28	5	115	2.332	0.915	1.417	4.65	3.09	0.52	3	3.28	4.66	1.00E-9	3.1	2.7				446	0.44	0.31	1.4
12.700	41.667	8.139	0.205	66.226		9.09	2.25	5	115	2.351	0.926	1.425	4.73	3.04	0.57	3	3.27	4.75	1.00E-9	3.1	2.7				455	0.45	0.32	1.4
12.800	41.995	9.417	0.231	74.976		10.50	2.20	5	115	2.369	0.936	1.434	5.67	2.85	0.55	3	3.19	5.73	1.00E-9	3.4	2.9				525	0.54	0.38	1.7
12.900	42.323	10.176	0.228	88.482		11.45	1.99	5	115	2.388	0.946	1.442	6.28	2.52	0.60	3	3.12	6.39	1.00E-9	3.5	3.0				573	0.60	0.42	1.9
13.000	42.651	11.105	0.215	97.753		12.51	1.72	5	115	2.407	0.956	1.451	6.97	2.13	0.60	3	3.05	7.14	1.00E-9	3.7	3.1				626	0.67	0.46	2.1
13.100	42.979	11.434	0.232	95.624		12.81	1.81	5	115	2.426	0.966	1.459	7.12	2.23	0.57	3	3.05	7.29	1.00E-9	3.8	3.2				641	0.69	0.47	2.1
13.200	43.307	12.103	0.246	85.228		13.33	1.85	5	115	2.445	0.977	1.468	7.42	2.26	0.47	3	3.04	7.61	1.00E-9	4.0	3.4				667	0.73	0.49	2.2
13.300	43.635	9.766	0.244	81.522		10.94	2.23	5	115	2.463	0.987	1.477	5.74	2.87	0.58	3	3.19	5.81	1.00E-9	3.5	3.0				547	0.57	0.38	1.7
13.400	43.963	8.568	0.227	86.453		9.81	2.31	5	115	2.482	0.997	1.485	4.94	3.10	0.71	3	3.26	4.96	1.00E-9	3.3	2.8				491	0.49	0.33	1.5
13.500	44.291	15.579	0.273	73.092		16.63	1.64	6	115	2.501	1.007	1.494	9.46	1.93	0.30	4	2.91	9.85	3.00E-8	4.7	4.0				832	0.94	0.63	2.8
13.600	44.619	39.076	0.426	36.125		39.60	1.08	7	118	2.520	1.018	1.503	24.67	1.15	0.04	5	2.44	27.03	3.00E-6	9.3	7.8	28	32	158	716			
13.700	44.948	42.032	0.565	26.112		42.41	1.33	7	118	2.540	1.028	1.512	26.37	1.42	0.02	5	2.47	28.86	3.00E-6	10.1	8.4	29	33	170	734			
13.800	45.276	37.398	0.617	17.632		37.65	1.64	7	118	2.559	1.038	1.521	23.07	1.76	0.01	4	2.57	25.01	3.00E-8	9.4	7.8				1883	2.34	1.54	6.9
13.900	45.604	31.876	0.817	20.101		32.17	2.54	6	115	2.578	1.048	1.529	19.35	2.76	0.01	4	2.74	20.59	3.00E-8	8.8	7.3				1608	1.97	1.29	5.8
14.000	45.932	19.573	0.857	46.533		20.24	4.23	4	115	2.597	1.059	1.538	11.47	4.85	0.13	3	3.07	11.78	1.00E-9	6.6	5.4				1012	1.18	0.76	3.4
14.100	46.260	20.781	0.643	39.046		21.34	3.01	5	115	2.615	1.069	1.547	12.11	3.43	0.09	3	2.96	12.59	1.00E-9	6.5	5.4				1067	1.25	0.81	3.6
14.200	46.588	17.376	0.377	59.028		18.23	2.07	6	115	2.634	1.079	1.555	10.03	2.42	0.20	3	2.94	10.46	1.00E-9	5.4	4.4				911	1.04	0.67	3.0
14.300	46.916	13.901	0.377	103.564		15.39	2.45	5	115	2.653	1.089	1.564	8.15	2.96	0.50	3	3.07	8.38	1.00E-9	4.6	3.8				770	0.85	0.54	2.4
14.400	47.244	16.428	0.307	75.133		17.51	1.76	6	115	2.672	1.100	1.572	9.44	2.07	0.29	3	2.93	9.87	1.00E-9	5.0	4.1				875	0.99	0.63	2.8
14.500	47.572	12.563	0.339	80.762		13.73	2.47	5	115	2.691	1.110	1.581	6.98	3.07	0.43	3	3.13	7.13	1.00E-9	4.4	3.6				686	0.74	0.47	2.1
14.600	47.900	21.840	0.632	110.655		23.43	2.70	5	115	2.709	1.120	1.589	13.04	3.05	0.33	3	2.91	13.69	1.00E-9	6.6	5.4				1172	1.38	0.87	3.9
14.700	48.228	33.544	0.782	106.208		35.07	2.23	6	115	2.728	1.130	1.598	20.24	2.42	0.20	4	2.69	21.84	3.00E-8	9.0	7.3				1754	2.16	1.35	6.1
14.800	48.556	23.677	0.600	81.403		24.85	2.41	6	115	2.747	1.140	1.607	13.76	2.71	0.21	4	2.86	14.55	3.00E-8	7.0	5.6				1242	1.47	0.92	4.1
14.900	48.885	14.090	0.399	95.115		15.46	2.58	5	115	2.766	1.151	1.615	7.86	3.15	0.45	3	3.10	8.07	1.00E-9	4.8	3.9				773	0.85	0.52	2.4
15.000	49.213	13.651	0.343	113.796		15.29	2.25	5	115	2.785	1.161	1.624	7.70	2.75	0.56	3	3.07	7.94	1.00E-9	4.6	3.7				764	0.83	0.51	2.3
15.100	49.541	14.221	0.379	109.889		15.80	2.40	5	115	2.803	1.171	1.632	7.96	2.92	0.52	3	3.07	8.21	1.00E-9	4.8	3.8				790	0.87	0.53	2.4
15.200	49.869	12.553	0.318	125.140		14.35	2.22	5	115	2.822	1.181	1.641	7.03	2.76	0.68	3	3.10	7.22	1.00E-9	4.3	3.4				718	0.77	0.47	2.1
15.300	50.197	14.080	0.345	124.437		15.87	2.18	5	115	2.841	1.192	1.649	7.90	2.65	0.60	3	3.05	8.17	1.00E-9	4.7	3.7				794	0.87	0.53	2.4
15.400	50.525	15.079	0.369	109.632		16.66	2.21	5	115	2.860	1.202	1.658	8.32	2.67	0.48	3	3.04	8.63	1.00E-9	4.9	3.9				833	0.92	0.55	2.5
15.500	50.853	13.371	0.374	108.426		14.93	2.50	5	115	2.879	1.212	1.666	7.23	3.10	0.55	3	3.12	7.42	1.00E-9	4.6	3.7				747	0.80	0.48	2.2
15.600	51.181	11.864	0.325	109.663		13.44	2.42	5	115	2.897	1.222	1.675	6.30	3.09	0.63	3	3.17	6.41	1.00E-9	4.2	3.4				672	0.70	0.42	1.9
15.700	51.509	11.474	0.304	113.865		13.11	2.32	5	115	2.916	1.233	1.684	6.06	2.98	0.68	3	3.18	6.17	1.00E-9	4.1	3.3				656	0.68	0.40	1.8
15.800	51.837	12.632	0.319	112.904		14.26	2.24	5	115	2.935	1.243	1.692	6.69	2.82	0.61	3	3.13	6.86	1.00E-9	4.4	3.5				713	0.75	0.45	2.0
15.900	52.165	11.834	0.316	116.680		13.51	2.34	5	115	2.954	1.253	1.701	6.21	3.00	0.68	3	3.17	6.33	1.00E-9	4.2	3.3				676	0.70	0.41	1.9

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
16.000	52.493	12.842	0.312	127.000		14.67	2.13	5	115	2.973	1.263	1.709	6.84	2.67	0.67	3	3.11	7.04	1.00E-9	4.4	3.5				734	0.78	0.46	2.1
16.100	52.822	14.570	0.362	119.085		16.28	2.22	5	115	2.991	1.274	1.718	7.74	2.72	0.55	3	3.07	8.01	1.00E-9	4.9	3.8				814	0.89	0.52	2.3
16.200	53.150	13.152	0.358	116.095		14.82	2.41	5	115	3.010	1.284	1.726	6.84	3.03	0.60	3	3.14	7.02	1.00E-9	4.6	3.6				741	0.79	0.46	2.1
16.300	53.478	11.694	0.302	117.527		13.39	2.26	5	115	3.029	1.294	1.735	5.97	2.92	0.69	3	3.18	6.09	1.00E-9	4.2	3.3				669	0.69	0.40	1.8
16.400	53.806	12.673	0.308	127.258		14.51	2.12	5	115	3.048	1.304	1.743	6.57	2.69	0.69	3	3.12	6.75	1.00E-9	4.4	3.4				725	0.76	0.44	2.0
16.500	54.134	14.360	0.352	127.107		16.19	2.17	5	115	3.067	1.314	1.752	7.49	2.68	0.60	3	3.07	7.76	1.00E-9	4.8	3.7				810	0.87	0.50	2.2
16.600	54.462	13.632	0.376	109.789		15.21	2.47	5	115	3.085	1.325	1.761	6.89	3.10	0.54	3	3.14	7.07	1.00E-9	4.8	3.7				761	0.81	0.46	2.1
16.700	54.790	11.704	0.354	98.802		13.13	2.69	5	115	3.104	1.335	1.769	5.67	3.53	0.58	3	3.24	5.72	1.00E-9	4.4	3.4				656	0.67	0.38	1.7
16.800	55.118	12.503	0.337	98.212		13.92	2.42	5	115	3.123	1.345	1.778	6.07	3.12	0.53	3	3.19	6.19	1.00E-9	4.5	3.5				696	0.72	0.40	1.8
16.900	55.446	18.415	0.384	100.486		19.86	1.93	6	115	3.142	1.355	1.786	9.36	2.30	0.35	3	2.96	9.89	1.00E-9	5.7	4.4				993	1.11	0.62	2.8
17.000	55.774	33.654	0.711	53.475		34.42	2.07	6	115	3.160	1.366	1.795	17.42	2.28	0.08	4	2.73	19.08	3.00E-8	9.2	7.1				1721	2.08	1.16	5.2
17.100	56.102	23.468	0.731	30.912		23.91	3.06	5	115	3.179	1.376	1.803	11.50	3.52	0.04	3	2.99	12.10	1.00E-9	7.4	5.7				1196	1.38	0.77	3.4
17.200	56.430	23.118	0.577	40.114		23.70	2.44	6	115	3.198	1.386	1.812	11.31	2.82	0.07	3	2.94	12.01	1.00E-9	7.1	5.4				1185	1.37	0.75	3.4
17.300	56.759	17.086	0.613	57.250		17.91	3.42	5	115	3.217	1.396	1.821	8.07	4.17	0.19	3	3.16	8.27	1.00E-9	6.0	4.6				896	0.98	0.54	2.4
17.400	57.087	11.944	0.432	86.478		13.19	3.28	4	115	3.236	1.407	1.829	5.44	4.34	0.48	3	3.31	5.44	1.00E-9	4.7	3.6				659	0.66	0.36	1.6
17.500	57.415	11.414	0.320	105.542		12.93	2.47	5	115	3.254	1.417	1.838	5.27	3.31	0.64	3	3.25	5.31	1.00E-9	4.3	3.3				647	0.65	0.35	1.6
17.600	57.743	11.734	0.299	116.453		13.41	2.23	5	115	3.273	1.427	1.846	5.49	2.95	0.69	3	3.21	5.58	1.00E-9	4.3	3.3				671	0.68	0.37	1.6
17.700	58.071	19.643	0.380	104.820		21.15	1.80	6	115	3.292	1.437	1.855	9.63	2.13	0.34	3	2.93	10.26	1.00E-9	6.0	4.5				1058	1.19	0.64	2.9
17.800	58.399	19.603	0.660	84.298		20.82	3.17	5	115	3.311	1.448	1.863	9.40	3.77	0.26	3	3.08	9.77	1.00E-9	6.6	5.0				1041	1.17	0.63	2.8
17.900	58.727	13.701	0.553	91.880		15.02	3.68	4	115	3.330	1.458	1.872	6.25	4.73	0.44	3	3.28	6.28	1.00E-9	5.3	4.0				751	0.78	0.42	1.9
18.000	59.055	17.855	0.335	83.940		19.06	1.76	6	115	3.348	1.468	1.880	8.36	2.13	0.29	3	2.98	8.84	1.00E-9	5.6	4.2				953	1.05	0.56	2.5
18.100	59.383	17.795	0.478	64.053		18.72	2.55	5	115	3.367	1.478	1.889	8.13	3.11	0.20	3	3.08	8.45	1.00E-9	6.0	4.5				936	1.02	0.54	2.4
18.200	59.711	10.895	0.405	76.886		12.00	3.38	4	115	3.386	1.488	1.898	4.54	4.70	0.47	3	3.39	4.54	1.00E-9	4.6	3.4				600	0.57	0.30	1.4
18.300	60.039	9.777	0.271	97.031		11.17	2.43	5	115	3.405	1.499	1.906	4.08	3.49	0.71	3	3.36	4.08	1.00E-9	4.0	3.0				559	0.52	0.27	1.2
18.400	60.367	12.063	0.310	102.797		13.54	2.29	5	115	3.424	1.509	1.915	5.29	3.07	0.58	3	3.23	5.35	1.00E-9	4.5	3.4				677	0.67	0.35	1.6
18.500	60.696	21.710	0.626	70.272		22.72	2.76	5	115	3.442	1.519	1.923	10.02	3.25	0.18	3	3.02	10.56	1.00E-9	7.0	5.2				1136	1.29	0.67	3.0
18.600	61.024	14.170	0.586	58.550		15.01	3.90	4	115	3.461	1.529	1.932	5.98	5.07	0.23	3	3.31	5.98	1.00E-9	5.6	4.2				751	0.77	0.40	1.8
18.700	61.352	10.885	0.338	92.150		12.21	2.77	5	115	3.480	1.540	1.940	4.50	3.87	0.58	3	3.35	4.50	1.00E-9	4.4	3.3				611	0.58	0.30	1.4
18.800	61.680	21.840	0.912	114.493		23.49	3.88	4	115	3.499	1.550	1.949	10.26	4.56	0.33	3	3.09	10.66	1.00E-9	7.4	5.5				1174	1.33	0.68	3.1
18.900	62.008	80.918	1.589	57.206		81.74	1.94	7	118	3.518	1.560	1.958	39.95	2.03	0.03	5	2.41	47.11	3.00E-6	18.9	13.9	37	35	327	996			
19.000	62.336	123.848	1.700	19.693		124.13	1.37	8	121	3.538	1.570	1.968	61.29	1.41	0.00	5	2.17	75.74	3.00E-6	26.1	19.1	47	38	497	1147			
19.100	62.664	120.723	0.642	11.527		120.89	0.53	9	124	3.558	1.581	1.978	59.33	0.55	-0.01	6	1.95	76.54	3.00E-4	23.3	17.0	47	38	484	1138			

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Sounding:	CPT-03
Site:	RESOLUTION MINE	Date:	7/28/2009
Engineer:	B.BURGESS	Time:	9:16 AM

Col 1 Depth (m)	Col 2 Depth (ft)	Col 3 q_c (tsf)	Col 4 f_s (tsf)	Col 5 u (psi)	Col 6 Other	Col 7 q_t (tsf)	Col 8 R_f (%)
0.050	0.164	0.000	0.000	0.000			
0.100	0.328	0.000	0.000	0.000			
0.150	0.492	0.000	0.000	0.000			
0.200	0.656	0.000	0.000	0.000			
0.250	0.820	0.000	0.000	0.000			
0.300	0.984	0.000	0.000	0.000			
0.350	1.148	0.000	0.000	0.000			
0.400	1.312	0.000	0.000	0.000			
0.450	1.476	0.000	0.000	0.000			
0.500	1.640	0.000	0.000	0.000			
0.550	1.804	0.000	0.000	0.000			
0.600	1.969	0.000	0.000	0.000			
0.650	2.133	28.191	0.595	1.639		28.21	2.11
0.700	2.297	16.088	0.550	3.109		16.13	3.41
0.750	2.461	25.824	0.414	5.163		25.90	1.60
0.800	2.625	33.434	0.313	4.410		33.50	0.93
0.850	2.789	30.378	0.208	3.995		30.44	0.68
0.900	2.953	32.445	0.295	3.769		32.50	0.91
0.950	3.117	27.652	0.364	3.656		27.70	1.31
1.000	3.281	17.136	0.267	3.449		17.19	1.55
1.050	3.445	12.583	0.243	3.863		12.64	1.92
1.100	3.609	10.186	0.253	4.447		10.25	2.47
1.150	3.773	8.358	0.247	4.994		8.43	2.93
1.200	3.937	6.651	0.244	5.503		6.73	3.63
1.250	4.101	5.602	0.193	6.011		5.69	3.39
1.300	4.265	6.052	0.137	6.106		6.14	2.23
1.350	4.429	4.464	0.065	5.861		4.55	1.43
1.400	4.593	3.296	0.057	6.049		3.38	1.68
1.450	4.757	3.326	0.084	6.539		3.42	2.46
1.500	4.921	3.955	0.110	5.917		4.04	2.72
1.550	5.085	3.865	0.147	5.446		3.94	3.73
1.600	5.249	3.865	0.168	5.898		3.95	4.25
1.650	5.413	4.015	0.213	6.294		4.11	5.19
1.700	5.577	4.194	0.231	6.878		4.29	5.38
1.750	5.741	5.033	0.281	7.613		5.14	5.46
1.800	5.906	6.531	0.234	7.557		6.64	3.52
1.850	6.070	3.535	0.161	6.954		3.64	4.43
1.900	6.234	2.607	0.117	7.085		2.71	4.32
1.950	6.398	2.397	0.085	7.594		2.51	3.39

2.000	6.562	2.337	0.079	8.141	2.45	3.22
2.050	6.726	2.307	0.079	8.876	2.43	3.24
2.100	6.890	2.457	0.074	9.912	2.60	2.85
2.150	7.054	2.247	0.068	11.269	2.41	2.82
2.200	7.218	1.977	0.061	11.307	2.14	2.85
2.250	7.382	1.947	0.054	11.589	2.11	2.55
2.300	7.546	1.768	0.042	11.344	1.93	2.17
2.350	7.710	1.648	0.042	11.137	1.81	2.32
2.400	7.874	1.558	0.045	10.817	1.71	2.63
2.450	8.038	1.618	0.046	11.231	1.78	2.58
2.500	8.202	1.798	0.042	12.042	1.97	2.13
2.550	8.366	2.067	0.041	13.116	2.26	1.82
2.600	8.530	2.217	0.042	14.001	2.42	1.74
2.650	8.694	2.277	0.069	14.925	2.49	2.77
2.700	8.858	3.116	0.068	16.470	3.35	2.03
2.750	9.022	2.966	0.059	16.301	3.20	1.84
2.800	9.186	2.846	0.057	17.770	3.10	1.84
2.850	9.350	2.427	0.047	17.733	2.68	1.75
2.900	9.514	2.007	0.046	17.130	2.25	2.04
2.950	9.678	1.798	0.043	17.205	2.05	2.10
3.000	9.843	1.618	0.038	16.564	1.86	2.05
3.050	10.007	1.558	0.038	16.395	1.79	2.12
3.100	10.171	1.558	0.035	16.187	1.79	1.95
3.150	10.335	1.438	0.037	15.792	1.67	2.22
3.200	10.499	1.528	0.042	15.547	1.75	2.40
3.250	10.663	1.498	0.051	15.245	1.72	2.97
3.300	10.827	1.738	0.054	15.245	1.96	2.76
3.350	10.991	1.438	0.053	11.947	1.61	3.29
3.400	11.155	1.438	0.062	11.740	1.61	3.86
3.450	11.319	2.007	0.070	12.306	2.18	3.20
3.500	11.483	2.397	0.051	13.700	2.59	1.97
3.550	11.647	2.187	0.044	15.339	2.41	1.83
3.600	11.811	5.512	0.117	17.280	5.76	2.03
3.650	11.975	8.838	0.147	7.801	8.95	1.64
3.700	12.139	8.838	0.285	5.182	8.91	3.20
3.750	12.303	16.178	0.409	5.672	16.26	2.52
3.800	12.467	27.502	0.435	5.879	27.59	1.58
3.850	12.631	45.387	0.336	5.974	45.47	0.74
3.900	12.795	27.951	0.265	5.333	28.03	0.95
3.950	12.959	10.546	0.253	4.711	10.61	2.38
4.000	13.123	5.543	0.172	4.654	5.61	3.07
4.050	13.287	2.876	0.143	5.220	2.95	4.85
4.100	13.451	2.846	0.057	5.653	2.93	1.95
4.150	13.615	2.546	0.050	6.709	2.64	1.89
4.200	13.780	2.187	0.043	7.632	2.30	1.87
4.250	13.944	2.007	0.039	8.894	2.14	1.83
4.300	14.108	1.977	0.049	10.402	2.13	2.30
4.350	14.272	2.127	0.052	11.929	2.30	2.26
4.400	14.436	2.726	0.046	12.551	2.91	1.58
4.450	14.600	1.977	0.026	12.777	2.16	1.20
4.500	14.764	1.738	0.027	13.399	1.93	1.40
4.550	14.928	1.917	0.059	14.341	2.12	2.78

4.600	15.092	1.558	0.036	14.642	1.77	2.04
4.650	15.256	3.086	0.018	5.710	3.17	0.57
4.700	15.420	2.457	0.016	6.840	2.56	0.63
4.750	15.584	2.487	0.021	8.066	2.60	0.81
4.800	15.748	2.577	0.026	9.215	2.71	0.96
4.850	15.912	2.756	0.031	10.477	2.91	1.07
4.900	16.076	2.846	0.029	11.929	3.02	0.96
4.950	16.240	2.876	0.021	13.436	3.07	0.68
5.000	16.404	2.636	0.015	14.605	2.85	0.53
5.050	16.568	2.846	0.016	15.942	3.08	0.52
5.100	16.732	3.086	0.025	18.430	3.35	0.75
5.150	16.896	3.026	0.029	20.371	3.32	0.87
5.200	17.060	3.026	0.038	22.086	3.34	1.14
5.250	17.224	2.996	0.035	23.292	3.33	1.05
5.300	17.388	2.996	0.035	24.046	3.34	1.05
5.350	17.552	2.996	0.035	24.686	3.35	1.04
5.400	17.717	3.116	0.034	25.289	3.48	0.98
5.450	17.881	3.176	0.039	26.345	3.56	1.10
5.500	18.045	3.236	0.044	26.872	3.62	1.21
5.550	18.209	3.265	0.047	27.438	3.66	1.28
5.600	18.373	3.326	0.042	27.871	3.73	1.13
5.650	18.537	3.326	0.043	28.304	3.73	1.15
5.700	18.701	3.415	0.044	28.512	3.83	1.15
5.750	18.865	3.445	0.047	29.021	3.86	1.22
5.800	19.029	3.505	0.047	28.719	3.92	1.20
5.850	19.193	3.355	0.050	28.625	3.77	1.33
5.900	19.357	3.265	0.052	28.606	3.68	1.41
5.950	19.521	3.265	0.049	28.361	3.67	1.33
6.000	19.685	3.206	0.040	28.097	3.61	1.11
6.050	19.849	3.265	0.042	28.851	3.68	1.14
6.100	20.013	3.415	0.044	29.077	3.83	1.15
6.150	20.177	3.415	0.046	28.908	3.83	1.20
6.200	20.341	3.415	0.047	29.642	3.84	1.22
6.250	20.505	3.386	0.039	29.944	3.82	1.02
6.300	20.669	3.445	0.042	30.528	3.88	1.08
6.350	20.833	3.445	0.041	31.018	3.89	1.05
6.400	20.997	3.326	0.034	30.585	3.77	0.90
6.450	21.161	3.445	0.029	30.472	3.88	0.75
6.500	21.325	3.386	0.031	31.169	3.83	0.81
6.550	21.490	3.445	0.034	31.960	3.91	0.87
6.600	21.654	3.595	0.040	32.205	4.06	0.99
6.650	21.818	3.775	0.047	5.521	3.85	1.22
6.700	21.982	3.984	0.049	10.289	4.13	1.19
6.750	22.146	3.805	0.048	9.988	3.95	1.22
6.800	22.310	3.745	0.044	9.912	3.89	1.13
6.850	22.474	3.685	0.042	10.232	3.83	1.10
6.900	22.638	3.685	0.044	12.117	3.86	1.14
6.950	22.802	3.805	0.045	17.092	4.05	1.11
7.000	22.966	3.925	0.050	20.032	4.21	1.19
7.050	23.130	4.074	0.056	26.175	4.45	1.26
7.100	23.294	3.895	0.053	30.830	4.34	1.22
7.150	23.458	3.895	0.051	35.371	4.40	1.16

7.200	23.622	4.883	0.062	37.934	5.43	1.14
7.250	23.786	7.999	0.077	28.719	8.41	0.92
7.300	23.950	11.923	0.096	24.630	12.28	0.78
7.350	24.114	9.767	0.234	21.200	10.07	2.32
7.400	24.278	5.722	0.221	23.047	6.05	3.65
7.450	24.442	4.913	0.169	26.062	5.29	3.20
7.500	24.606	4.494	0.058	29.774	4.92	1.18
7.550	24.770	6.321	0.022	28.983	6.74	0.33
7.600	24.934	4.913	0.023	28.908	5.33	0.43
7.650	25.098	4.344	0.010	30.962	4.79	0.21
7.700	25.262	4.015	0.031	32.488	4.48	0.69
7.750	25.427	4.254	0.031	26.005	4.63	0.67
7.800	25.591	4.224	0.035	32.733	4.70	0.75
7.850	25.755	4.314	0.046	38.763	4.87	0.94
7.900	25.919	4.314	0.054	41.515	4.91	1.10
7.950	26.083	4.404	0.054	41.458	5.00	1.08
8.000	26.247	4.434	0.045	40.912	5.02	0.90
8.050	26.411	4.584	0.042	41.119	5.18	0.81
8.100	26.575	4.224	0.043	42.438	4.84	0.89
8.150	26.739	4.284	0.039	41.910	4.89	0.80
8.200	26.903	4.554	0.050	43.870	5.19	0.96
8.250	27.067	4.494	0.054	45.133	5.14	1.05
8.300	27.231	4.554	0.056	45.717	5.21	1.07
8.350	27.395	4.674	0.059	46.621	5.35	1.10
8.400	27.559	4.763	0.059	48.091	5.46	1.08
8.450	27.723	4.793	0.065	49.655	5.51	1.18
8.500	27.887	4.824	0.067	50.522	5.55	1.21
8.550	28.051	4.853	0.068	51.012	5.59	1.22
8.600	28.215	4.883	0.070	51.389	5.62	1.24
8.650	28.379	4.973	0.068	51.333	5.71	1.19
8.700	28.543	5.243	0.070	51.107	5.98	1.17
8.750	28.707	5.333	0.073	48.977	6.04	1.21
8.800	28.871	5.183	0.082	48.035	5.87	1.40
8.850	29.035	12.414	0.080	51.012	13.15	0.61
8.900	29.199	12.642	0.218	41.081	13.23	1.65
8.950	29.364	6.801	0.147	34.410	7.30	2.01
9.000	29.528	7.969	0.113	8.122	8.09	1.40
9.050	29.692	6.381	0.078	10.101	6.53	1.20
9.100	29.856	5.782	0.065	15.415	6.00	1.08
9.150	30.020	5.692	0.062	25.365	6.06	1.02
9.200	30.184	5.453	0.050	33.129	5.93	0.84
9.250	30.348	4.973	0.055	39.140	5.54	0.99
9.300	30.512	5.363	0.069	44.228	6.00	1.15
9.350	30.676	5.393	0.049	43.757	6.02	0.81
9.400	30.840	4.853	0.038	43.229	5.48	0.69
9.450	31.004	4.674	0.036	44.926	5.32	0.68
9.500	31.168	5.093	0.038	46.753	5.77	0.66
9.550	31.332	5.543	0.044	48.487	6.24	0.70
9.600	31.496	6.291	0.051	52.595	7.05	0.72
9.650	31.660	6.112	0.051	53.085	6.88	0.74
9.700	31.824	5.662	0.073	54.254	6.44	1.13
9.750	31.988	5.482	0.080	56.157	6.29	1.27

9.800	32.152	5.423	0.077	54.875	6.21	1.24
9.850	32.316	5.543	0.075	55.855	6.35	1.18
9.900	32.480	5.543	0.085	54.819	6.33	1.34
9.950	32.644	6.441	0.083	52.897	7.20	1.15
10.000	32.808	6.741	0.080	50.164	7.46	1.07
10.050	32.972	7.100	0.049	47.922	7.79	0.63
10.100	33.136	7.430	0.043	42.890	8.05	0.53
10.150	33.301	6.022	0.029	42.589	6.64	0.44
10.200	33.465	5.962	0.049	43.135	6.58	0.74
10.250	33.629	14.500	0.063	45.566	15.16	0.42
10.300	33.793	19.114	0.159	30.717	19.56	0.81
10.350	33.957	14.859	0.175	30.434	15.30	1.14
10.400	34.121	12.613	0.158	30.585	13.05	1.21
10.450	34.285	10.725	0.087	31.697	11.18	0.78
10.500	34.449	8.059	0.073	35.277	8.57	0.85
10.550	34.613	6.112	0.059	41.986	6.72	0.88
10.600	34.777	5.363	0.051	48.600	6.06	0.84
10.650	34.941	5.213	0.042	51.992	5.96	0.70
10.700	35.105	5.453	0.036	52.313	6.21	0.58
10.750	35.269	5.512	0.049	53.349	6.28	0.78
10.800	35.433	5.872	0.062	51.276	6.61	0.94
10.850	35.597	7.580	0.089	58.380	8.42	1.06
10.900	35.761	8.389	0.105	66.861	9.35	1.12
10.950	35.925	10.785	0.124	78.224	11.91	1.04
11.000	36.089	10.605	0.137	81.126	11.77	1.16
11.050	36.253	11.175	0.143	95.335	12.55	1.14
11.100	36.417	11.145	0.138	90.624	12.45	1.11
11.150	36.581	10.516	0.139	93.771	11.87	1.17
11.200	36.745	10.396	0.124	88.758	11.67	1.06
11.250	36.909	9.347	0.102	81.899	10.53	0.97
11.300	37.073	7.909	0.062	73.192	8.96	0.69
11.350	37.238	6.891	0.067	69.951	7.90	0.85
11.400	37.402	6.561	0.077	70.762	7.58	1.02
11.450	37.566	6.351	0.066	63.676	7.27	0.91
11.500	37.730	6.172	0.064	62.432	7.07	0.91
11.550	37.894	6.441	0.061	63.676	7.36	0.83
11.600	38.058	6.231	0.066	63.073	7.14	0.92
11.650	38.222	6.052	0.066	64.373	6.98	0.95
11.700	38.386	6.201	0.010	65.259	7.14	0.14
11.750	38.550	6.441	0.096	65.862	7.39	1.30
11.800	38.714	4.045	0.094	47.356	4.73	1.99
11.850	38.878	6.201	0.093	55.592	7.00	1.33
11.900	39.042	5.992	0.072	60.774	6.87	1.05
11.950	39.206	6.022	0.049	60.566	6.89	0.71
12.000	39.370	5.782	0.033	59.662	6.64	0.50
12.050	39.534	6.052	0.033	59.888	6.91	0.48
12.100	39.698	5.962	0.028	59.587	6.82	0.41
12.150	39.862	6.022	0.042	61.942	6.91	0.61
12.200	40.026	6.052	0.053	66.540	7.01	0.76
12.250	40.190	6.351	0.062	69.951	7.36	0.84
12.300	40.354	6.891	0.074	73.098	7.94	0.93
12.350	40.518	7.879	0.081	74.794	8.96	0.90

12.400	40.682	6.831	0.065	76.113	7.93	0.82
12.450	40.846	7.520	0.079	81.088	8.69	0.91
12.500	41.011	9.407	0.069	83.350	10.61	0.65
12.550	41.175	9.347	0.111	83.632	10.55	1.05
12.600	41.339	10.066	0.110	84.405	11.28	0.98
12.650	41.503	10.695	0.142	73.004	11.75	1.21
12.700	41.667	9.317	0.156	71.327	10.34	1.51
12.750	41.831	8.179	0.103	68.104	9.16	1.12
12.800	41.995	7.250	0.143	65.768	8.20	1.74
12.850	42.159	8.029	0.177	73.833	9.09	1.95
12.900	42.323	7.729	0.151	63.921	8.65	1.75
12.950	42.487	7.100	0.141	71.459	8.13	1.73
13.000	42.651	11.564	0.091	68.161	12.55	0.73
13.050	42.815	18.035	0.243	41.326	18.63	1.30
13.100	42.979	14.859	0.322	41.609	15.46	2.08
13.150	43.143	11.294	0.250	50.993	12.03	2.08
13.200	43.307	21.271	0.147	47.507	21.96	0.67
13.250	43.471	18.395	0.126	33.525	18.88	0.67
13.300	43.635	11.204	0.163	37.029	11.74	1.39
13.350	43.799	8.479	0.177	51.747	9.22	1.92
13.400	43.963	7.580	0.119	55.309	8.38	1.42
13.450	44.127	7.580	0.095	57.909	8.41	1.13
13.500	44.291	8.179	0.085	63.431	9.09	0.93
13.550	44.455	8.209	0.108	71.383	9.24	1.17
13.600	44.619	8.358	0.109	82.841	9.55	1.14
13.650	44.783	10.755	0.158	90.058	12.05	1.31
13.700	44.948	12.613	0.155	87.514	13.87	1.12
13.750	45.112	10.516	0.205	93.243	11.86	1.73
13.800	45.276	11.864	0.178	107.113	13.41	1.33
13.850	45.440	12.013	0.184	36.879	12.54	1.47
13.900	45.604	11.594	0.176	78.883	12.73	1.38
13.950	45.768	10.785	0.196	83.425	11.99	1.64
14.000	45.932	8.958	0.197	77.451	10.07	1.96
14.050	46.096	8.748	0.145	88.023	10.02	1.45
14.100	46.260	8.778	0.098	88.381	10.05	0.98
14.150	46.424	8.239	0.112	90.605	9.54	1.17
14.200	46.588	10.216	0.120	95.240	11.59	1.04
14.250	46.752	9.377	0.111	89.022	10.66	1.04
14.300	46.916	8.718	0.122	94.167	10.07	1.21
14.350	47.080	9.227	0.187	94.506	10.59	1.77
14.400	47.244	14.740	0.205	94.769	16.10	1.27
14.450	47.408	9.018	0.225	60.699	9.89	2.27
14.500	47.572	9.737	0.149	71.138	10.76	1.38
14.550	47.736	8.538	0.099	73.871	9.60	1.03
14.600	47.900	9.407	0.188	83.858	10.61	1.77
14.650	48.064	11.923	0.228	82.012	13.10	1.74
14.700	48.228	17.047	0.402	78.130	18.17	2.21
14.750	48.392	25.375	0.564	37.444	25.91	2.18
14.800	48.556	14.080	0.467	33.600	14.56	3.21
14.850	48.720	13.092	0.316	65.353	14.03	2.25
14.900	48.885	10.785	0.140	83.670	11.99	1.17
14.950	49.049	10.006	0.139	92.508	11.34	1.23

15.000	49.213	9.077	0.127	97.031	10.47	1.21
15.050	49.377	10.246	0.153	108.055	11.80	1.30
15.100	49.541	14.080	0.180	103.664	15.57	1.16
15.150	49.705	12.463	0.203	98.802	13.89	1.46
15.200	49.869	11.684	0.208	112.691	13.31	1.56
15.250	50.033	12.673	0.192	115.159	14.33	1.34
15.300	50.197	11.085	0.159	107.452	12.63	1.26
15.350	50.361	10.366	0.158	113.671	12.00	1.32
15.400	50.525	11.354	0.143	119.418	13.07	1.09
15.450	50.689	12.073	0.145	116.987	13.76	1.05
15.500	50.853	12.343	0.157	122.904	14.11	1.11
15.550	51.017	12.942	0.178	122.019	14.70	1.21
15.600	51.181	13.302	0.220	118.796	15.01	1.47
15.650	51.345	11.384	0.207	91.604	12.70	1.63
15.700	51.509	9.587	0.186	89.286	10.87	1.71
15.750	51.673	9.917	0.278	100.197	11.36	2.45
15.800	51.837	33.284	0.608	44.567	33.93	1.79
15.850	52.001	20.941	0.461	24.517	21.29	2.16
15.900	52.165	24.566	0.435	15.754	24.79	1.75
15.950	52.329	14.949	0.281	23.047	15.28	1.84
16.000	52.493	17.346	0.309	38.952	17.91	1.73
16.050	52.657	18.425	0.495	51.220	19.16	2.58
16.100	52.822	22.529	0.723	59.549	23.39	3.09
16.150	52.986	73.938	1.846	17.940	74.20	2.49
16.200	53.150	50.360	1.998	-6.294	50.27	3.97
16.250	53.314	28.970	2.039	-4.372	28.91	7.05
16.300	53.478	33.314	1.828	-3.920	33.26	5.50
16.350	53.642	27.083	1.882	-3.505	27.03	6.96
16.400	53.806	23.937	1.499	-3.015	23.89	6.27
16.450	53.970	22.918	1.648	-2.337	22.88	7.20
16.500	54.134	23.338	1.689	-1.885	23.31	7.25
16.550	54.298	25.854	1.886	-1.489	25.83	7.30
16.600	54.462	30.737	1.877	-1.036	30.72	6.11
16.650	54.626	25.674	1.670	-0.603	25.67	6.51
16.700	54.790	23.997	1.512	0.226	24.00	6.30
16.750	54.954	26.603	1.525	1.432	26.62	5.73
16.800	55.118	31.517	1.540	2.243	31.55	4.88
16.850	55.282	31.517	1.663	3.109	31.56	5.27
16.900	55.446	33.703	1.842	4.447	33.77	5.46
16.950	55.610	58.749	1.925	5.145	58.82	3.27
17.000	55.774	35.231	1.808	4.824	35.30	5.12
17.050	55.938	28.041	1.563	5.521	28.12	5.56
17.100	56.102	38.616	1.655	5.898	38.70	4.28
17.150	56.266	34.902	1.649	5.220	34.98	4.71
17.200	56.430	27.712	1.516	5.126	27.79	5.46
17.250	56.594	27.292	1.038	5.220	27.37	3.79
17.300	56.759	15.549	0.757	5.785	15.63	4.84
17.350	56.923	15.189	0.592	6.143	15.28	3.87
17.400	57.087	16.777	0.727	6.501	16.87	4.31
17.450	57.251	38.467	0.989	6.746	38.56	2.56
17.500	57.415	49.012	0.766	6.143	49.10	1.56
17.550	57.579	33.074	1.088	6.275	33.16	3.28

17.600	57.743	31.696	1.127	7.557	31.80	3.54
17.650	57.907	38.736	1.284	7.745	38.85	3.31
17.700	58.071	49.641	1.681	7.764	49.75	3.38
17.750	58.235	58.329	1.979	7.745	58.44	3.39
17.800	58.399	66.957	2.264	7.387	67.06	3.38
17.850	58.563	71.451	2.319	6.897	71.55	3.24
17.900	58.727	71.541	2.327	6.973	71.64	3.25
17.950	58.891	66.987	2.368	8.348	67.11	3.53
18.000	59.055	68.395	2.337	8.800	68.52	3.41
18.050	59.219	78.222	3.095	8.650	78.35	3.95
18.100	59.383	85.681	2.885	7.764	85.79	3.36
18.150	59.547	108.390	1.150	7.990	108.51	1.06
18.200	59.711	115.220	2.932	7.801	115.33	2.54
18.250	59.875	58.179	1.431	5.201	58.25	2.46
18.300	60.039	98.533	1.404	5.182	98.61	1.42
18.350	60.203	126.694	0.024	2.770	126.73	0.02
18.400	60.367	139.696	0.024	2.488	139.73	0.02

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Units:	Imperial
Site:	RESOLUTION MINE	Data averaging interval:	0.100 meters
Engineer:	B.BURGESS	Assumed depth of water:	12.003 feet
		Net area ratio of cone:	0.80
		Unit weight of water:	62.4 lb/ft^3
		Relative density constant, C_{DR}:	350
Sounding:	CPT-03	Young's modulus for sands, α:	4
Date:	7/28/2009	Small strain shear modulus number, S_G (sands):	180
Time:	9:16 AM	Small strain shear modulus number, C_G (clays):	50
		N_{kt} for clays:	15
		OCR number, k_{ocr}:	0.3

Interpretation based on Lunne, Robertson and Powell, 1997

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
0.100	0.328	0.000	0.000	0.000							0.000																	
0.200	0.656	0.000	0.000	0.000							0.000																	
0.300	0.984	0.000	0.000	0.000							0.000																	
0.400	1.312	0.000	0.000	0.000							0.000																	
0.500	1.640	0.000	0.000	0.000							0.000																	
0.600	1.969	9.397	0.198	0.546		9.40	2.11	5	115	0.113	0.000	0.113	82.39	2.13	0.00	5	2.19	39.03	3.00E-6	2.0	6.1	33	40	38	187			
0.700	2.297	23.368	0.520	3.304		23.42	2.22	6	115	0.132	0.000	0.132	176.96	2.23	0.01	6	1.99	77.60	3.00E-4	4.6	13.0	47	43	94	267			
0.800	2.625	29.879	0.312	4.523		29.94	1.04	7	118	0.151	0.000	0.151	197.44	1.05	0.01	6	1.71	77.57	3.00E-4	5.3	14.0	47	44	120	303			
0.900	2.953	30.158	0.289	3.807		30.21	0.96	7	118	0.170	0.000	0.170	176.50	0.96	0.01	6	1.72	73.79	3.00E-4	5.3	13.3	46	43	121	317			
1.000	3.281	19.124	0.291	3.656		19.18	1.52	6	115	0.189	0.000	0.189	100.45	1.53	0.01	6	2.03	52.01	3.00E-4	3.8	9.0	39	41	77	282			
1.100	3.609	10.376	0.248	4.435		10.44	2.37	5	115	0.208	0.000	0.208	49.24	2.42	0.03	5	2.39	31.54	3.00E-6	2.4	5.4	30	37	42	237			
1.200	3.937	6.870	0.228	5.503		6.95	3.28	3	111	0.226	0.000	0.226	29.74	3.39	0.06	4	2.66	22.00	3.00E-8	1.8	3.9				347	0.45	1.98	8.9
1.300	4.265	5.373	0.132	5.993		5.46	2.41	4	115	0.245	0.000	0.245	21.29	2.53	0.08	4	2.69	16.22	3.00E-8	1.4	3.0				273	0.35	1.42	6.4
1.400	4.593	3.695	0.069	6.150		3.78	1.81	1	111	0.263	0.000	0.263	13.38	1.95	0.13	4	2.79	10.77	3.00E-8	1.0	2.1				189	0.23	0.89	4.0
1.500	4.921	3.715	0.114	5.967		3.80	2.99	3	111	0.281	0.000	0.281	12.51	3.23	0.12	3	2.94	10.79	1.00E-9	1.1	2.2				190	0.23	0.83	3.8
1.600	5.249	3.915	0.176	5.879		4.00	4.40	3	111	0.300	0.000	0.300	12.35	4.76	0.11	3	3.04	11.17	1.00E-9	1.3	2.4				200	0.25	0.82	3.7
1.700	5.577	4.414	0.242	6.928		4.51	5.35	3	111	0.318	0.000	0.318	13.20	5.76	0.12	3	3.07	12.13	1.00E-9	1.5	2.7				226	0.28	0.88	4.0
1.800	5.906	5.033	0.225	7.375		5.14	4.38	3	111	0.336	0.000	0.336	14.28	4.69	0.11	3	2.99	12.81	1.00E-9	1.6	2.8				257	0.32	0.95	4.3
1.900	6.234	2.846	0.121	7.211		2.95	4.10	3	111	0.355	0.000	0.355	7.32	4.66	0.20	3	3.22	7.11	1.00E-9	1.1	1.8				148	0.17	0.49	2.2
2.000	6.562	2.347	0.081	8.204		2.47	3.29	3	111	0.373	0.000	0.373	5.61	3.87	0.28	3	3.27	5.54	1.00E-9	0.9	1.5				123	0.14	0.37	1.7
2.100	6.890	2.337	0.074	10.019		2.48	2.97	3	111	0.391	0.000	0.391	5.34	3.52	0.35	3	3.26	5.27	1.00E-9	0.9	1.5				124	0.14	0.36	1.6
2.200	7.218	2.057	0.061	11.388		2.22	2.75	3	111	0.409	0.000	0.409	4.43	3.37	0.45	3	3.32	4.43	1.00E-9	0.8	1.3				111	0.12	0.30	1.3
2.300	7.546	1.788	0.046	11.357		1.95	2.36	1	111	0.428	0.000	0.428	3.56	3.02	0.54	3	3.38	3.56	1.00E-9	0.7	1.2				98	0.10	0.24	1.1
2.400	7.874	1.608	0.044	11.062		1.77	2.51	3	111	0.446	0.000	0.446	2.96	3.36	0.60	3	3.47	2.96	1.00E-9	0.7	1.1				88	0.09	0.20	0.9
2.500	8.202	1.828	0.043	12.130		2.00	2.15	1	111	0.464	0.000	0.464	3.31	2.80	0.57	3	3.39	3.31	1.00E-9	0.8	1.2				100	0.10	0.22	1.0
2.600	8.530	2.187	0.051	14.014		2.39	2.12	1	111	0.482	0.000	0.482	3.95	2.66	0.53	3	3.31	3.95	1.00E-9	0.9	1.3				119	0.13	0.26	1.2
2.700	8.858	2.786	0.065	15.899		3.02	2.17	1	111	0.501	0.000	0.501	5.02	2.60	0.46	3	3.22	4.92	1.00E-9	1.0	1.5				151	0.17	0.33	1.5
2.800	9.186	2.746	0.054	17.268		2.99	1.81	1	111	0.519	0.000	0.519	4.77	2.19	0.50	3	3.20	4.66	1.00E-9	1.0	1.4				150	0.17	0.32	1.4
2.900	9.514	2.077	0.045	17.356		2.33	1.95	1	111	0.537	0.000	0.537	3.33	2.53	0.70	3	3.36	3.33	1.00E-9	0.9	1.2				116	0.12	0.22	1.0
3.000	9.843	1.658	0.040	16.721		1.90	2.09	1	111	0.556	0.000	0.556	2.42	2.95	0.90	3	3.52	2.42	1.00E-9	0.8	1.1				95	0.09	0.16	0.7
3.100	10.171	1.518	0.037	16.125		1.75	2.10	1	111	0.574	0.000	0.574	2.05	3.12	0.99	3	3.59	2.05	1.00E-9	0.8	1.0				88	0.08	0.14	0.6
3.200	10.499	1.488	0.043	15.528		1.71	2.53	3	111	0.592	0.000	0.592	1.89	3.87	1.00	3	3.67	1.89	1.00E-9	0.8	1.1				86	0.07	0.13	0.6
3.300	10.827	1.558	0.053	14.146		1.76	2.99	3	111	0.610	0.000	0.610	1.89	4.57	0.88	2	3.71	1.89	3.00E-7	0.9	1.2				88	0.08	0.13	0.6
3.400	11.155	1.628	0.062	11.998		1.80	3.43	3	111	0.629	0.000	0.629	1.86	5.26	0.74	2	3.74	1.86	3.00E-7	1.0	1.3				90	0.08	0.12	0.6
3.500	11.483	2.197	0.055	13.782		2.40	2.30	1	111	0.647	0.000	0.647	2.70	3.15	0.57	3	3.49	2.70	1.00E-9	1.0	1.3				120	0.12	0.18	0.8
3.600	11.811	5.512	0.103	13.473		5.71	1.80	4	115	0.666	0.000	0.666	7.57	2.04	0.19	3	3.01	7.26	1.00E-9	1.8	2.2				285	0.34	0.50	2.3
3.700	12.139	11.285	0.280	6.218		11.37	2.46	5	115	0.685	0.004	0.680	15.71	2.62	0.04	4	2.80	14.70	3.00E-8	3.2	4.0				569	0.71	1.05	4.7
3.800	12.467	29.689	0.393	5.842		29.77	1.32	7	118	0.704	0.014	0.689	42.17	1.35	0.01	5	2.29	36.99	3.00E-6	6.6	8.1	33	36	119	502			
3.900	12.795	27.961	0.285	5.339		28.04	1.02	7	118	0.723	0.025	0.698	39.11	1.04	0.01	5	2.25	34.28	3.00E-6	6.1	7.5	31	35	112	494			
4.000	13.123	6.322	0.189	4.862		6.39	2.96	3	111	0.741	0.035	0.706	8.00	3.35	0.06	3	3.10	7.80	1.00E-9	2.2	2.6				320	0.38	0.53	2.4
4.100	13.451	2.756	0.083	5.861		2.84	2.93	3	111	0.760	0.045	0.715	2.91	4.01	0.18	3	3.52	2.91	1.00E-9	1.3	1.6				142	0.14	0.19	0.9
4.200	13.780	2.247	0.044	7.745		2.36	1.87	1	111	0.778	0.055	0.723	2.19	2.78	0.32	3	3.55	2.19	1.00E-9	1.1	1.3				118	0.11	0.15	0.7
4.300	14.108	2.037	0.047	10.408		2.19	2.13	1	111	0.796	0.066	0.731	1.90	3.36	0.49	3	3.64	1.90	1.00E-9	1.1	1.3				109	0.09	0.13	0.6
4.400	14.436	2.277	0.041	12.419		2.46	1.68	1	111	0.815	0.076	0.739	2.22	2.52	0.50	3	3.52	2.22	1.00E-9	1.1	1.3				123	0.11	0.15	0.7
4.500	14.764	1.877	0.037	13.506		2.07	1.80	1	111	0.833	0.086	0.747	1.66	3.01	0.72	3	3.67	1.66	1.00E-9	1.0	1.2				104	0.08	0.11	0.5
4.600	15.092	2.187	0.038	11.564		2.35	1.60	1	111	0.851	0.096	0.755	1.99	2.51	0.49	3	3.56	1.99	1.00E-9	1.1	1.3				118	0.10	0.13	0.6
4.700	15.420	2.677	0.018	6.872		2.78	0.66	1	111	0.869	0.107	0.763	2.50	0.96	0.20	1	3.30	2.50	3.00E-8	1.1	1.2				139	0.13	0.17	0.7
4.800	15.748	2.607	0.026	9.253		2.74	0.95	1	111	0.888	0.117	0.771	2.40	1.40	0.30	3	3.38	2.40	1.00E-9	1.1	1.3				137	0.12	0.16	0.7
4.900	16.076	2.826	0.027	11.947		3.00	0.90	1	111	0.906	0.127	0.779	2.69	1.29	0.35	3	3.32	2.69	1.00E-9	1.1	1.3				150	0.14	0.18	0.8
5.000	16.404	2.786	0.017	14.661		3.00	0.58	1	111	0.924	0.137	0.787	2.63	0.84	0.44	1	3.26	2.62	3.00E-8	1.1	1.2				150	0.14	0.18	0.8
5.100	16.732	2.986	0.023	18.248		3.25	0.72	1	111	0.942	0.148	0.795	2.90	1.01	0.51	1	3.25	2.89	3.00E-8	1.1	1.3				162	0.15	0.19	0.9
5.200	17.060	3.016	0.034	21.916		3.33	1.02	1	111	0.961	0.158	0.803	2.95	1.43	0.60	3	3.30	2.95	1.00E-9	1.2	1.4				167	0.16	0.20	0.9
5.300	17.388	2.996	0.035	24.008		3.34	1.05	1	111	0.979	0.168	0.811	2.91	1.48	0.66	3	3.31	2.91	1.00E-9	1.2	1.4				167	0.16	0.19	0.9
5.400	17.717	3.096	0.036	25.440		3.46	1.04	1	111	0.997	0.178	0.819	3.01	1.46	0.67	3	3.30	3.01	1.00E-9	1.2	1.4				173	0.16	0.20	0.9
5.500	18.045	3.226	0.043	26.885		3.61	1.20	1	111	1.016	0.188	0.827	3.14	1.67	0.67	3	3.30	3.14	1.00E-9	1.3	1.4				181	0.17	0.21	0.9
5.600	18.373	3.306	0.044	27.871		3.71	1.19	1	111	1.034	0.199	0.835	3.20	1.65	0.68	3	3.29	3.20	1.00E-9	1.3	1.5				185	0.18	0.21	1.0
5.700	18.701	3.395	0.045	28.612		3.81	1.17	1	111	1.052	0.209	0.843	3.27	1.62	0.67	3	3.28	3.26	1.00E-9	1.3	1.5				190	0.18	0.22	1.0
5.800	19.029	3.435	0.048	28.788		3.85	1.25	1	111	1.070	0.219	0.851	3.27	1.73	0.67	3	3.30	3.26	1.00E-9	1.3	1.5				192	0.19	0.22	1.0
5.900	19.357	3.295	0.050	28.531		3.71	1.36	1	111	1.089	0.229	0.859	3.05	1.92	0.70	3	3.34	3.05	1.00E-9	1.3	1.5				185	0.17	0.20	0.9
6.000	19.685	3.245	0.044	28.436		3.65	1.19	1	111	1.107	0.240	0.867	2.94	1.71	0.71	3	3.34	2.94	1.00E-9	1.3	1.4				183	0.17	0.20	0.9
6.100	20.013	3.365	0.044	28.945		3.78	1.16	1	111	1.125	0.250	0.875	3.04	1.66	0.69	3	3.32	3.04	1.00E-9	1.3	1.5				189	0.18	0.20	0.9
6.200	20.341	3.405	0.044	29.498		3.83	1.15	1	111	1.143	0.260	0.883	3.04	1.64	0.69	3	3.31	3.04	1.00E-9	1.4	1.5				192	0.18	0.20	0.9
6.300	20.669	3.425	0.041	30.497		3.86	1.05	1	111	1.162	0.270	0.891	3.03	1.50	0.71	3	3.30	3.03	1.00E-9	1.3	1.5				193	0.18	0.20	0.9
6.400	20.997	3.405	0.035	30.692		3.85	0.90	1	111	1.180	0.281	0.899	2.97	1.30	0.72	3	3.28	2.96	1.00E-9	1.3	1.4				192	0.18	0.20	0.9
6.500	21.325	3.425	0.031	31.200		3.87	0.81	1	111	1.198	0.291	0.907	2.95	1.17	0.73	3	3.27	2.94	1.00E-9	1.3	1.4				194	0.18	0.20	0.9
6.600	21.654	3.605	0.040	23.229		3.94	1.02	1	111	1.217	0.301	0.915	2.97	1.48	0.50	3	3.30	2.97	1.00E-9	1.4	1.5				197	0.18	0.20	0.9
6.700	21.982	3.855	0.048	8.599		3.98	1.21	1	111	1.235	0.311	0.924	2.97	1.75	0.11	3	3.34	2.97	1.00E-9	1.6	1.7				199	0.18	0.20	0.9
6.800	22.310	3.745	0.045	10.044		3.89	1.15	1	111	1.253	0.322	0.932	2.83	1.69	0.15	3	3.35	2.83	1.00E-9	1.5	1.6				194	0.18	0.19	0.8
6.900	22.638	3.725	0.044	13.147		3.91	1.12	1	111	1.271	0.332	0.940	2.81	1.65	0.23	3	3.35	2.81	1.00E-9	1.5	1.6				196	0.18	0.19	0.8
7.000	22.966	3.935	0.050	21.100		4.24	1.19	1	111	1.290	0.342	0.948	3.11	1.71	0.40	3	3.31	3.11	1.00E-9	1.6	1.7				212	0.20	0.21	0.9

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
7.100	23.294	3.955	0.053	30.792		4.40	1.21	1	111	1.308	0.352	0.956	3.23	1.73	0.60	3	3.30	3.23	1.00E-9	1.6	1.6				220	0.21	0.22	1.0
7.200	23.622	5.592	0.063	34.008		6.08	1.04	1	111	1.326	0.363	0.964	4.93	1.33	0.44	3	3.09	4.90	1.00E-9	1.9	2.0				304	0.32	0.33	1.5
7.300	23.950	9.896	0.136	24.850		10.25	1.32	5	115	1.345	0.373	0.972	9.16	1.52	0.16	4	2.87	9.06	3.00E-8	2.9	3.1				513	0.59	0.61	2.7
7.400	24.278	6.801	0.208	23.436		7.14	2.91	4	115	1.364	0.383	0.981	5.89	3.60	0.23	3	3.23	5.88	1.00E-9	2.5	2.6				357	0.38	0.39	1.8
7.500	24.606	5.243	0.083	28.273		5.65	1.47	1	111	1.382	0.393	0.989	4.32	1.94	0.38	3	3.21	4.31	1.00E-9	1.9	2.0				282	0.28	0.29	1.3
7.600	24.934	5.193	0.018	29.618		5.62	0.33	1	111	1.400	0.403	0.997	4.23	0.43	0.41	1	2.97	4.21	3.00E-8	1.6	1.7				281	0.28	0.28	1.3
7.700	25.262	4.204	0.024	29.818		4.63	0.52	1	111	1.419	0.414	1.005	3.20	0.75	0.54	1	3.16	3.19	3.00E-8	1.5	1.5				232	0.21	0.21	1.0
7.800	25.591	4.264	0.037	32.500		4.73	0.79	1	111	1.437	0.424	1.013	3.25	1.13	0.58	3	3.22	3.25	1.00E-9	1.6	1.6				237	0.22	0.22	1.0
7.900	25.919	4.344	0.051	40.579		4.93	1.04	1	111	1.455	0.434	1.021	3.40	1.48	0.72	3	3.25	3.40	1.00E-9	1.6	1.7				246	0.23	0.23	1.0
8.000	26.247	4.474	0.047	41.163		5.07	0.93	1	111	1.473	0.444	1.029	3.49	1.31	0.70	3	3.22	3.49	1.00E-9	1.7	1.7				253	0.24	0.23	1.0
8.100	26.575	4.364	0.041	41.822		4.97	0.83	1	111	1.492	0.455	1.037	3.35	1.19	0.74	3	3.22	3.35	1.00E-9	1.6	1.6				248	0.23	0.22	1.0
8.200	26.903	4.444	0.048	43.638		5.07	0.94	1	111	1.510	0.465	1.045	3.41	1.34	0.75	3	3.23	3.41	1.00E-9	1.7	1.7				254	0.24	0.23	1.0
8.300	27.231	4.574	0.056	45.824		5.23	1.08	1	111	1.528	0.475	1.053	3.52	1.52	0.76	3	3.24	3.52	1.00E-9	1.7	1.7				262	0.25	0.23	1.1
8.400	27.559	4.743	0.061	48.122		5.44	1.12	1	111	1.547	0.485	1.061	3.67	1.57	0.77	3	3.23	3.67	1.00E-9	1.8	1.8				272	0.26	0.24	1.1
8.500	27.887	4.823	0.067	50.396		5.55	1.20	1	111	1.565	0.496	1.069	3.73	1.67	0.79	3	3.24	3.73	1.00E-9	1.8	1.8				277	0.27	0.25	1.1
8.600	28.215	4.903	0.069	51.245		5.64	1.22	1	111	1.583	0.506	1.077	3.77	1.69	0.78	3	3.24	3.77	1.00E-9	1.8	1.8				282	0.27	0.25	1.1
8.700	28.543	5.183	0.070	50.472		5.91	1.19	1	111	1.601	0.516	1.085	3.97	1.63	0.72	3	3.21	3.97	1.00E-9	1.9	1.9				295	0.29	0.26	1.2
8.800	28.871	7.643	0.078	49.341		8.35	0.94	1	111	1.620	0.526	1.093	6.16	1.16	0.45	3	2.97	6.18	1.00E-9	2.4	2.4				418	0.45	0.41	1.8
8.900	29.199	10.619	0.148	42.168		11.23	1.32	5	115	1.638	0.537	1.102	8.70	1.55	0.26	4	2.90	8.74	3.00E-8	3.2	3.1				561	0.64	0.58	2.6
9.000	29.528	7.050	0.113	17.544		7.30	1.54	5	115	1.657	0.547	1.111	5.08	2.00	0.13	3	3.15	5.10	1.00E-9	2.5	2.4				365	0.38	0.34	1.5
9.100	29.856	5.952	0.068	16.960		6.20	1.10	1	111	1.676	0.557	1.119	4.04	1.51	0.15	3	3.19	4.05	1.00E-9	2.2	2.1				310	0.30	0.27	1.2
9.200	30.184	5.373	0.056	32.545		5.84	0.95	1	111	1.694	0.567	1.127	3.68	1.34	0.43	3	3.20	3.69	1.00E-9	2.0	1.9				292	0.28	0.25	1.1
9.300	30.512	5.243	0.058	42.375		5.85	0.99	1	111	1.712	0.577	1.135	3.65	1.39	0.60	3	3.21	3.66	1.00E-9	1.9	1.9				293	0.28	0.24	1.1
9.400	30.840	4.973	0.041	43.971		5.61	0.73	1	111	1.730	0.588	1.143	3.39	1.06	0.67	3	3.19	3.40	1.00E-9	1.8	1.7				280	0.26	0.23	1.0
9.500	31.168	5.103	0.039	46.722		5.78	0.68	1	111	1.749	0.598	1.151	3.50	0.98	0.69	3	3.17	3.51	1.00E-9	1.8	1.7				289	0.27	0.23	1.1
9.600	31.496	5.982	0.049	51.389		6.72	0.72	1	111	1.767	0.608	1.159	4.28	0.98	0.62	3	3.09	4.30	1.00E-9	2.0	1.9				336	0.33	0.29	1.3
9.700	31.824	5.752	0.068	54.499		6.54	1.04	1	111	1.785	0.618	1.167	4.07	1.43	0.70	3	3.17	4.09	1.00E-9	2.1	2.0				327	0.32	0.27	1.2
9.800	32.152	5.483	0.077	55.629		6.28	1.23	1	111	1.803	0.629	1.175	3.81	1.73	0.75	3	3.24	3.82	1.00E-9	2.1	2.0				314	0.30	0.25	1.1
9.900	32.480	5.842	0.081	54.524		6.63	1.22	1	111	1.822	0.639	1.183	4.06	1.69	0.68	3	3.21	4.08	1.00E-9	2.1	2.0				331	0.32	0.27	1.2
10.000	32.808	6.761	0.071	50.328		7.49	0.94	1	111	1.840	0.649	1.191	4.74	1.25	0.53	3	3.09	4.78	1.00E-9	2.3	2.2				374	0.38	0.32	1.4
10.100	33.136	6.851	0.040	44.467		7.49	0.54	1	111	1.858	0.659	1.199	4.70	0.72	0.45	4	3.00	4.75	3.00E-8	2.2	2.1				375	0.38	0.31	1.4
10.200	33.465	8.828	0.047	43.763		9.46	0.50	1	111	1.877	0.670	1.207	6.28	0.62	0.33	4	2.86	6.39	3.00E-8	2.6	2.4				473	0.51	0.42	1.9
10.300	33.793	16.158	0.132	35.572		16.67	0.79	6	115	1.895	0.680	1.216	12.15	0.90	0.13	4	2.66	12.49	3.00E-8	4.3	4.0				833	0.98	0.81	3.6
10.400	34.121	12.732	0.140	30.905		13.18	1.06	6	115	1.914	0.690	1.224	9.20	1.24	0.14	4	2.83	9.40	3.00E-8	3.7	3.4				659	0.75	0.61	2.8
10.500	34.449	8.299	0.073	36.320		8.82	0.83	1	111	1.932	0.700	1.232	5.59	1.06	0.28	3	2.99	5.67	1.00E-9	2.6	2.4				441	0.46	0.37	1.7
10.600	34.777	5.563	0.051	47.526		6.25	0.81	1	111	1.951	0.711	1.240	3.46	1.18	0.63	3	3.20	3.48	1.00E-9	2.0	1.9				312	0.29	0.23	1.0
10.700	35.105	5.393	0.042	52.551		6.15	0.69	1	111	1.969	0.721	1.248	3.35	1.01	0.73	3	3.19	3.37	1.00E-9	2.0	1.8				307	0.28	0.22	1.0
10.800	35.433	6.321	0.067	54.335		7.10	0.94	1	111	1.987	0.731	1.256	4.07	1.30	0.62	3	3.16	4.10	1.00E-9	2.2	2.1				355	0.34	0.27	1.2
10.900	35.761	8.918	0.106	67.822		9.89	1.07	5	115	2.006	0.741	1.265	6.24	1.34	0.53	3	3.00	6.34	1.00E-9	2.8	2.6				495	0.53	0.42	1.9
11.000	36.089	10.855	0.135	84.895		12.08	1.12	6	115	2.025	0.751	1.273	7.89	1.34	0.53	4	2.90	8.07	3.00E-8	3.3	3.0				604	0.67	0.53	2.4
11.100	36.417	10.945	0.140	93.243		12.29	1.14	6	115	2.044	0.762	1.282	7.99	1.37	0.58	4	2.90	8.18	3.00E-8	3.3	3.0				614	0.68	0.53	2.4
11.200	36.745	10.086	0.122	88.143		11.36	1.07	6	115	2.062	0.772	1.290	7.20	1.31	0.60	4	2.93	7.36	3.00E-8	3.1	2.8				568	0.62	0.48	2.2
11.300	37.073	8.049	0.077	75.014		9.13	0.84	1	111	2.081	0.782	1.299	5.43	1.09	0.66	3	3.01	5.53	1.00E-9	2.6	2.3				456	0.47	0.36	1.6
11.400	37.402	6.601	0.070	68.130		7.58	0.92	1	111	2.099	0.792	1.307	4.20	1.28	0.75	3	3.14	4.24	1.00E-9	2.3	2.1				379	0.37	0.28	1.3
11.500	37.730	6.321	0.064	63.261		7.23	0.88	1	111	2.117	0.803	1.315	3.89	1.24	0.73	3	3.17	3.93	1.00E-9	2.3	2.0				362	0.34	0.26	1.2
11.600	38.058	6.241	0.064	63.707		7.16	0.90	1	111	2.136	0.813	1.323	3.80	1.28	0.75	3	3.18	3.83	1.00E-9	2.2	2.0				358	0.33	0.25	1.1
11.700	38.386	6.231	0.057	65.165		7.17	0.80	1	111	2.154	0.823	1.331	3.77	1.14	0.77	3	3.16	3.81	1.00E-9	2.2	2.0				358	0.33	0.25	1.1
11.800	38.714	5.562	0.094	56.270		6.37	1.48	1	111	2.172	0.833	1.339	3.14	2.25	0.77	3	3.36	3.14	1.00E-9	2.3	2.0				319	0.28	0.21	0.9
11.900	39.042	6.072	0.071	58.977		6.92	1.03	1	111	2.190	0.844	1.347	3.51	1.51	0.72	3	3.24	3.53	1.00E-9	2.3	2.0				346	0.32	0.23	1.1
12.000	39.370	5.952	0.038	60.039		6.82	0.56	1	111	2.209	0.854	1.355	3.40	0.83	0.75	1	3.15	3.44	3.00E-8	2.1	1.9				341	0.31	0.23	1.0
12.100	39.698	6.012	0.034	60.472		6.88	0.50	1	111	2.227	0.864	1.363	3.42	0.74	0.75	1	3.13	3.46	3.00E-8	2.1	1.8				344	0.31	0.23	1.0
12.200	40.026	6.142	0.052	66.144		7.09	0.74	1	111	2.245	0.874	1.371	3.54	1.08	0.80	3	3.18	3.57	1.00E-9	2.2	1.9				355	0.32	0.24	1.1
12.300	40.354	7.040	0.072	72.614		8.09	0.89	1	111	2.263	0.885	1.379	4.22	1.24	0.75	3	3.13	4.28	1.00E-9	2.5	2.2				404	0.39	0.28	1.3
12.400	40.682	7.410	0.075	77.332		8.52	0.88	1	111	2.282	0.895	1.387	4.50	1.20	0.75	3	3.10	4.58	1.00E-9	2.5	2.2				426	0.42	0.30	1.4
12.500	41.011	8.758	0.086	82.690		9.95	0.87	5	115	2.301	0.905	1.396	5.48	1.13	0.66	3	3.01	5.62	1.00E-9	2.8	2.5				497	0.51	0.37	1.6
12.600	41.339	10.036	0.121	80.347		11.19	1.08	6	115	2.319	0.915	1.404	6.32	1.36	0.55	3	2.99	6.49	1.00E-9	3.2	2.8				560	0.59	0.42	1.9
12.700	41.667	9.397	0.134	70.812		10.42	1.28	5	115	2.338	0.926	1.413	5.72	1.65	0.52	3	3.07	5.84	1.00E-9	3.1	2.7				521	0.54	0.38	1.7
12.800	41.995	7.819	0.141	69.235		8.82	1.60	5	115	2.357	0.936	1.421	4.55	2.18	0.63	3	3.22	4.58	1.00E-9	2.9	2.5				441	0.43	0.30	1.4
12.900	42.323	7.619	0.156	69.738		8.62	1.81	5	115	2.376	0.946	1.430	4.37	2.50	0.65	3	3.26	4.39	1.00E-9	2.9	2.5				431	0.42	0.29	1.3
13.000	42.651	12.233	0.158	60.315		13.10	1.21	6	115	2.395	0.956	1.438	7.44	1.48	0.32	4	2.95	7.70	3.00E-8	3.8	3.2				655	0.71	0.50	2.2
13.100	42.979	14.729	0.272	44.643		15.37	1.77	6	115	2.413	0.966	1.447	8.96	2.10	0.17	3	2.95	9.26	1.00E-9	4.6	3.9				769	0.86	0.60	2.7
13.200	43.307	16.987	0.174	44.008		17.62	0.99	6	115	2.432	0.977	1.455	10.44	1.15	0.14	4	2.77	10.99	3.00E-8	4.7	4.0				881	1.01	0.70	3.1
13.300	43.635	12.693	0.155	40.767		13.28	1.17	6	115	2.451	0.987	1.464	7.40	1.43	0.18	4	2.94	7.66	3.00E-8	3.9	3.3				664	0.72	0.49	2.2
13.400	43.963	7.880	0.130	54.988		8.67	1.50	5	115	2.470	0.997	1.473	4.21	2.10	0.48	3	3.24	4.24	1.00E-9	3.0	2.5				434	0.41	0.28	1.3
13.500	44.291	7.989	0.096	64.241		8.91	1.08	5	115	2.489	1.007	1.481	4.34	1.49	0.56	3	3.16	4.40	1.00E-9	2.8	2.4				446	0.43	0.29	1.3
13.600	44.619	9.107	0.125	81.427		10.28	1.22	5	115	2.507	1.018	1.490	5.22	1.61	0.62	3	3.10	5.33	1.00E-9	3.1	2.6				514	0.52	0.35	1.6
13.700	44.948	11.295	0.173	90.272		12.59	1.37	6	115	2.526	1.028	1.498	6.72	1.71	0.54	3	3.02	6.93	1.00E-9	3.6	3.1				630	0.67	0.45	2.0
13.800	45.276	11.464	0.189	79.078		12.60	1.50	5	115	2.545	1.038	1.507	6.68	1.88	0.46	3	3.04	6.87	1.00E-9	3.8	3.1				630	0.67	0.45	2.0
13.900	45.604	11.464	0.185	66.396		12.42	1.49	5	115	2.564	1.048	1.515	6.50	1.88	0.38	3	3.05	6.69	1.00E-9	3.8	3.2				621	0.66	0.43	2.0
14.000	45.932	9.497	0.179	82.966		10.69	1.68	5	115	2.582	1.059	1.524	5.32	2.21	0.61	3	3.16	5.41	1.00E-9	3.4	2.8				535	0.54	0.35	1.6
14.100	46.260	8.588	0.118	89.003		9.87	1.20	5	115	2.601	1.069	1.532	4.74	1.63	0.73	3	3.14	4.83	1.00E-9	3.0	2.5				493	0.48	0.32	1.4
14.200	46.588	9.277	0.114	91.622		10.60	1.08	5	115	2.620	1.079	1.541	5.18	1.43	0.69	3	3.08	5.31	1.00E-9	3.1	2.6				530	0.53	0.35	1.6
14.300	46.916	9.107	0.140	92.565		10.44	1.34	5	115	2.639	1.089	1.550	5.03	1.79	0.71	3	3.14	5.13	1.00E-9	3.2	2.6				522	0.52	0.34	1.5
14.400	47.244	10.995	0.206	83.325		12.19	1.69	5	115	2.658	1.100	1.558	6.12	2.16	0.51	3	3.10	6.27	1.00E-9	3.8	3.1				610	0.64	0.41	1.8
14.500	47.572	9.098	0.158	68.569		10.09	1.56	5	115	2.676	1.110	1.567	4.73	2.13	0.52	3	3.20	4.79	1.00E-9	3.3	2.7				504	0.49	0.32	1.4
14.600	47.900	9.956	0.172	79.914		11.11	1.55	5	115	2.695	1.120	1.575	5.34	2.04	0.55	3	3.14	5.45	1.00E-9	3.5	2.9				555	0.56	0.36	1.6
14.700	48.228	18.115	0.398	65.862		19.06	2.09	6	115	2.714	1.130	1.584	10.32	2.43	0.22	3	2.93	10.80	1.00E-9	5.6	4.5				953	1.09	0.69	3.1
14.800	48.556	17.516	0.449	45.466		18.17	2.47	5	115	2.733	1.140	1.592	9.69	2.91	0.14	3	3.00	10.07	1.00E-9	5.6	4.6				909	1.03	0.65	2.9
14.900	48.885	11.294	0.198	80.510		12.45	1.59	5	115	2.752	1.151	1.601	6.06	2.04	0.48	3	3.09	6.22	1.00E-9	3.8	3.1				623	0.65	0.40	1.8
15.000	49.213	9.776	0.140	99.198		11.20	1.25	5	115	2.770	1.161	1.610	5.24	1.66	0.71	3	3.10	5.38	1.00E-9	3.3	2.7				560	0.56	0.35	1.6
15.100	49.541	12.263	0.179	103.507		13.75	1.30	6	115	2.789	1.171	1.618	6.78	1.63	0.57	3	3.00	7.04	1.00E-9	3.9	3.2				688	0.73	0.45	2.0
15.200	49.869	12.273	0.201	108.884		13.84	1.45	6	115	2.808	1.181	1.627	6.78	1.82	0.60	3	3.03	7.03	1.00E-9	4.0	3.2				692	0.74	0.45	2.0
15.300	50.197	11.375	0.170	112.094		12.99	1.31	6	115	2.827	1.192	1.635	6.21	1.67	0.68	3	3.04	6.43	1.00E-9	3.7	3.0				649	0.68	0.41	1.9
15.400	50.525	11.264	0.149	116.692		12.94	1.15	6	115	2.846	1.202	1.644	6.14	1.47	0.71	3	3.02	6.38	1.00E-9	3.6	2.9				647	0.67	0.41	1.8
15.500	50.853	12.453	0.160	120.637		14.19	1.13	6	115	2.864	1.212	1.652	6.85	1.41	0.66	3	2.97	7.17	1.00E-9	3.9	3.1				709	0.76	0.46	2.1
15.600	51.181	12.543	0.202	110.806		14.14	1.43	6	115	2.883	1.222	1.661	6.78	1.79	0.60	3	3.02	7.04	1.00E-9	4.1	3.2				707	0.75	0.45	2.0
15.700	51.509	10.296	0.224	93.696		11.65	1.92	5	115	2.902	1.233	1.669	5.24	2.56	0.63	3	3.20	5.32	1.00E-9	3.8	3.0				582	0.58	0.35	1.6
15.800	51.837	21.381	0.449	56.427		22.19	2.02	6	115	2.921	1.243	1.678	11.49	2.33	0.15	4	2.89	12.17	3.00E-8	6.4	5.1				1110	1.28	0.77	3.4
15.900	52.165	20.152	0.392	21.106		20.46	1.92	6	115	2.940	1.253	1.687	10.39	2.24	0.02	3	2.91	10.97	1.00E-9	6.1	4.8				1023	1.17	0.69	3.1

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{t1}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
16.000	52.493	16.907	0.362	37.740		17.45	2.07	5	115	2.958	1.263	1.695	8.55	2.50	0.10	3	3.01	8.92	1.00E-9	5.4	4.3				873	0.97	0.57	2.6
16.100	52.822	38.297	1.021	42.903		38.92	2.62	6	115	2.977	1.274	1.704	21.09	2.84	0.05	4	2.72	22.93	3.00E-8	10.4	8.2				1946	2.40	1.41	6.3
16.200	53.150	51.089	1.961	2.425		51.12	3.84	5	115	2.996	1.284	1.712	28.11	4.07	-0.02	4	2.73	30.56	3.00E-8	13.9	11.0				2556	3.21	1.87	8.4
16.300	53.478	29.789	1.916	-3.932		29.73	6.45	3	111	3.014	1.294	1.720	15.53	7.17	-0.06	3	3.08	16.05	1.00E-9	10.0	7.9				1487	1.78	1.04	4.7
16.400	53.806	24.646	1.676	-2.952		24.60	6.81	3	111	3.033	1.304	1.728	12.48	7.77	-0.07	3	3.18	12.72	1.00E-9	8.9	6.9				1230	1.44	0.83	3.7
16.500	54.134	24.037	1.741	-1.904		24.01	7.25	3	111	3.051	1.314	1.736	12.07	8.31	-0.07	3	3.21	12.25	1.00E-9	8.8	6.9				1200	1.40	0.80	3.6
16.600	54.462	27.422	1.811	-1.043		27.41	6.61	3	111	3.069	1.325	1.744	13.95	7.44	-0.06	3	3.13	14.33	1.00E-9	9.5	7.4				1370	1.62	0.93	4.2
16.700	54.790	25.425	1.569	0.352		25.43	6.17	3	111	3.087	1.335	1.752	12.75	7.02	-0.06	3	3.14	13.07	1.00E-9	8.9	6.9				1271	1.49	0.85	3.8
16.800	55.118	29.879	1.576	2.261		29.91	5.27	3	111	3.106	1.345	1.760	15.23	5.88	-0.04	3	3.03	15.88	1.00E-9	9.7	7.6				1496	1.79	1.02	4.6
16.900	55.446	41.323	1.810	4.234		41.38	4.37	4	115	3.124	1.355	1.769	21.63	4.73	-0.03	3	2.85	23.19	1.00E-9	12.1	9.4				2069	2.55	1.44	6.5
17.000	55.774	40.674	1.765	5.163		40.75	4.33	4	115	3.143	1.366	1.778	21.15	4.69	-0.03	3	2.86	22.68	1.00E-9	12.0	9.2				2037	2.51	1.41	6.3
17.100	56.102	33.853	1.622	5.546		33.93	4.78	4	115	3.162	1.376	1.786	17.23	5.27	-0.03	3	2.96	18.19	1.00E-9	10.6	8.1				1697	2.05	1.15	5.2
17.200	56.430	29.969	1.401	5.189		30.04	4.66	4	115	3.181	1.386	1.795	14.97	5.22	-0.04	3	3.00	15.70	1.00E-9	9.6	7.4				1502	1.79	1.00	4.5
17.300	56.759	19.343	0.796	5.716		19.43	4.10	4	115	3.200	1.396	1.803	9.00	4.90	-0.06	3	3.16	9.21	1.00E-9	6.9	5.3				971	1.08	0.60	2.7
17.400	57.087	23.478	0.769	6.463		23.57	3.26	5	115	3.218	1.407	1.812	11.23	3.78	-0.05	3	3.01	11.78	1.00E-9	7.6	5.8				1179	1.36	0.75	3.4
17.500	57.415	40.184	0.948	6.388		40.28	2.35	6	115	3.237	1.417	1.820	20.35	2.56	-0.03	4	2.71	22.44	3.00E-8	10.9	8.3				2014	2.47	1.36	6.1
17.600	57.743	34.502	1.166	7.192		34.61	3.37	5	115	3.256	1.427	1.829	17.14	3.72	-0.03	3	2.86	18.43	1.00E-9	10.2	7.7				1730	2.09	1.14	5.1
17.700	58.071	48.902	1.648	7.751		49.01	3.36	5	115	3.275	1.437	1.838	24.89	3.60	-0.02	4	2.73	27.38	3.00E-8	13.4	10.2				2451	3.05	1.66	7.5
17.800	58.399	65.579	2.187	7.343		65.68	3.33	6	115	3.294	1.448	1.846	33.80	3.51	-0.01	4	2.62	37.88	3.00E-8	17.0	12.8				3284	4.16	2.25	10.1
17.900	58.727	69.993	2.338	7.406		70.10	3.34	6	115	3.312	1.458	1.855	36.01	3.50	-0.01	4	2.60	40.54	3.00E-8	17.9	13.5				3505	4.45	2.40	10.8
18.000	59.055	71.201	2.600	8.599		71.33	3.65	6	115	3.331	1.468	1.863	36.49	3.82	-0.01	4	2.62	40.97	3.00E-8	18.4	13.9				3566	4.53	2.43	10.9
18.100	59.383	90.764	2.377	8.135		90.88	2.62	7	118	3.351	1.478	1.872	46.75	2.72	-0.01	5	2.44	54.19	3.00E-6	21.5	16.2	39	36	364	1016			
18.200	59.711	93.930	1.838	6.997		94.03	1.95	7	118	3.370	1.488	1.881	48.19	2.03	-0.01	5	2.35	56.84	3.00E-6	21.4	16.0	40	37	376	1030			
18.300	60.039	94.469	0.953	4.384		94.53	1.01	8	121	3.390	1.499	1.891	48.20	1.05	-0.01	5	2.17	58.70	3.00E-6	19.9	14.9	41	37	378	1033			

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Sounding:	CPT--04
Site:	RESOLUTION MINE	Date:	7/30/2009
Engineer:	B.BURGESS	Time:	6:44 AM

Col 1 Depth (m)	Col 2 Depth (ft)	Col 3 q_c (tsf)	Col 4 f_s (tsf)	Col 5 u (psi)	Col 6 Other	Col 7 q_t (tsf)	Col 8 R_f (%)
0.050	0.164	0.000	0.000	0.000			
0.100	0.328	0.000	0.000	0.000			
0.150	0.492	0.000	0.000	0.000			
0.200	0.656	0.000	0.000	0.000			
0.250	0.820	0.000	0.000	0.000			
0.300	0.984	0.000	0.000	0.000			
0.350	1.148	0.000	0.000	0.000			
0.400	1.312	0.000	0.000	0.000			
0.450	1.476	0.000	0.000	0.000			
0.500	1.640	0.000	0.000	0.000			
0.550	1.804	0.000	0.000	0.000			
0.600	1.969	0.000	0.000	0.000			
0.650	2.133	16.625	0.261	0.289		16.63	1.57
0.700	2.297	17.351	0.394	-0.109		17.35	2.27
0.750	2.461	19.665	0.389	1.157		19.68	1.98
0.800	2.625	25.072	0.575	1.338		25.09	2.29
0.850	2.789	21.467	0.500	1.410		21.49	2.33
0.900	2.953	14.984	0.482	1.446		15.00	3.21
0.950	3.117	16.168	0.449	1.519		16.19	2.77
1.000	3.281	9.873	0.313	1.555		9.90	3.16
1.050	3.445	14.742	0.243	1.591		14.76	1.65
1.100	3.609	40.271	0.318	1.591		40.29	0.79
1.150	3.773	38.549	0.402	1.555		38.57	1.04
1.200	3.937	31.609	0.452	1.555		31.63	1.43
1.250	4.101	25.153	0.530	1.555		25.18	2.11
1.300	4.265	18.615	0.695	1.519		18.64	3.73
1.350	4.429	11.002	0.411	1.483		11.02	3.73
1.400	4.593	7.855	0.270	1.519		7.88	3.43
1.450	4.757	17.916	0.302	1.627		17.94	1.68
1.500	4.921	14.204	0.360	1.591		14.23	2.53
1.550	5.085	7.344	0.287	1.591		7.37	3.90
1.600	5.249	10.680	0.269	2.025		10.71	2.51
1.650	5.413	14.688	0.290	2.133		14.72	1.97
1.700	5.577	10.518	0.244	2.097		10.55	2.31
1.750	5.741	13.208	0.327	2.061		13.24	2.47
1.800	5.906	11.325	0.379	1.989		11.35	3.34
1.850	6.070	8.877	0.301	2.025		8.91	3.38
1.900	6.234	5.515	0.190	1.989		5.54	3.43
1.950	6.398	11.541	0.227	2.061		11.57	1.96

2.000	6.562	11.648	0.261	2.097	11.68	2.23
2.050	6.726	6.725	0.209	2.061	6.75	3.09
2.100	6.890	5.434	0.139	2.061	5.46	2.54
2.150	7.054	5.192	0.082	2.097	5.22	1.57
2.200	7.218	5.273	0.065	2.748	5.31	1.22
2.250	7.382	4.250	0.064	2.965	4.29	1.49
2.300	7.546	4.089	0.051	3.218	4.14	1.23
2.350	7.710	4.116	0.049	3.472	4.17	1.18
2.400	7.874	4.008	0.048	3.761	4.06	1.18
2.450	8.038	3.820	0.048	4.158	3.88	1.24
2.500	8.202	4.681	0.124	4.593	4.75	2.61
2.550	8.366	12.590	0.218	4.882	12.66	1.72
2.600	8.530	13.961	0.376	4.773	14.03	2.68
2.650	8.694	11.864	0.166	4.701	11.93	1.39
2.700	8.858	12.186	0.145	4.665	12.25	1.18
2.750	9.022	19.261	0.307	4.375	19.32	1.59
2.800	9.186	15.495	0.397	4.231	15.56	2.55
2.850	9.350	8.070	0.317	4.158	8.13	3.90
2.900	9.514	5.461	0.145	4.195	5.52	2.63
2.950	9.678	8.770	0.171	4.520	8.84	1.94
3.000	9.843	15.280	0.333	5.750	15.36	2.17
3.050	10.007	8.097	0.360	5.569	8.18	4.40
3.100	10.171	10.572	0.370	5.569	10.65	3.47
3.150	10.335	10.007	0.291	5.569	10.09	2.88
3.200	10.499	6.053	0.177	5.497	6.13	2.89
3.250	10.663	5.569	0.086	5.460	5.65	1.52
3.300	10.827	5.784	0.053	5.460	5.86	0.90
3.350	10.991	6.349	0.091	5.533	6.43	1.42
3.400	11.155	5.999	0.099	5.822	6.08	1.63
3.450	11.319	5.326	0.085	6.039	5.41	1.57
3.500	11.483	9.308	0.256	6.473	9.40	2.72
3.550	11.647	10.868	0.240	6.618	10.96	2.19
3.600	11.811	6.752	0.211	6.545	6.85	3.08
3.650	11.975	7.317	0.163	6.907	7.42	2.20
3.700	12.139	6.564	0.174	7.377	6.67	2.61
3.750	12.303	31.716	0.230	9.258	31.85	0.72
3.800	12.467	34.030	0.295	9.185	34.16	0.86
3.850	12.631	35.886	0.418	8.498	36.01	1.16
3.900	12.795	33.815	0.571	8.100	33.93	1.68
3.950	12.959	19.261	0.465	7.775	19.37	2.40
4.000	13.123	28.219	0.527	7.702	28.33	1.86
4.050	13.287	17.862	0.588	7.594	17.97	3.27
4.100	13.451	11.110	0.476	7.558	11.22	4.24
4.150	13.615	7.156	0.349	7.485	7.26	4.80
4.200	13.780	5.945	0.193	7.522	6.05	3.19
4.250	13.944	5.165	0.108	7.775	5.28	2.05
4.300	14.108	4.654	0.098	8.390	4.77	2.05
4.350	14.272	4.277	0.105	9.185	4.41	2.38
4.400	14.436	5.569	0.111	10.198	5.72	1.94
4.450	14.600	18.992	0.326	10.921	19.15	1.70
4.500	14.764	13.101	0.441	8.787	13.23	3.33
4.550	14.928	7.479	0.359	7.811	7.59	4.73

4.600	15.092	4.573	0.216	8.245	4.69	4.60
4.650	15.256	4.385	0.081	9.113	4.52	1.79
4.700	15.420	4.008	0.021	9.908	4.15	0.51
4.750	15.584	4.197	0.064	10.849	4.35	1.47
4.800	15.748	2.367	0.129	10.993	2.53	5.11
4.850	15.912	9.173	0.122	14.718	9.38	1.30
4.900	16.076	7.210	0.104	13.308	7.40	1.41
4.950	16.240	6.913	0.078	12.693	7.10	1.10
5.000	16.404	7.021	0.069	12.440	7.20	0.96
5.050	16.568	6.941	0.167	12.332	7.12	2.35
5.100	16.732	8.285	0.186	12.332	8.46	2.20
5.150	16.896	7.963	0.170	12.332	8.14	2.09
5.200	17.060	5.488	0.130	12.910	5.67	2.29
5.250	17.224	4.896	0.090	13.959	5.10	1.77
5.300	17.388	5.810	0.093	15.550	6.03	1.54
5.350	17.552	4.896	0.094	16.744	5.14	1.83
5.400	17.717	4.439	0.122	18.298	4.70	2.59
5.450	17.881	4.600	0.078	20.034	4.89	1.60
5.500	18.045	4.223	0.070	23.289	4.56	1.54
5.550	18.209	4.788	0.096	25.314	5.15	1.86
5.600	18.373	4.977	0.088	26.761	5.36	1.64
5.650	18.537	4.466	0.080	28.713	4.88	1.64
5.700	18.701	4.223	0.053	31.498	4.68	1.13
5.750	18.865	4.492	0.061	34.680	4.99	1.22
5.800	19.029	5.945	0.098	38.224	6.50	1.51
5.850	19.193	6.322	0.114	41.696	6.92	1.65
5.900	19.357	5.165	0.093	39.924	5.74	1.62
5.950	19.521	4.573	0.064	40.647	5.16	1.24
6.000	19.685	5.165	0.085	44.191	5.80	1.47
6.050	19.849	6.429	0.101	45.710	7.09	1.43
6.100	20.013	6.645	0.167	45.783	7.30	2.29
6.150	20.177	9.792	0.306	48.893	10.50	2.92
6.200	20.341	35.752	0.428	32.402	36.22	1.18
6.250	20.505	43.472	0.572	8.209	43.59	1.31
6.300	20.669	26.148	0.682	1.736	26.17	2.61
6.350	20.833	14.258	0.528	1.772	14.28	3.70
6.400	20.997	12.913	0.392	1.989	12.94	3.03
6.450	21.161	29.026	0.690	2.531	29.06	2.37
6.500	21.325	19.100	0.544	2.567	19.14	2.84
6.550	21.490	64.401	0.699	2.567	64.44	1.08
6.600	21.654	99.965	0.896	2.676	100.00	0.90
6.650	21.818	62.464	1.058	2.676	62.50	1.69
6.700	21.982	31.367	0.839	2.640	31.41	2.67
6.750	22.146	19.907	0.879	2.640	19.95	4.41
6.800	22.310	17.351	0.687	2.712	17.39	3.95
6.850	22.474	15.092	0.565	2.748	15.13	3.73
6.900	22.638	11.272	0.397	2.784	11.31	3.51
6.950	22.802	6.564	0.296	2.784	6.60	4.48
7.000	22.966	5.515	0.167	3.110	5.56	3.00
7.050	23.130	15.307	0.330	3.905	15.36	2.15
7.100	23.294	19.987	0.421	4.231	20.05	2.10
7.150	23.458	14.580	0.530	4.195	14.64	3.62

7.200	23.622	10.572	0.376	4.195	10.63	3.54
7.250	23.786	5.434	0.227	4.231	5.49	4.13
7.300	23.950	5.300	0.102	4.918	5.37	1.90
7.350	24.114	5.165	0.081	5.931	5.25	1.54
7.400	24.278	5.084	0.121	7.196	5.19	2.33
7.450	24.442	6.618	0.131	8.715	6.74	1.94
7.500	24.606	34.945	0.314	10.234	35.09	0.89
7.550	24.770	31.609	0.641	9.366	31.74	2.02
7.600	24.934	20.284	0.517	8.498	20.41	2.53
7.650	25.098	27.278	0.421	7.992	27.39	1.54
7.700	25.262	37.420	0.438	7.485	37.53	1.17
7.750	25.427	34.164	0.676	6.799	34.26	1.97
7.800	25.591	19.987	0.641	5.569	20.07	3.19
7.850	25.755	13.504	0.507	5.497	13.58	3.73
7.900	25.919	12.105	0.376	5.569	12.19	3.09
7.950	26.083	9.873	0.342	5.750	9.96	3.44
8.000	26.247	25.879	0.630	5.967	25.96	2.43
8.050	26.411	14.903	0.617	5.858	14.99	4.12
8.100	26.575	10.330	0.476	5.858	10.41	4.57
8.150	26.739	8.313	0.453	5.822	8.40	5.39
8.200	26.903	10.707	0.484	5.822	10.79	4.49
8.250	27.067	9.173	0.425	6.075	9.26	4.59
8.300	27.231	6.322	0.245	6.328	6.41	3.82
8.350	27.395	7.317	0.226	7.377	7.42	3.04
8.400	27.559	10.142	0.168	8.390	10.26	1.64
8.450	27.723	14.527	0.486	8.715	14.65	3.32
8.500	27.887	16.786	0.606	8.860	16.91	3.58
8.550	28.051	11.379	0.501	8.787	11.51	4.35
8.600	28.215	8.285	0.512	9.041	8.42	6.08
8.650	28.379	14.607	0.437	9.764	14.75	2.96
8.700	28.543	10.088	0.367	9.402	10.22	3.59
8.750	28.707	10.303	0.277	9.908	10.45	2.65
8.800	28.871	16.221	0.476	10.812	16.38	2.91
8.850	29.035	19.019	0.677	10.596	19.17	3.53
8.900	29.199	11.487	0.536	10.198	11.63	4.61
8.950	29.364	7.182	0.319	10.451	7.33	4.35
9.000	29.528	17.970	0.321	13.055	18.16	1.77
9.050	29.692	34.783	0.643	12.910	34.97	1.84
9.100	29.856	24.346	0.577	11.934	24.52	2.35
9.150	30.020	19.826	0.506	10.162	19.97	2.53
9.200	30.184	21.763	0.604	9.981	21.91	2.76
9.250	30.348	12.213	0.486	9.185	12.35	3.94
9.300	30.512	7.667	0.345	10.017	7.81	4.42
9.350	30.676	6.698	0.170	12.151	6.87	2.47
9.400	30.840	6.618	0.114	15.369	6.84	1.67
9.450	31.004	8.043	0.213	19.094	8.32	2.56
9.500	31.168	8.070	0.166	21.517	8.38	1.98
9.550	31.332	7.398	0.296	23.831	7.74	3.82
9.600	31.496	11.621	0.254	27.339	12.01	2.11
9.650	31.660	6.887	0.237	25.169	7.25	3.27
9.700	31.824	6.483	0.135	30.305	6.92	1.95
9.750	31.988	6.645	0.106	35.693	7.16	1.48

9.800	32.152	6.026	0.082	42.528	6.64	1.24
9.850	32.316	5.192	0.073	43.396	5.82	1.25
9.900	32.480	6.107	0.071	53.268	6.87	1.03
9.950	32.644	6.214	0.065	56.993	7.03	0.92
10.000	32.808	6.322	0.073	59.524	7.18	1.02
10.050	32.972	6.376	0.069	60.248	7.24	0.95
10.100	33.136	6.564	0.060	60.501	7.44	0.81
10.150	33.301	6.349	0.064	61.152	7.23	0.89
10.200	33.465	6.591	0.073	63.575	7.51	0.97
10.250	33.629	6.941	0.094	65.636	7.89	1.19
10.300	33.793	8.823	0.121	68.421	9.81	1.23
10.350	33.957	8.205	0.137	59.271	9.06	1.51
10.400	34.121	7.102	0.125	62.165	8.00	1.56
10.450	34.285	7.909	0.071	63.069	8.82	0.81
10.500	34.449	9.335	0.229	61.839	10.23	2.24
10.550	34.613	10.034	0.255	41.154	10.63	2.40
10.600	34.777	6.698	0.243	41.262	7.29	3.33
10.650	34.941	6.187	0.171	50.014	6.91	2.48
10.700	35.105	7.102	0.167	55.908	7.91	2.11
10.750	35.269	16.974	0.169	47.374	17.66	0.96
10.800	35.433	21.521	0.452	23.976	21.87	2.07
10.850	35.597	11.836	0.499	19.275	12.11	4.12
10.900	35.761	7.479	0.313	22.855	7.81	4.01
10.950	35.925	9.684	0.356	29.545	10.11	3.52
11.000	36.089	12.509	0.251	28.099	12.91	1.94
11.050	36.253	10.518	0.290	28.026	10.92	2.66
11.100	36.417	8.151	0.246	32.004	8.61	2.86
11.150	36.581	8.124	0.201	37.501	8.66	2.32
11.200	36.745	10.599	0.198	41.841	11.20	1.77
11.250	36.909	29.376	0.697	39.237	29.94	2.33
11.300	37.073	16.679	0.718	10.704	16.83	4.27
11.350	37.238	9.631	0.548	10.162	9.78	5.60
11.400	37.402	7.344	0.233	12.729	7.53	3.10
11.450	37.566	6.752	0.127	16.020	6.98	1.82
11.500	37.730	7.236	0.132	20.396	7.53	1.75
11.550	37.894	7.667	0.120	24.663	8.02	1.50
11.600	38.058	7.021	0.135	28.641	7.43	1.82
11.650	38.222	7.748	0.124	35.295	8.26	1.50
11.700	38.386	12.590	0.134	41.371	13.19	1.02
11.750	38.550	24.964	0.465	43.793	25.59	1.82
11.800	38.714	21.171	0.407	18.515	21.44	1.90
11.850	38.878	12.321	0.588	19.962	12.61	4.66
11.900	39.042	9.092	0.488	21.553	9.40	5.19
11.950	39.206	8.474	0.299	26.942	8.86	3.37
12.000	39.370	9.711	0.131	34.246	10.20	1.28
12.050	39.534	9.173	0.098	39.273	9.74	1.01
12.100	39.698	8.689	0.084	45.493	9.34	0.90
12.150	39.862	8.124	0.085	50.556	8.85	0.96
12.200	40.026	7.290	0.077	58.548	8.13	0.95
12.250	40.190	7.317	0.057	64.371	8.24	0.69
12.300	40.354	8.151	0.060	68.638	9.14	0.66
12.350	40.518	8.447	0.072	68.746	9.44	0.76

12.400	40.682	7.721	0.070	73.267	8.78	0.80
12.450	40.846	7.801	0.062	76.883	8.91	0.70
12.500	41.011	7.882	0.078	79.234	9.02	0.86
12.550	41.175	8.420	0.099	81.656	9.60	1.03
12.600	41.339	8.420	0.111	76.341	9.52	1.17
12.650	41.503	7.640	0.119	73.990	8.71	1.37
12.700	41.667	7.263	0.082	72.435	8.31	0.99
12.750	41.831	6.833	0.080	68.168	7.81	1.02
12.800	41.995	14.150	0.276	70.627	15.17	1.82
12.850	42.159	43.822	0.305	37.320	44.36	0.69
12.900	42.323	39.599	0.559	4.412	39.66	1.41
12.950	42.487	22.301	0.670	4.593	22.37	3.00
13.000	42.651	11.971	0.502	6.184	12.06	4.16
13.050	42.815	11.971	0.260	8.137	12.09	2.15
13.100	42.979	11.675	0.114	9.221	11.81	0.97
13.150	43.143	9.227	0.155	10.415	9.38	1.65
13.200	43.307	8.339	0.136	13.236	8.53	1.59
13.250	43.471	14.930	0.248	16.744	15.17	1.63
13.300	43.635	16.168	0.345	18.732	16.44	2.10
13.350	43.799	13.128	0.349	22.999	13.46	2.59
13.400	43.963	13.827	0.250	29.943	14.26	1.75
13.450	44.127	15.118	0.229	38.839	15.68	1.46
13.500	44.291	18.077	0.268	43.613	18.71	1.43
13.550	44.455	17.943	0.389	49.146	18.65	2.09
13.600	44.619	28.946	0.765	41.624	29.55	2.59
13.650	44.783	15.253	0.733	30.341	15.69	4.67
13.700	44.948	9.631	0.506	31.534	10.09	5.02
13.750	45.112	8.259	0.219	36.344	8.78	2.49
13.800	45.276	9.120	0.169	42.781	9.74	1.74
13.850	45.440	8.716	0.204	49.905	9.43	2.16
13.900	45.604	10.330	0.103	27.231	10.72	0.96
13.950	45.768	24.722	0.178	27.484	25.12	0.71
14.000	45.932	18.077	0.491	27.303	18.47	2.66
14.050	46.096	9.900	0.505	28.641	10.31	4.90
14.100	46.260	8.313	0.344	33.198	8.79	3.91
14.150	46.424	8.178	0.141	39.960	8.75	1.61
14.200	46.588	7.613	0.051	46.940	8.29	0.62
14.250	46.752	7.721	0.042	55.076	8.51	0.49
14.300	46.916	7.586	0.029	62.851	8.49	0.34
14.350	47.080	7.613	0.038	68.674	8.60	0.44
14.400	47.244	7.936	0.043	74.785	9.01	0.48
14.450	47.408	8.420	0.050	79.776	9.57	0.52
14.500	47.572	8.366	0.054	82.163	9.55	0.57
14.550	47.736	8.339	0.093	84.297	9.55	0.97
14.600	47.900	9.415	0.182	86.575	10.66	1.71
14.650	48.064	25.153	0.138	84.658	26.37	0.52
14.700	48.228	50.924	0.754	44.445	51.56	1.46
14.750	48.392	23.807	1.132	23.759	24.15	4.69
14.800	48.556	18.024	0.945	24.736	18.38	5.14
14.850	48.720	16.733	0.629	27.701	17.13	3.67
14.900	48.885	15.791	0.511	29.654	16.22	3.15
14.950	49.049	14.015	0.371	29.256	14.44	2.57

15.000	49.213	12.267	0.263	34.391	12.76	2.06
15.050	49.377	11.567	0.178	45.783	12.23	1.46
15.100	49.541	13.155	0.121	68.421	14.14	0.86
15.150	49.705	12.939	0.120	93.410	14.28	0.84
15.200	49.869	12.132	0.123	111.202	13.73	0.90
15.250	50.033	13.370	0.174	122.991	15.14	1.15
15.300	50.197	14.849	0.208	126.355	16.67	1.25
15.350	50.361	20.337	0.400	125.993	22.15	1.81
15.400	50.525	23.323	0.591	68.240	24.31	2.43
15.450	50.689	14.742	0.570	66.324	15.70	3.63
15.500	50.853	12.294	0.306	79.812	13.44	2.28
15.550	51.017	14.231	0.253	81.078	15.40	1.64
15.600	51.181	10.249	0.216	82.018	11.43	1.89
15.650	51.345	36.801	0.355	88.166	38.07	0.93
15.700	51.509	42.046	0.467	27.773	42.45	1.10
15.750	51.673	40.917	0.583	22.421	41.24	1.41
15.800	51.837	37.258	0.595	21.987	37.57	1.58
15.850	52.001	33.842	0.605	22.927	34.17	1.77
15.900	52.165	24.830	0.898	24.157	25.18	3.57
15.950	52.329	14.258	0.735	29.654	14.69	5.01
16.000	52.493	9.846	0.501	35.476	10.36	4.84
16.050	52.657	9.388	0.207	53.232	10.15	2.04
16.100	52.822	10.007	0.125	75.220	11.09	1.13
16.150	52.986	10.545	0.106	92.469	11.88	0.89
16.200	53.150	11.164	0.119	100.136	12.61	0.94
16.250	53.314	10.411	0.103	103.318	11.90	0.87
16.300	53.478	11.890	0.145	97.641	13.30	1.09
16.350	53.642	9.792	0.122	91.637	11.11	1.10
16.400	53.806	9.200	0.081	98.075	10.61	0.76
16.450	53.970	9.146	0.043	102.378	10.62	0.40
16.500	54.134	9.200	0.060	103.463	10.69	0.56
16.550	54.298	11.245	0.065	108.164	12.80	0.51
16.600	54.462	16.679	0.078	76.377	17.78	0.44
16.650	54.626	11.783	0.109	73.701	12.84	0.85
16.700	54.790	13.262	0.045	85.056	14.49	0.31
16.750	54.954	21.682	0.356	74.605	22.76	1.56
16.800	55.118	14.796	0.432	71.314	15.82	2.73
16.850	55.282	12.401	0.364	79.197	13.54	2.69
16.900	55.446	9.684	0.250	93.084	11.02	2.27
16.950	55.610	11.487	0.141	88.998	12.77	1.10
17.000	55.774	12.321	0.148	88.925	13.60	1.09
17.050	55.938	10.545	0.172	96.158	11.93	1.44
17.100	56.102	10.599	0.089	101.618	12.06	0.74
17.150	56.266	13.343	0.113	108.598	14.91	0.76
17.200	56.430	12.751	0.166	108.888	14.32	1.16
17.250	56.594	15.038	0.240	125.197	16.84	1.43
17.300	56.759	14.796	0.302	108.092	16.35	1.85
17.350	56.923	12.590	0.289	106.139	14.12	2.05
17.400	57.087	14.823	0.296	112.468	16.44	1.80
17.450	57.251	16.437	0.378	105.669	17.96	2.10
17.500	57.415	17.916	0.344	88.998	19.20	1.79
17.550	57.579	17.432	0.401	95.182	18.80	2.13

17.600	57.743	14.957	0.332	92.072	16.28	2.04
17.650	57.907	14.311	0.297	93.084	15.65	1.90
17.700	58.071	11.191	0.247	97.026	12.59	1.96
17.750	58.235	31.851	0.392	106.067	33.38	1.17
17.800	58.399	55.174	0.923	39.237	55.74	1.66
17.850	58.563	48.207	1.129	36.597	48.73	2.32
17.900	58.727	28.784	1.240	39.454	29.35	4.22
17.950	58.891	17.782	0.871	42.383	18.39	4.74
18.000	59.055	13.854	0.560	61.188	14.74	3.80
18.050	59.219	16.437	0.370	103.138	17.92	2.06
18.100	59.383	19.073	0.463	107.766	20.62	2.24
18.150	59.547	17.136	0.447	94.495	18.50	2.42
18.200	59.711	17.540	0.554	103.246	19.03	2.91
18.250	59.875	20.848	0.483	82.777	22.04	2.19
18.300	60.039	45.248	0.790	59.742	46.11	1.71
18.350	60.203	38.549	1.280	47.265	39.23	3.26
18.400	60.367	22.920	1.215	58.585	23.76	5.11
18.450	60.531	24.238	0.978	79.306	25.38	3.85
18.500	60.696	19.100	0.560	83.862	20.31	2.76
18.550	60.860	14.123	0.292	116.229	15.80	1.85
18.600	61.024	32.551	0.370	138.361	34.54	1.07
18.650	61.188	28.488	0.531	110.370	30.08	1.77
18.700	61.352	19.288	0.529	147.004	21.40	2.47
18.750	61.516	17.028	0.332	150.258	19.19	1.73
18.800	61.680	15.818	0.259	151.633	18.00	1.44
18.850	61.844	18.643	0.759	155.719	20.89	3.63
18.900	62.008	19.315	0.834	113.444	20.95	3.98
18.950	62.172	15.361	0.714	18.226	15.62	4.57
19.000	62.336	14.554	0.418	23.036	14.89	2.81
19.050	62.500	15.468	0.234	30.738	15.91	1.47
19.100	62.664	12.886	0.184	40.177	13.46	1.37
19.150	62.828	12.617	0.177	57.500	13.45	1.32
19.200	62.992	14.634	0.208	84.875	15.86	1.31
19.250	63.156	17.701	0.284	112.034	19.31	1.47
19.300	63.320	18.938	0.425	108.743	20.50	2.07
19.350	63.484	13.935	0.454	107.151	15.48	2.93
19.400	63.648	17.163	0.329	118.326	18.87	1.74
19.450	63.812	36.209	0.583	88.962	37.49	1.56
19.500	63.976	35.510	0.746	59.235	36.36	2.05
19.550	64.140	32.443	1.297	59.814	33.30	3.89
19.600	64.304	25.018	1.089	63.792	25.94	4.20
19.650	64.469	43.580	1.571	78.438	44.71	3.51
19.700	64.633	34.810	1.485	62.201	35.71	4.16
19.750	64.797	22.570	0.971	64.118	23.49	4.13
19.800	64.961	48.395	1.122	92.289	49.72	2.26
19.850	65.125	53.910	1.652	64.118	54.83	3.01
19.900	65.289	31.770	1.478	59.488	32.63	4.53
19.950	65.453	23.000	1.518	60.935	23.88	6.36
20.000	65.617	19.530	1.161	60.645	20.40	5.69
20.050	65.781	20.095	0.789	63.466	21.01	3.76
20.100	65.945	52.484	0.541	83.645	53.69	1.01
20.150	66.109	73.601	0.844	48.929	74.31	1.14

20.200	66.273	62.599	1.341	46.325	63.27	2.12
20.250	66.437	37.581	1.248	45.131	38.23	3.26
20.300	66.601	33.573	0.961	46.687	34.25	2.81
20.350	66.765	33.599	0.963	47.337	34.28	2.81
20.400	66.929	24.319	0.787	55.076	25.11	3.13
20.450	67.093	33.653	0.529	64.334	34.58	1.53
20.500	67.257	40.567	0.454	68.384	41.55	1.09
20.550	67.421	37.339	0.773	61.803	38.23	2.02
20.600	67.585	23.108	0.740	64.009	24.03	3.08
20.650	67.749	16.894	0.597	76.341	17.99	3.32
20.700	67.913	14.957	0.305	89.142	16.24	1.88
20.750	68.077	15.280	0.211	95.832	16.66	1.27
20.800	68.241	12.643	0.245	102.885	14.12	1.73
20.850	68.406	14.930	0.312	112.540	16.55	1.89
20.900	68.570	15.065	0.216	98.617	16.49	1.31
20.950	68.734	12.670	0.254	99.015	14.10	1.80
21.000	68.898	11.191	0.169	96.556	12.58	1.34
21.050	69.062	13.881	0.120	115.578	15.55	0.77
21.100	69.226	16.759	0.219	108.743	18.32	1.20
21.150	69.390	12.670	0.249	110.334	14.26	1.75
21.200	69.554	11.864	0.183	120.713	13.60	1.35
21.250	69.718	11.110	0.133	120.677	12.85	1.04
21.300	69.882	17.432	0.400	127.331	19.27	2.08
21.350	70.046	33.088	0.979	63.575	34.00	2.88
21.400	70.210	20.122	0.899	56.017	20.93	4.30
21.450	70.374	14.365	0.687	58.801	15.21	4.52
21.500	70.538	18.320	0.555	78.365	19.45	2.85
21.550	70.702	14.769	0.444	79.306	15.91	2.79
21.600	70.866	14.527	0.434	92.289	15.86	2.74
21.650	71.030	25.987	0.409	89.902	27.28	1.50
21.700	71.194	28.031	0.488	70.048	29.04	1.68
21.750	71.358	24.534	0.821	65.456	25.48	3.22
21.800	71.522	16.948	0.661	74.063	18.01	3.67
21.850	71.686	17.540	0.722	91.348	18.86	3.83
21.900	71.850	26.444	0.570	69.687	27.45	2.08
21.950	72.014	30.156	0.985	58.006	30.99	3.18
22.000	72.178	24.884	0.957	42.600	25.50	3.75
22.050	72.343	18.427	0.730	48.314	19.12	3.82
22.100	72.507	12.724	0.470	59.524	13.58	3.46
22.150	72.671	11.675	0.243	83.754	12.88	1.89
22.200	72.835	11.595	0.127	107.803	13.15	0.97
22.250	72.999	13.182	0.159	113.480	14.82	1.07
22.300	73.163	14.742	0.213	112.866	16.37	1.30
22.350	73.327	26.686	0.599	88.057	27.95	2.14
22.400	73.491	18.400	0.552	83.429	19.60	2.82
22.450	73.655	45.140	0.724	91.493	46.46	1.56
22.500	73.819	40.755	1.094	50.592	41.48	2.64
22.550	73.983	21.656	0.904	51.207	22.39	4.04
22.600	74.147	17.513	0.592	67.336	18.48	3.20
22.650	74.311	26.309	0.625	72.146	27.35	2.29
22.700	74.475	19.907	0.452	74.099	20.97	2.16
22.750	74.639	23.162	0.518	79.414	24.31	2.13

22.800	74.803	18.750	0.497	77.570	19.87	2.50
22.850	74.967	19.665	0.637	97.026	21.06	3.02
22.900	75.131	34.380	0.316	71.567	35.41	0.89
22.950	75.295	30.748	0.706	68.168	31.73	2.23
23.000	75.459	26.820	0.569	68.023	27.80	2.05
23.050	75.623	36.451	0.410	62.020	37.34	1.10
23.100	75.787	23.942	0.285	62.382	24.84	1.15
23.150	75.951	18.643	0.235	81.620	19.82	1.19
23.200	76.115	25.637	0.399	81.584	26.81	1.49
23.250	76.280	17.459	0.433	82.741	18.65	2.32
23.300	76.444	21.602	0.328	104.801	23.11	1.42
23.350	76.608	49.444	0.825	63.539	50.36	1.64
23.400	76.772	35.940	1.318	50.918	36.67	3.59
23.450	76.936	20.714	1.211	55.040	21.51	5.63
23.500	77.100	14.446	0.733	73.592	15.51	4.73
23.550	77.264	16.248	0.436	101.727	17.71	2.46
23.600	77.428	36.881	0.603	98.690	38.30	1.57
23.650	77.592	46.566	0.725	54.028	47.34	1.53
23.700	77.756	58.645	1.121	41.841	59.25	1.89
23.750	77.920	44.306	1.154	36.308	44.83	2.57
23.800	78.084	31.743	0.983	37.682	32.29	3.04
23.850	78.248	17.916	0.729	48.025	18.61	3.92
23.900	78.412	16.302	0.413	75.907	17.40	2.37
23.950	78.576	37.661	0.850	87.479	38.92	2.18
24.000	78.740	36.612	0.727	59.452	37.47	1.94
24.050	78.904	24.803	0.584	56.559	25.62	2.28
24.100	79.068	25.502	0.711	62.888	26.41	2.69
24.150	79.232	25.422	0.542	64.479	26.35	2.06
24.200	79.396	33.815	0.649	65.889	34.76	1.87
24.250	79.560	21.359	0.755	70.048	22.37	3.38
24.300	79.724	14.500	0.599	97.569	15.90	3.77
24.350	79.888	13.370	0.316	127.692	15.21	2.08
24.400	80.052	13.370	0.156	134.636	15.31	1.02
24.450	80.217	13.020	0.157	138.144	15.01	1.05
24.500	80.381	13.666	0.124	138.107	15.65	0.79
24.550	80.545	14.338	0.124	130.477	16.22	0.76
24.600	80.709	13.101	0.139	132.430	15.01	0.93
24.650	80.873	13.155	0.162	135.251	15.10	1.07
24.700	81.037	13.343	0.099	134.238	15.28	0.65
24.750	81.201	13.289	0.117	129.898	15.16	0.77
24.800	81.365	13.773	0.109	134.527	15.71	0.69
24.850	81.529	14.338	0.175	127.692	16.18	1.08
24.900	81.693	12.751	0.193	132.321	14.66	1.32
24.950	81.857	13.128	0.236	132.538	15.04	1.57
25.000	82.021	17.647	0.209	100.281	19.09	1.09
25.050	82.185	27.923	0.420	105.741	29.45	1.43
25.100	82.349	17.620	0.410	71.495	18.65	2.20
25.150	82.513	13.693	0.344	95.290	15.07	2.28
25.200	82.677	12.832	0.174	126.463	14.65	1.19
25.250	82.841	14.338	0.185	135.359	16.29	1.14
25.300	83.005	14.042	0.151	128.777	15.90	0.95
25.350	83.169	14.554	0.188	133.478	16.48	1.14

25.400	83.333	15.065	0.138	137.927	17.05	0.81
25.450	83.497	18.051	0.184	125.450	19.86	0.93
25.500	83.661	14.876	0.248	127.259	16.71	1.48
25.550	83.825	14.015	0.191	144.183	16.09	1.19
25.600	83.990	14.150	0.135	145.123	16.24	0.83
25.650	84.154	14.150	0.123	143.568	16.22	0.76
25.700	84.318	13.935	0.145	145.919	16.04	0.90
25.750	84.482	13.854	0.124	146.534	15.96	0.78
25.800	84.646	14.634	0.120	141.037	16.66	0.72
25.850	84.810	15.226	0.174	145.304	17.32	1.00
25.900	84.974	15.441	0.344	142.122	17.49	1.97
25.950	85.138	15.710	0.260	135.251	17.66	1.47
26.000	85.302	17.324	0.272	22.349	17.65	1.54
26.050	85.466	15.495	0.101	28.279	15.90	0.64
26.100	85.630	22.731	0.242	36.055	23.25	1.04
26.150	85.794	17.243	0.358	45.927	17.90	2.00
26.200	85.958	15.925	0.369	68.348	16.91	2.18
26.250	86.122	15.602	0.262	96.917	17.00	1.54
26.300	86.286	15.038	0.174	122.159	16.80	1.04
26.350	86.450	33.223	0.715	137.059	35.20	2.03
26.400	86.614	23.243	0.800	89.649	24.53	3.26
26.450	86.778	16.517	0.686	97.677	17.92	3.83
26.500	86.942	14.742	0.286	129.247	16.60	1.72
26.550	87.106	14.876	0.127	144.219	16.95	0.75
26.600	87.270	14.607	0.135	151.705	16.79	0.80
26.650	87.434	14.661	0.129	155.647	16.90	0.76
26.700	87.598	14.823	0.132	156.081	17.07	0.77
26.750	87.762	15.011	0.161	157.130	17.27	0.93
26.800	87.927	15.280	0.123	156.478	17.53	0.70
26.850	88.091	16.221	0.134	153.441	18.43	0.73
26.900	88.255	15.145	0.106	151.018	17.32	0.61
26.950	88.419	15.630	0.117	152.754	17.83	0.66
27.000	88.583	15.145	0.148	147.474	17.27	0.86
27.050	88.747	14.957	0.119	160.276	17.26	0.69
27.100	88.911	16.974	0.141	157.527	19.24	0.73
27.150	89.075	15.441	0.187	150.331	17.61	1.06
27.200	89.239	14.849	0.164	164.217	17.21	0.95
27.250	89.403	17.432	0.132	161.722	19.76	0.67
27.300	89.567	15.495	0.209	152.862	17.70	1.18
27.350	89.731	16.033	0.139	166.423	18.43	0.75
27.400	89.895	23.861	0.193	142.700	25.92	0.74
27.450	90.059	18.912	0.209	138.758	20.91	1.00
27.500	90.223	18.992	0.221	143.062	21.05	1.05
27.550	90.387	17.459	0.157	140.748	19.49	0.81
27.600	90.551	16.141	0.104	143.098	18.20	0.57
27.650	90.715	15.226	0.121	150.150	17.39	0.70
27.700	90.879	14.849	0.109	155.430	17.09	0.64
27.750	91.043	16.141	0.106	155.394	18.38	0.58
27.800	91.207	15.737	0.111	156.876	18.00	0.62
27.850	91.371	15.710	0.112	165.772	18.10	0.62
27.900	91.535	15.710	0.108	168.051	18.13	0.60
27.950	91.699	15.172	0.109	170.365	17.63	0.62

28.000	91.864	15.549	0.107	163.132	17.90	0.60
28.050	92.028	15.468	0.115	170.763	17.93	0.64
28.100	92.192	16.329	0.115	173.584	18.83	0.61
28.150	92.356	15.925	0.127	175.247	18.45	0.69
28.200	92.520	16.356	0.130	178.610	18.93	0.69
28.250	92.684	16.248	0.140	177.056	18.80	0.74
28.300	92.848	16.195	0.159	177.670	18.75	0.85
28.350	93.012	16.221	0.156	177.706	18.78	0.83
28.400	93.176	16.544	0.131	169.750	18.99	0.69
28.450	93.340	16.302	0.135	166.315	18.70	0.72
28.500	93.504	15.576	0.095	167.291	17.98	0.53
28.550	93.668	16.437	0.105	163.530	18.79	0.56
28.600	93.832	16.383	0.124	170.727	18.84	0.66
28.650	93.996	16.248	0.132	171.848	18.72	0.71
28.700	94.160	16.275	0.137	176.441	18.82	0.73
28.750	94.324	16.921	0.131	179.008	19.50	0.67
28.800	94.488	17.566	0.130	176.079	20.10	0.65
28.850	94.652	17.782	0.154	177.670	20.34	0.76
28.900	94.816	17.243	0.108	176.549	19.79	0.55
28.950	94.980	17.566	0.138	176.188	20.10	0.69
29.000	95.144	17.028	0.151	176.802	19.57	0.77
29.050	95.308	17.271	0.117	173.005	19.76	0.59
29.100	95.472	17.862	0.114	175.717	20.39	0.56
29.150	95.636	17.002	0.121	181.468	19.62	0.62
29.200	95.801	17.109	0.129	184.071	19.76	0.65
29.250	95.965	17.028	0.134	186.277	19.71	0.68
29.300	96.129	17.513	0.144	188.338	20.23	0.71
29.350	96.293	18.024	0.140	185.952	20.70	0.68
29.400	96.457	18.105	0.125	184.180	20.76	0.60
29.450	96.621	17.889	0.120	187.037	20.58	0.58
29.500	96.785	17.755	0.125	189.893	20.49	0.61
29.550	96.949	17.728	0.137	190.364	20.47	0.67
29.600	97.113	18.212	0.140	189.929	20.95	0.67
29.650	97.277	18.615	0.140	185.735	21.29	0.66
29.700	97.441	18.777	0.143	184.216	21.43	0.67
29.750	97.605	18.589	0.145	187.687	21.29	0.68
29.800	97.769	18.508	0.141	186.747	21.20	0.67
29.850	97.933	17.943	0.133	187.254	20.64	0.64
29.900	98.097	17.593	0.108	187.362	20.29	0.53
29.950	98.261	17.997	0.138	189.387	20.72	0.67
30.000	98.425	18.374	0.125	191.882	21.14	0.59
30.050	98.589	18.992	0.143	184.360	21.65	0.66
30.100	98.753	18.777	0.160	196.873	21.61	0.74
30.150	98.917	19.154	0.169	196.439	21.98	0.77
30.200	99.081	19.584	0.172	195.282	22.40	0.77
30.250	99.245	19.369	0.143	191.014	22.12	0.65
30.300	99.409	18.965	0.141	196.186	21.79	0.65
30.350	99.573	19.154	0.138	196.294	21.98	0.63
30.400	99.738	19.073	0.143	198.898	21.94	0.65
30.450	99.902	19.342	0.153	202.334	22.26	0.69
30.500	100.066	20.149	0.189	208.807	23.16	0.82
30.550	100.230	21.279	0.195	201.104	24.17	0.81

30.600	100.394	21.548	0.187	199.007	24.41	0.77
30.650	100.558	20.956	0.182	205.552	23.92	0.76
30.700	100.722	20.956	0.195	207.939	23.95	0.81
30.750	100.886	20.795	0.171	203.889	23.73	0.72
30.800	101.050	20.041	0.150	206.710	23.02	0.65
30.850	101.214	20.122	0.158	210.904	23.16	0.68
30.900	101.378	21.010	0.173	212.061	24.06	0.72
30.950	101.542	21.924	0.343	207.180	24.91	1.38
31.000	101.706	22.220	0.358	209.458	25.24	1.42
31.050	101.870	23.700	0.295	178.068	26.26	1.12
31.100	102.034	21.817	0.308	206.239	24.79	1.24
31.150	102.198	22.462	0.371	226.454	25.72	1.44
31.200	102.362	29.726	0.448	178.285	32.29	1.39
31.250	102.526	25.018	0.399	156.153	27.27	1.46
31.300	102.690	27.332	0.378	171.523	29.80	1.27
31.350	102.854	26.955	0.406	160.927	29.27	1.39
31.400	103.018	25.987	0.732	164.434	28.35	2.58
31.450	103.182	26.632	0.562	165.519	29.02	1.94
31.500	103.346	77.771	0.569	163.096	80.12	0.71
31.550	103.511	147.579	0.527	120.641	149.32	0.35
31.600	103.675	154.466	0.370	111.166	156.07	0.24
31.650	103.839	161.434	0.010	97.713	162.84	0.01
31.700	104.003	146.019	0.010	74.099	147.09	0.01

GREGG DRILLING & TESTING, INC.

CONE PENETRATION TEST DATA

Client:	YELLOW JACKET DRILLING	Units:	Imperial
Site:	RESOLUTION MINE	Data averaging interval:	0.100 meters
Engineer:	B.BURGESS	Assumed depth of water:	12.003 feet
		Net area ratio of cone:	0.80
		Unit weight of water:	62.4 lb/ft^3
		Relative density constant, C_{DR}:	350
Sounding:	CPT--04	Young's modulus for sands, α:	4
Date:	7/30/2009	Small strain shear modulus number, S_G (sands):	180
Time:	6:44 AM	Small strain shear modulus number, C_G (clays):	50
		N_{kt} for clays:	15
		OCR number, k_{ocr}:	0.3

Interpretation based on Lunne, Robertson and Powell, 1997

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
0.100	0.328	0.000	0.000	0.000							0.000																	
0.200	0.656	0.000	0.000	0.000							0.000																	
0.300	0.984	0.000	0.000	0.000							0.000																	
0.400	1.312	0.000	0.000	0.000							0.000																	
0.500	1.640	0.000	0.000	0.000							0.000																	
0.600	1.969	5.542	0.087	0.096		5.54	1.57	1	111	0.110	0.000	0.110	49.55	1.60	0.00	5	2.28	24.58	3.00E-6	1.2	3.8	27	37	22	155			
0.700	2.297	17.880	0.348	0.446		17.89	1.95	6	115	0.128	0.000	0.128	138.26	1.96	0.00	6	2.01	61.01	3.00E-4	3.5	10.1	42	42	72	242			
0.800	2.625	22.068	0.488	1.302		22.09	2.21	6	115	0.147	0.000	0.147	149.00	2.22	0.00	5	2.03	70.18	3.00E-6	4.4	11.8	45	43	88	272			
0.900	2.953	17.540	0.477	1.458		17.56	2.72	5	115	0.166	0.000	0.166	104.76	2.74	0.01	5	2.20	56.73	3.00E-6	3.7	9.4	40	41	70	262			
1.000	3.281	13.594	0.335	1.555		13.62	2.46	5	115	0.185	0.000	0.185	72.67	2.49	0.01	5	2.28	42.48	3.00E-6	3.0	7.2	35	39	54	249			
1.100	3.609	31.187	0.321	1.579		31.21	1.03	7	118	0.204	0.000	0.204	151.87	1.04	0.00	6	1.78	71.66	3.00E-4	5.7	12.9	45	43	125	340			
1.200	3.937	31.770	0.461	1.555		31.79	1.45	7	118	0.223	0.000	0.223	141.27	1.46	0.00	6	1.91	73.74	3.00E-4	6.0	13.2	46	42	127	353			
1.300	4.265	18.257	0.545	1.519		18.28	2.98	5	115	0.242	0.000	0.242	74.45	3.02	0.01	5	2.33	48.41	3.00E-6	4.1	8.6	37	39	73	301			
1.400	4.593	12.258	0.328	1.543		12.28	2.67	5	115	0.261	0.000	0.261	46.04	2.73	0.01	5	2.45	32.14	3.00E-6	2.9	5.9	30	36	49	270			
1.500	4.921	13.155	0.316	1.603		13.18	2.40	5	115	0.280	0.000	0.280	46.09	2.45	0.01	5	2.42	32.35	3.00E-6	3.1	6.0	30	36	53	283			
1.600	5.249	10.904	0.282	1.916		10.93	2.58	5	115	0.299	0.000	0.299	35.60	2.65	0.01	4	2.53	26.48	3.00E-8	2.7	5.1				547	0.71	2.37	10.7
1.700	5.577	12.805	0.287	2.097		12.83	2.24	5	115	0.317	0.000	0.317	39.43	2.29	0.01	5	2.45	28.95	3.00E-6	3.0	5.6	29	35	51	293			
1.800	5.906	11.137	0.336	2.025		11.17	3.01	4	115	0.336	0.000	0.336	32.21	3.10	0.01	4	2.60	25.29	3.00E-8	2.9	5.1				558	0.72	2.15	9.7
1.900	6.234	8.644	0.239	2.025		8.67	2.76	4	115	0.355	0.000	0.355	23.43	2.88	0.02	4	2.69	19.14	3.00E-8	2.3	4.0				434	0.55	1.56	7.0
2.000	6.562	9.971	0.232	2.073		10.00	2.32	5	115	0.374	0.000	0.374	25.75	2.41	0.02	4	2.61	20.72	3.00E-8	2.6	4.3				500	0.64	1.72	7.7
2.100	6.890	5.784	0.143	2.073		5.81	2.47	4	115	0.393	0.000	0.393	13.81	2.64	0.03	4	2.85	12.05	3.00E-8	1.7	2.8				291	0.36	0.92	4.1
2.200	7.218	4.905	0.070	2.603		4.94	1.42	1	111	0.411	0.000	0.411	11.03	1.55	0.04	4	2.81	9.57	3.00E-8	1.4	2.2				247	0.30	0.74	3.3
2.300	7.546	4.152	0.055	3.218		4.20	1.30	1	111	0.429	0.000	0.429	8.78	1.45	0.06	4	2.88	7.82	3.00E-8	1.2	1.9				210	0.25	0.59	2.6
2.400	7.874	3.981	0.048	3.797		4.04	1.20	1	111	0.447	0.000	0.447	8.02	1.35	0.08	4	2.90	7.22	3.00E-8	1.2	1.8				202	0.24	0.53	2.4
2.500	8.202	7.030	0.130	4.544		7.10	1.83	5	115	0.466	0.000	0.466	14.22	1.96	0.05	4	2.77	12.45	3.00E-8	2.0	3.0				355	0.44	0.95	4.3
2.600	8.530	12.805	0.253	4.785		12.87	1.97	5	115	0.485	0.000	0.485	25.54	2.04	0.03	4	2.57	21.49	3.00E-8	3.2	4.8				644	0.83	1.70	7.7
2.700	8.858	14.437	0.206	4.580		14.50	1.42	6	115	0.504	0.000	0.504	27.78	1.47	0.02	5	2.46	22.99	3.00E-6	3.4	5.0	26	33	58	356			
2.800	9.186	14.275	0.340	4.255		14.34	2.37	5	115	0.523	0.000	0.523	26.43	2.46	0.02	4	2.61	22.79	3.00E-8	3.7	5.2				717	0.92	1.76	7.9
2.900	9.514	7.434	0.211	4.291		7.50	2.82	4	115	0.541	0.000	0.541	12.84	3.03	0.04	3	2.91	11.86	1.00E-9	2.3	3.1				375	0.46	0.86	3.9
3.000	9.843	10.716	0.288	5.280		10.79	2.67	5	115	0.560	0.000	0.560	18.26	2.81	0.04	4	2.77	16.48	3.00E-8	3.0	4.1				540	0.68	1.22	5.5
3.100	10.171	9.559	0.340	5.569		9.64	3.53	3	111	0.579	0.000	0.579	15.66	3.76	0.04	3	2.90	14.54	1.00E-9	2.9	3.9				482	0.60	1.04	4.7
3.200	10.499	7.210	0.185	5.509		7.29	2.53	4	115	0.597	0.000	0.597	11.20	2.76	0.06	3	2.94	10.51	1.00E-9	2.2	2.9				364	0.45	0.75	3.4
3.300	10.827	5.901	0.077	5.484		5.98	1.28	1	111	0.616	0.000	0.616	8.71	1.43	0.07	4	2.88	8.13	3.00E-8	1.8	2.3				299	0.36	0.58	2.6
3.400	11.155	5.891	0.092	5.798		5.97	1.53	1	111	0.634	0.000	0.634	8.43	1.72	0.08	4	2.93	7.95	3.00E-8	1.8	2.3				299	0.36	0.56	2.5
3.500	11.483	8.501	0.194	6.377		8.59	2.25	5	115	0.653	0.000	0.653	12.17	2.44	0.06	4	2.88	11.43	3.00E-8	2.5	3.2				430	0.53	0.81	3.6
3.600	11.811	8.312	0.205	6.690		8.41	2.43	4	115	0.671	0.000	0.671	11.52	2.65	0.06	3	2.92	10.92	1.00E-9	2.5	3.2				420	0.52	0.77	3.5
3.700	12.139	15.199	0.189	7.847		15.31	1.23	6	115	0.690	0.004	0.686	21.31	1.29	0.04	5	2.52	19.25	3.00E-6	3.7	4.6	23	31	61	402			
3.800	12.467	33.877	0.314	8.980		34.01	0.92	7	118	0.710	0.014	0.695	47.90	0.94	0.02	5	2.15	41.41	3.00E-6	7.1	8.7	34	36	136	526			
3.900	12.795	29.654	0.485	8.124		29.77	1.63	6	115	0.728	0.025	0.704	41.27	1.67	0.02	5	2.35	36.71	3.00E-6	6.7	8.3	32	36	119	506			
4.000	13.123	21.781	0.527	7.690		21.89	2.41	6	115	0.747	0.035	0.712	29.69	2.49	0.02	4	2.57	27.20	3.00E-8	5.5	6.7				1095	1.41	1.98	8.9
4.100	13.451	12.043	0.471	7.546		12.15	3.88	3	111	0.765	0.045	0.720	15.81	4.14	0.04	3	2.92	15.12	1.00E-9	3.7	4.4				608	0.76	1.05	4.7
4.200	13.780	6.089	0.217	7.594		6.20	3.50	3	111	0.784	0.055	0.728	7.43	4.00	0.09	3	3.17	7.32	1.00E-9	2.2	2.6				310	0.36	0.50	2.2
4.300	14.108	4.699	0.104	8.450		4.82	2.15	4	115	0.803	0.066	0.737	5.45	2.58	0.14	3	3.18	5.38	1.00E-9	1.7	2.0				241	0.27	0.36	1.6
4.400	14.436	9.613	0.181	10.101		9.76	1.85	5	115	0.821	0.076	0.745	11.99	2.02	0.07	4	2.84	11.41	3.00E-8	2.8	3.3				488	0.60	0.80	3.6
4.500	14.764	13.191	0.375	9.173		13.32	2.82	5	115	0.840	0.086	0.754	16.56	3.01	0.05	4	2.82	15.76	3.00E-8	3.8	4.5				666	0.83	1.10	5.0
4.600	15.092	5.479	0.219	8.390		5.60	3.90	3	111	0.858	0.096	0.762	6.22	4.61	0.11	3	3.27	6.20	1.00E-9	2.1	2.5				280	0.32	0.41	1.9
4.700	15.420	4.197	0.055	9.957		4.34	1.27	1	111	0.877	0.107	0.770	4.50	1.60	0.18	3	3.16	4.43	1.00E-9	1.5	1.7				217	0.23	0.30	1.3
4.800	15.748	5.246	0.105	12.187		5.42	1.94	4	115	0.895	0.117	0.779	5.81	2.32	0.17	3	3.14	5.72	1.00E-9	1.8	2.1				271	0.30	0.39	1.7
4.900	16.076	7.765	0.101	13.573		7.96	1.27	5	115	0.914	0.127	0.787	8.95	1.44	0.12	4	2.87	8.61	3.00E-8	2.3	2.7				398	0.47	0.60	2.7
5.000	16.404	6.958	0.105	12.488		7.14	1.47	5	115	0.933	0.137	0.796	7.80	1.69	0.12	3	2.96	7.57	1.00E-9	2.2	2.5				357	0.41	0.52	2.3
5.100	16.732	7.730	0.174	12.332		7.91	2.20	4	115	0.952	0.148	0.804	8.65	2.51	0.11	3	3.01	8.44	1.00E-9	2.5	2.8				395	0.46	0.58	2.6
5.200	17.060	6.116	0.130	13.067		6.30	2.06	4	115	0.971	0.158	0.813	6.56	2.44	0.15	3	3.10	6.46	1.00E-9	2.1	2.4				315	0.36	0.44	2.0
5.300	17.388	5.201	0.092	15.418		5.42	1.70	1	111	0.989	0.168	0.821	5.40	2.08	0.21	3	3.14	5.33	1.00E-9	1.8	2.1				271	0.30	0.36	1.6
5.400	17.717	4.645	0.098	18.359		4.91	2.00	4	115	1.008	0.178	0.829	4.70	2.51	0.29	3	3.23	4.68	1.00E-9	1.7	2.0				245	0.26	0.31	1.4
5.500	18.045	4.537	0.081	22.879		4.87	1.67	1	111	1.026	0.188	0.838	4.59	2.12	0.38	3	3.21	4.55	1.00E-9	1.7	1.9				243	0.26	0.31	1.4
5.600	18.373	4.744	0.088	26.929		5.13	1.71	1	111	1.044	0.199	0.846	4.83	2.15	0.43	3	3.19	4.80	1.00E-9	1.7	1.9				257	0.27	0.32	1.5
5.700	18.701	4.394	0.065	31.630		4.85	1.33	1	111	1.063	0.209	0.854	4.44	1.71	0.55	3	3.17	4.40	1.00E-9	1.6	1.8				242	0.25	0.30	1.3
5.800	19.029	5.586	0.091	38.200		6.14	1.48	1	111	1.081	0.219	0.862	5.87	1.80	0.50	3	3.08	5.79	1.00E-9	1.9	2.1				307	0.34	0.39	1.8
5.900	19.357	5.353	0.090	40.756		5.94	1.52	1	111	1.099	0.229	0.870	5.57	1.87	0.56	3	3.11	5.50	1.00E-9	1.8	2.0				297	0.32	0.37	1.7
6.000	19.685	5.389	0.083	43.516		6.02	1.39	1	111	1.117	0.240	0.878	5.58	1.70	0.59	3	3.09	5.51	1.00E-9	1.8	2.0				301	0.33	0.37	1.7
6.100	20.013	7.622	0.191	46.795		8.30	2.31	4	115	1.136	0.250	0.886	8.08	2.67	0.44	3	3.05	7.97	1.00E-9	2.5	2.7				415	0.48	0.54	2.4
6.200	20.341	29.672	0.435	29.835		30.10	1.45	6	115	1.155	0.260	0.895	32.35	1.50	0.07	5	2.41	30.92	3.00E-6	6.9	7.5	30	34	120	550			
6.300	20.669	27.959	0.594	3.906		28.02	2.12	6	115	1.174	0.270	0.903	29.71	2.21	0.00	4	2.54	28.65	3.00E-8	6.9	7.5				1401	1.79	1.98	8.9
6.400	20.997	18.732	0.537	2.097		18.76	2.86	5	115	1.193	0.281	0.912	19.27	3.05	-0.01	4	2.77	18.81	3.00E-8	5.2	5.6				938	1.17	1.28	5.8
6.500	21.325	37.509	0.644	2.555		37.55	1.72	6	115	1.211	0.291	0.921	39.47	1.77	0.00	5	2.38	37.97	3.00E-6	8.6	9.3	33	35	150	597			
6.600	21.654	75.610	0.884	2.640		75.65	1.17	8	121	1.231	0.301	0.930	80.01	1.19	0.00	6	2.03	76.16	3.00E-4	15.1	16.1	47	39	303	757			
6.700	21.982	37.913	0.925	2.652		37.95	2.44	6	115	1.250	0.311	0.939	39.10	2.52	0.00	5	2.48	37.96	3.00E-6	9.2	9.7	33	35	152	604			
6.800	22.310	17.450	0.710	2.700		17.49	4.06	4	115	1.269	0.322	0.947	17.12	4.38	-0.01	3	2.91	16.90	1.00E-9	5.3	5.6				874	1.08	1.14	5.1
6.900	22.638	10.976	0.419	2.772		11.02	3.81	3	111	1.287	0.332	0.955	10.18	4.31	-0.01	3	3.08	10.11	1.00E-9	3.7	3.9				551	0.65	0.68	3.1
7.000	22.966	9.129	0.264	3.266		9.18	2.88	4	115	1.306	0.342	0.964	8.17	3.36	-0.01	3	3.10	8.12	1.00E-9	3.1	3.3				459	0.52	0.54	2.4

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
7.100	23.294	16.625	0.427	4.110		16.68	2.56	5	115	1.325	0.352	0.972	15.80	2.78	0.00	4	2.82	15.60	3.00E-8	4.8	5.0				834	1.02	1.05	4.7
7.200	23.622	10.195	0.378	4.207		10.26	3.68	3	111	1.343	0.363	0.980	9.09	4.24	-0.01	3	3.12	9.05	1.00E-9	3.5	3.7				513	0.59	0.61	2.7
7.300	23.950	5.300	0.137	5.027		5.37	2.54	4	115	1.362	0.373	0.989	4.05	3.41	0.00	3	3.36	4.05	1.00E-9	2.2	2.3				269	0.27	0.27	1.2
7.400	24.278	5.622	0.111	7.281		5.73	1.94	4	115	1.381	0.383	0.998	4.36	2.55	0.03	3	3.27	4.35	1.00E-9	2.2	2.2				286	0.29	0.29	1.3
7.500	24.606	24.391	0.362	9.438		24.53	1.48	6	115	1.399	0.393	1.006	22.99	1.57	0.01	5	2.54	22.72	3.00E-6	6.1	6.2	25	32	98	534			
7.600	24.934	26.390	0.526	8.619		26.51	1.99	6	115	1.418	0.403	1.015	24.73	2.10	0.01	4	2.59	24.51	3.00E-8	6.7	6.8				1326	1.67	1.65	7.4
7.700	25.262	32.954	0.512	7.425		33.06	1.55	7	118	1.437	0.414	1.024	30.89	1.62	0.00	5	2.44	30.63	3.00E-6	7.8	7.9	30	34	132	593			
7.800	25.591	22.552	0.608	5.955		22.64	2.69	5	115	1.456	0.424	1.032	20.52	2.87	0.00	4	2.73	20.43	3.00E-8	6.2	6.3				1132	1.41	1.37	6.2
7.900	25.919	11.827	0.408	5.605		11.91	3.43	4	115	1.475	0.434	1.041	10.02	3.91	0.00	3	3.06	10.01	1.00E-9	3.9	4.0				595	0.70	0.67	3.0
8.000	26.247	16.885	0.530	5.858		16.97	3.12	5	115	1.494	0.444	1.049	14.75	3.42	0.00	3	2.89	14.73	1.00E-9	5.1	5.1				848	1.03	0.98	4.4
8.100	26.575	11.182	0.515	5.846		11.27	4.57	3	111	1.512	0.455	1.057	9.22	5.28	0.00	3	3.17	9.22	1.00E-9	4.0	4.0				563	0.65	0.61	2.8
8.200	26.903	9.398	0.454	5.906		9.48	4.79	3	111	1.530	0.465	1.066	7.46	5.71	0.00	3	3.26	7.46	1.00E-9	3.6	3.6				474	0.53	0.50	2.2
8.300	27.231	7.604	0.299	6.593		7.70	3.88	3	111	1.549	0.475	1.074	5.73	4.86	0.00	3	3.31	5.73	1.00E-9	3.0	3.0				385	0.41	0.38	1.7
8.400	27.559	10.662	0.293	8.161		10.78	2.72	5	115	1.567	0.485	1.082	8.51	3.18	0.01	3	3.07	8.53	1.00E-9	3.6	3.5				539	0.61	0.57	2.6
8.500	27.887	14.231	0.531	8.787		14.36	3.70	4	115	1.586	0.496	1.091	11.71	4.16	0.01	3	3.02	11.74	1.00E-9	4.6	4.6				718	0.85	0.78	3.5
8.600	28.215	11.424	0.483	9.197		11.56	4.18	3	111	1.605	0.506	1.099	9.06	4.86	0.02	3	3.15	9.07	1.00E-9	4.0	4.0				578	0.66	0.60	2.7
8.700	28.543	11.666	0.360	9.691		11.81	3.05	4	115	1.623	0.516	1.107	9.20	3.54	0.02	3	3.07	9.23	1.00E-9	3.9	3.8				590	0.68	0.61	2.8
8.800	28.871	15.181	0.477	10.439		15.33	3.11	5	115	1.642	0.526	1.116	12.27	3.48	0.02	3	2.96	12.34	1.00E-9	4.7	4.6				767	0.91	0.82	3.7
8.900	29.199	12.563	0.511	10.415		12.71	4.02	3	111	1.660	0.537	1.124	9.83	4.62	0.02	3	3.11	9.87	1.00E-9	4.3	4.2				636	0.74	0.66	3.0
9.000	29.528	19.978	0.428	12.139		20.15	2.12	6	115	1.679	0.547	1.132	16.31	2.31	0.02	4	2.76	16.50	3.00E-8	5.5	5.4				1008	1.23	1.09	4.9
9.100	29.856	26.318	0.575	11.669		26.49	2.17	6	115	1.698	0.557	1.141	21.73	2.32	0.01	4	2.66	22.05	3.00E-8	6.9	6.7				1324	1.65	1.45	6.5
9.200	30.184	17.934	0.532	9.776		18.07	2.94	5	115	1.717	0.567	1.150	14.23	3.25	0.01	3	2.89	14.38	1.00E-9	5.4	5.2				904	1.09	0.95	4.3
9.300	30.512	8.859	0.334	10.451		9.01	3.70	3	111	1.735	0.577	1.158	6.28	4.59	0.02	3	3.27	6.29	1.00E-9	3.4	3.3				450	0.48	0.42	1.9
9.400	30.840	7.120	0.166	15.538		7.34	2.26	4	115	1.754	0.588	1.166	4.79	2.96	0.10	3	3.26	4.80	1.00E-9	2.7	2.6				367	0.37	0.32	1.4
9.500	31.168	7.837	0.225	21.481		8.15	2.76	4	115	1.773	0.598	1.175	5.43	3.53	0.15	3	3.26	5.43	1.00E-9	3.0	2.8				407	0.42	0.36	1.6
9.600	31.496	8.635	0.262	25.446		9.00	2.91	4	115	1.791	0.608	1.183	6.09	3.64	0.17	3	3.22	6.11	1.00E-9	3.2	3.0				450	0.48	0.41	1.8
9.700	31.824	6.672	0.159	30.389		7.11	2.24	4	115	1.810	0.618	1.192	4.45	3.01	0.30	3	3.29	4.45	1.00E-9	2.6	2.5				355	0.35	0.30	1.3
9.800	32.152	5.954	0.087	40.539		6.54	1.33	1	111	1.829	0.629	1.200	3.93	1.85	0.49	3	3.24	3.94	1.00E-9	2.2	2.1				327	0.31	0.26	1.2
9.900	32.480	5.838	0.070	51.219		6.58	1.06	1	111	1.847	0.639	1.208	3.91	1.47	0.64	3	3.19	3.93	1.00E-9	2.1	2.0				329	0.32	0.26	1.2
10.000	32.808	6.304	0.069	58.922		7.15	0.96	1	111	1.865	0.649	1.216	4.35	1.30	0.68	3	3.13	4.38	1.00E-9	2.2	2.0				358	0.35	0.29	1.3
10.100	33.136	6.430	0.064	60.634		7.30	0.88	1	111	1.883	0.659	1.224	4.43	1.19	0.68	3	3.11	4.47	1.00E-9	2.2	2.0				365	0.36	0.30	1.3
10.200	33.465	6.627	0.077	63.454		7.54	1.02	1	111	1.902	0.670	1.232	4.58	1.37	0.69	3	3.12	4.62	1.00E-9	2.3	2.1				377	0.38	0.31	1.4
10.300	33.793	7.990	0.117	64.443		8.92	1.32	5	115	1.920	0.680	1.241	5.64	1.68	0.57	3	3.08	5.70	1.00E-9	2.7	2.5				446	0.47	0.38	1.7
10.400	34.121	7.739	0.111	61.502		8.62	1.29	5	115	1.939	0.690	1.249	5.35	1.66	0.56	3	3.10	5.41	1.00E-9	2.6	2.4				431	0.45	0.36	1.6
10.500	34.449	9.093	0.185	55.354		9.89	1.87	5	115	1.958	0.700	1.258	6.31	2.33	0.41	3	3.11	6.37	1.00E-9	3.1	2.9				494	0.53	0.42	1.9
10.600	34.777	7.640	0.223	44.143		8.28	2.69	4	115	1.977	0.711	1.266	4.97	3.54	0.39	3	3.29	4.98	1.00E-9	3.0	2.7				414	0.42	0.33	1.5
10.700	35.105	10.088	0.169	51.099		10.82	1.56	5	115	1.996	0.721	1.275	6.92	1.91	0.34	3	3.03	7.03	1.00E-9	3.3	3.0				541	0.59	0.46	2.1
10.800	35.433	16.777	0.373	30.208		17.21	2.17	5	115	2.014	0.731	1.283	11.84	2.46	0.10	4	2.89	12.13	3.00E-8	5.0	4.5				861	1.01	0.79	3.6
10.900	35.761	9.666	0.389	23.892		10.01	3.89	3	111	2.033	0.741	1.291	6.18	4.88	0.12	3	3.29	6.18	1.00E-9	3.8	3.4				501	0.53	0.41	1.9
11.000	36.089	10.904	0.299	28.557		11.31	2.64	5	115	2.051	0.751	1.300	7.13	3.23	0.14	3	3.14	7.20	1.00E-9	3.8	3.4				566	0.62	0.48	2.1
11.100	36.417	8.931	0.246	32.510		9.40	2.61	4	115	2.070	0.762	1.309	5.60	3.35	0.22	3	3.23	5.63	1.00E-9	3.3	3.0				470	0.49	0.37	1.7
11.200	36.745	16.033	0.365	39.526		16.60	2.20	5	115	2.089	0.772	1.317	11.02	2.52	0.14	3	2.92	11.30	1.00E-9	4.9	4.4				830	0.97	0.73	3.3
11.300	37.073	18.562	0.654	20.034		18.85	3.47	5	115	2.108	0.782	1.326	12.63	3.91	0.04	3	2.98	12.91	1.00E-9	5.9	5.2				943	1.12	0.84	3.8
11.400	37.402	7.909	0.303	12.970		8.10	3.74	3	111	2.126	0.792	1.334	4.48	5.07	0.02	3	3.41	4.48	1.00E-9	3.4	3.0				405	0.40	0.30	1.3
11.500	37.730	7.218	0.126	20.360		7.51	1.68	5	115	2.145	0.803	1.342	4.00	2.35	0.12	3	3.28	4.01	1.00E-9	2.8	2.5				376	0.36	0.27	1.2
11.600	38.058	7.479	0.126	29.533		7.90	1.60	5	115	2.164	0.813	1.351	4.25	2.20	0.23	3	3.24	4.27	1.00E-9	2.8	2.5				395	0.38	0.28	1.3
11.700	38.386	15.101	0.241	40.153		15.68	1.54	6	115	2.183	0.823	1.359	9.93	1.79	0.15	4	2.88	10.25	3.00E-8	4.5	4.0				784	0.90	0.66	3.0
11.800	38.714	19.485	0.487	27.423		19.88	2.45	5	115	2.201	0.833	1.368	12.92	2.75	0.06	4	2.88	13.35	3.00E-8	5.8	5.1				994	1.18	0.86	3.9
11.900	39.042	9.962	0.458	22.819		10.29	4.45	3	111	2.220	0.844	1.376	5.87	5.68	0.10	3	3.35	5.87	1.00E-9	4.1	3.6				515	0.54	0.39	1.8
12.000	39.370	9.119	0.176	33.487		9.60	1.83	5	115	2.238	0.854	1.385	5.32	2.39	0.21	3	3.18	5.37	1.00E-9	3.3	2.9				480	0.49	0.35	1.6
12.100	39.698	8.662	0.089	45.107		9.31	0.96	5	115	2.257	0.864	1.393	5.06	1.26	0.34	3	3.06	5.17	1.00E-9	2.9	2.5				466	0.47	0.34	1.5
12.200	40.026	7.577	0.073	57.825		8.41	0.87	1	111	2.275	0.874	1.401	4.38	1.19	0.54	3	3.11	4.45	1.00E-9	2.6	2.3				420	0.41	0.29	1.3
12.300	40.354	7.972	0.063	67.252		8.94	0.70	1	111	2.294	0.885	1.409	4.72	0.95	0.60	3	3.04	4.83	1.00E-9	2.6	2.3				447	0.44	0.31	1.4
12.400	40.682	7.990	0.068	72.965		9.04	0.75	1	111	2.312	0.895	1.417	4.75	1.01	0.65	3	3.05	4.86	1.00E-9	2.6	2.3				452	0.45	0.32	1.4
12.500	41.011	8.034	0.080	79.258		9.18	0.87	5	115	2.331	0.905	1.426	4.80	1.16	0.70	3	3.07	4.90	1.00E-9	2.7	2.3				459	0.46	0.32	1.4
12.600	41.339	8.160	0.110	77.329		9.27	1.18	5	115	2.350	0.915	1.434	4.83	1.58	0.67	3	3.13	4.91	1.00E-9	2.8	2.4				464	0.46	0.32	1.4
12.700	41.667	7.245	0.094	71.531		8.28	1.13	5	115	2.368	0.926	1.443	4.09	1.59	0.72	3	3.19	4.14	1.00E-9	2.6	2.3				414	0.39	0.27	1.2
12.800	41.995	21.602	0.220	58.705		22.45	0.98	6	115	2.387	0.936	1.451	13.82	1.10	0.16	4	2.65	14.71	3.00E-8	5.7	4.8				1122	1.34	0.92	4.1
12.900	42.323	35.241	0.511	15.442		35.46	1.44	7	118	2.407	0.946	1.461	22.63	1.55	0.01	5	2.54	24.37	3.00E-6	8.8	7.5	26	32	142	684			
13.000	42.651	15.414	0.477	6.305		15.51	3.08	5	115	2.425	0.956	1.469	8.90	3.65	-0.04	3	3.09	9.10	1.00E-9	5.2	4.4				775	0.87	0.59	2.7
13.100	42.979	10.958	0.176	9.258		11.09	1.59	5	115	2.444	0.966	1.478	5.85	2.04	-0.03	3	3.11	5.97	1.00E-9	3.7	3.2				555	0.58	0.39	1.8
13.200	43.307	10.832	0.180	13.465		11.03	1.63	5	115	2.463	0.977	1.486	5.76	2.10	0.00	3	3.12	5.87	1.00E-9	3.7	3.2				551	0.57	0.38	1.7
13.300	43.635	14.742	0.314	19.492		15.02	2.09	5	115	2.482	0.987	1.495	8.39	2.50	0.03	3	3.02	8.65	1.00E-9	4.8	4.0				751	0.84	0.56	2.5
13.400	43.963	14.024	0.276	30.594		14.46	1.91	5	115	2.501	0.997	1.503	7.96	2.31	0.10	3	3.02	8.20	1.00E-9	4.5	3.8				723	0.80	0.53	2.4
13.500	44.291	17.046	0.295	43.866		17.68	1.67	6	115	2.519	1.007	1.512	10.03	1.95	0.14	4	2.89	10.48	3.00E-8	5.1	4.3				884	1.01	0.67	3.0
13.600	44.619	20.714	0.629	40.370		21.30	2.95	5	115	2.538	1.018	1.520	12.34	3.35	0.10	3	2.95	12.82	1.00E-9	6.4	5.4				1065	1.25	0.82	3.7
13.700	44.948	11.048	0.486	32.740		11.52	4.22	3	111	2.556	1.028	1.529	5.86	5.42	0.15	3	3.33	5.86	1.00E-9	4.5	3.7				576	0.60	0.39	1.8
13.800	45.276	8.698	0.197	43.010		9.32	2.12	5	115	2.575	1.038	1.537	4.39	2.93	0.31	3	3.29	4.39	1.00E-9	3.4	2.8				466	0.45	0.29	1.3
13.900	45.604	14.589	0.162	34.873		15.09	1.07	6	115	2.594	1.048	1.546	8.09	1.29	0.12	4	2.89	8.48	3.00E-8	4.4	3.6				755	0.83	0.54	2.4
14.000	45.932	17.566	0.391	27.809		17.97	2.18	5	115	2.613	1.059	1.554	9.88	2.55	0.06	3	2.96	10.28	1.00E-9	5.5	4.5				898	1.02	0.66	3.0
14.100	46.260	8.797	0.330	33.933		9.29	3.55	3	111	2.631	1.069	1.562	4.26	4.96	0.21	3	3.43	4.26	1.00E-9	3.8	3.2				464	0.44	0.28	1.3
14.200	46.588	7.837	0.078	47.325		8.52	0.92	1	111	2.649	1.079	1.570	3.74	1.33	0.40	3	3.19	3.79	1.00E-9	2.9	2.3				426	0.39	0.25	1.1
14.300	46.916	7.640	0.036	62.200		8.54	0.43	1	111	2.668	1.089	1.578	3.72	0.62	0.58	1	3.07	3.82	3.00E-8	2.6	2.1				427	0.39	0.25	1.1
14.400	47.244	7.990	0.044	74.412		9.06	0.48	1	111	2.686	1.100	1.586	4.02	0.68	0.67	1	3.05	4.14	3.00E-8	2.6	2.2				453	0.43	0.27	1.2
14.500	47.572	8.375	0.066	82.079		9.56	0.69	1	111	2.704	1.110	1.594	4.30	0.96	0.70	3	3.08	4.42	1.00E-9	2.8	2.3				478	0.46	0.29	1.3
14.600	47.900	14.302	0.138	85.177		15.53	0.89	6	115	2.723	1.120	1.603	7.99	1.08	0.39	4	2.86	8.45	3.00E-8	4.2	3.4				776	0.85	0.53	2.4
14.700	48.228	33.295	0.675	50.954		34.03	1.98	6	115	2.742	1.130	1.612	19.41	2.16	0.08	4	2.68	21.02	3.00E-8	8.9	7.2				1701	2.09	1.29	5.8
14.800	48.556	19.521	0.902	25.399		19.89	4.54	3	111	2.760	1.140	1.620	10.58	5.27	0.04	3	3.12	10.83	1.00E-9	6.8	5.5				994	1.14	0.71	3.2
14.900	48.885	15.513	0.504	28.870		15.93	3.16	5	115	2.779	1.151	1.628	8.08	3.83	0.07	3	3.13	8.26	1.00E-9	5.4	4.4				796	0.88	0.54	2.4
15.000	49.213	12.616	0.271	36.477		13.14	2.06	5	115	2.798	1.161	1.637	6.32	2.62	0.14	3	3.13	6.47	1.00E-9	4.4	3.5				657	0.69	0.42	1.9
15.100	49.541	12.554	0.140	69.205		13.55	1.03	6	115	2.816	1.171	1.645	6.52	1.30	0.36	3	2.97	6.82	1.00E-9	3.9	3.2				678	0.72	0.43	2.0
15.200	49.869	12.814	0.139	109.201		14.39	0.97	6	115	2.835	1.181	1.654	6.98	1.20	0.58	4	2.93	7.35	3.00E-8	3.9	3.1				719	0.77	0.47	2.1
15.300	50.197	16.185	0.261	125.113		17.99	1.45	6	115	2.854	1.192	1.662	9.10	1.72	0.52	4	2.90	9.62	3.00E-8	4.9	3.9				899	1.01	0.61	2.7
15.400	50.525	19.467	0.520	86.852		20.72	2.51	5	115	2.873	1.202	1.671	10.68	2.92	0.28	3	2.97	11.19	1.00E-9	6.1	4.8				1036	1.19	0.71	3.2
15.500	50.853	13.756	0.376	75.738		14.85	2.53	5	115	2.892	1.212	1.679	7.12	3.15	0.35	3	3.13	7.29	1.00E-9	4.8	3.8				742	0.80	0.47	2.1
15.600	51.181	20.427	0.275	83.754		21.63	1.27	6	115	2.910	1.222	1.688	11.09	1.47	0.26	4	2.79	11.92	3.00E-8	5.8	4.6				1082	1.25	0.74	3.3
15.700	51.509	39.921	0.468	46.120		40.59	1.15	7	118	2.930	1.233	1.697	22.19	1.24	0.06	5	2.50	24.88	3.00E-6	9.7	7.7	27	32	162	752			
15.800	51.837	37.339	0.594	22.445		37.66	1.58	7	118	2.949	1.243	1.706	20.35	1.71	0.01	4	2.60	22.50	3.00E-8	9.6	7.5				1883	2.31	1.36	6.1
15.900	52.165	24.310	0.746	25.579		24.68	3.02	5	115	2.968	1.253	1.715	12.66	3.44	0.03	3	2.95	13.34	1.00E-9	7.5	5.9				1234	1.45	0.84	3.8

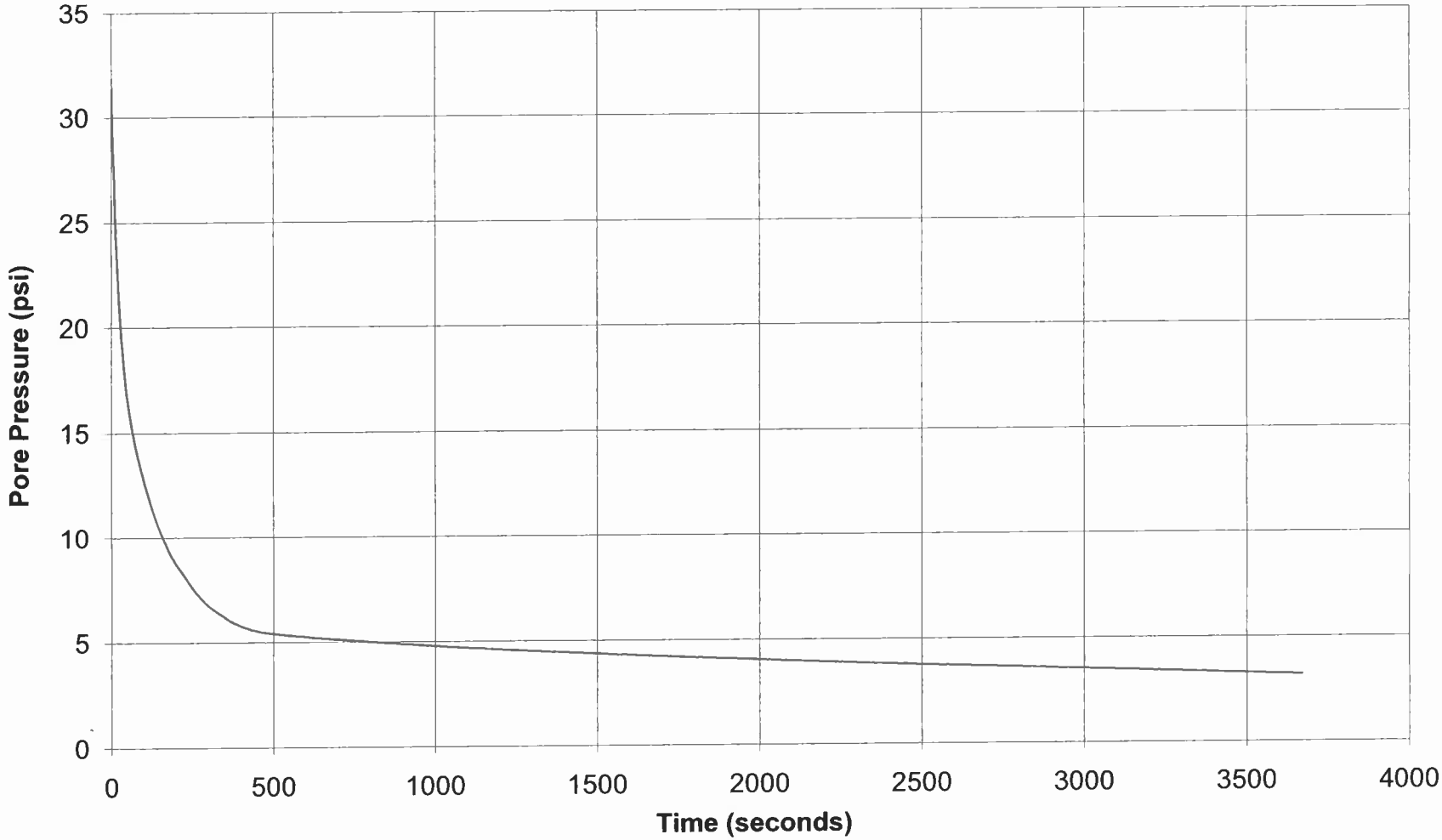
Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
16.000	52.493	11.164	0.481	39.454		11.73	4.10	3	111	2.986	1.263	1.723	5.08	5.50	0.18	3	3.39	5.08	1.00E-9	4.7	3.7				587	0.58	0.34	1.5
16.100	52.822	9.980	0.146	73.640		11.04	1.32	5	115	3.005	1.274	1.731	4.64	1.82	0.50	3	3.17	4.74	1.00E-9	3.6	2.8				552	0.54	0.31	1.4
16.200	53.150	10.707	0.109	98.641		12.13	0.90	6	115	3.024	1.284	1.740	5.23	1.20	0.64	3	3.04	5.44	1.00E-9	3.5	2.7				606	0.61	0.35	1.6
16.300	53.478	10.698	0.123	97.532		12.10	1.02	6	115	3.042	1.294	1.748	5.18	1.36	0.63	3	3.07	5.37	1.00E-9	3.6	2.8				605	0.60	0.35	1.6
16.400	53.806	9.379	0.082	97.363		10.78	0.76	6	115	3.061	1.304	1.757	4.39	1.06	0.74	3	3.09	4.54	1.00E-9	3.2	2.5				539	0.51	0.29	1.3
16.500	54.134	9.864	0.056	104.668		11.37	0.49	6	115	3.080	1.314	1.766	4.70	0.68	0.75	1	2.99	4.93	3.00E-8	3.1	2.4				569	0.55	0.31	1.4
16.600	54.462	13.236	0.084	86.081		14.48	0.58	6	115	3.099	1.325	1.774	6.41	0.74	0.43	4	2.88	6.85	3.00E-8	3.9	3.0				724	0.76	0.43	1.9
16.700	54.790	15.576	0.170	77.787		16.70	1.02	6	115	3.118	1.335	1.783	7.62	1.25	0.31	4	2.90	8.11	3.00E-8	4.7	3.6				835	0.91	0.51	2.3
16.800	55.118	16.293	0.384	75.039		17.37	2.21	5	115	3.136	1.345	1.791	7.95	2.70	0.29	3	3.05	8.27	1.00E-9	5.4	4.1				869	0.95	0.53	2.4
16.900	55.446	11.191	0.252	87.093		12.44	2.02	5	115	3.155	1.355	1.800	5.16	2.71	0.53	3	3.21	5.24	1.00E-9	4.1	3.2				622	0.62	0.34	1.5
17.000	55.774	11.451	0.154	91.360		12.77	1.20	6	115	3.174	1.366	1.808	5.30	1.60	0.54	3	3.09	5.49	1.00E-9	3.9	3.0				638	0.64	0.35	1.6
17.100	56.102	11.496	0.125	102.125		12.97	0.96	6	115	3.193	1.376	1.817	5.38	1.28	0.61	3	3.04	5.61	1.00E-9	3.8	2.9				648	0.65	0.36	1.6
17.200	56.430	13.711	0.173	114.228		15.36	1.13	6	115	3.212	1.386	1.826	6.65	1.42	0.56	3	2.98	7.01	1.00E-9	4.3	3.3				768	0.81	0.44	2.0
17.300	56.759	14.141	0.277	113.143		15.77	1.76	6	115	3.230	1.396	1.834	6.84	2.21	0.54	3	3.06	7.12	1.00E-9	4.7	3.6				789	0.84	0.46	2.1
17.400	57.087	14.617	0.321	108.092		16.17	1.98	5	115	3.249	1.407	1.843	7.01	2.48	0.49	3	3.08	7.28	1.00E-9	4.9	3.7				809	0.86	0.47	2.1
17.500	57.415	17.262	0.374	96.616		18.65	2.01	6	115	3.268	1.417	1.851	8.31	2.43	0.36	3	3.01	8.73	1.00E-9	5.6	4.2				933	1.03	0.55	2.5
17.600	57.743	15.567	0.343	93.446		16.91	2.03	5	115	3.287	1.427	1.860	7.33	2.52	0.39	3	3.07	7.63	1.00E-9	5.2	3.9				846	0.91	0.49	2.2
17.700	58.071	19.118	0.312	98.726		20.54	1.52	6	115	3.306	1.437	1.868	9.22	1.81	0.33	4	2.91	9.87	3.00E-8	5.8	4.4				1027	1.15	0.61	2.8
17.800	58.399	45.077	0.815	60.634		45.95	1.77	7	118	3.325	1.448	1.877	22.70	1.91	0.07	4	2.59	25.67	3.00E-8	11.5	8.6				2298	2.84	1.51	6.8
17.900	58.727	31.591	1.080	39.478		32.16	3.36	5	115	3.344	1.458	1.886	15.28	3.75	0.05	3	2.91	16.38	1.00E-9	9.5	7.1				1608	1.92	1.02	4.6
18.000	59.055	16.024	0.600	68.903		17.02	3.53	4	115	3.363	1.468	1.895	7.21	4.40	0.26	3	3.21	7.33	1.00E-9	5.9	4.4				851	0.91	0.48	2.2
18.100	59.383	17.549	0.427	101.800		19.01	2.24	5	115	3.381	1.478	1.903	8.21	2.73	0.37	3	3.05	8.60	1.00E-9	5.8	4.3				951	1.04	0.55	2.5
18.200	59.711	18.508	0.495	93.506		19.85	2.49	5	115	3.400	1.488	1.912	8.61	3.01	0.32	3	3.05	9.01	1.00E-9	6.1	4.5				993	1.10	0.57	2.6
18.300	60.039	34.882	0.851	63.261		35.79	2.38	6	115	3.419	1.499	1.920	16.86	2.63	0.09	4	2.78	18.53	3.00E-8	9.8	7.3				1790	2.16	1.12	5.1
18.400	60.367	28.569	1.158	61.719		29.46	3.93	5	115	3.438	1.509	1.929	13.49	4.45	0.11	3	2.99	14.27	1.00E-9	9.1	6.7				1473	1.73	0.90	4.0
18.500	60.696	19.154	0.610	93.132		20.49	2.98	5	115	3.457	1.519	1.937	8.79	3.58	0.30	3	3.09	9.15	1.00E-9	6.5	4.8				1025	1.14	0.59	2.6
18.600	61.024	25.054	0.398	121.653		26.81	1.48	6	115	3.475	1.529	1.946	11.99	1.70	0.31	4	2.80	13.16	3.00E-8	7.1	5.2				1340	1.56	0.80	3.6
18.700	61.352	21.601	0.464	135.877		23.56	1.97	6	115	3.494	1.540	1.954	10.27	2.31	0.41	3	2.92	11.01	1.00E-9	6.6	4.9				1178	1.34	0.68	3.1
18.800	61.680	17.163	0.450	152.537		19.36	2.32	5	115	3.513	1.550	1.963	8.07	2.84	0.60	3	3.06	8.45	1.00E-9	5.7	4.2				968	1.06	0.54	2.4
18.900	62.008	17.773	0.769	95.796		19.15	4.02	4	115	3.532	1.560	1.972	7.92	4.92	0.34	3	3.20	8.08	1.00E-9	6.5	4.8				958	1.04	0.53	2.4
19.000	62.336	15.128	0.455	24.000		15.47	2.94	5	115	3.551	1.570	1.980	6.02	3.82	0.01	3	3.24	6.10	1.00E-9	5.7	4.2				774	0.79	0.40	1.8
19.100	62.664	13.657	0.198	42.805		14.27	1.39	6	115	3.569	1.581	1.989	5.38	1.85	0.14	3	3.12	5.58	1.00E-9	4.7	3.4				714	0.71	0.36	1.6
19.200	62.992	14.984	0.223	84.803		16.21	1.38	6	115	3.588	1.591	1.997	6.32	1.77	0.36	3	3.05	6.64	1.00E-9	4.9	3.6				810	0.84	0.42	1.9
19.300	63.320	16.858	0.388	109.309		18.43	2.10	6	115	3.607	1.601	2.006	7.39	2.61	0.42	3	3.07	7.73	1.00E-9	5.6	4.1				922	0.99	0.49	2.2
19.400	63.648	22.436	0.455	104.813		23.94	1.90	6	115	3.626	1.611	2.014	10.09	2.24	0.29	3	2.92	10.86	1.00E-9	6.8	5.0				1197	1.35	0.67	3.0
19.500	63.976	34.721	0.875	69.337		35.72	2.45	6	115	3.645	1.622	2.023	15.86	2.73	0.11	4	2.81	17.46	3.00E-8	9.9	7.2				1786	2.14	1.06	4.8
19.600	64.304	33.680	1.319	67.348		34.65	3.81	5	115	3.663	1.632	2.032	15.25	4.26	0.10	3	2.94	16.39	1.00E-9	10.4	7.5				1733	2.07	1.02	4.6
19.700	64.633	33.653	1.342	68.252		34.64	3.88	5	115	3.682	1.642	2.040	15.17	4.34	0.11	3	2.95	16.28	1.00E-9	10.4	7.5				1732	2.06	1.01	4.6
19.800	64.961	41.625	1.248	73.508		42.68	2.92	6	115	3.701	1.652	2.049	19.03	3.20	0.09	4	2.79	21.09	3.00E-8	11.8	8.4				2134	2.60	1.27	5.7
19.900	65.289	36.227	1.549	61.514		37.11	4.17	5	115	3.720	1.663	2.057	16.23	4.64	0.08	3	2.94	17.45	1.00E-9	11.2	8.0				1856	2.23	1.08	4.9
20.000	65.617	20.875	1.156	61.682		21.76	5.31	3	111	3.738	1.673	2.065	8.73	6.41	0.15	3	3.24	8.84	1.00E-9	7.9	5.6				1088	1.20	0.58	2.6
20.100	65.945	48.727	0.725	65.347		49.67	1.46	7	118	3.757	1.683	2.074	22.13	1.58	0.07	5	2.55	25.76	3.00E-6	12.2	8.7	27	32	199	860			
20.200	66.273	57.927	1.144	46.795		58.60	1.95	7	118	3.777	1.693	2.083	26.31	2.09	0.03	4	2.56	30.61	3.00E-8	14.5	10.4				2930	3.65	1.75	7.9
20.300	66.601	34.918	1.057	46.385		35.59	2.97	6	115	3.795	1.703	2.092	15.20	3.33	0.05	3	2.88	16.60	1.00E-9	10.4	7.4				1779	2.12	1.01	4.6
20.400	66.929	30.524	0.760	55.582		31.32	2.43	6	115	3.814	1.714	2.101	13.10	2.76	0.08	3	2.88	14.30	1.00E-9	9.1	6.4				1566	1.83	0.87	3.9
20.500	67.257	37.186	0.585	64.840		38.12	1.54	7	118	3.834	1.724	2.110	16.25	1.71	0.09	4	2.69	18.48	3.00E-8	9.9	7.0				1906	2.29	1.08	4.9
20.600	67.585	25.780	0.703	67.384		26.75	2.63	6	115	3.852	1.734	2.118	10.81	3.07	0.14	3	2.97	11.58	1.00E-9	8.1	5.7				1338	1.53	0.72	3.2
20.700	67.913	15.710	0.371	87.105		16.96	2.19	5	115	3.871	1.744	2.127	6.16	2.83	0.35	3	3.16	6.35	1.00E-9	5.6	3.9				848	0.87	0.41	1.8
20.800	68.241	14.284	0.256	103.752		15.78	1.62	6	115	3.890	1.755	2.135	5.57	2.15	0.48	3	3.14	5.77	1.00E-9	5.0	3.5				789	0.79	0.37	1.7
20.900	68.570	14.222	0.261	103.391		15.71	1.66	6	115	3.909	1.765	2.144	5.50	2.21	0.48	3	3.15	5.70	1.00E-9	5.0	3.5				786	0.79	0.37	1.7
21.000	68.898	12.581	0.181	103.716		14.07	1.29	6	115	3.928	1.775	2.152	4.71	1.78	0.56	3	3.16	4.86	1.00E-9	4.5	3.1				704	0.68	0.31	1.4
21.100	69.226	14.437	0.196	111.552		16.04	1.22	6	115	3.946	1.785	2.161	5.60	1.62	0.52	3	3.07	5.88	1.00E-9	4.8	3.4				802	0.81	0.37	1.7
21.200	69.554	11.881	0.188	117.241		13.57	1.39	6	115	3.965	1.796	2.170	4.43	1.96	0.69	3	3.20	4.53	1.00E-9	4.4	3.0				678	0.64	0.30	1.3
21.300	69.882	20.543	0.504	103.861		22.04	2.29	6	115	3.984	1.806	2.178	8.29	2.79	0.31	3	3.05	8.77	1.00E-9	6.8	4.7				1102	1.20	0.55	2.5
21.400	70.210	22.525	0.855	59.464		23.38	3.66	5	115	4.003	1.816	2.187	8.86	4.41	0.13	3	3.14	9.20	1.00E-9	7.9	5.5				1169	1.29	0.59	2.7
21.500	70.538	15.818	0.562	72.157		16.86	3.33	5	115	4.022	1.826	2.195	5.85	4.38	0.26	3	3.28	5.88	1.00E-9	6.1	4.3				843	0.86	0.39	1.8
21.600	70.866	18.428	0.429	87.166		19.68	2.18	6	115	4.040	1.837	2.204	7.10	2.74	0.28	3	3.10	7.43	1.00E-9	6.3	4.4				984	1.04	0.47	2.1
21.700	71.194	26.184	0.573	75.135		27.27	2.10	6	115	4.059	1.847	2.212	10.49	2.47	0.15	3	2.93	11.40	1.00E-9	8.0	5.6				1363	1.55	0.70	3.1
21.800	71.522	19.674	0.735	76.956		20.78	3.54	5	115	4.078	1.857	2.221	7.52	4.40	0.22	3	3.19	7.71	1.00E-9	7.2	4.9				1039	1.11	0.50	2.3
21.900	71.850	24.713	0.759	73.014		25.76	2.95	5	115	4.097	1.867	2.229	9.72	3.50	0.16	3	3.05	10.30	1.00E-9	8.1	5.6				1288	1.44	0.65	2.9
22.000	72.178	24.489	0.891	49.640		25.20	3.53	5	115	4.115	1.877	2.238	9.42	4.22	0.08	3	3.10	9.86	1.00E-9	8.4	5.8				1260	1.41	0.63	2.8
22.100	72.507	14.275	0.481	63.864		15.19	3.17	5	115	4.134	1.888	2.247	4.92	4.35	0.25	3	3.34	4.92	1.00E-9	5.8	4.0				760	0.74	0.33	1.5
22.200	72.835	12.151	0.176	101.679		13.61	1.30	6	115	4.153	1.898	2.255	4.20	1.86	0.57	3	3.21	4.29	1.00E-9	4.5	3.1				681	0.63	0.28	1.3
22.300	73.163	18.203	0.324	104.801		19.71	1.64	6	115	4.172	1.908	2.264	6.87	2.08	0.36	3	3.05	7.28	1.00E-9	6.0	4.1				986	1.04	0.46	2.1
22.400	73.491	30.075	0.625	87.660		31.34	1.99	6	115	4.191	1.918	2.272	11.95	2.30	0.16	4	2.87	13.21	3.00E-8	8.9	6.1				1567	1.81	0.80	3.6
22.500	73.819	35.850	0.907	64.431		36.78	2.47	6	115	4.209	1.929	2.281	14.28	2.79	0.08	4	2.85	15.86	3.00E-8	10.5	7.1				1839	2.17	0.95	4.3
22.600	74.147	21.826	0.707	63.563		22.74	3.11	5	115	4.228	1.939	2.289	8.09	3.82	0.14	3	3.13	8.42	1.00E-9	7.6	5.2				1137	1.23	0.54	2.4
22.700	74.475	23.126	0.532	75.220		24.21	2.20	6	115	4.247	1.949	2.298	8.69	2.66	0.17	3	3.02	9.29	1.00E-9	7.5	5.1				1210	1.33	0.58	2.6
22.800	74.803	20.526	0.551	84.670		21.74	2.53	5	115	4.266	1.959	2.307	7.58	3.15	0.24	3	3.11	7.94	1.00E-9	7.0	4.8				1087	1.17	0.51	2.3
22.900	75.131	28.264	0.553	78.920		29.40	1.88	6	115	4.285	1.970	2.315	10.85	2.20	0.15	4	2.89	11.96	3.00E-8	8.5	5.7				1470	1.67	0.72	3.3
23.000	75.459	31.340	0.562	66.070		32.29	1.74	6	115	4.303	1.980	2.324	12.04	2.01	0.10	4	2.83	13.47	3.00E-8	9.1	6.1				1615	1.87	0.80	3.6
23.100	75.787	26.345	0.310	68.674		27.33	1.13	7	118	4.323	1.990	2.333	9.86	1.35	0.13	4	2.82	11.07	3.00E-8	7.6	5.1				1367	1.53	0.66	3.0
23.200	76.115	20.580	0.356	81.982		21.76	1.63	6	115	4.342	2.000	2.341	7.44	2.04	0.22	3	3.02	7.97	1.00E-9	6.6	4.5				1088	1.16	0.50	2.2
23.300	76.444	29.502	0.529	83.694		30.71	1.72	6	115	4.360	2.011	2.350	11.21	2.01	0.15	4	2.86	12.48	3.00E-8	8.7	5.8				1535	1.76	0.75	3.4
23.400	76.772	35.366	1.118	56.499		36.18	3.09	5	115	4.379	2.021	2.358	13.48	3.52	0.06	3	2.93	14.76	1.00E-9	10.8	7.3				1809	2.12	0.90	4.0
23.500	77.100	17.136	0.793	76.786		18.24	4.35	3	111	4.397	2.031	2.366	5.85	5.73	0.25	3	3.35	5.85	1.00E-9	7.0	4.7				912	0.92	0.39	1.8
23.600	77.428	33.232	0.588	84.815		34.45	1.71	6	115	4.416	2.041	2.375	12.65	1.96	0.14	4	2.81	14.27	3.00E-8	9.5	6.3				1723	2.00	0.84	3.8
23.700	77.756	49.839	1.000	44.059		50.47	1.98	7	118	4.436	2.051	2.384	19.31	2.17	0.02	4	2.68	22.48	3.00E-8	13.3	8.9				2524	3.07	1.29	5.8
23.800	78.084	31.322	0.955	40.672		31.91	2.99	5	115	4.454	2.062	2.393	11.47	3.48	0.03	3	2.99	12.41	1.00E-9	9.9	6.6				1595	1.83	0.76	3.4
23.900	78.412	23.960	0.664	70.470		24.97	2.66	5	115	4.473	2.072	2.401	8.54	3.24	0.15	3	3.07	9.04	1.00E-9	8.0	5.3				1249	1.37	0.57	2.6
24.000	78.740	33.025	0.720	67.830		34.00	2.12	6	115	4.492	2.082	2.410	12.25	2.44	0.09	4	2.87	13.63	3.00E-8	9.8	6.5				1700	1.97	0.82	3.7
24.100	79.068	25.242	0.612	61.309		26.13	2.34	6	115	4.511	2.092	2.418	8.94	2.83	0.11	3	3.02	9.59	1.00E-9	8.2	5.4				1306	1.44	0.60	2.7
24.200	79.396	26.865	0.649	66.805		27.83	2.33	6	115	4.530	2.103	2.427	9.60	2.78	0.12	3	2.99	10.38	1.00E-9	8.6	5.6				1391	1.55	0.64	2.9
24.300	79.724	16.410	0.557	98.436		17.83	3.12	5	115	4.548	2.113	2.435	5.45	4.19	0.37	3	3.30	5.47	1.00E-9	6.4	4.2				891	0.89	0.36	1.6
24.400	80.052	13.253	0.210	133.491		15.18	1.38	6	115	4.567	2.123	2.444	4.34	1.98	0.71	3	3.21	4.44	1.00E-9	4.9	3.2				759	0.71	0.29	1.3
24.500	80.381	13.675	0.135	135.576		15.63	0.86	6	115	4.586	2.133	2.453	4.50	1.22	0.69	3	3.11	4.74	1.00E-9	4.7	3.1				781	0.74	0.30	1.4
24.600	80.709	13.531	0.142	132.719		15.44	0.92	6	115	4.605	2.144	2.461	4.40	1.31	0.68	3	3.13	4.61	1.00E-9	4.7	3.1				772	0.72	0.29	1.3
24.700	81.037	13.262	0.126	133.129		15.18	0.83	6	115	4.624	2.154	2.470	4.27	1.19	0.70	3	3.12	4.48	1.00E-9	4.6	3.0				759	0.70	0.28	1.3
24.800	81.365	13.800	0.134	130.706		15.68	0.85	6	115	4.642	2.164	2.478	4.45	1.21	0.66	3	3.11	4.69	1.00E-9	4.7	3.1				784	0.74	0.30	1.3

Col 1i	Col 2i	Col 3i	Col 4i	Col 5i	Col 6i	Col 7i	Col 8i	Col 9i	Col 10i	Col 11i	Col 12i	Col 13i	Col 14i	Col 15i	Col 16i	Col 17i	Col 18i	Col 19i	Col 20i	Col 21i	Col 22i	Col 23i	Col 24i	Col 25i	Col 26i	Col 27i	Col 28i	Col 29i
Depth	Depth	q_c	f_s	u	Other	q_t	R_f	SBT	Unit Weight, γ	Total Overburden Stress, σ_v	Insitu pore pressure, u_o	Effective overburden stress, σ'_v	Normalized cone resistance, Q_{tl}	Normalized Friction raio, F_r	Normalized pore pressure ratio, B_q	Soil Behavior Type (normalized) SBT_n	SBTn Index, I_c	Normalized Cone resistance, Q_{tn}	Estimated permeability, k_{SBT}	SPT N_{60}	SPT $(N_1)_{60}$	Relative Density, D_r	Friction Angle, φ'	Young's modulus, E_s	Small strain shear modulus, G_o	Undrained shear strength, s_u	Undrained strength ratio, s_u/σ'_v	Over consolidation ratio, OCR
(m)	(ft)	(tsf)	(tsf)	(psi)		(tsf)	(%)		(pcf)	(tsf)	(tsf)	(tsf)							(ft/sec)	(blows/ft)	(blows/ft)	(%)	(degrees)	(tsf)	(tsf)	(tsf)		
24.900	81.693	13.406	0.201	130.850		15.29	1.32	6	115	4.661	2.174	2.487	4.27	1.89	0.68	3	3.21	4.38	1.00E-9	4.9	3.2				764	0.71	0.28	1.3
25.000	82.021	19.566	0.288	112.853		21.19	1.36	6	115	4.680	2.185	2.495	6.62	1.75	0.36	3	3.03	7.11	1.00E-9	6.4	4.1				1060	1.10	0.44	2.0
25.100	82.349	19.745	0.391	90.842		21.05	1.86	6	115	4.699	2.195	2.504	6.53	2.39	0.27	3	3.10	6.89	1.00E-9	6.7	4.4				1053	1.09	0.44	2.0
25.200	82.677	13.621	0.234	119.037		15.34	1.53	6	115	4.718	2.205	2.512	4.23	2.21	0.60	3	3.25	4.29	1.00E-9	5.1	3.3				767	0.71	0.28	1.3
25.300	83.005	14.311	0.175	132.538		16.22	1.08	6	115	4.736	2.215	2.521	4.56	1.52	0.64	3	3.14	4.76	1.00E-9	5.0	3.3				811	0.77	0.30	1.4
25.400	83.333	15.890	0.170	132.285		17.79	0.96	6	115	4.755	2.226	2.530	5.15	1.30	0.56	3	3.06	5.49	1.00E-9	5.3	3.4				890	0.87	0.34	1.5
25.500	83.661	15.647	0.208	132.297		17.55	1.18	6	115	4.774	2.236	2.538	5.03	1.63	0.57	3	3.12	5.29	1.00E-9	5.4	3.5				878	0.85	0.34	1.5
25.600	83.990	14.105	0.150	144.291		16.18	0.92	6	115	4.793	2.246	2.547	4.47	1.31	0.71	3	3.12	4.70	1.00E-9	4.9	3.1				809	0.76	0.30	1.3
25.700	84.318	13.980	0.131	145.340		16.07	0.81	6	115	4.811	2.256	2.555	4.41	1.16	0.73	3	3.10	4.65	1.00E-9	4.8	3.1				804	0.75	0.29	1.3
25.800	84.646	14.571	0.139	144.292		16.65	0.84	6	115	4.830	2.266	2.564	4.61	1.18	0.69	3	3.09	4.88	1.00E-9	4.9	3.2				832	0.79	0.31	1.4
25.900	84.974	15.459	0.259	140.892		17.49	1.48	6	115	4.849	2.277	2.572	4.91	2.05	0.62	3	3.17	5.09	1.00E-9	5.5	3.6				874	0.84	0.33	1.5
26.000	85.302	16.176	0.211	61.960		17.07	1.24	6	115	4.868	2.287	2.581	4.73	1.73	0.18	3	3.15	4.93	1.00E-9	5.7	3.7				853	0.81	0.32	1.4
26.100	85.630	18.490	0.234	36.754		19.02	1.23	6	115	4.887	2.297	2.590	5.46	1.65	0.02	3	3.09	5.79	1.00E-9	6.3	4.0				951	0.94	0.36	1.6
26.200	85.958	16.257	0.330	70.397		17.27	1.91	6	115	4.905	2.307	2.598	4.76	2.67	0.22	3	3.24	4.84	1.00E-9	6.1	3.9				864	0.82	0.32	1.4
26.300	86.286	21.288	0.384	118.712		23.00	1.67	6	115	4.924	2.318	2.607	6.93	2.12	0.34	3	3.05	7.43	1.00E-9	7.0	4.5				1150	1.20	0.46	2.1
26.400	86.614	24.328	0.734	108.128		25.88	2.83	5	115	4.943	2.328	2.615	8.01	3.50	0.26	3	3.11	8.44	1.00E-9	8.4	5.3				1294	1.40	0.53	2.4
26.500	86.942	15.378	0.366	123.714		17.16	2.13	5	115	4.962	2.338	2.624	4.65	3.00	0.54	3	3.28	4.69	1.00E-9	5.9	3.8				858	0.81	0.31	1.4
26.600	87.270	14.715	0.130	150.524		16.88	0.77	6	115	4.981	2.348	2.632	4.52	1.10	0.71	3	3.08	4.81	1.00E-9	5.0	3.1				844	0.79	0.30	1.4
26.700	87.598	14.832	0.141	156.286		17.08	0.82	6	115	4.999	2.359	2.641	4.58	1.16	0.74	3	3.09	4.86	1.00E-9	5.0	3.2				854	0.81	0.31	1.4
26.800	87.927	15.504	0.139	155.683		17.75	0.79	6	115	5.018	2.369	2.649	4.80	1.09	0.69	3	3.06	5.14	1.00E-9	5.1	3.3				887	0.85	0.32	1.4
26.900	88.255	15.665	0.119	152.404		17.86	0.67	6	115	5.037	2.379	2.658	4.82	0.93	0.67	3	3.03	5.21	1.00E-9	5.1	3.2				893	0.85	0.32	1.4
27.000	88.583	15.244	0.128	153.501		17.45	0.73	6	115	5.056	2.389	2.667	4.65	1.03	0.70	3	3.06	4.98	1.00E-9	5.1	3.2				873	0.83	0.31	1.4
27.100	88.911	15.791	0.149	156.045		18.04	0.83	6	115	5.075	2.400	2.675	4.85	1.15	0.68	3	3.06	5.18	1.00E-9	5.3	3.3				902	0.86	0.32	1.5
27.200	89.239	15.907	0.161	158.757		18.19	0.88	6	115	5.093	2.410	2.684	4.88	1.23	0.69	3	3.07	5.21	1.00E-9	5.3	3.3				910	0.87	0.33	1.5
27.300	89.567	16.320	0.160	160.336		18.63	0.86	6	115	5.112	2.420	2.692	5.02	1.18	0.68	3	3.06	5.39	1.00E-9	5.4	3.4				931	0.90	0.33	1.5
27.400	89.895	19.602	0.180	149.294		21.75	0.83	7	118	5.132	2.430	2.701	6.15	1.09	0.50	4	2.96	6.78	3.00E-8	6.1	3.8				1088	1.11	0.41	1.8
27.500	90.223	18.454	0.196	140.856		20.48	0.96	6	115	5.150	2.440	2.710	5.66	1.28	0.50	3	3.02	6.13	1.00E-9	6.0	3.7				1024	1.02	0.38	1.7
27.600	90.551	16.275	0.127	144.665		18.36	0.69	6	115	5.169	2.451	2.718	4.85	0.97	0.60	3	3.03	5.24	1.00E-9	5.3	3.3				918	0.88	0.32	1.5
27.700	90.879	15.405	0.112	153.658		17.62	0.64	6	115	5.188	2.461	2.727	4.56	0.90	0.69	3	3.05	4.91	1.00E-9	5.1	3.2				881	0.83	0.30	1.4
27.800	91.207	15.863	0.110	159.347		18.16	0.60	6	115	5.207	2.471	2.736	4.73	0.85	0.70	3	3.02	5.14	1.00E-9	5.1	3.2				908	0.86	0.32	1.4
27.900	91.535	15.531	0.110	168.063		17.95	0.61	6	115	5.226	2.481	2.744	4.64	0.86	0.76	3	3.03	5.02	1.00E-9	5.1	3.1				898	0.85	0.31	1.4
28.000	91.864	15.396	0.110	168.087		17.82	0.62	6	115	5.244	2.492	2.753	4.57	0.88	0.76	3	3.04	4.93	1.00E-9	5.1	3.1				891	0.84	0.30	1.4
28.100	92.192	15.907	0.119	173.198		18.40	0.65	6	115	5.263	2.502	2.761	4.76	0.91	0.76	3	3.03	5.15	1.00E-9	5.2	3.2				920	0.88	0.32	1.4
28.200	92.520	16.176	0.132	176.971		18.72	0.71	6	115	5.282	2.512	2.770	4.85	0.98	0.76	3	3.04	5.25	1.00E-9	5.3	3.3				936	0.90	0.32	1.5
28.300	92.848	16.221	0.152	177.477		18.78	0.81	6	115	5.301	2.522	2.778	4.85	1.13	0.76	3	3.06	5.21	1.00E-9	5.4	3.3				939	0.90	0.32	1.5
28.400	93.176	16.356	0.141	171.257		18.82	0.75	6	115	5.320	2.533	2.787	4.84	1.04	0.73	3	3.05	5.22	1.00E-9	5.4	3.3				941	0.90	0.32	1.5
28.500	93.504	16.105	0.112	165.712		18.49	0.60	6	115	5.338	2.543	2.796	4.71	0.85	0.71	3	3.02	5.11	1.00E-9	5.2	3.2				925	0.88	0.31	1.4
28.600	93.832	16.356	0.120	168.702		18.79	0.64	6	115	5.357	2.553	2.804	4.79	0.90	0.71	3	3.03	5.20	1.00E-9	5.3	3.3				939	0.90	0.32	1.4
28.700	94.160	16.481	0.133	175.766		19.01	0.70	6	115	5.376	2.563	2.813	4.85	0.98	0.74	3	3.04	5.25	1.00E-9	5.4	3.3				951	0.91	0.32	1.5
28.800	94.488	17.423	0.138	177.586		19.98	0.69	7	118	5.395	2.574	2.822	5.17	0.95	0.70	3	3.01	5.65	1.00E-9	5.6	3.4				999	0.97	0.34	1.6
28.900	94.816	17.530	0.133	176.802		20.08	0.66	7	118	5.415	2.584	2.831	5.18	0.91	0.69	3	3.00	5.67	1.00E-9	5.6	3.4				1004	0.98	0.35	1.6
29.000	95.144	17.288	0.135	175.332		19.81	0.68	7	118	5.434	2.594	2.840	5.06	0.94	0.70	3	3.01	5.52	1.00E-9	5.6	3.4				991	0.96	0.34	1.5
29.100	95.472	17.378	0.117	176.730		19.92	0.59	7	118	5.453	2.604	2.849	5.08	0.81	0.70	4	2.99	5.59	3.00E-8	5.5	3.4				996	0.96	0.34	1.5
29.200	95.801	17.046	0.128	183.939		19.70	0.65	7	118	5.473	2.614	2.858	4.98	0.90	0.75	3	3.01	5.43	1.00E-9	5.5	3.3				985	0.95	0.33	1.5
29.300	96.129	17.522	0.139	186.856		20.21	0.69	7	118	5.492	2.625	2.867	5.13	0.95	0.74	3	3.01	5.61	1.00E-9	5.6	3.4				1011	0.98	0.34	1.5
29.400	96.457	18.006	0.128	185.723		20.68	0.62	7	118	5.511	2.635	2.876	5.27	0.85	0.71	4	2.98	5.82	3.00E-8	5.7	3.4				1034	1.01	0.35	1.6
29.500	96.785	17.791	0.127	189.098		20.51	0.62	7	118	5.530	2.645	2.885	5.19	0.85	0.73	4	2.98	5.72	3.00E-8	5.6	3.4				1026	1.00	0.35	1.6
29.600	97.113	18.185	0.139	188.676		20.90	0.67	7	118	5.550	2.655	2.894	5.30	0.91	0.71	4	2.99	5.84	3.00E-8	5.8	3.5				1045	1.02	0.35	1.6
29.700	97.441	18.660	0.143	185.879		21.34	0.67	7	118	5.569	2.666	2.903	5.43	0.90	0.68	4	2.98	6.00	3.00E-8	5.9	3.6				1067	1.05	0.36	1.6
29.800	97.769	18.347	0.140	187.229		21.04	0.66	7	118	5.588	2.676	2.913	5.31	0.90	0.70	4	2.99	5.85	3.00E-8	5.8	3.5				1052	1.03	0.35	1.6
29.900	98.097	17.844	0.126	188.001		20.55	0.61	7	118	5.608	2.686	2.922	5.11	0.85	0.73	4	2.99	5.63	3.00E-8	5.7	3.4				1028	1.00	0.34	1.5
30.000	98.425	18.454	0.135	188.543		21.17	0.64	7	118	5.627	2.696	2.931	5.30	0.87	0.70	4	2.98	5.86	3.00E-8	5.8	3.5				1058	1.04	0.35	1.6
30.100	98.753	18.974	0.157	192.557		21.75	0.72	7	118	5.646	2.707	2.940	5.48	0.98	0.69	3	2.99	6.04	1.00E-9	6.0	3.6				1087	1.07	0.37	1.6
30.200	99.081	19.369	0.161	194.245		22.17	0.73	7	118	5.666	2.717	2.949	5.60	0.98	0.68	4	2.98	6.19	3.00E-8	6.1	3.7				1108	1.10	0.37	1.7
30.300	99.409	19.163	0.141	194.498		21.96	0.64	7	118	5.685	2.727	2.958	5.50	0.86	0.69	4	2.96	6.12	3.00E-8	6.0	3.6				1098	1.09	0.37	1.7
30.400	99.738	19.190	0.145	199.175		22.06	0.66	7	118	5.704	2.737	2.967	5.51	0.88	0.71	4	2.97	6.12	3.00E-8	6.0	3.6				1103	1.09	0.37	1.7
30.500	100.066	20.257	0.179	204.082		23.20	0.77	7	118	5.724	2.748	2.976	5.87	1.02	0.68	4	2.97	6.52	3.00E-8	6.3	3.8				1160	1.16	0.39	1.8
30.600	100.394	21.261	0.188	201.888		24.17	0.78	7	118	5.743	2.758	2.985	6.17	1.02	0.64	4	2.95	6.90	3.00E-8	6.6	3.9				1208	1.23	0.41	1.9
30.700	100.722	20.902	0.183	205.793		23.87	0.77	7	118	5.762	2.768	2.994	6.05	1.01	0.67	4	2.95	6.75	3.00E-8	6.5	3.9				1193	1.21	0.40	1.8
30.800	101.050	20.319	0.160	207.168		23.30	0.69	7	118	5.782	2.778	3.003	5.83	0.91	0.69	4	2.95	6.52	3.00E-8	6.3	3.7				1165	1.17	0.39	1.8
30.900	101.378	21.019	0.225	210.048		24.04	0.93	7	118	5.801	2.788	3.012	6.06	1.23	0.68	3	2.99	6.69	1.00E-9	6.7	4.0				1202	1.22	0.40	1.8
31.000	101.706	22.615	0.332	198.235		25.47	1.30	6	115	5.820	2.799	3.021	6.50	1.69	0.58	3	3.03	7.11	1.00E-9	7.3	4.3				1273	1.31	0.43	2.0
31.100	102.034	22.660	0.325	203.587		25.59	1.27	6	115	5.839	2.809	3.030	6.52	1.64	0.60	3	3.02	7.14	1.00E-9	7.3	4.3				1280	1.32	0.43	2.0
31.200	102.362	25.735	0.406	186.964		28.43	1.43	6	115	5.857	2.819	3.038	7.43	1.80	0.47	3	2.99	8.22	1.00E-9	8.2	4.8				1421	1.50	0.50	2.2
31.300	102.690	26.435	0.394	162.868		28.78	1.37	6	115	5.876	2.829	3.047	7.52	1.72	0.39	3	2.97	8.35	1.00E-9	8.3	4.9				1439	1.53	0.50	2.3
31.400	103.018	26.525	0.567	163.627		28.88	1.96	6	115	5.895	2.840	3.055	7.52	2.47	0.39	3	3.05	8.15	1.00E-9	8.8	5.2				1444	1.53	0.50	2.3
31.500	103.346	83.994	0.553	149.752		86.15	0.64	8	121	5.915	2.850	3.065	26.18	0.69	0.10	5	2.31	35.99	3.00E-6	18.7	11.0	32	33	345	1177			
31.600	103.675	154.493	0.302	109.840		156.07	0.19	9	124	5.935	2.860	3.075	48.83	0.20	0.03	6	1.86	77.66	3.00E-4	28.8	16.9	47	37	624	1436			

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

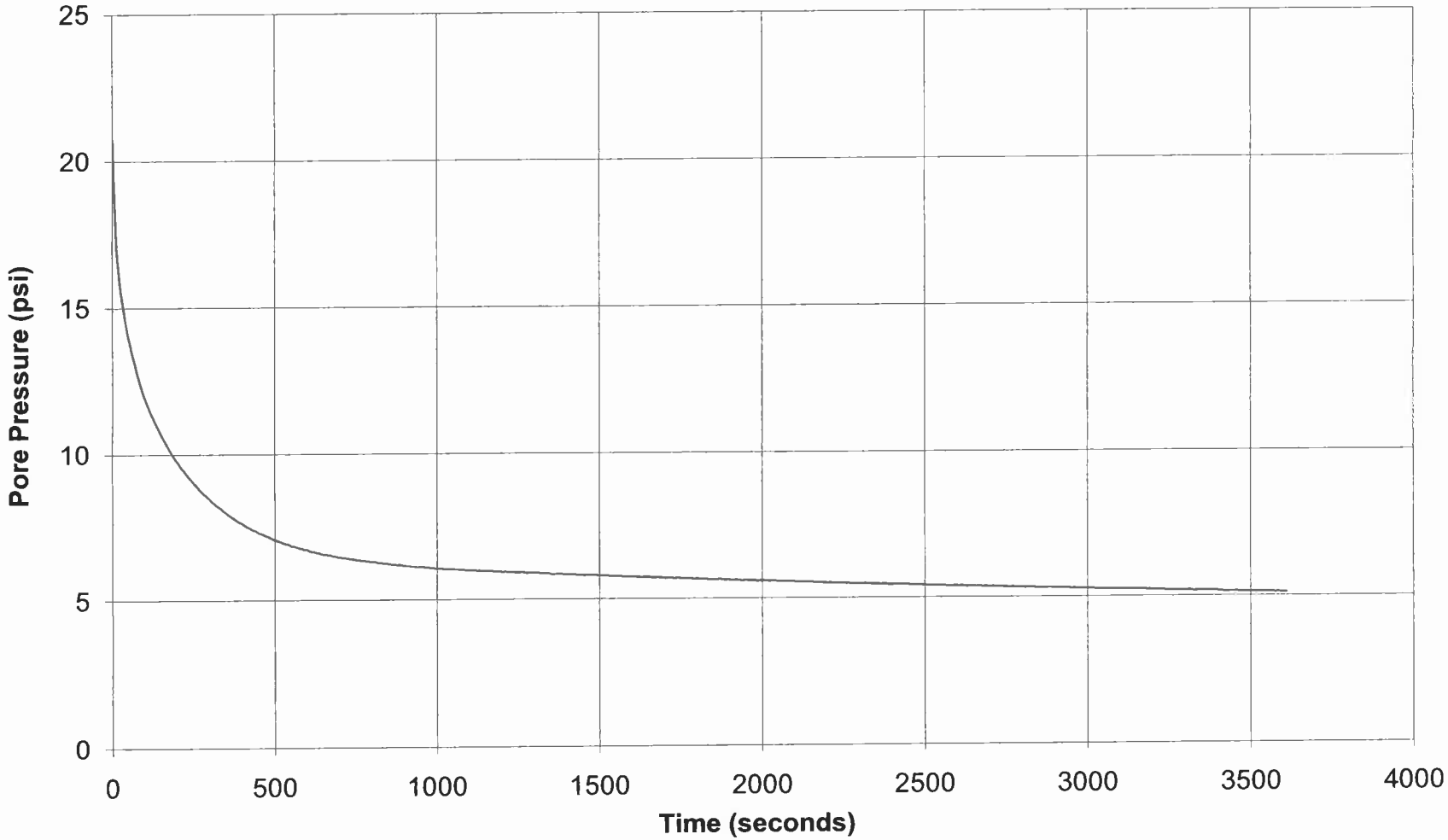
Sounding: CPT-01
Depth: 11.155
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

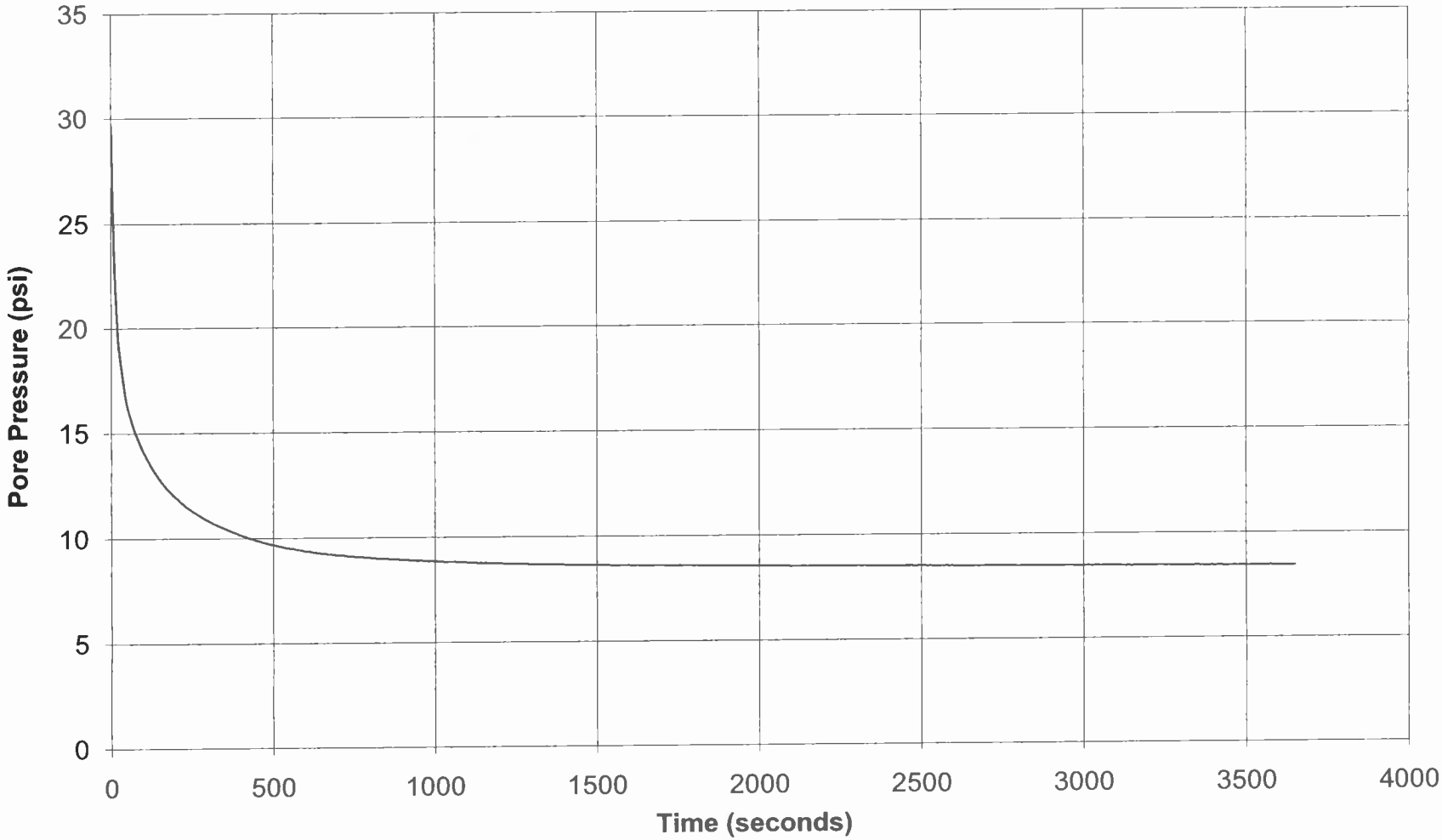
Sounding: CPT-01
Depth: 25.262
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

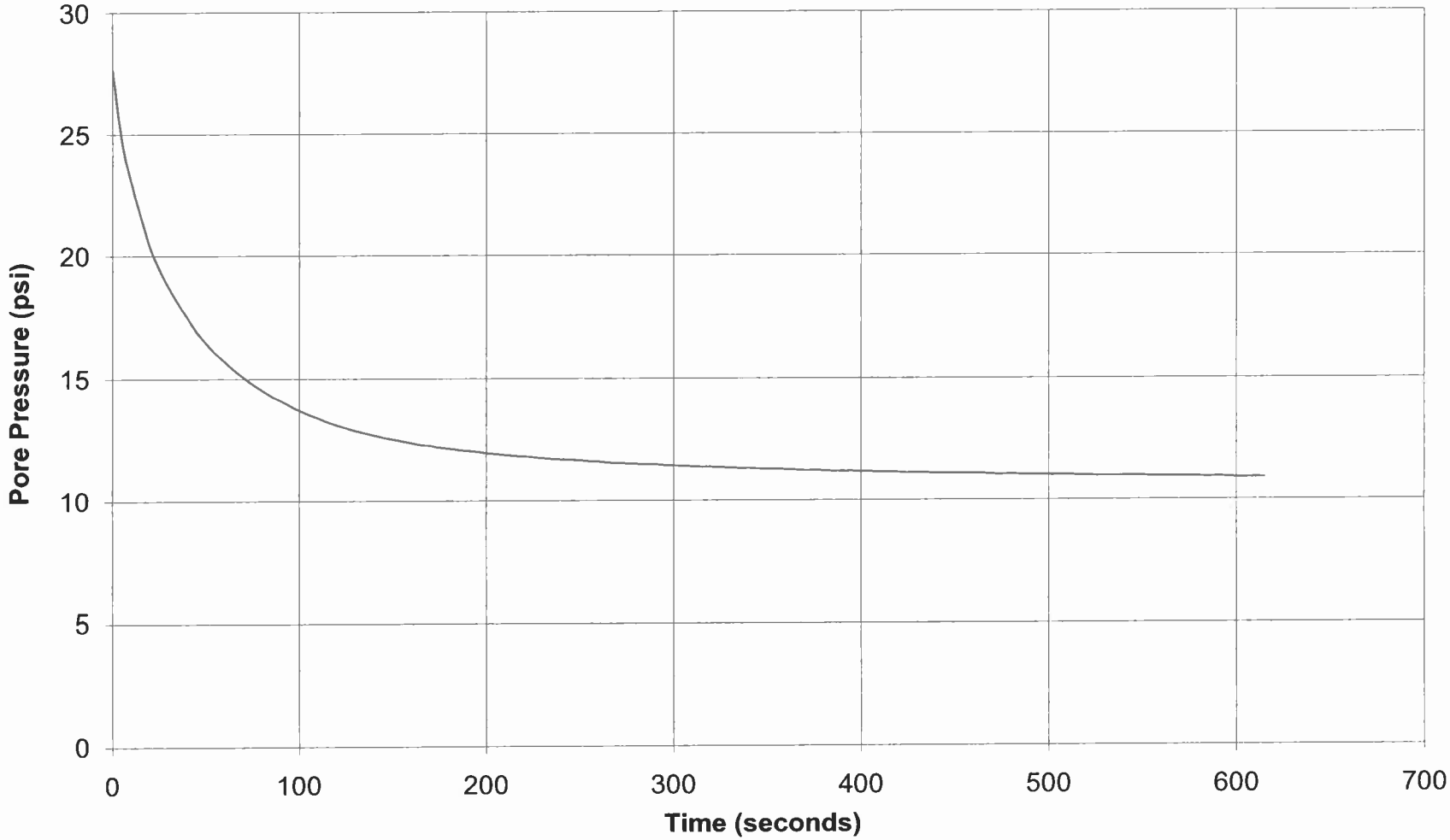
Sounding: CPT-01
Depth: 40.19
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

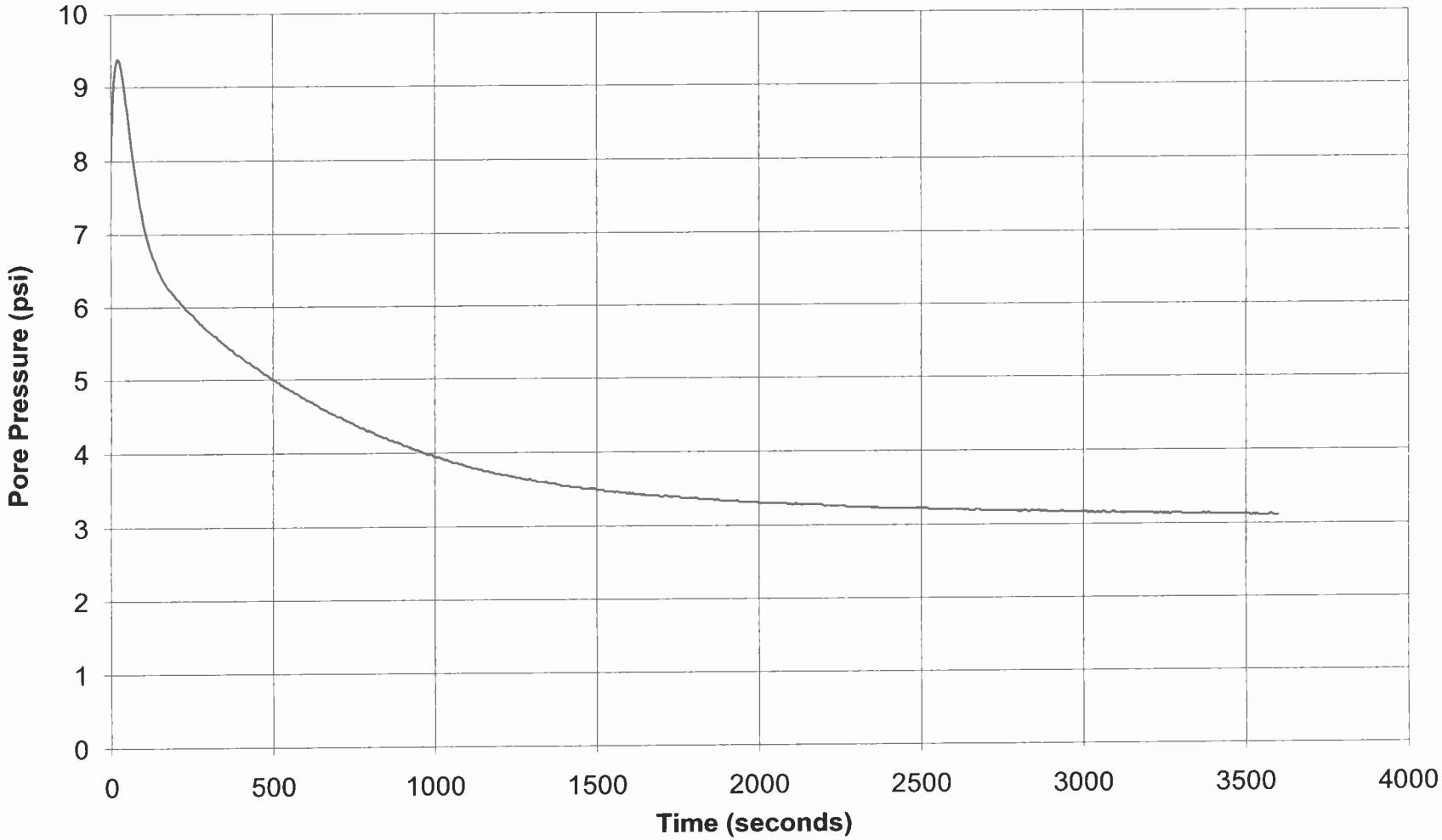
Sounding: CPT-01
Depth: 47.572
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

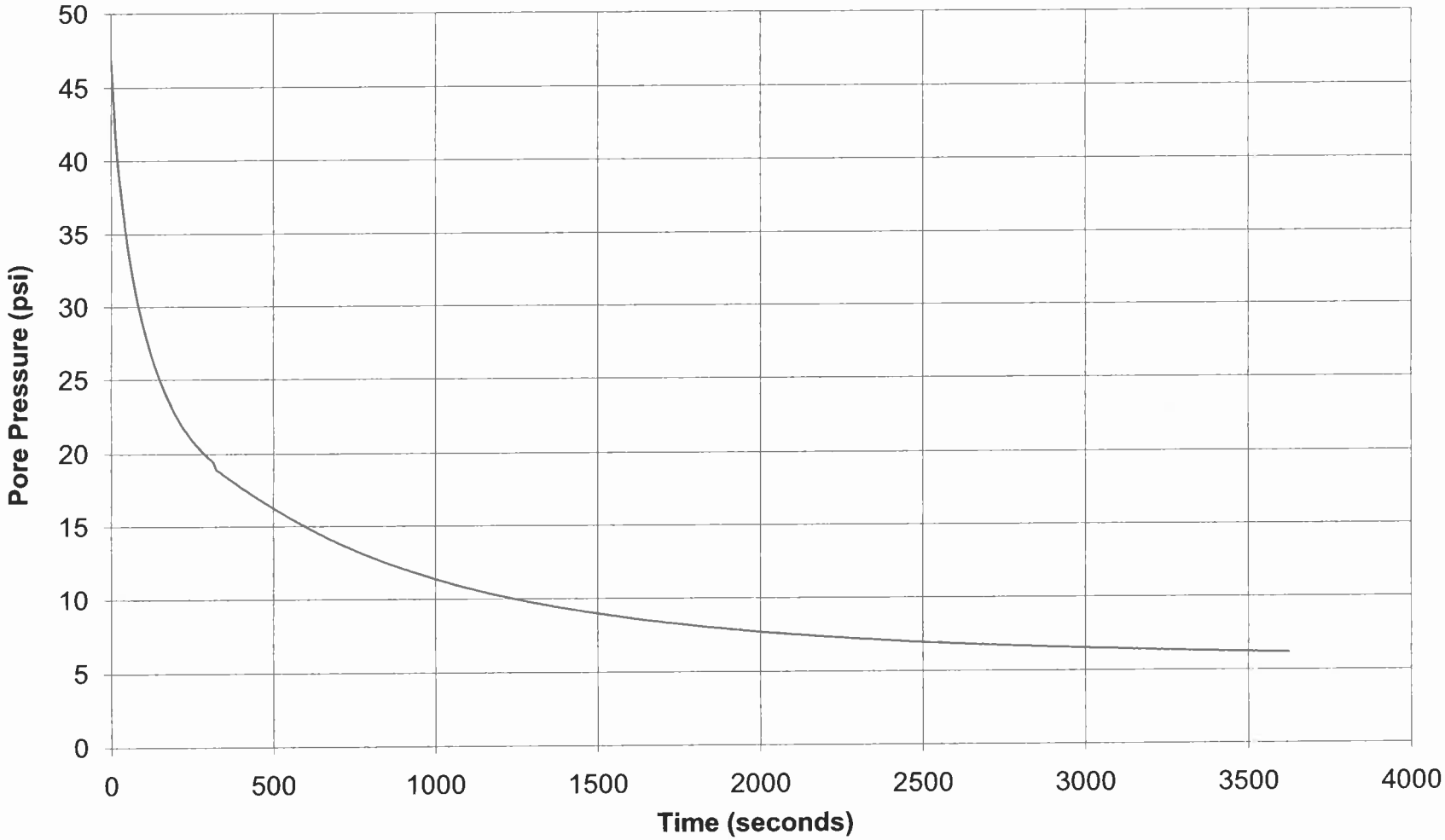
Sounding: CPT-02
Depth: 15.092
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

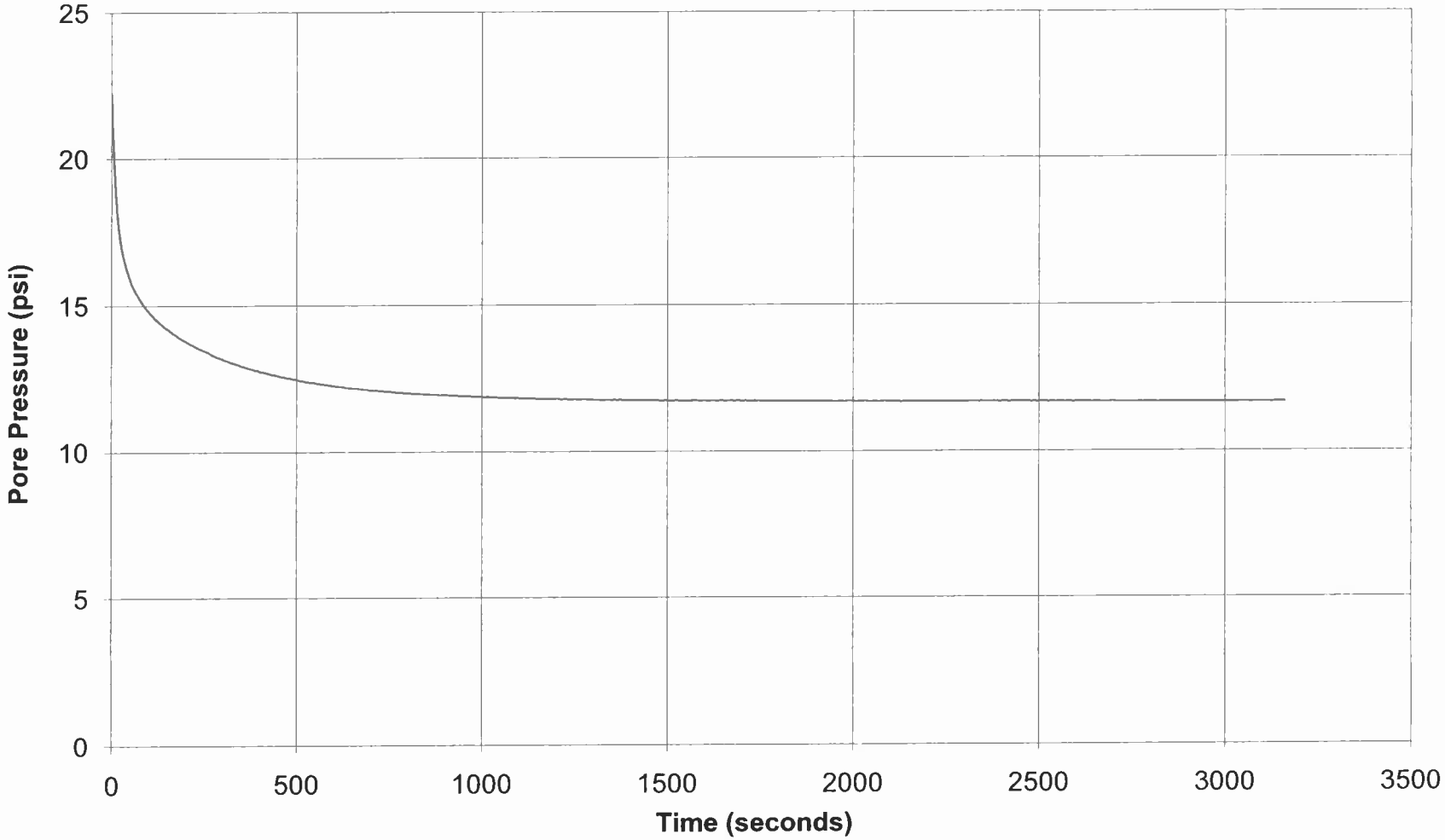
Sounding: CPT-02
Depth: 27.067
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

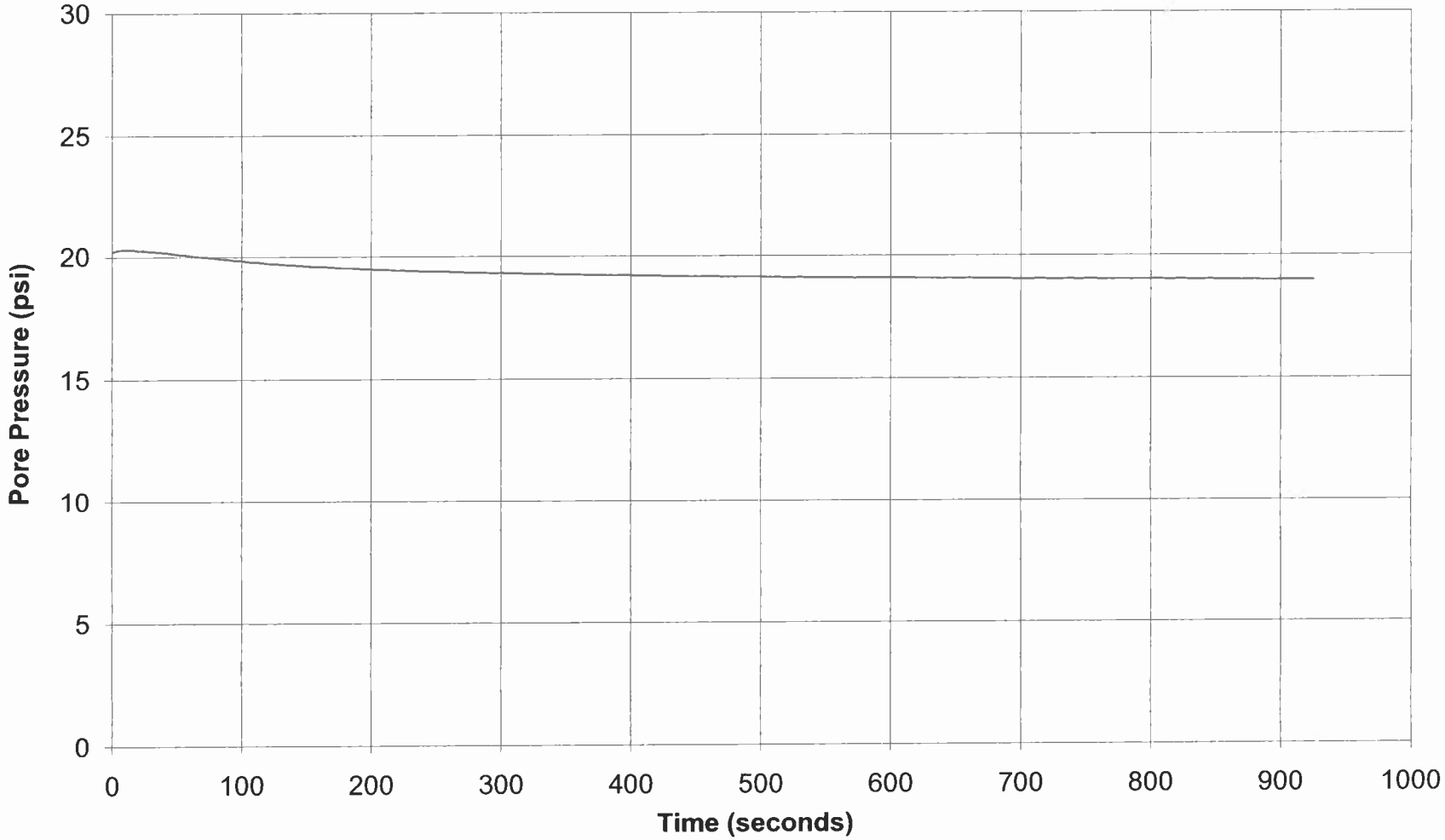
Sounding: CPT-02
Depth: 45.111
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

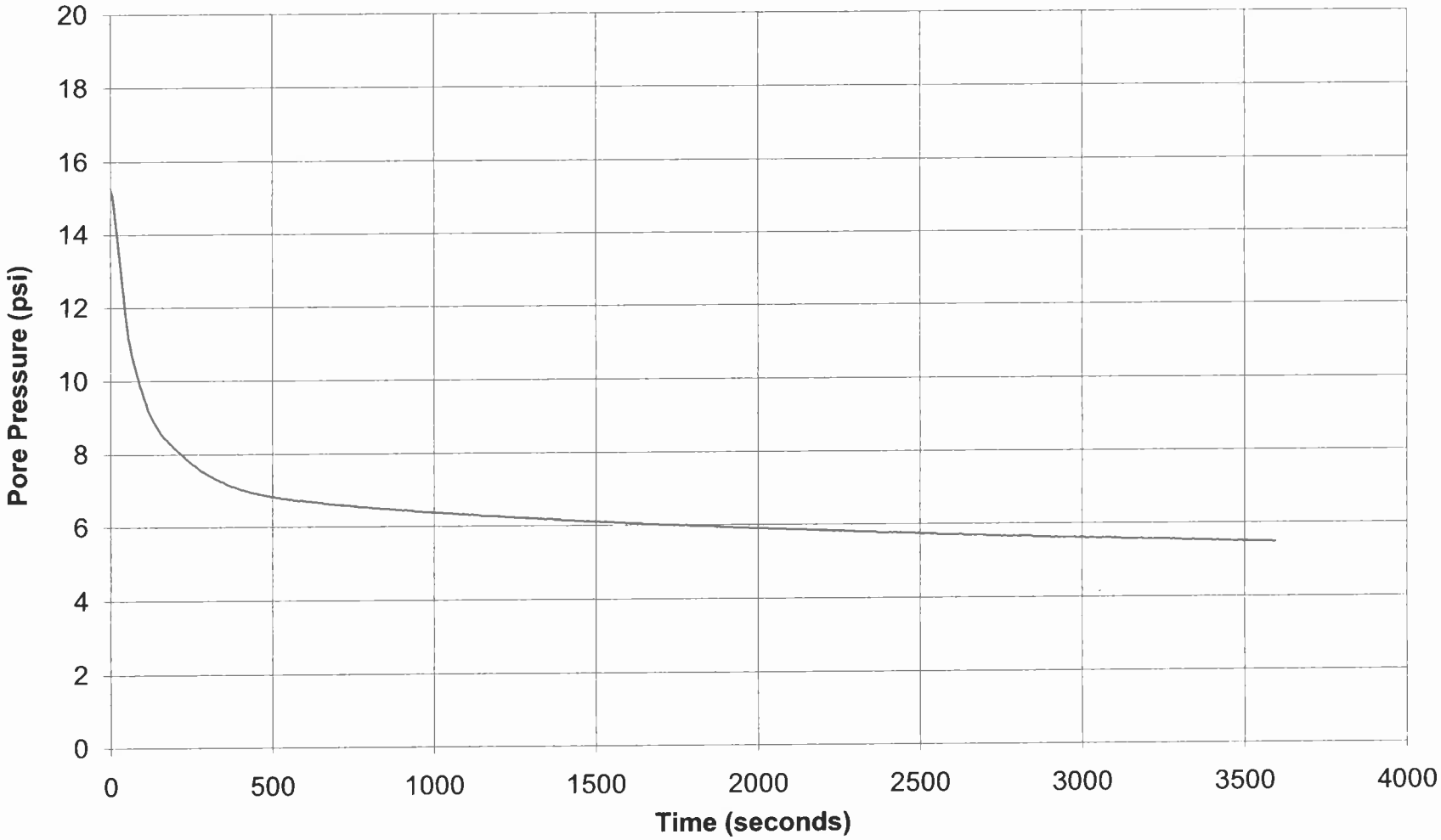
Sounding: CPT-02
Depth: 62.336
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

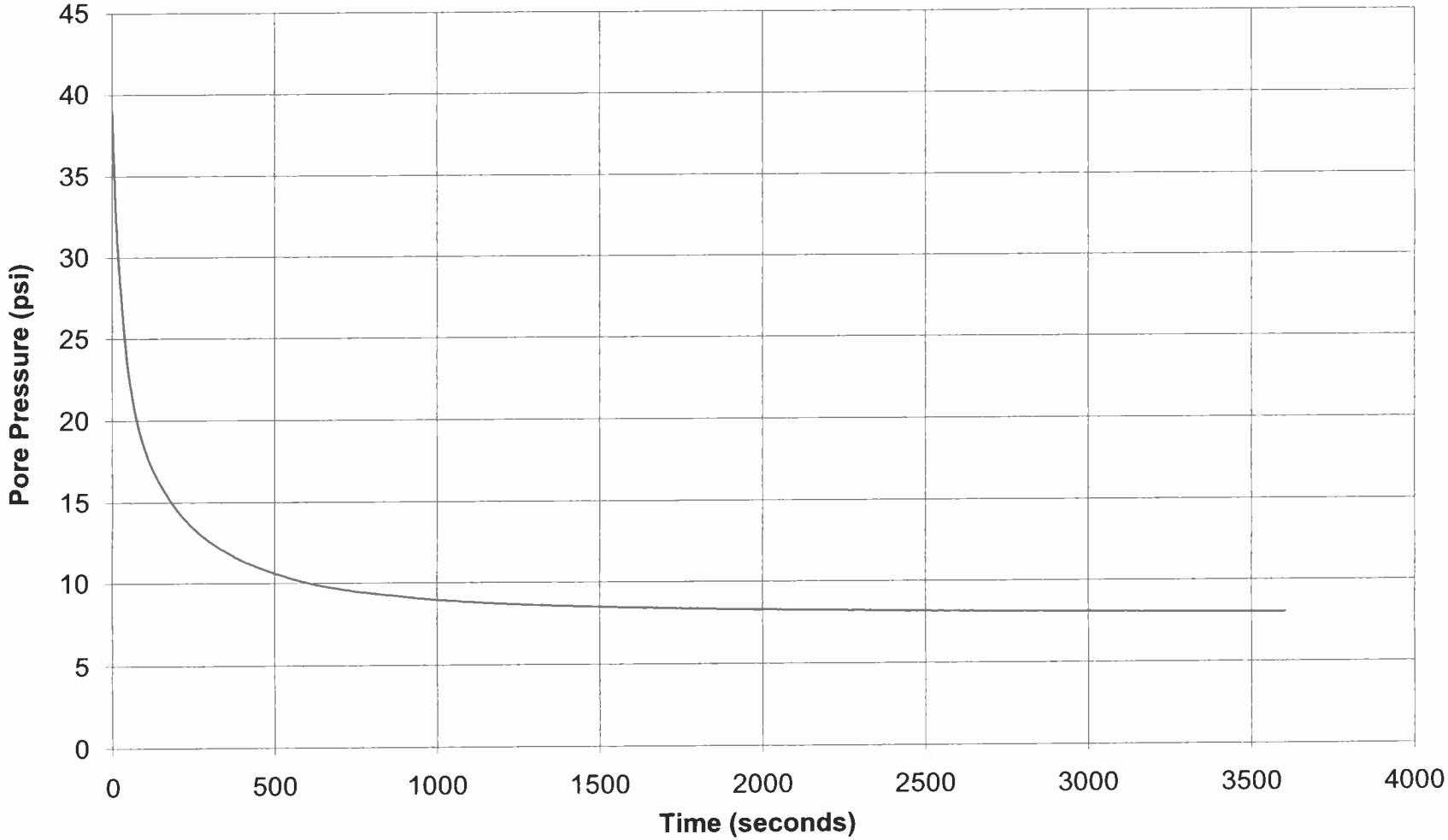
Sounding: CPT-03
Depth: 15.092
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

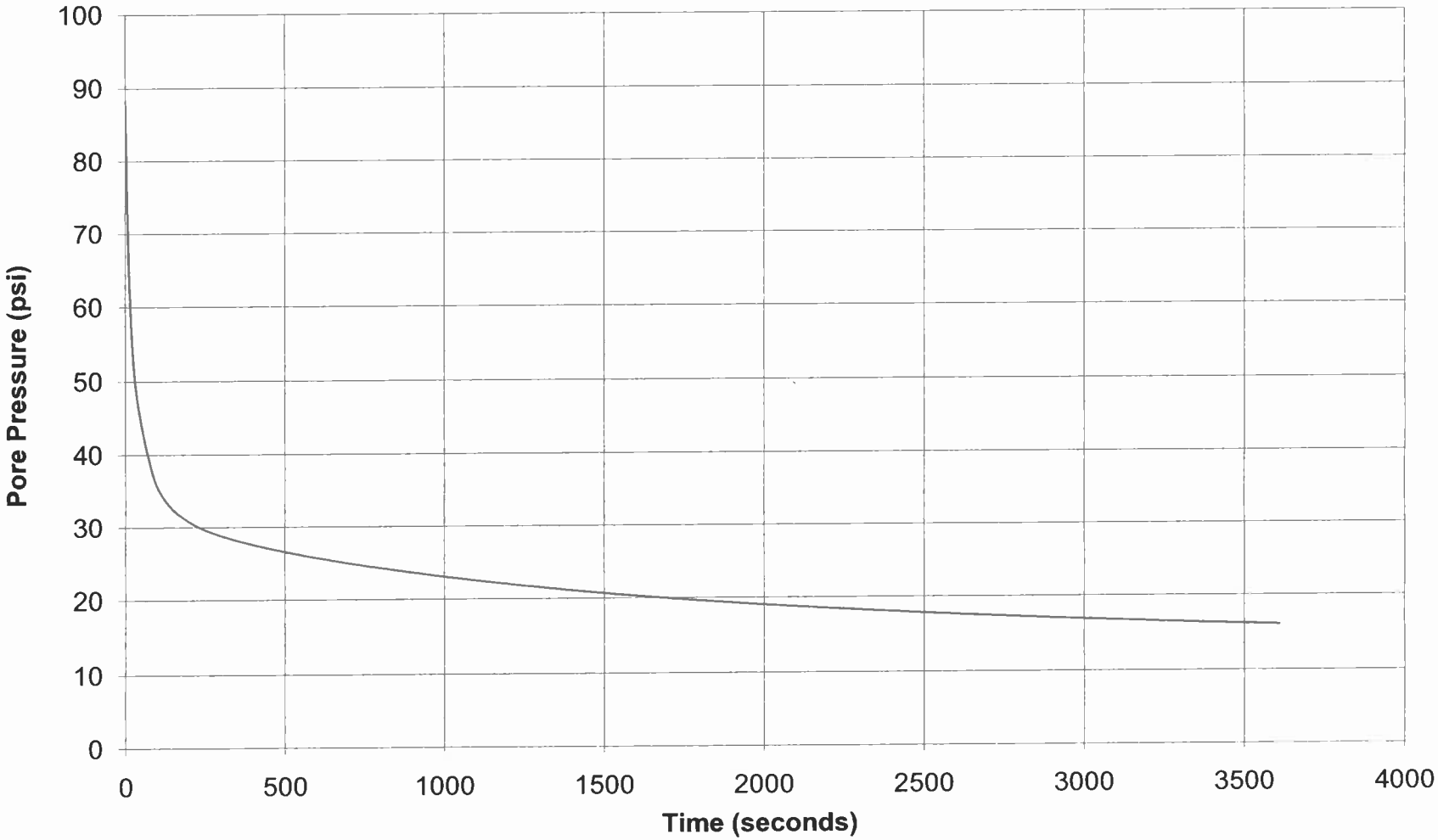
Sounding: CPT-03
Depth: 29.363
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

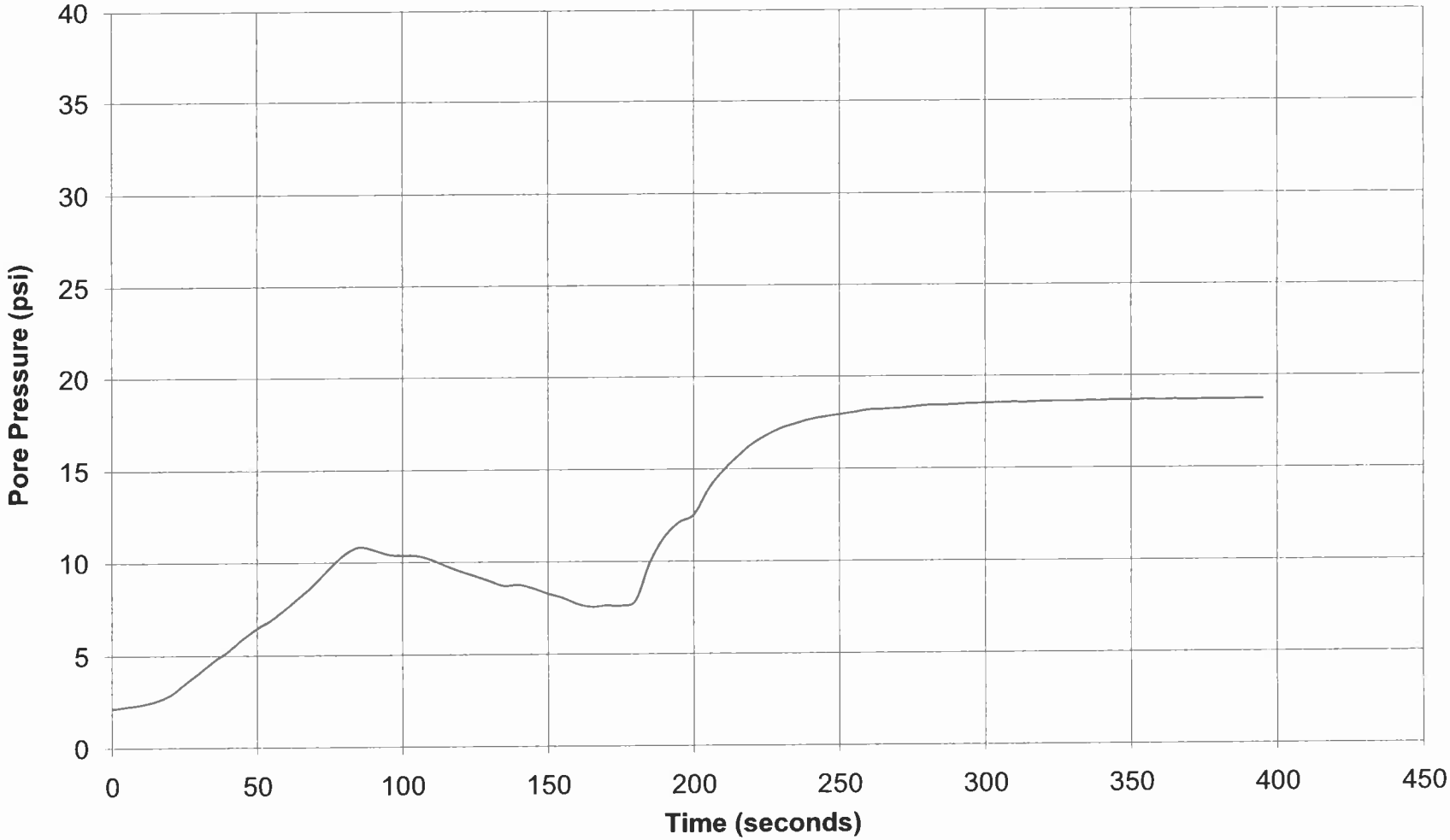
Sounding: CPT-03
Depth: 45.275
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

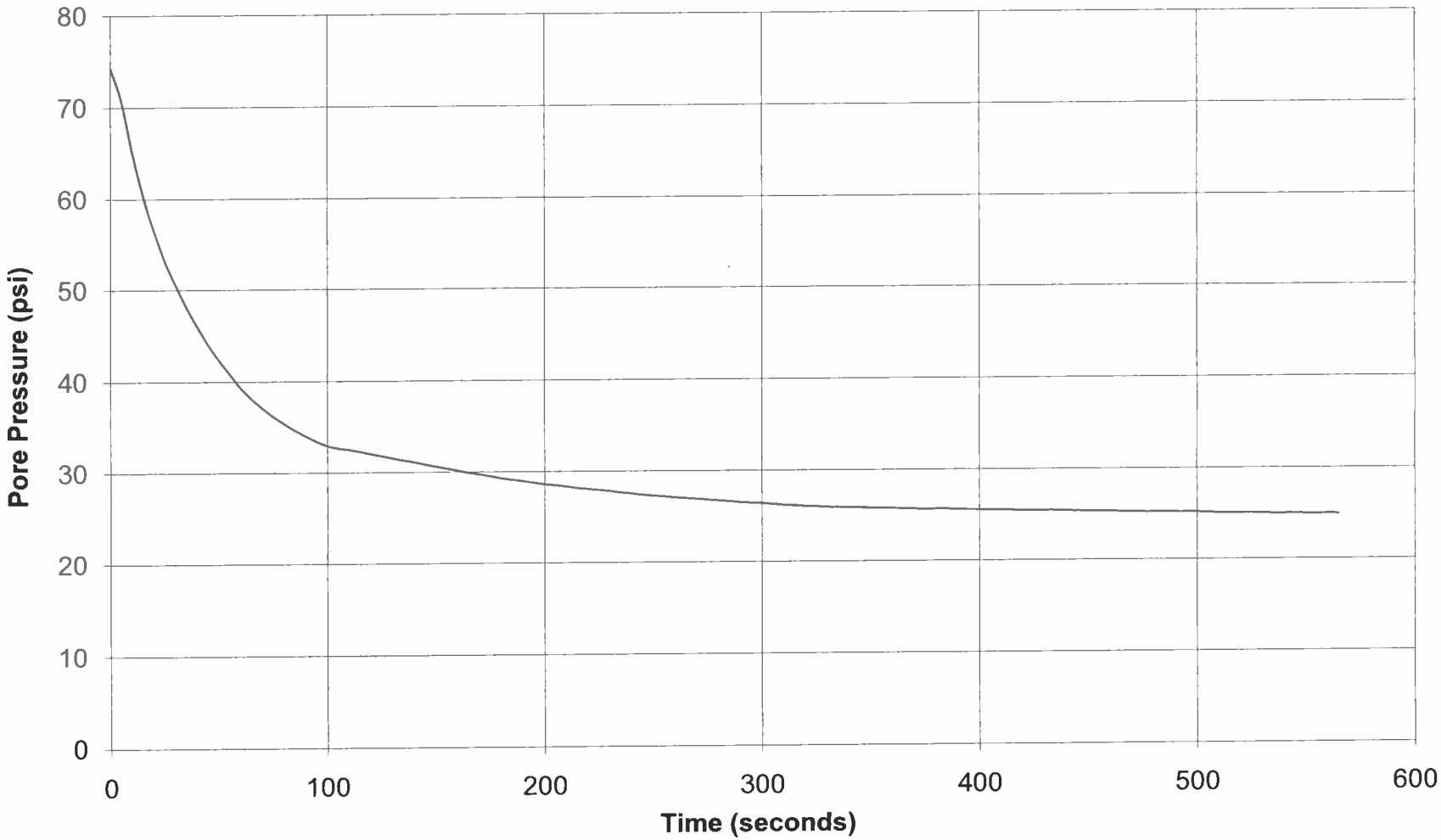
Sounding: CPT-03
Depth: 60.367
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

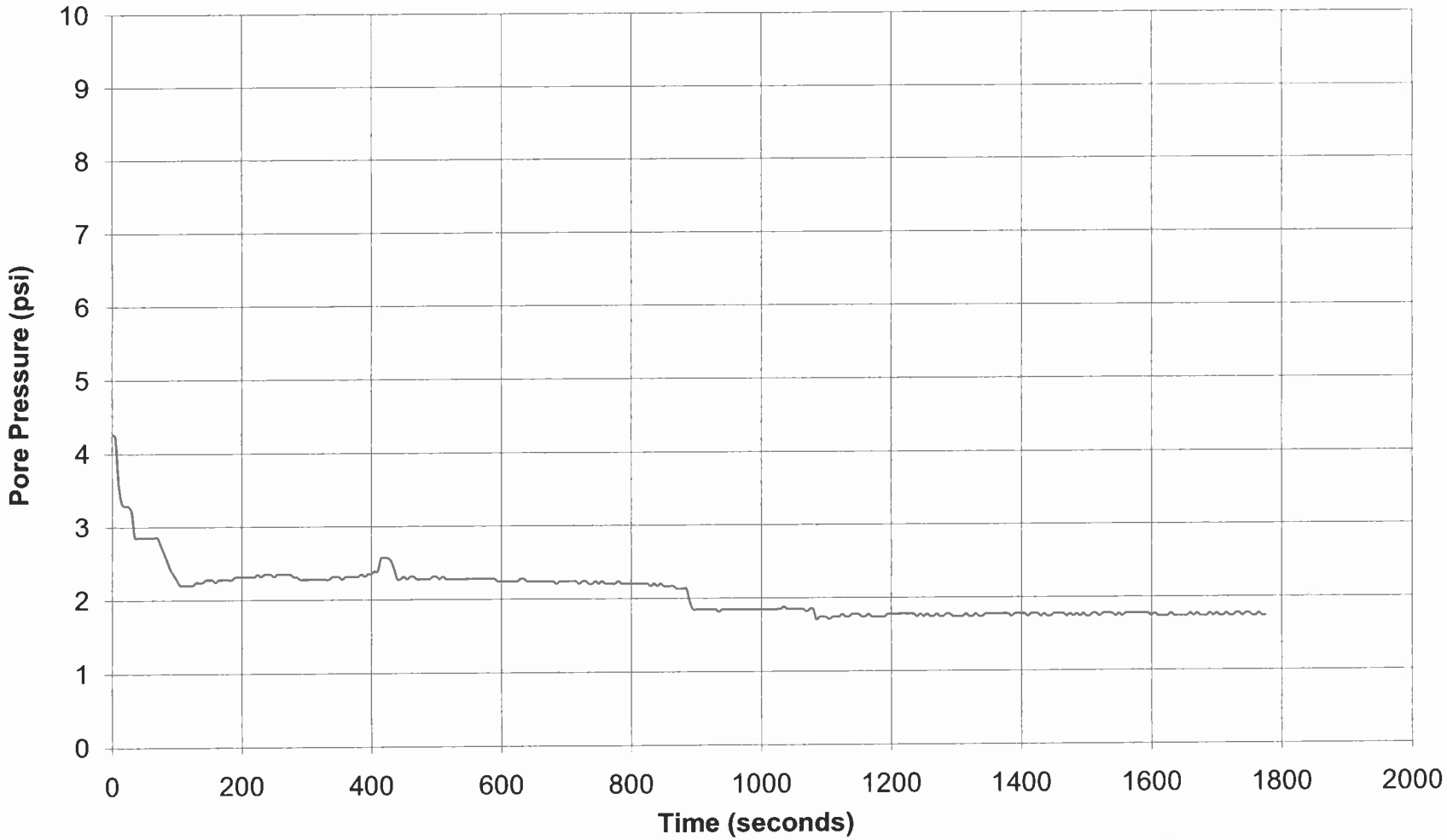
Sounding: CPT-04
Depth: 104.002
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

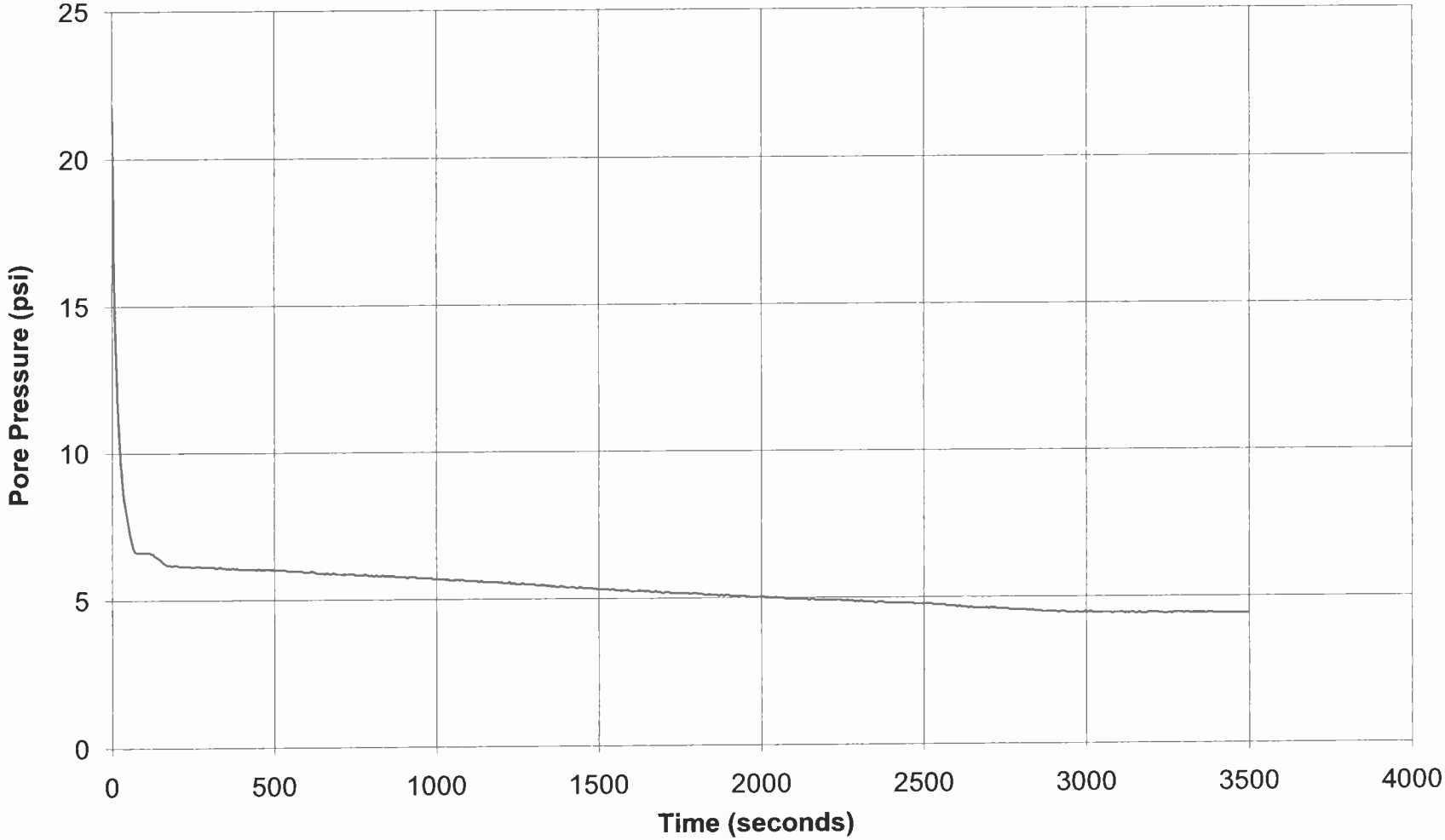
Sounding: CPT-04
Depth: 20.505
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

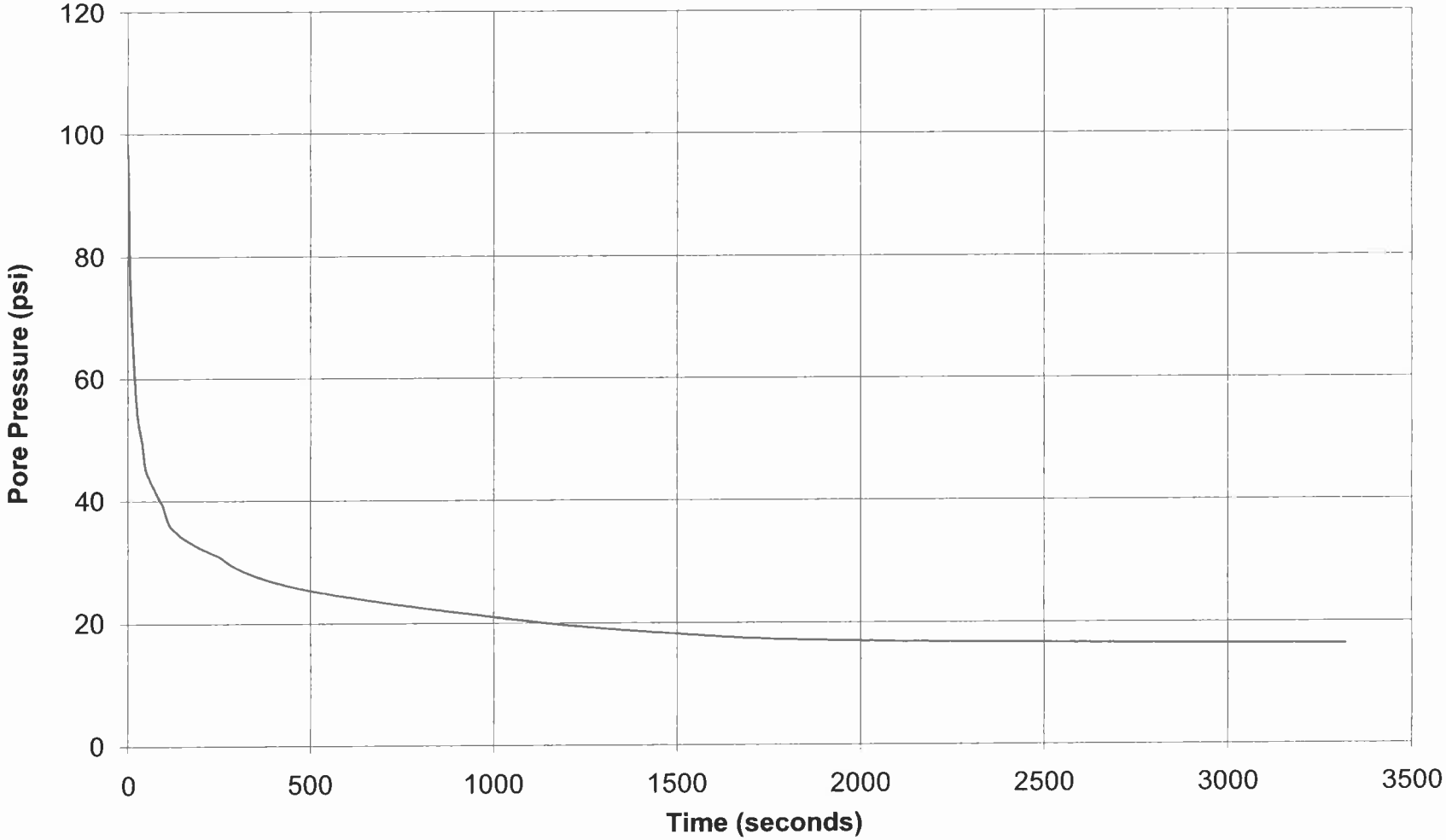
Sounding: CPT-04
Depth: 42.159
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

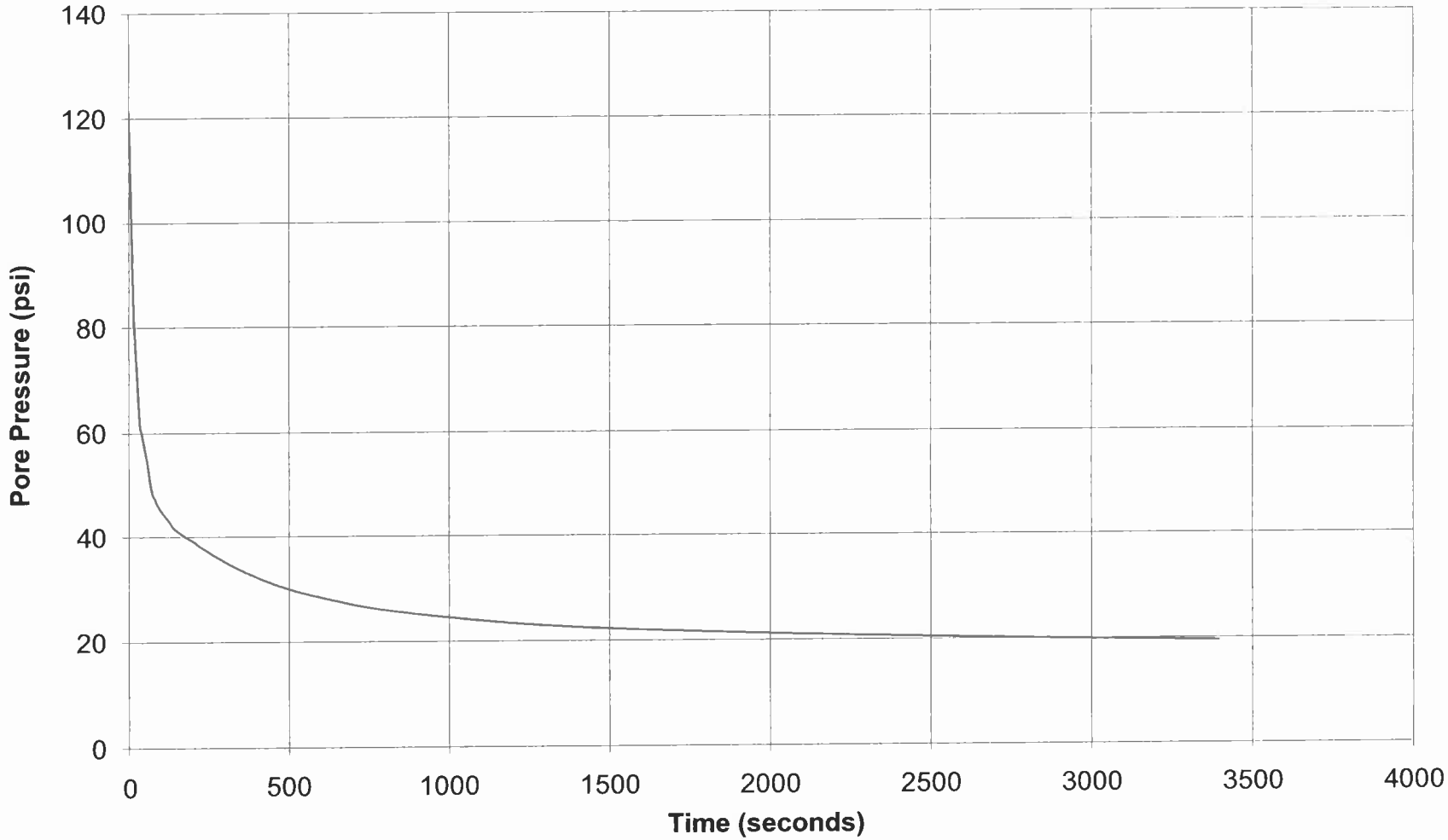
Sounding: CPT-04
Depth: 62.008
Site: RESOLUTION MINE
Engineer: B.BURGESS



GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: CPT-04
Depth: 85.138
Site: RESOLUTION MINE
Engineer: B.BURGESS



OBJECTIVE:

Estimate the horizontal coefficient of consolidation of the tailings within Tailings Pond 6 using the data collected from the CPT pore pressure dissipation tests.

ASSUMPTIONS:

1. Location of the porous element for the pore pressure probe was located above the cone base.
2. Equation used to calculate the coefficient of consolidation assumes one-dimensional consolidation.
3. Pore water dissipation tests allowed dynamic pore pressures, from pushing the probe into the saturated soils, to dissipate completely.

CALCULATIONS:

Coefficient of Consolidation

Using a rough estimate for the horizontal coefficient of consolidation from Torstensson (1975, 1977)[1,2] as found in Lune, Robertson and Powell, 1997[3]:

$$c = \frac{T_{50}}{t_{50}} r_0^2 ;$$

Where:

c – coefficient of consolidation

T_{50} – theoretical time factors for 50 percent consolidation[4]

t_{50} – measured time for 50 percent dissipation from pore water dissipation test

r_0 – penetrometer radius (cylindrical model) (2.54 centimeters)

Using the assumption of the porous element above the cone base and a degree of consolidation of 50 percent, the value of T_{50} is 0.245 (unitless).

---

[1] Torstensson, B.A., 1975. *Pore Pressure Sounding Instrument. Proceedings of the ASCE Specialty Conference on In Situ Measurement of Soil Properties*, Raleigh, North Carolina, 2, 48-54, American Society of Civil Engineers (ASCE).

[2] Torstensson, B.A., 1977. *The Pore Pressure Probe.* Norsk jord- og fjellteknisk forbnd. Fjellsprengningsteknikk- bergmekanikk – geoteknikk, Oslo, Foredrag, 34.1-34.15, Trondheim, Norway, Tapir.

[3] Lunne, T., Robertson, P.K., and Powell, J.J.M., 1997. *Cone Penetration Testing in Geotechnical Practice*. Blackie Academic & Professional, 1997, 312 p.

[4] Houlsby, G.T. and The, C.I., 1988. Analysis of the Piezocone in Clay. Proceedings of the International Symposium on Penetration Testing, ISOPT-1, Orlando, 2, 777-83, Balkema Pub., Rotterdam.

Table 1 provides the measured time for 50 percent dissipation from the pore water dissipation test and the resulting calculation for the horizontal coefficient of consolidation.

TABLE 1
SUMMARY OF COEFFICIENT OF CONSOLIDATION RESULTS

Location	Depth (feet)	t_{50} (seconds)	Coefficient of Consolidation (cm^2/sec)
BH-01	11.2	43.8	0.036
BH-01	25.3	72.9	0.022
BH-01	40.2	23.5	0.067
BH-01	47.6	26.2	0.060
BH-02	15.1	330.0	0.0048
BH-02	27.1	126.3	0.013
BH-02	45.1	27.8	0.057
BH-02	62.3	157.5	0.010
BH-03	15.1	76.1	0.021
BH-03	29.4	46.9	0.034
BH-03	45.3	26.1	0.061
BH-03	60.4	186.6	0.0085
BH-04	20.5	33.0	0.048
BH-04	42.2	12.5	0.13
BH-04	62.0	21.9	0.072
BH-04	85.1	25.8	0.061
BH-04	104.0	31.9	0.050

CONCLUSIONS:

The results from the pore water dissipation testing provide reasonable values of coefficient of consolidation and are representative of typical values for tailings.

APPENDIX C
GEOTECHNICAL LABORATORY TESTING RESULTS

TABLE 1
RCML/REVISITED REACTIVE STUDY/AZ
SUMMARY OF SOIL DATA

Sample Number	Boring/Pit Number	Sample Depth (ft)	U.S.C.S. Soil Classi-fication	Delivered Moisture (%)	Atterberg Limits			Grain Size Distribution			Specific Gravity	Moist/Den Relationship Modified Proctor		Additional Tests Comments (See Notes)
					LL	PL	PI	% Finer 3/4"	% Finer #4	% Finer #200		PCF (Dry)	Moist (%)	
1	BH-01	5	CL	51.0	38	23	15	100	97	93	3.41	--	--	
6	BH-01	30	CL-ML	31.5	26	19	7	100	100	93	3.74	--	--	
8	BH-01	40	CL-ML	33.5	25	18	7	100	100	93	--	--	--	T, DS, C
2	BH-02	10	ML	84.2	40	30	10	100	100	89	3.44	--	--	
4	BH-02	20	CL	37.8	30	21	9	100	100	100	3.67	--	--	
3	BH-03	15	CL-ML	41.6	27	20	7	100	100	99	3.61	--	--	
7	BH-03	35	CL-ML	29.3	23	19	4	100	100	91	3.79	--	--	
5	BH-03	25	CL	45.5	31	21	10	100	100	100	--	--	--	T, DS, C
2	BH-04	10	ML	69.4	NP	NP	NP	100	100	77	--	--	--	T, DS
4	BH-04	20	--	--	--	--	--	--	--	--	--	--	--	UW
5	BH-04	25	ML	24.7	NP	NP	NP	100	100	99	3.82	--	--	
8	BH-04	40	ML	26.9	21	19	2	100	100	91	3.85	--	--	
11	BH-04	55	CL-ML	29.1	26	20	6	100	100	89	--	--	--	
13	BH-04	65	ML	25.9	NP	NP	NP	100	100	90	3.87	--	--	
15	BH-04	75	ML	18.3	NP	NP	NP	100	100	86	--	--	--	
17	BH-04	85	ML	27.0	21	18	3	100	100	93	3.74	--	--	

NOTES:

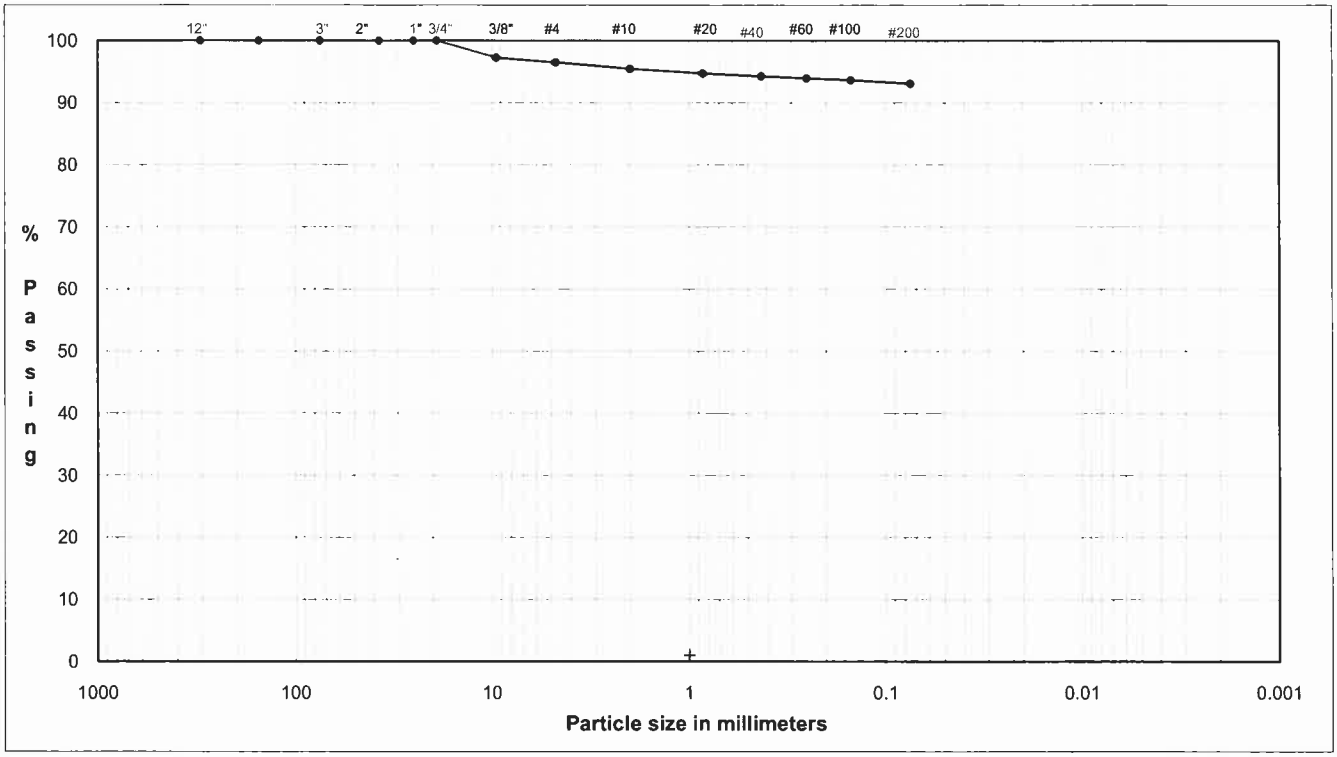
LL= LIQUID LIMIT
PL= PLASTIC LIMIT
PI= PLASTIC INDEX
SL= SHRINKAGE LIMIT
UW= UNIT WEIGHT

T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
PERM = PERMEABILITY

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

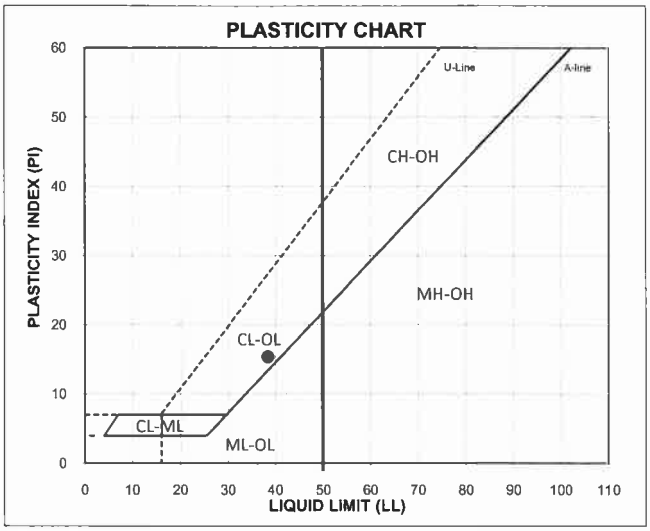
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-01, #1** Depth (ft): **5**
TYPE: **Pail**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	**100.0**		
6.0"	154.20	**100.0**	Cobbles	**0.00**
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
1.5"	37.50	**100.0**		
1.0"	25.00	**100.0**	Coarse Gravel	**0.00**
0.75"	19.00	**100.0**		
0.375"	9.50	**97.3**		
#4	4.75	**96.5**	Fine Gravel	**3.50**
#10	2.00	**95.5**	Coarse Sand	**1.02**
#20	0.85	**94.7**		
#40	0.43	**94.3**	Medium Sand	**1.20**
#60	0.25	**94.0**		
#100	0.15	**93.6**		
#200	0.08	**93.1**	Fine Sand	**1.19**
			Fines	**93.09**



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG
51.0	**38**	**23**	**15**	**3.41**

DESCRIPTION: Dark brown lean clay

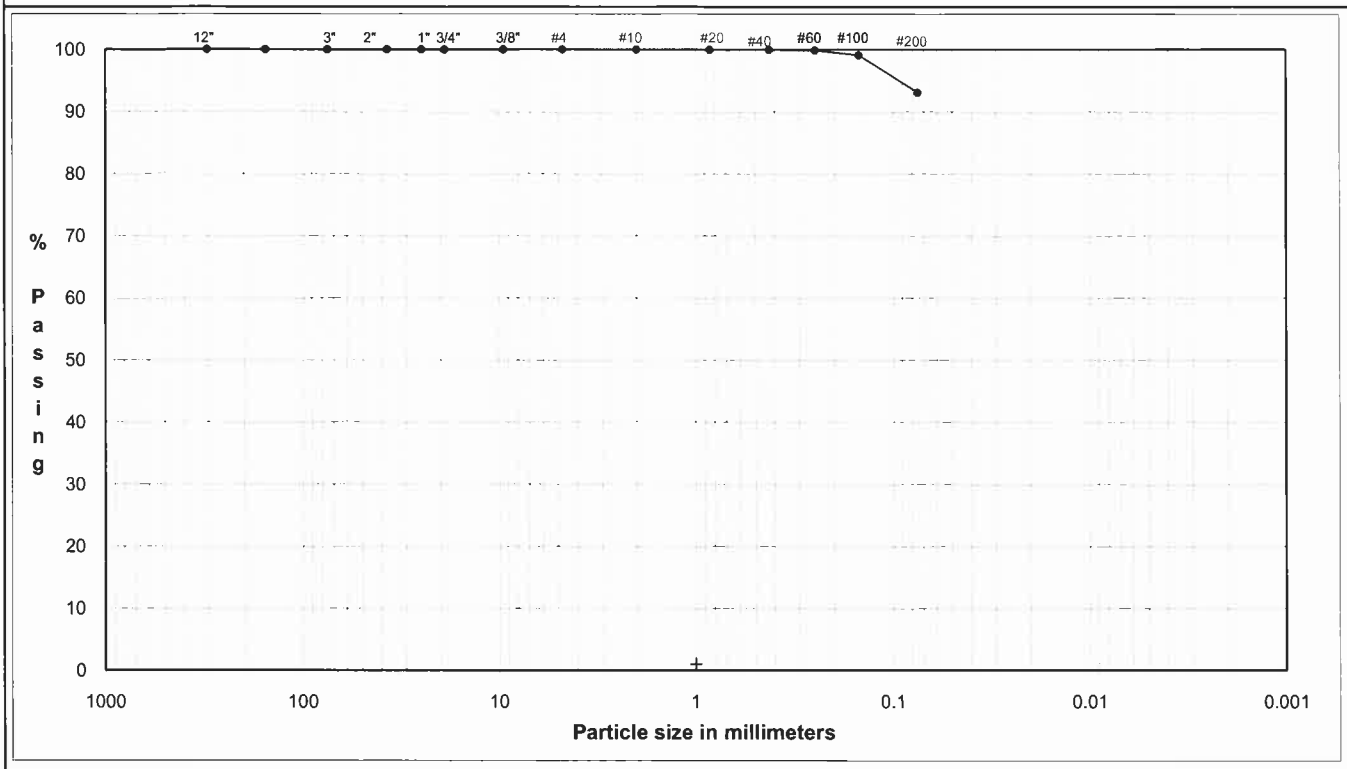
USCS: CL

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

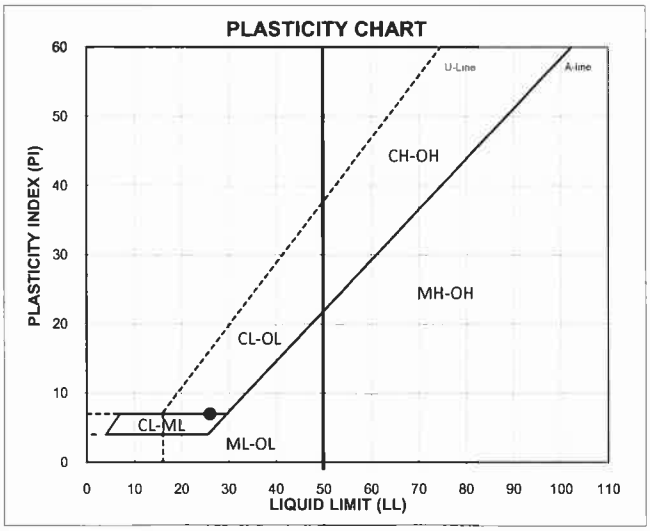
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-01, #6** Depth (ft): **30**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.01
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.05
#60	0.25	99.9		
#100	0.15	99.1		
#200	0.08	93.1	Fine Sand	6.84
			Fines	93.10



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG
31.5	26	19	7	3.74

DESCRIPTION: Dark brown silty clay

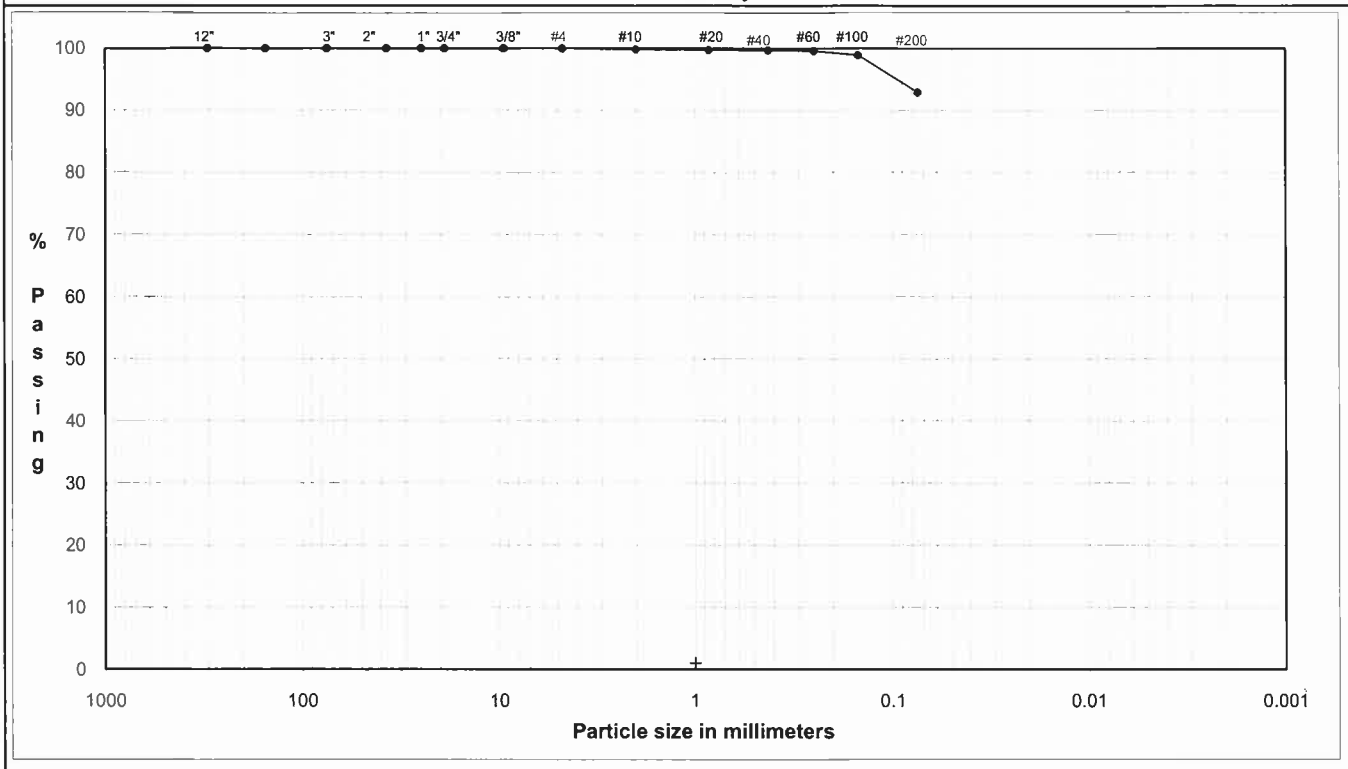
USCS: CL-ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

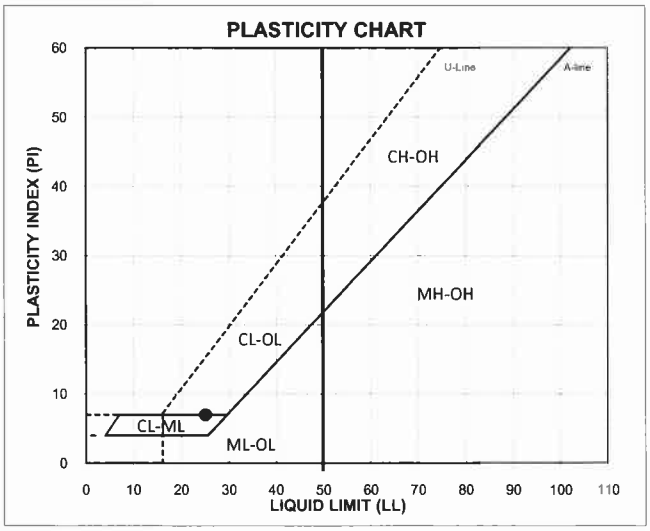
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-01, #8** Depth (ft): **40**
TYPE: **Shelby tube**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	**100.0**		
6.0"	154.20	**100.0**	Cobbles	**0.00**
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
1.5"	37.50	**100.0**		
1.0"	25.00	**100.0**	Coarse Gravel	**0.00**
0.75"	19.00	**100.0**		
0.375"	9.50	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.00**
#10	2.00	**99.9**	Coarse Sand	**0.15**
#20	0.85	**99.8**		
#40	0.43	**99.7**	Medium Sand	**0.18**
#60	0.25	**99.6**		
#100	0.15	**98.9**		
#200	0.08	**92.9**	Fine Sand	**6.76**
			Fines	**92.92**



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG (assumed)
33.5	25	18	7	--

DESCRIPTION: Brown silty clay

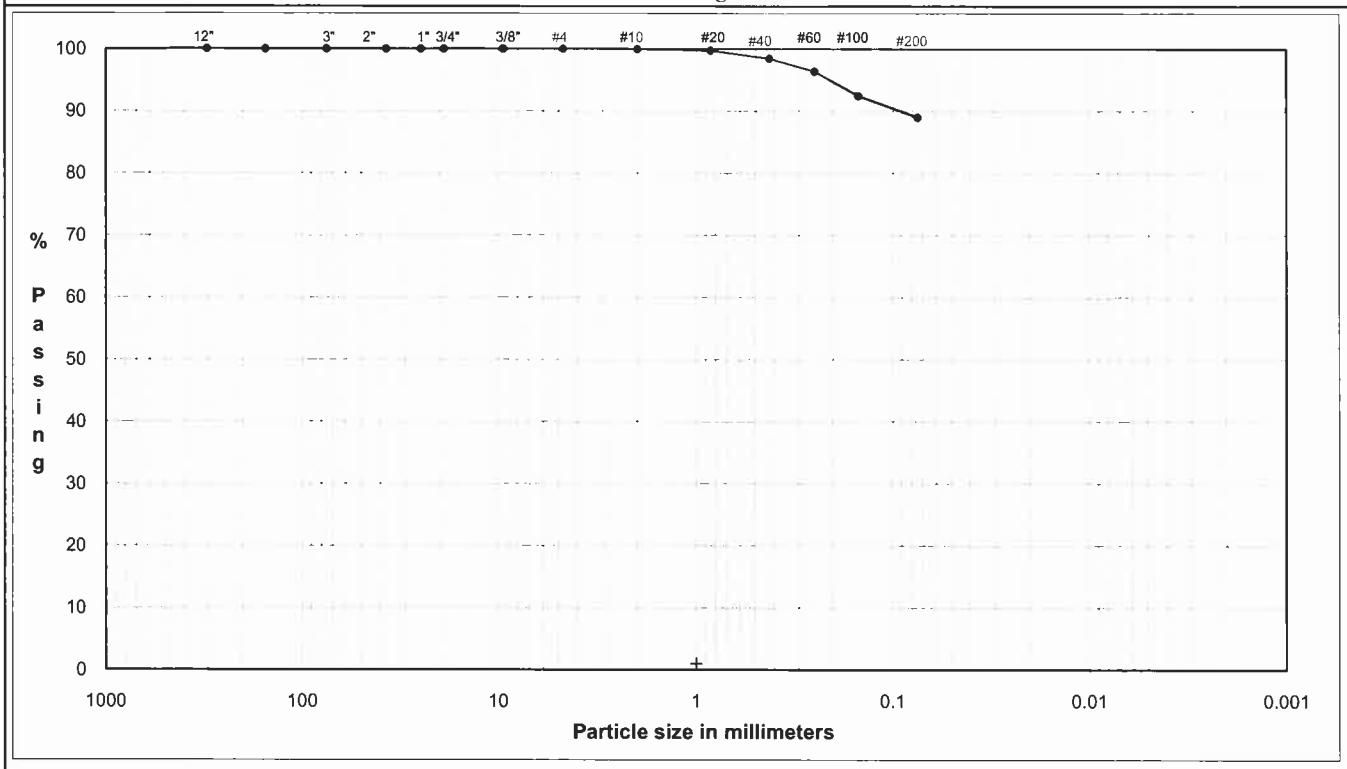
USCS: CL-ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

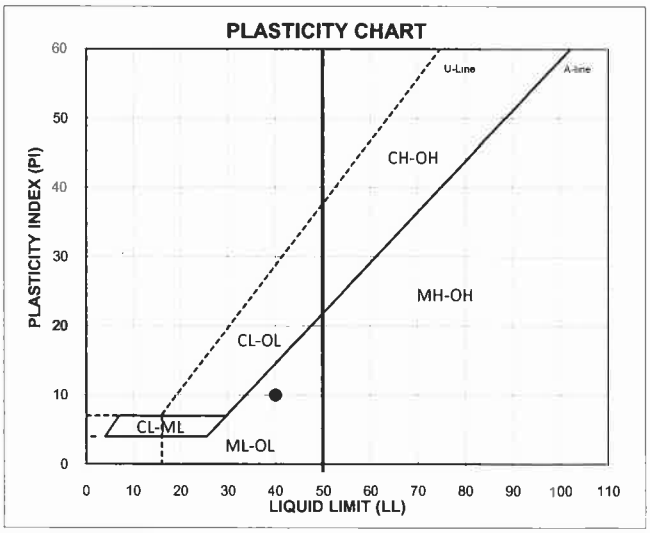
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-02, #2** Depth (ft): **10**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	**100.0**		
6.0"	154.20	**100.0**	Cobbles	**0.00**
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
1.5"	37.50	**100.0**		
1.0"	25.00	**100.0**	Coarse Gravel	**0.00**
0.75"	19.00	**100.0**		
0.375"	9.50	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.00**
#10	2.00	**99.9**	Coarse Sand	**0.07**
#20	0.85	**99.7**		
#40	0.43	**98.4**	Medium Sand	**1.49**
#60	0.25	**96.4**		
#100	0.15	**92.5**		
#200	0.08	**89.0**	Fine Sand	**9.44**
			Fines	**89.00**



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG
84.2	**40**	**30**	**10**	**3.44**

DESCRIPTION: Very pale brown silt

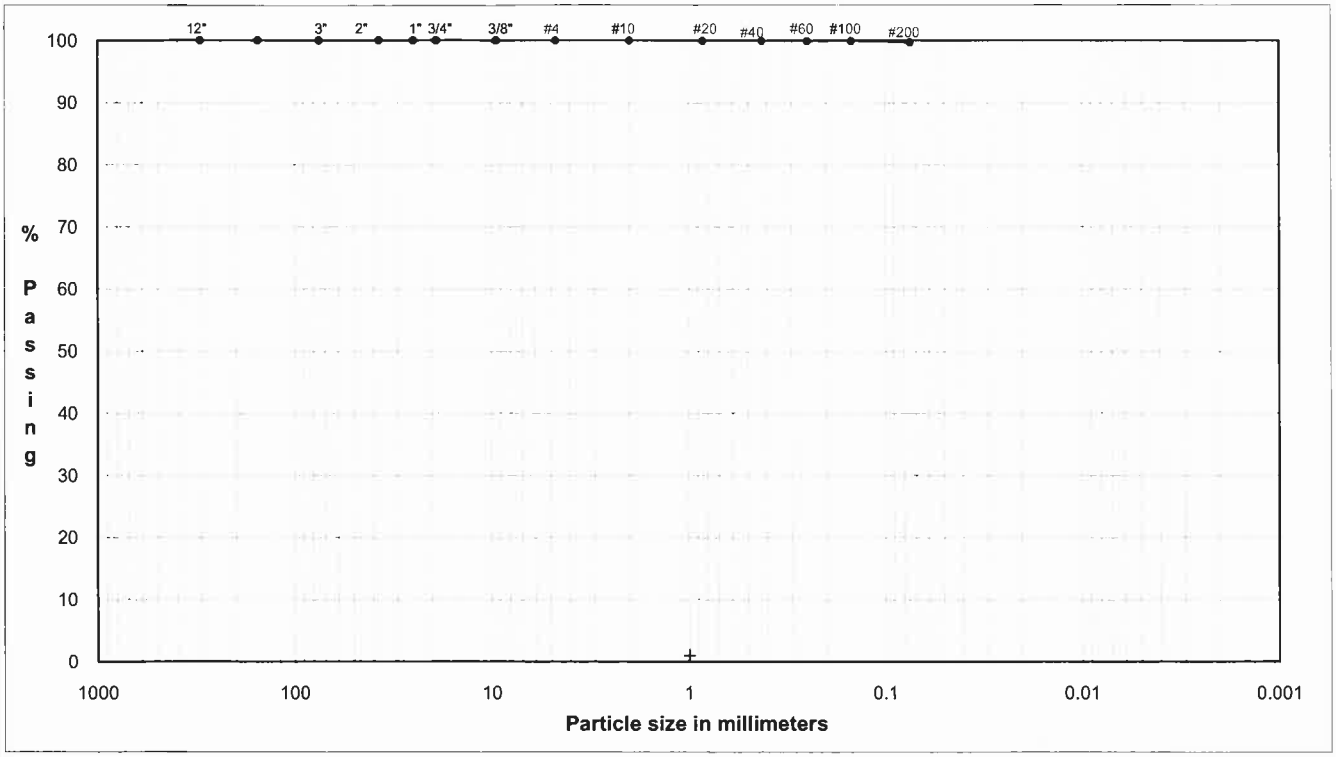
USCS: ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

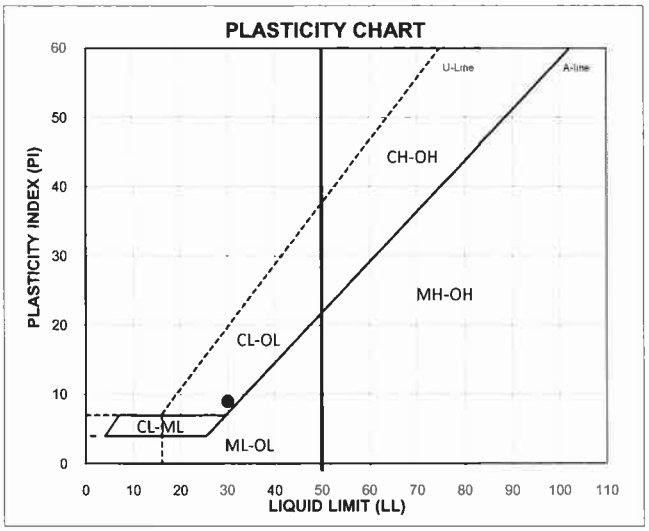
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-02, #4** Depth (ft): **20**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.00
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.06
#60	0.25	99.9		
#100	0.15	99.9		
#200	0.08	99.7	Fine Sand	0.26
			Fines	99.68



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG
37.8	30	21	9	3.67

DESCRIPTION: Dark brown lean clay

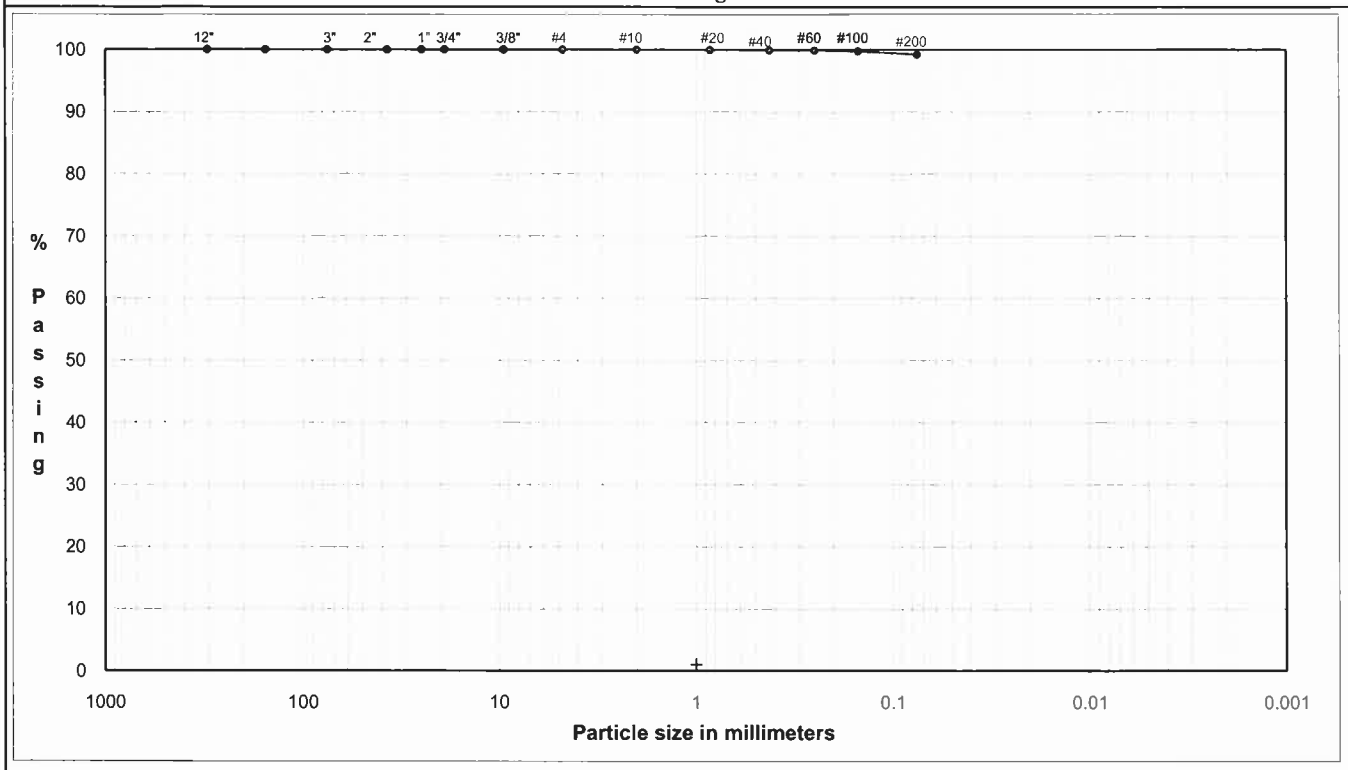
USCS: CL

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

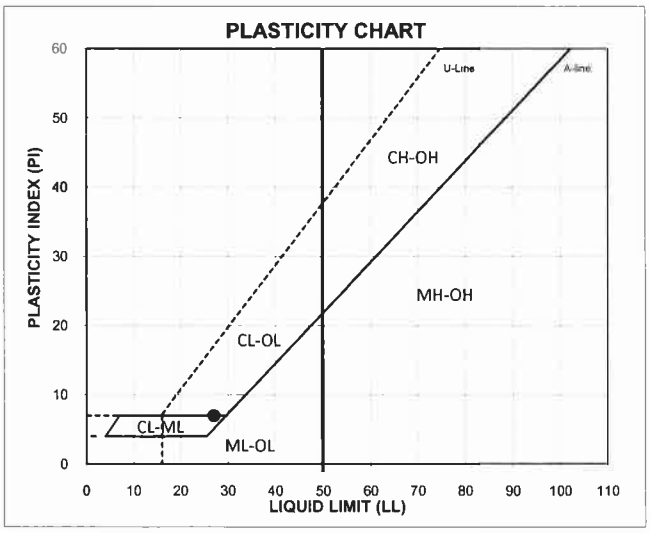
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-03, #3** Depth (ft): **15**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.01
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.09
#60	0.25	99.8		
#100	0.15	99.7		
#200	0.08	99.2	Fine Sand	0.68
			Fines	99.22



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG
41.6	27	20	7	3.61

DESCRIPTION: Dark brown silty clay

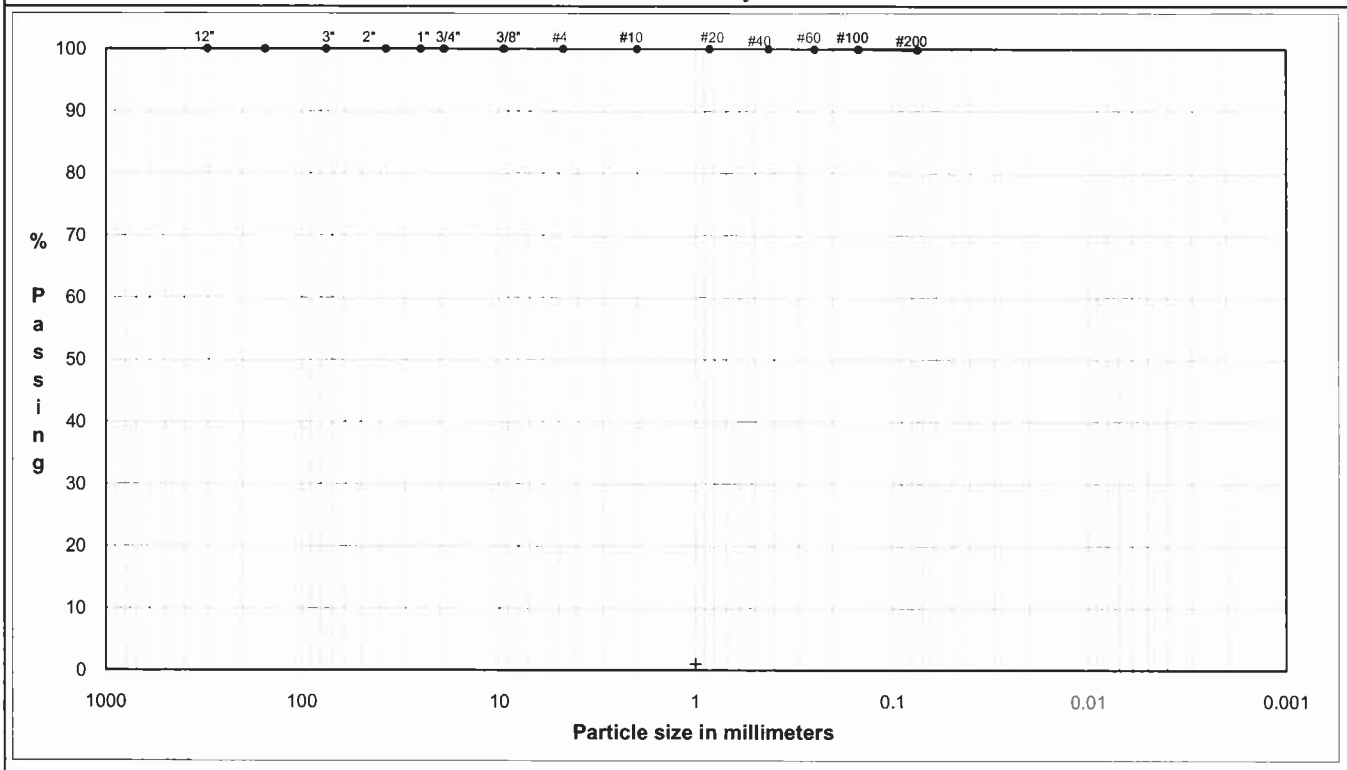
USCS: CL-ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

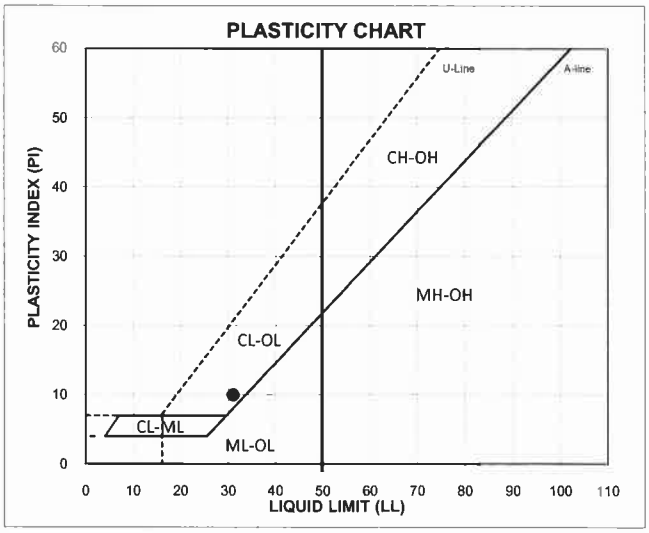
PROJECT NAME: **RCMA/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-03, #5** Depth (ft): **25**
TYPE: **Shelby tube**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.00
#20	0.85	100.0		
#40	0.43	100.0	Medium Sand	0.01
#60	0.25	100.0		
#100	0.15	100.0		
#200	0.08	99.8	Fine Sand	0.15
			Fines	99.84



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG (assumed)
45.5	31	21	10	--

DESCRIPTION: Dark reddish gray lean clay

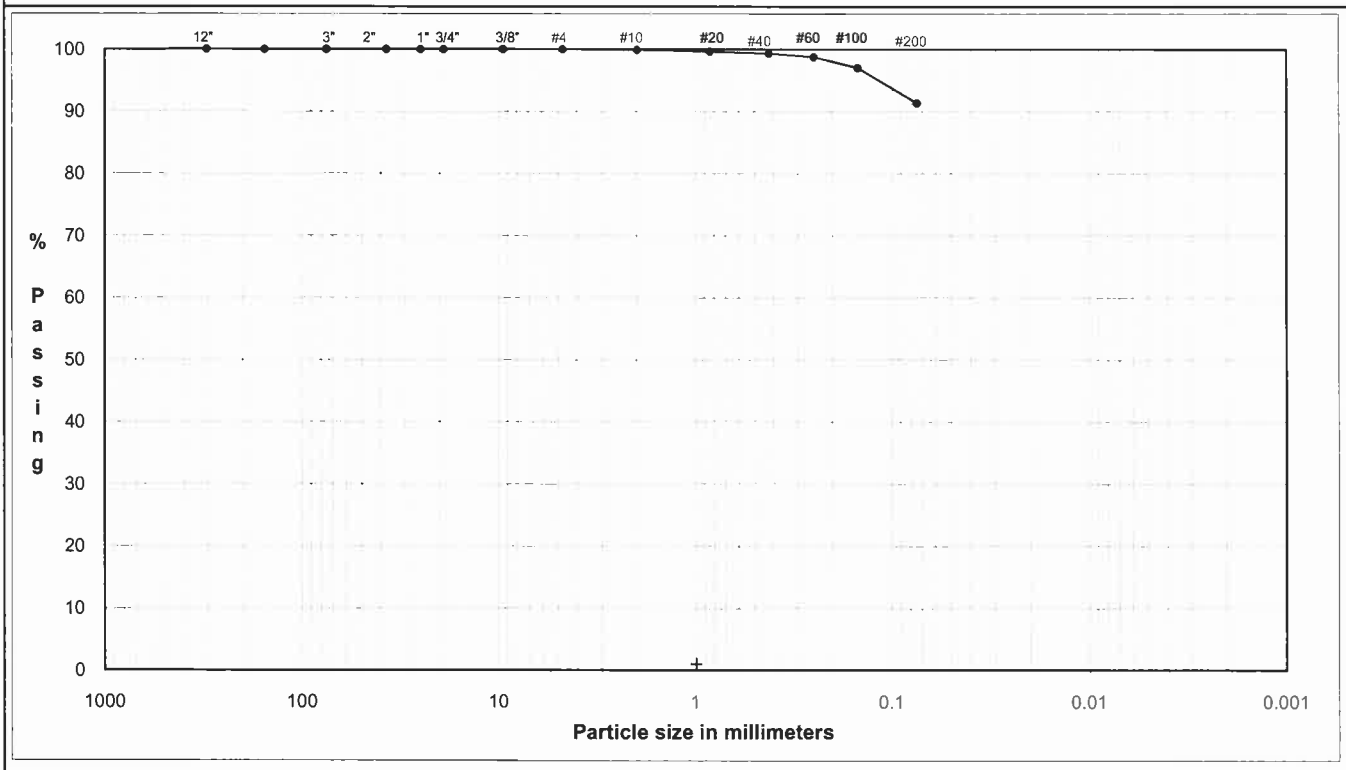
USCS: CL

TECH	MKS
DATE	8/18/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

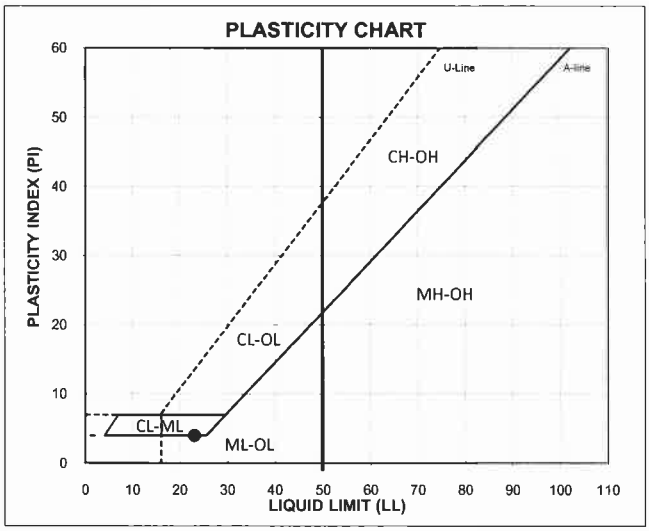
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-03, #7** Depth (ft): **35**
TYPE: **Pail**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	99.9	Coarse Sand	0.10
#20	0.85	99.6		
#40	0.43	99.3	Medium Sand	0.57
#60	0.25	98.8		
#100	0.15	97.0		
#200	0.08	91.3	Fine Sand	7.99
			Fines	91.34



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG
29.3	23	19	4	3.79

DESCRIPTION: Dark brown silty clay

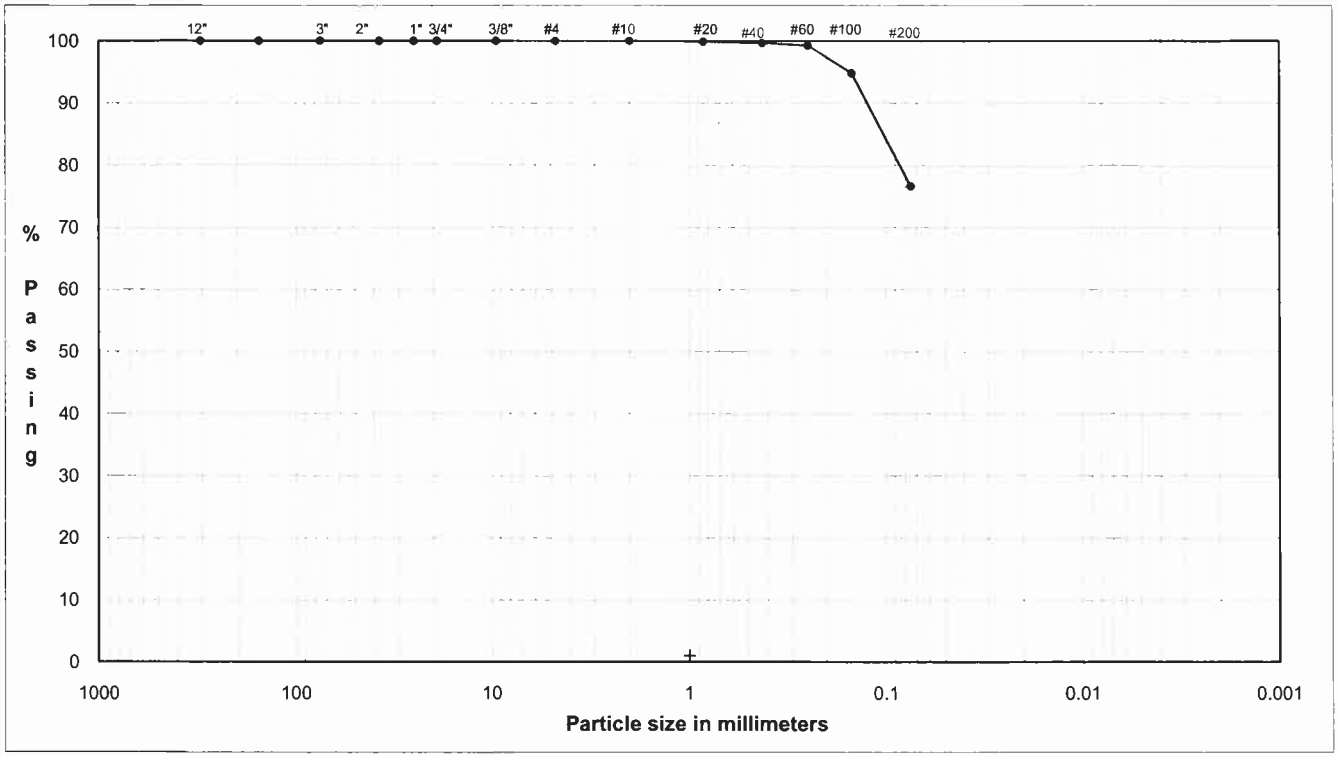
USCS: CL-ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

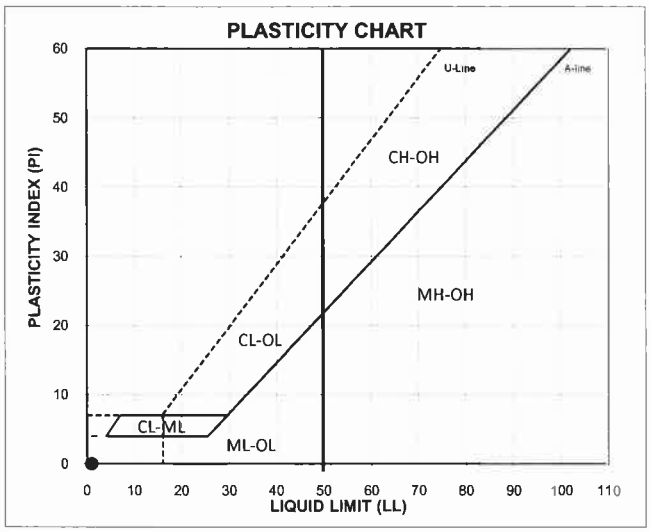
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #2** Depth (ft): **10**
TYPE: **Shelby tubes**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.02
#20	0.85	99.9		
#40	0.43	99.7	Medium Sand	0.29
#60	0.25	99.3		
#100	0.15	94.8		
#200	0.08	76.6	Fine Sand	23.09
			Fines	76.60



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG (assumed)
69.4	NP	NP	NP	--

DESCRIPTION: Brown silt with sand

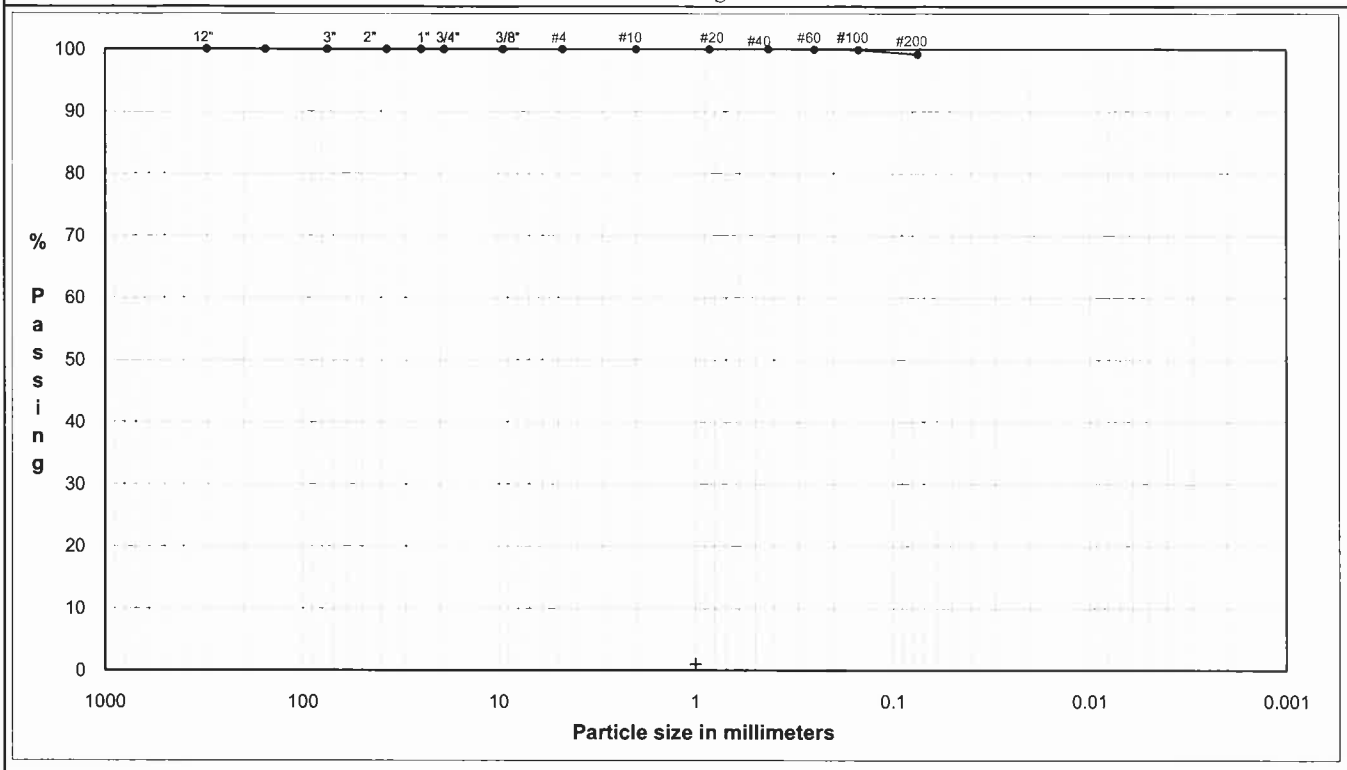
USCS: ML

TECH: MKS
DATE: 8/26/09
REVIEW: MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

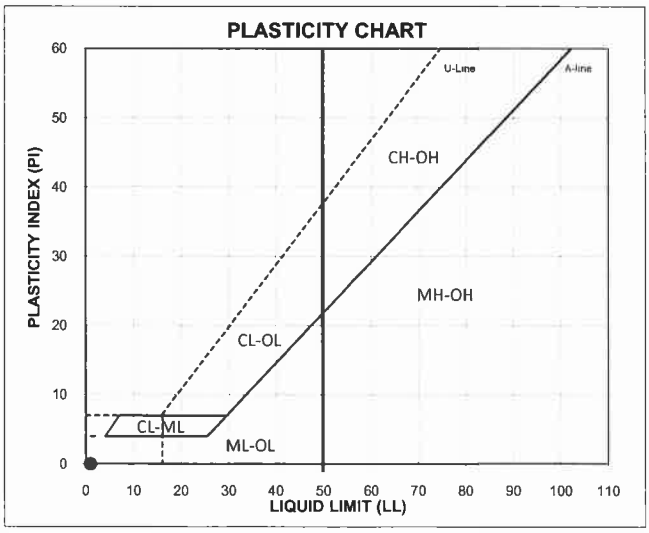
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #5** Depth (ft): **25**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.00
#20	0.85	100.0		
#40	0.43	100.0	Medium Sand	0.02
#60	0.25	99.9		
#100	0.15	99.9		
#200	0.08	99.2	Fine Sand	0.83
			Fines	99.15



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG
24.7	NP	NP	NP	3.82

DESCRIPTION: Dark brown silt

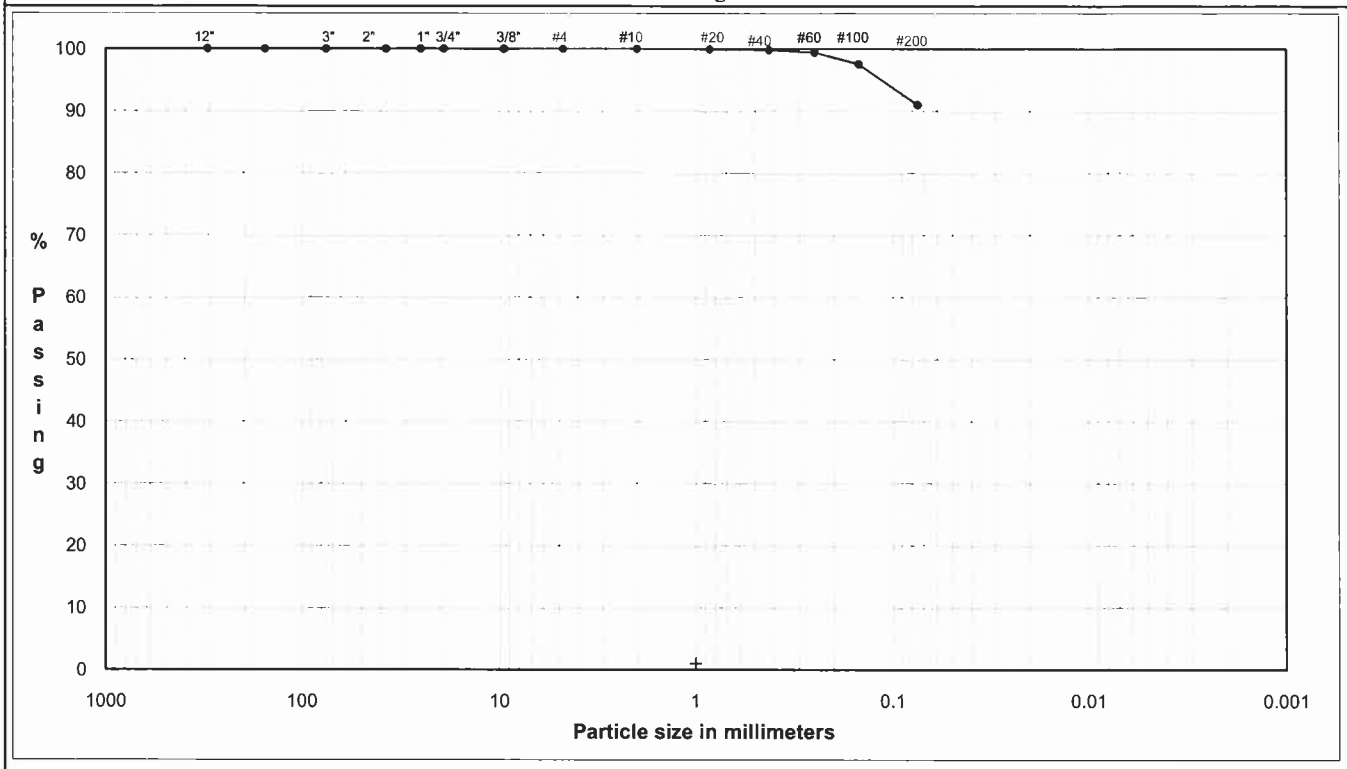
USCS: ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

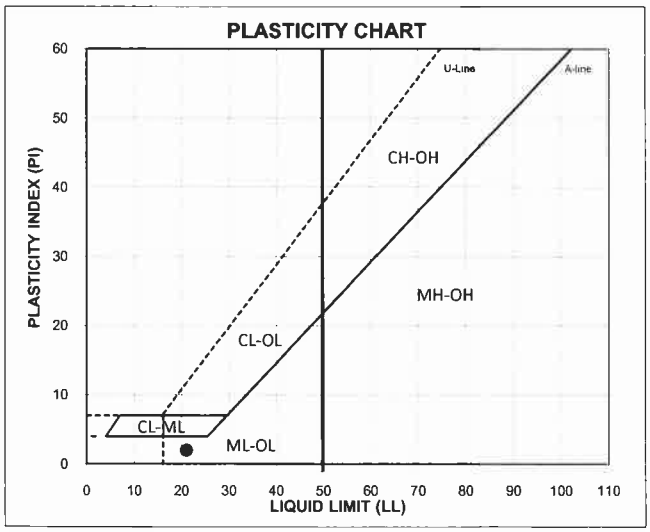
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #8** Depth (ft): **40**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.01
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.14
#60	0.25	99.4		
#100	0.15	97.6		
#200	0.08	91.0	Fine Sand	8.83
			Fines	91.02



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG
26.9	21	19	2	3.85

DESCRIPTION: Very dark gray silt

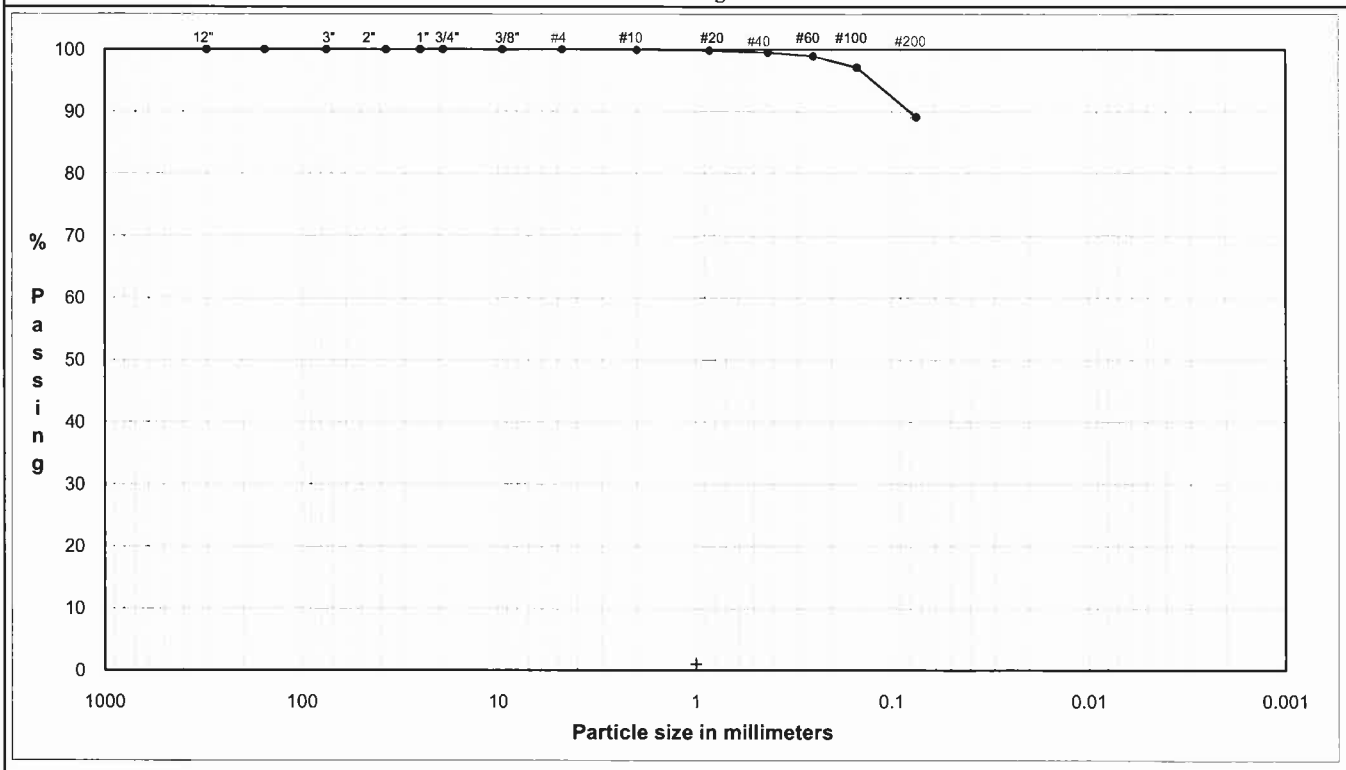
USCS: ML

TECH: MKS
DATE: 8/26/09
REVIEW: MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

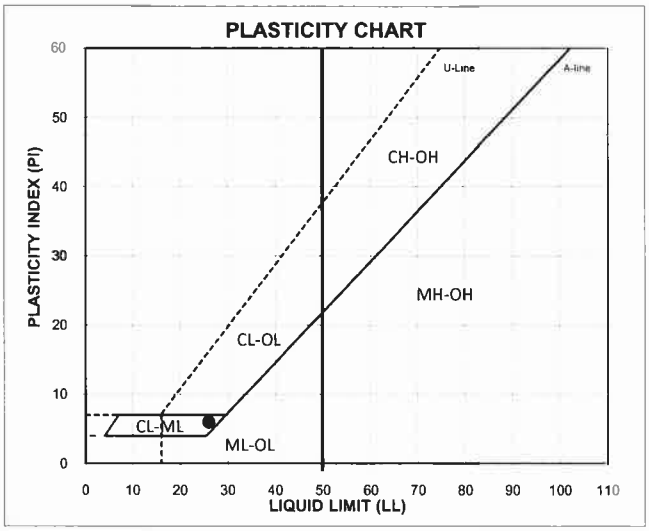
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #11** Depth (ft): **55**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	99.9	Coarse Sand	0.08
#20	0.85	99.8		
#40	0.43	99.5	Medium Sand	0.42
#60	0.25	98.9		
#100	0.15	97.1		
#200	0.08	89.1	Fine Sand	10.39
			Fines	89.11



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG (assumed)
29.1	26	20	6	--

DESCRIPTION: Very dark gray silty clay

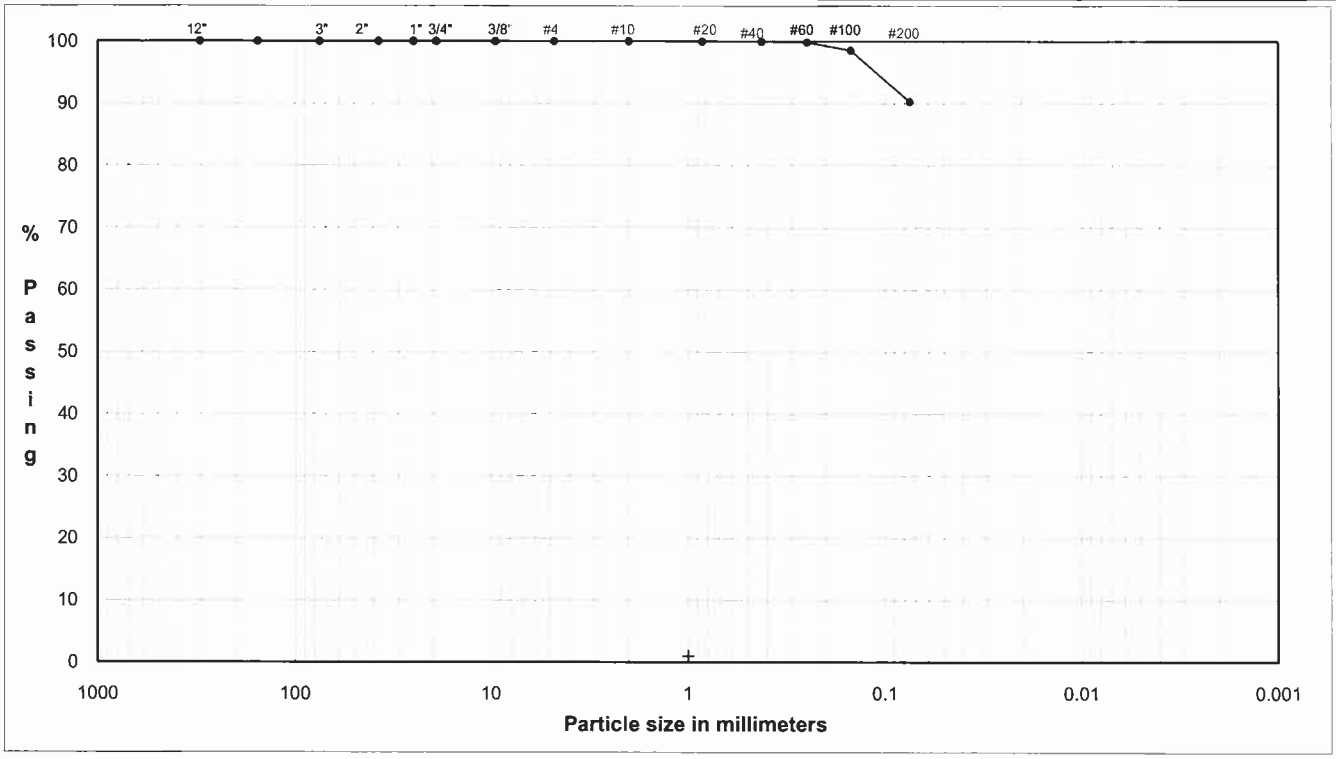
USCS: CL-ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

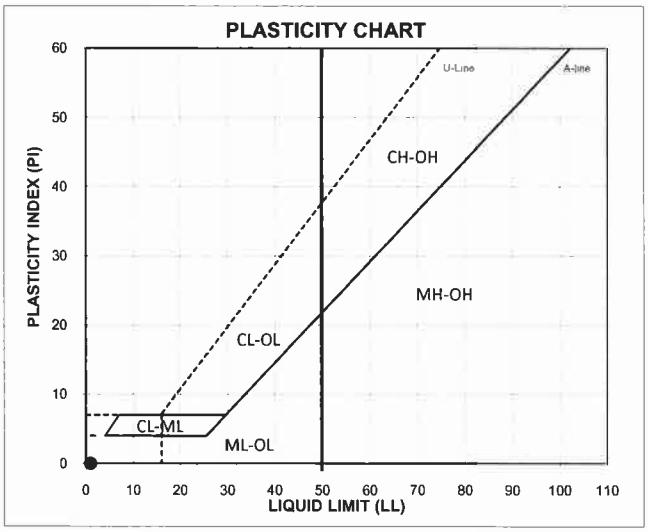
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #13** Depth (ft): **65**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	**100.0**		
6.0"	154.20	**100.0**	Cobbles	**0.00**
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
3.0"	75.00	**100.0**		
1.5"	37.50	**100.0**		
1.0"	25.00	**100.0**	Coarse Gravel	**0.00**
0.75"	19.00	**100.0**		
0.375"	9.50	**100.0**		
#4	4.75	**100.0**	Fine Gravel	**0.00**
#10	2.00	**100.0**	Coarse Sand	**0.00**
#20	0.85	**100.0**		
#40	0.43	**99.9**	Medium Sand	**0.07**
#60	0.25	**99.9**		
#100	0.15	**98.6**		
#200	0.08	**90.3**	Fine Sand	**9.65**
			Fines	**90.28**



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG
25.9	**NP**	**NP**	**NP**	**3.87**

DESCRIPTION: Very dark gray silt

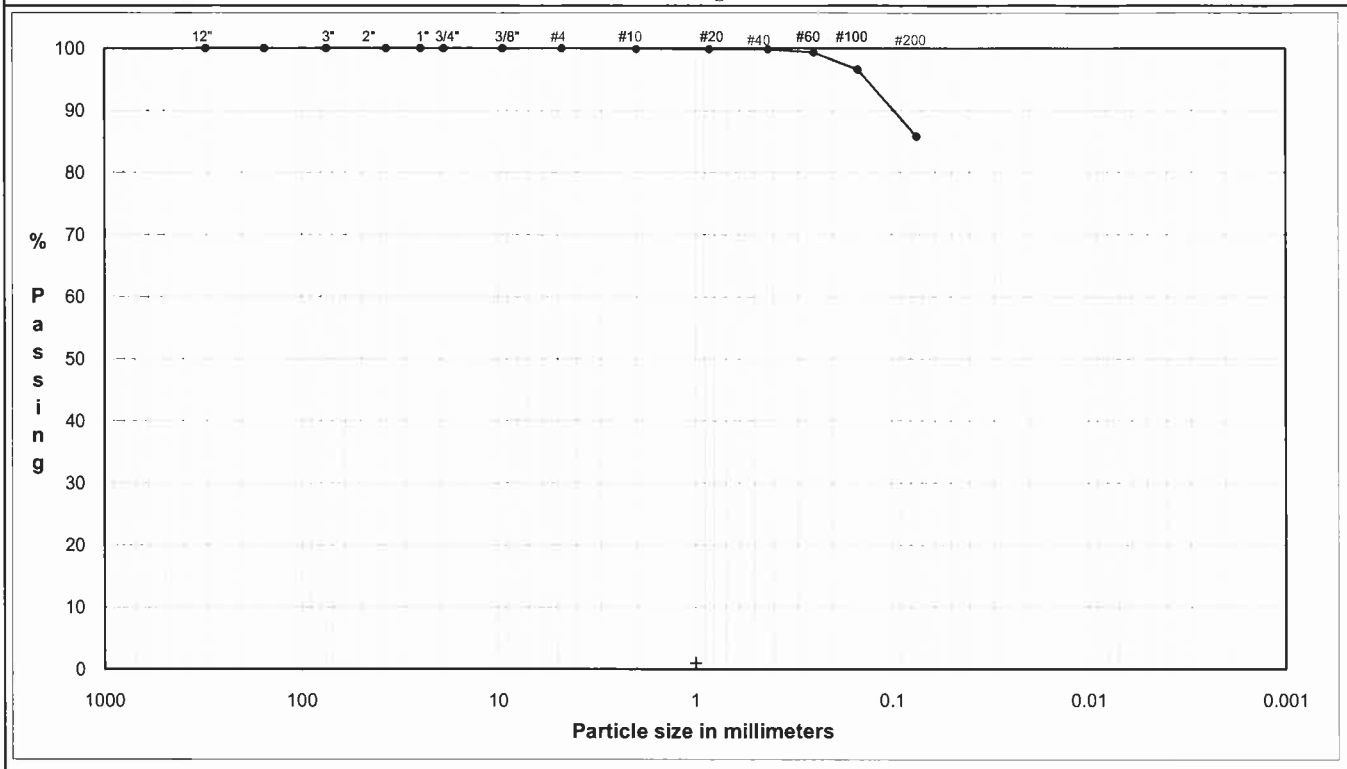
USCS: ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

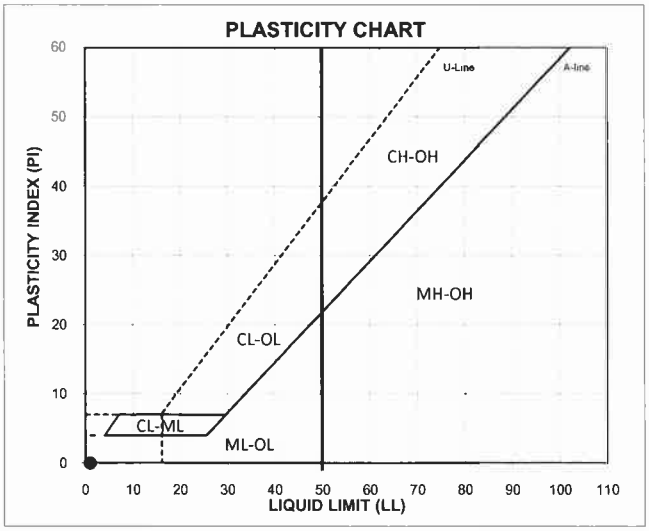
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #15** Depth (ft): **75**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	99.9	Coarse Sand	0.08
#20	0.85	99.9		
#40	0.43	99.8	Medium Sand	0.07
#60	0.25	99.3		
#100	0.15	96.6		
#200	0.08	85.8	Fine Sand	14.06
			Fines	85.79



ATTERBERG LIMITS

M_c(%)	LL	PL	PI	SG (assumed)
18.3	NP	NP	NP	--

DESCRIPTION: Dark brown silt

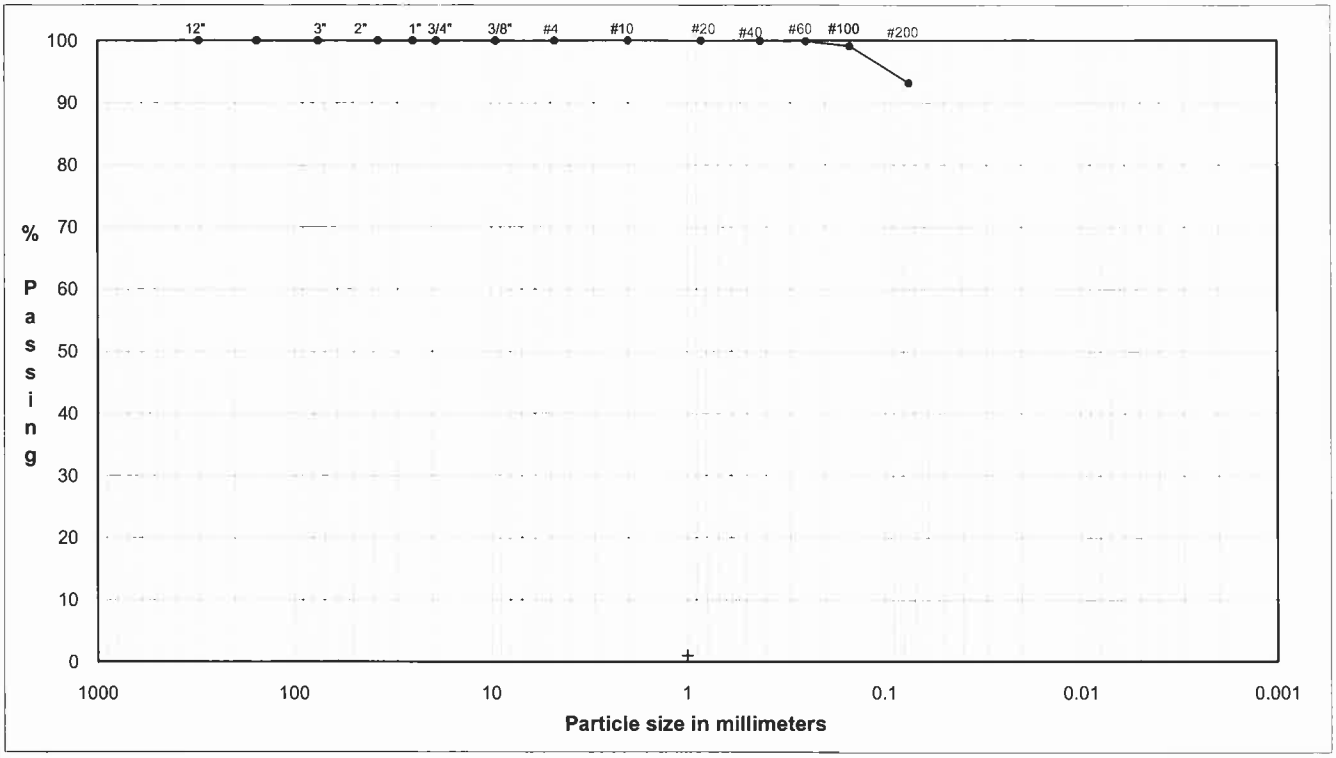
USCS: ML

TECH	MKS
DATE	8/26/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, C117, C136, D4318

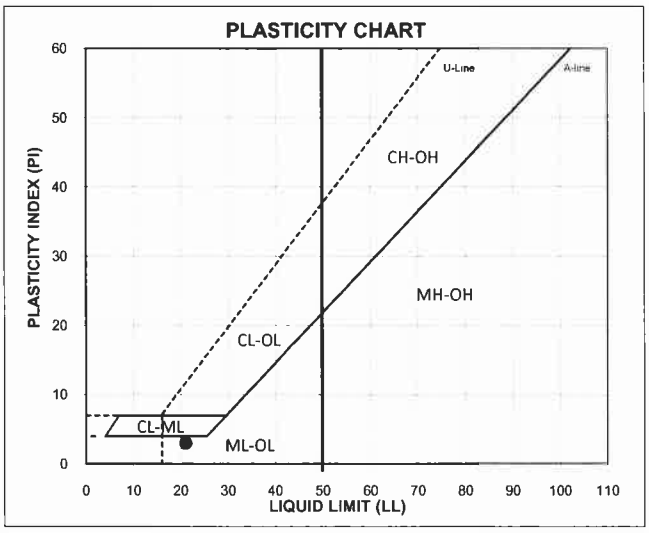
PROJECT NAME: **RCML/Revised Reactive Rock Study/AZ**
SAMPLE ID: **BH-04, #17** Depth (ft): **85**
TYPE: **Bag**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.80	100.0		
6.0"	154.20	100.0	Cobbles	0.00
3.0"	75.00	100.0		
3.0"	75.00	100.0		
3.0"	75.00	100.0		
1.5"	37.50	100.0		
1.0"	25.00	100.0	Coarse Gravel	0.00
0.75"	19.00	100.0		
0.375"	9.50	100.0		
#4	4.75	100.0	Fine Gravel	0.00
#10	2.00	100.0	Coarse Sand	0.01
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.05
#60	0.25	99.9		
#100	0.15	99.1		
#200	0.08	93.1	Fine Sand	6.80
			Fines	93.14



ATTERBERG LIMITS

M_c (%)	LL	PL	PI	SG
27.0	21	18	3	3.74

DESCRIPTION: Dark brown silt

USCS: ML

TECH: MKS
DATE: 8/26/09
REVIEW: MB

TABLE 1
RCML/REVISTIED REACTIVE STUDY/AZ
SUMMARY OF ORGANIC MATERIAL DATA

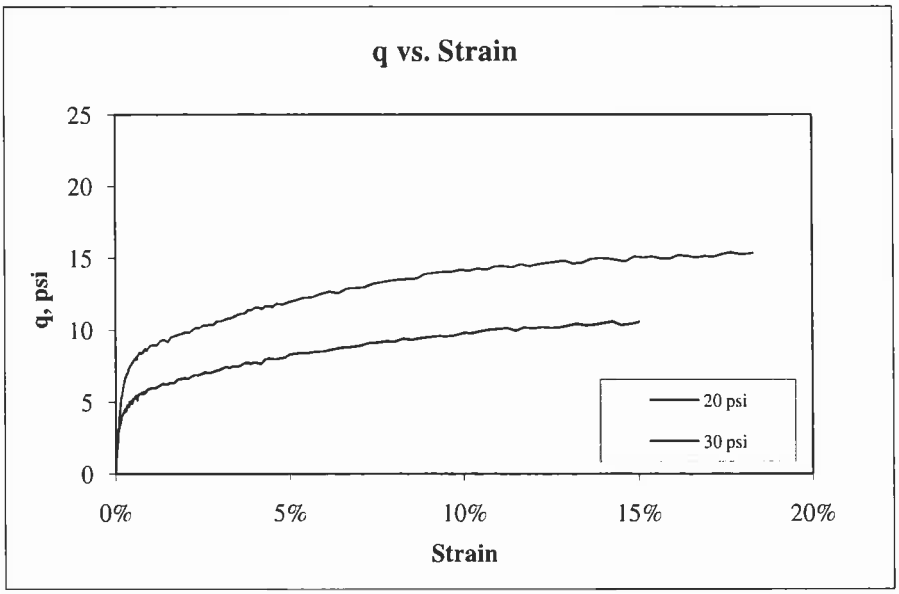
Boring Number	Sample Number	Sample Depth (ft)	Bulk Density			Additional Tests Comments (See Notes)
			Moisture (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	
BH-01	3	15	33.7	132.3	98.9	
BH-01	10	50	34	133.8	99.9	
BH-02	1	5	60.7	106.6	66.3	Bottom cap cracked
BH-02	7	35	21	157.4	130.1	
BH-02	9	45	34.6	134.3	99.8	
BH-03	2	10	39.7	128.4	91.9	Bottom cap cracked
BH-03	8	40	33.4	129.1	96.8	
BH-04	4	20	31.1	136.7	104.2	
BH-04	6	30	36.3	131.4	96.5	

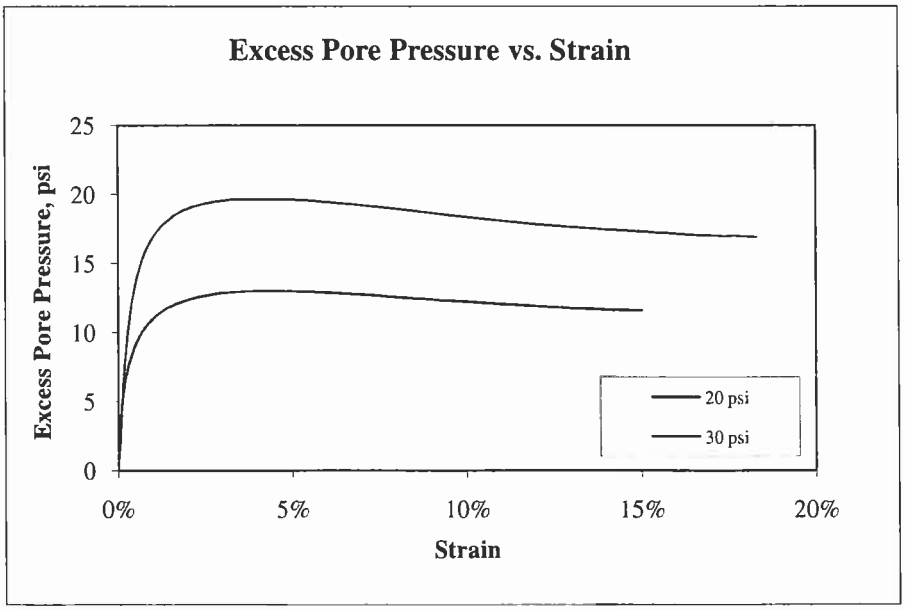
NOTE: Moisture Contents Determined at 110º C

Sample # =	BH-03 #5 @25'		Sample # =	BH-01 #8 @40'	
Point # =	1		Point # =	2	
	Initial			**Initial**	
Length =	16.40	cm	Length =	14.45	cm
Diameter =	7.17	cm	Diameter =	7.27	cm
Wet Weight =	1414.10	g	Wet Weight =	1387.38	g
Area =	40.4	cm^2	Area =	41.5	cm^2
Sample Area =	6.26	in^2	Sample Area =	6.43	in^2
Volume =	662.2	cm^3	Volume =	599.8	cm^3
Moisture Content =	45.5%		Moisture Content =	33.5%	
Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	971.89	g	Dry Weight of Solids =	1039.24	g
Wet Unit Weight =	2.14	g/cm^3	Wet Unit Weight =	2.31	g/cm^3
Dry Unit Weight =	1.47	g/cm^3	Dry Unit Weight =	1.73	g/cm^3
Wet Unit Weight =	133.3	pcf	Wet Unit Weight =	144.3	pcf
Dry Unit Weight =	91.6	pcf	Dry Unit Weight =	108.1	pcf
Cell Pressure =	70	psi	Cell Pressure =	80	psi
Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	20	psi	Confining Pressure =	30	psi

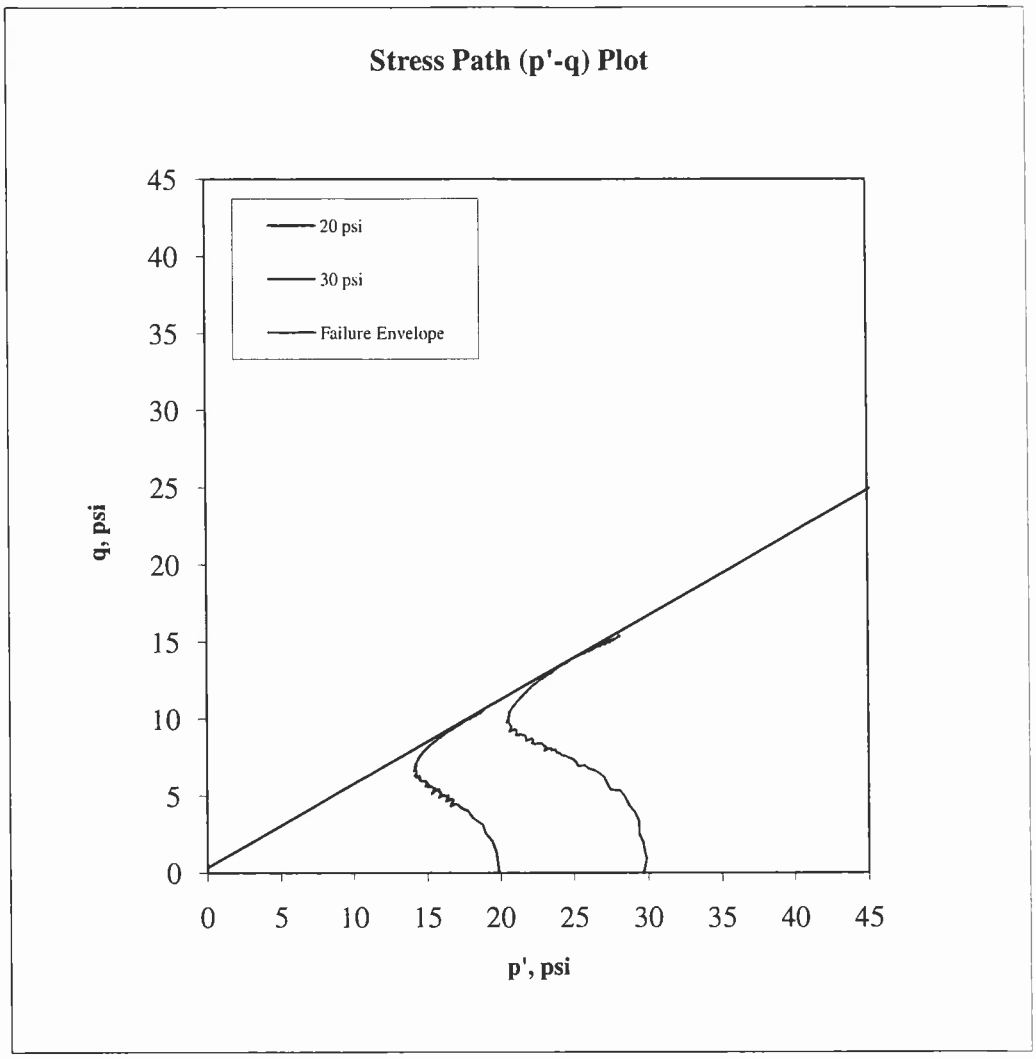
Notes: Visually described as: Point #1 - brown to reddish-brown slime. Point #2 - slime with a layer of sand.
Specimen was taken from a Shelby tube sample.
Failure was defined as the maximum principal stress ratio.
Rate of strain for Point #1 was 5% per hour. t_{50} = 6 min. Rate of strain for Point #2 was 3% per hour. t_{50} was not computed.
Test was a two-point triaxial test, per the specifier's request.

Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**				
Job Short Title: RCML/Reactive Rock Study Project/AZ					
Sample Number: BH-03 #5 @25' / BH-01 #8 @40'	**Reviewed:** JEO	**Date:** 8/25/2009	**Job Number:** 083-92589	**Figure:** 1	





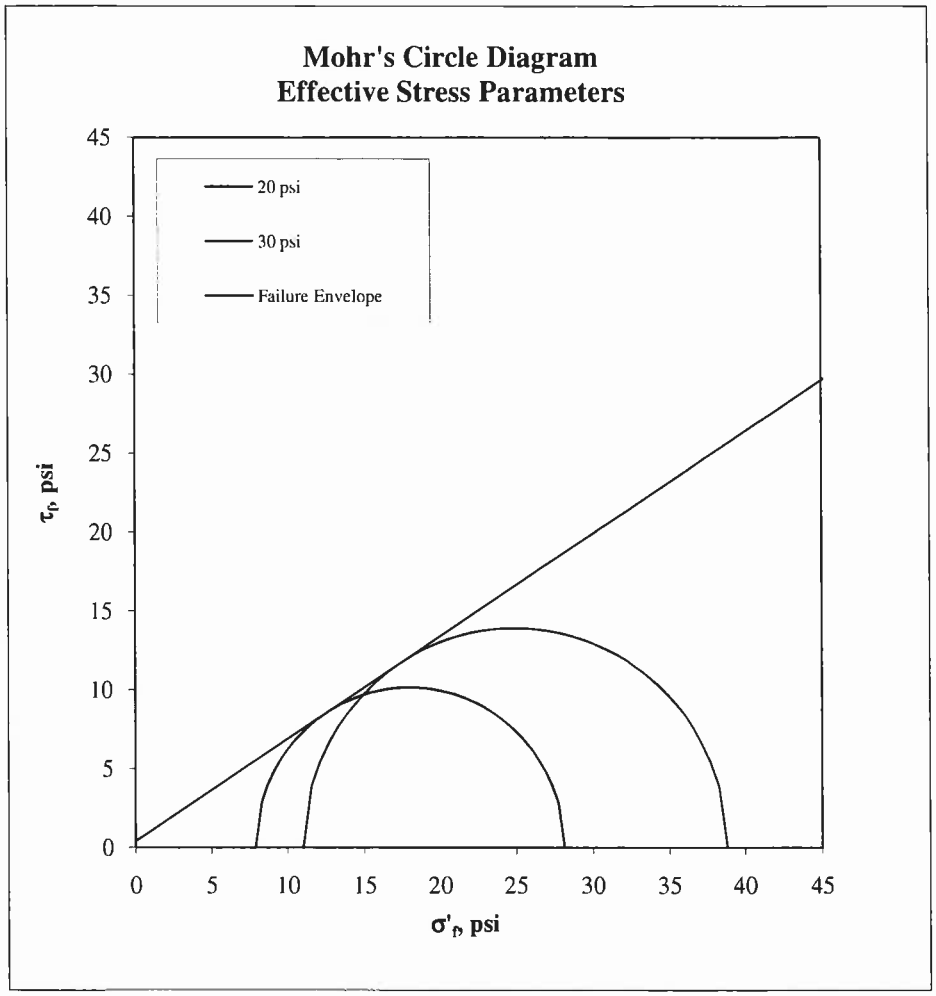
Golder Associates, Inc. Denver, Colorado	Title: C-U TRIAXIAL SHEAR DATA q AND EXCESS PORE PRESSURE PLOTS			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: BH-03 #5 @25' / BH-01 #8 @40'	Reviewed: JEO	Date: 8/25/2009	Job Number: 083-92589	Figure: 2



Stress Path Parameters

ψ' = 28.6 degrees
a' = 0.3 psi

Golder Associates, Inc. Denver, Colorado	Title: C-U TRIAXIAL SHEAR DATA STRESS PATH PLOT			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: BH-03 #5 @25' / BH-01 #8 @40'	Reviewed: JEO	Date: 8/25/2009	Job Number: 083-92589	Figure: 3



Effective Stress Shear Strength Parameters

ϕ' = 33.0 degrees
c' = 0.4 psi

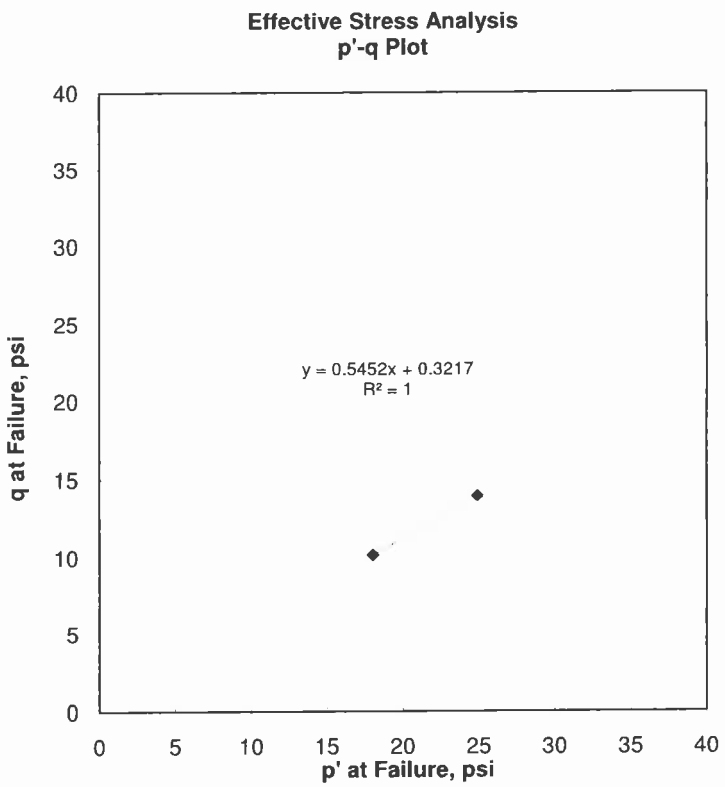
Golder Associates, Inc. Denver, Colorado	Title: C-U TRIAXIAL SHEAR DATA MOHR'S CIRCLE DIAGRAM			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: BH-03 #5 @25' / BH-01 #8 @40'	Reviewed: JEO	Date: 8/25/2009	Job Number: 083-92589	Figure: 4

Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: **RCML/Reactive Rock Study Project/AZ**
Project Number: **083-92589**

Sample Number	BH-03 #5 @25' / BH-01 #8 @40'
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	18.0	10.1
2	24.9	13.9

tan(ψ') =	0.55	
a' =	0.3	psi
ϕ' =	33.0	degrees
c' =	0.4	psi

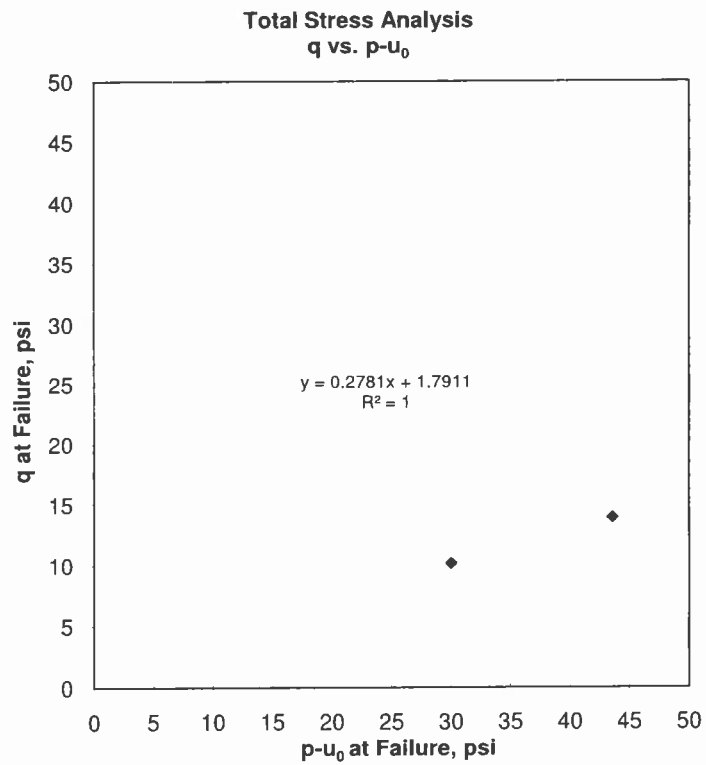


Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: **RCML/Reactive Rock Study Project/AZ**
Project Number: **083-92589**

Sample Number	BH-03 #5 @25' / BH-01 #8 @40'
Total Stress Analysis	

Point Number	$p-u_o$ (psi)	q (psi)
1	30.0	10.1
2	43.6	13.9

tan(ψ) =	**0.28**	
a =	**1.8**	**psi**
ϕ =	**16.1**	**degrees**
c =	**1.9**	**psi**



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: RCML/Reactive Rock Study Project/AZ
Project Number: 083-92589

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses
σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a'. a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p - u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

The relationships between ψ' and ϕ' and a' and c' are as follows:

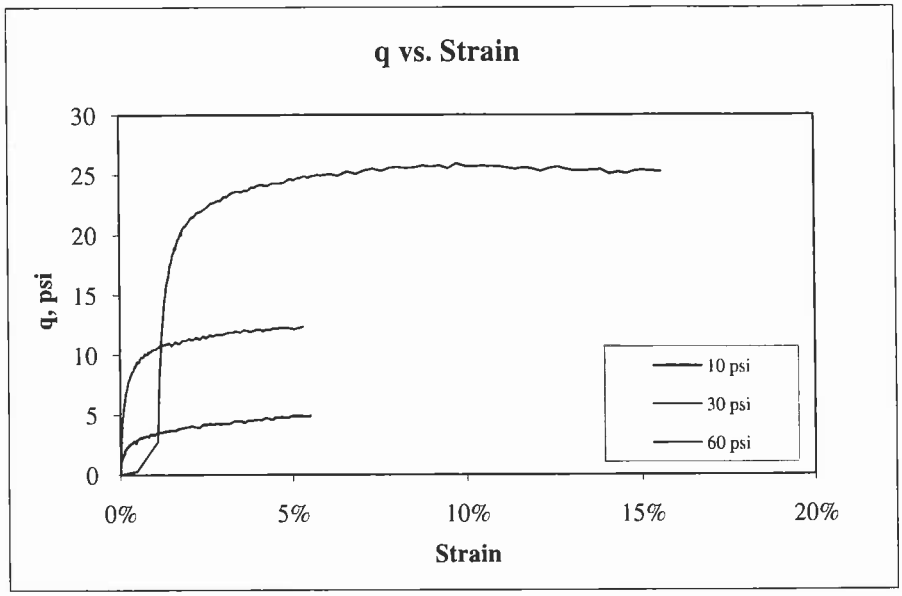
$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$

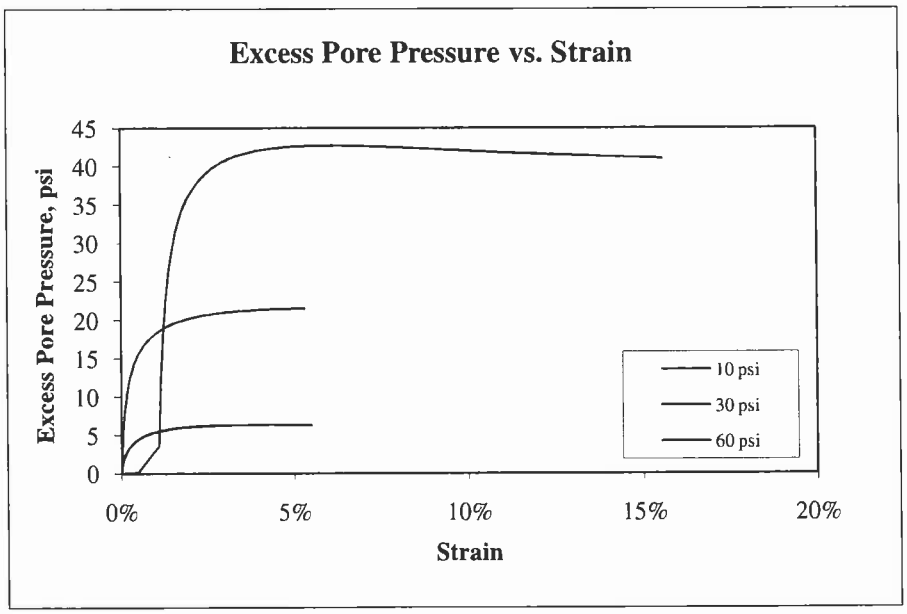
Golder Associates
Denver, Colorado
RCML- Reactive Rock Study
083-92589
BH-03 Spl 5 @25ft
BH-01 Spl 8 @40Ft
Triaxial Test Specimens

Sample # =	BH-4		Sample # =	BH-4		Sample # =	BH-4	
Point # =	1		Point # =	2		Point # =	3	
	Initial			**Initial**			**Initial**	
Length =	15.05	cm	Length =	15.05	cm	Length =	15.05	cm
Diameter =	7.20	cm	Diameter =	7.20	cm	Diameter =	7.20	cm
Wet Weight =	1205.90	g	Wet Weight =	1205.90	g	Wet Weight =	1205.90	g
Area =	40.7	cm^2	Area =	40.7	cm^2	Area =	40.7	cm^2
Sample Area =	6.31	in^2	Sample Area =	6.31	in^2	Sample Area =	6.31	in^2
Volume =	612.7	cm^3	Volume =	612.7	cm^3	Volume =	612.7	cm^3
Moisture Content =	69.4%		Moisture Content =	69.4%		Moisture Content =	69.4%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	711.87	g	Dry Weight of Solids =	711.87	g	Dry Weight of Solids =	711.87	g
Wet Unit Weight =	1.97	g/cm^3	Wet Unit Weight =	1.97	g/cm^3	Wet Unit Weight =	1.97	g/cm^3
Dry Unit Weight =	1.16	g/cm^3	Dry Unit Weight =	1.16	g/cm^3	Dry Unit Weight =	1.16	g/cm^3
Wet Unit Weight =	122.8	pcf	Wet Unit Weight =	122.8	pcf	Wet Unit Weight =	122.8	pcf
Dry Unit Weight =	72.5	pcf	Dry Unit Weight =	72.5	pcf	Dry Unit Weight =	72.5	pcf
Cell Pressure =	60	psi	Cell Pressure =	80	psi	Cell Pressure =	110	psi
Back Pressure =	50	psi	Back Pressure =	50	psi	Back Pressure =	50	psi
Confining Pressure =	10	psi	Confining Pressure =	30	psi	Confining Pressure =	60	psi

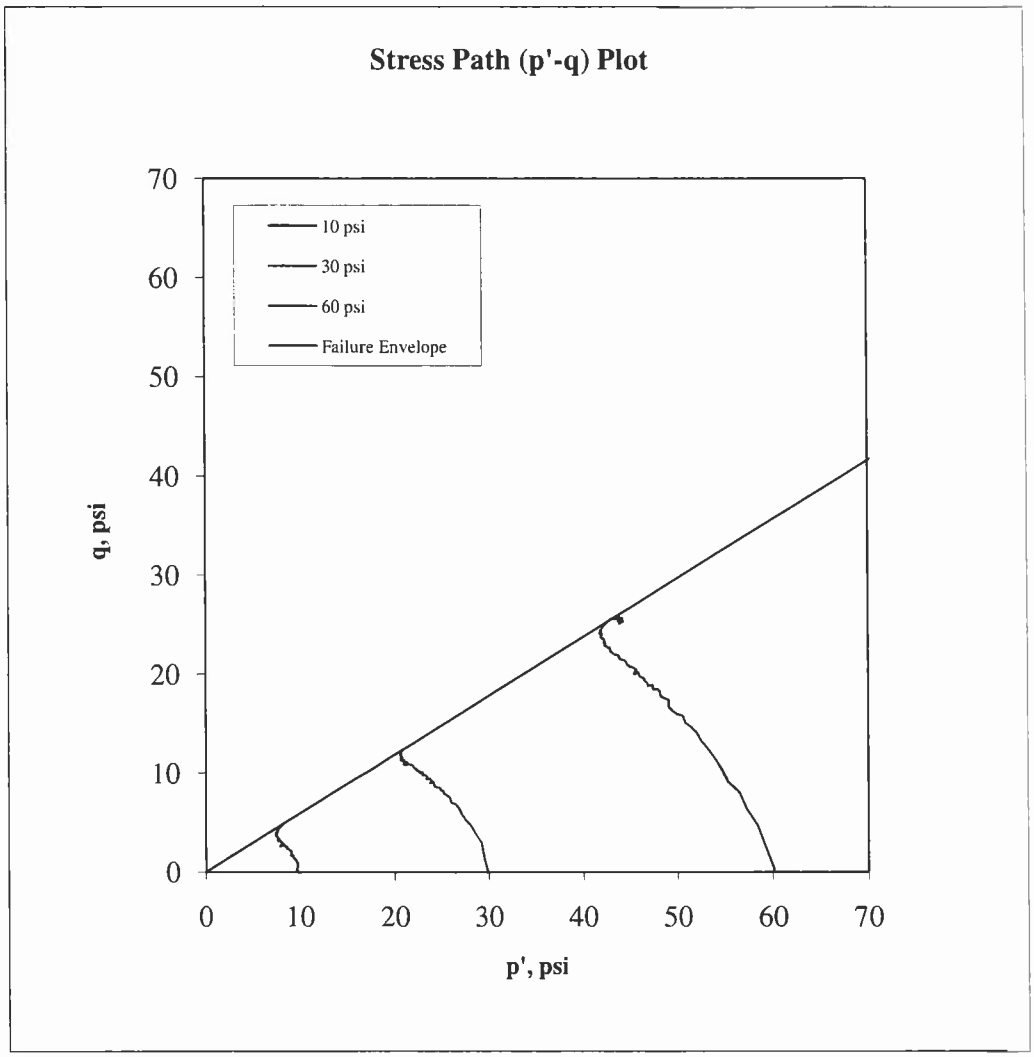
Notes: Specimen was taken from a Shelby tube sample.
Failure was defined as the maximum principal stress ratio.
Rate of strain was 5% per hour. t_{50} = 6 min.
Test was a staged triaxial test.

Golder Associates, Inc. **Denver, Colorado**	**Title:** **TRIAXIAL SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**				
Job Short Title: RCML/Reactive Rock Study Project/AZ					
Sample Number: **BH-04 #2 @10 '**	**Reviewed:** **JEO**	**Date:** **8/18/2009**	**Job Number:** **083-92589**	**Figure:** **1**	





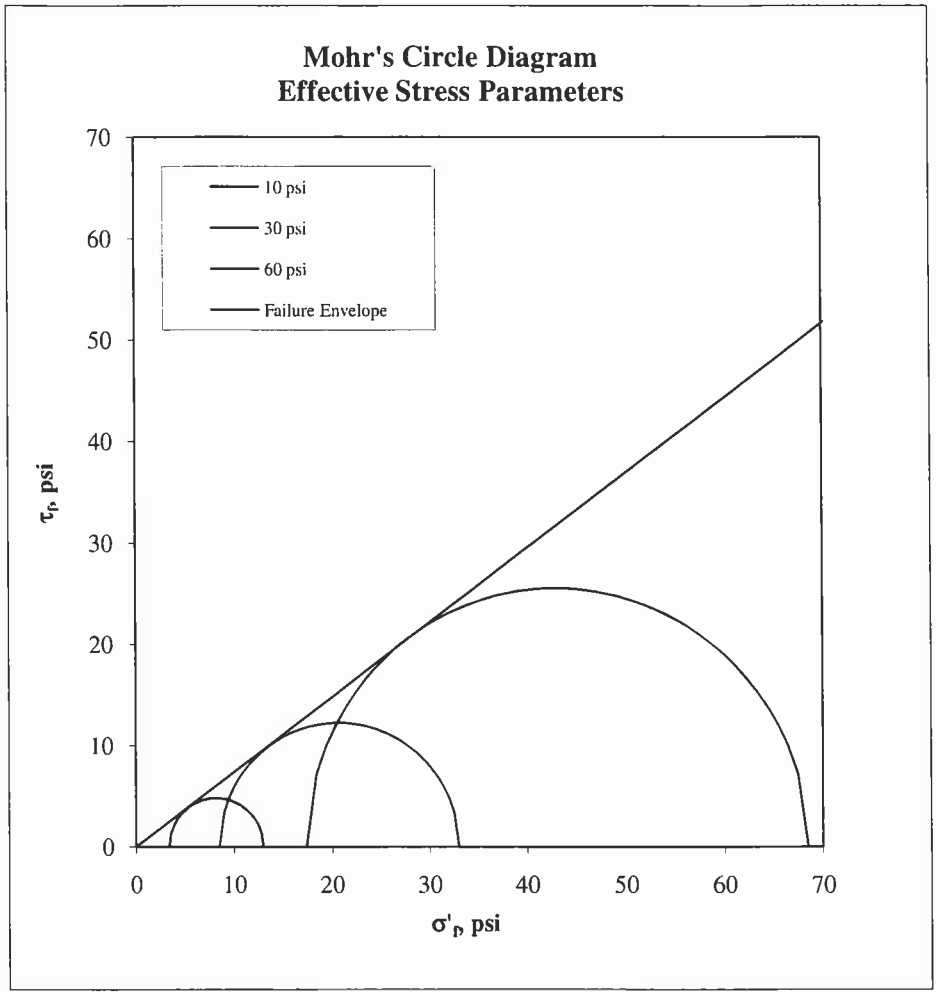
Golder Associates, Inc. Denver, Colorado	Title: C-U TRIAXIAL SHEAR DATA q AND EXCESS PORE PRESSURE PLOTS			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: BH-04 #2 @10 '	Reviewed: JEO	Date: 8/18/2009	Job Number: 083-92589	Figure: 2



Stress Path Parameters

ψ' = 30.7 degrees
a' = 0.0 psi

Golder Associates, Inc. **Denver, Colorado**	Title: **C-U TRIAXIAL SHEAR DATA** **STRESS PATH PLOT**			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: **BH-04 #2 @10 '**	Reviewed: **JEO**	Date: **8/18/2009**	Job Number: **083-92589**	Figure: **3**



Effective Stress Shear Strength Parameters

ϕ' = 36.4 degrees
c' = 0.0 psi

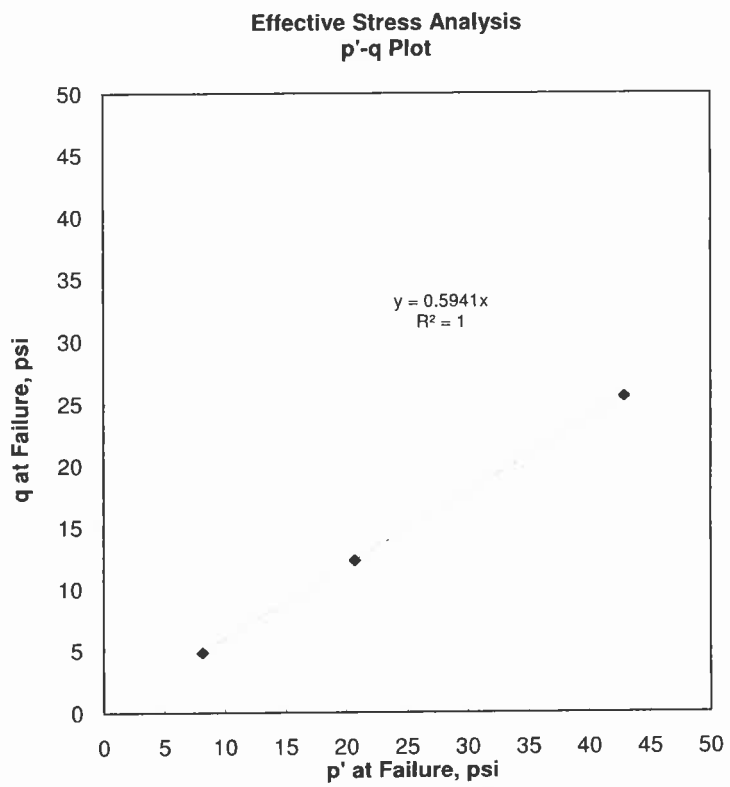
Golder Associates, Inc. Denver, Colorado	Title: C-U TRIAXIAL SHEAR DATA MOHR'S CIRCLE DIAGRAM			
Job Short Title: RCML/Reactive Rock Study Project/AZ				
Sample Number: BH-04 #2 @10 '	Reviewed: JEO	Date: 8/18/2009	Job Number: 083-92589	Figure: 4

Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: RCML/Reactive Rock Study Project/AZ
Project Number: 083-92589

Sample Number	BH-04 #2 @10 '
Effective Stress Analysis	

Point Number	p' (psi)	q (psi)
1	8.2	4.8
2	20.7	12.3
3	42.9	25.5

tan(ψ') =	0.59	
a' =	0.0	psi
ϕ' =	36.4	degrees
c' =	0.0	psi

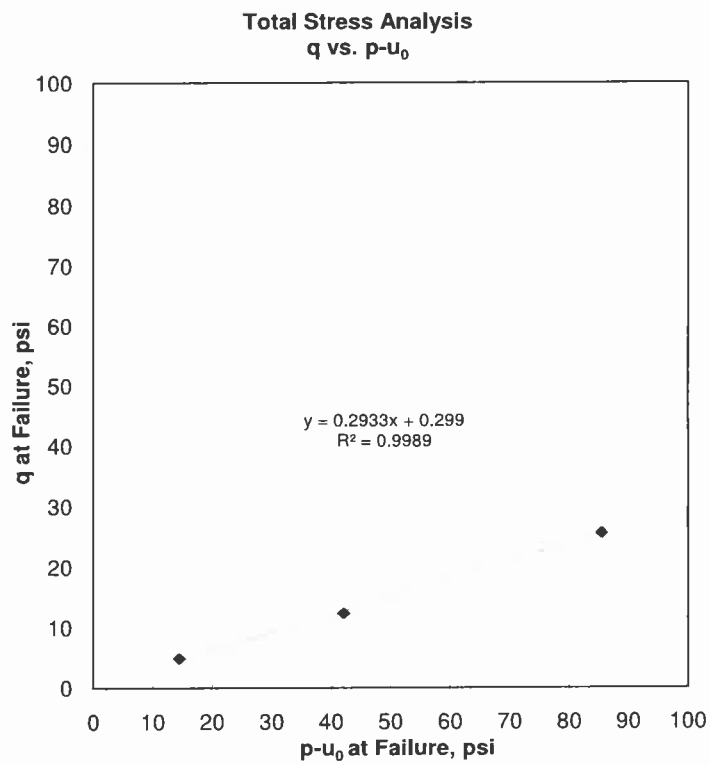


Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: RCML/Reactive Rock Study Project/AZ
Project Number: 083-92589

Sample Number	BH-04 #2 @10'
Total Stress Analysis	

Point Number	$p-u_o$ (psi)	q (psi)
1	14.5	4.8
2	42.1	12.3
3	85.5	25.5

$\tan(\psi)$ =	0.29	
a =	0.3	psi
ϕ =	17.1	degrees
c =	0.3	psi



Consolidated-Undrained Triaxial Lab Data
From: GOLDER ASSOCIATES INC.
Project: **RCML/Reactive Rock Study Project/AZ**
Project Number: **083-92589**

Mohr-Coulomb Failure Criteria:

$$\tau_{ff} = c' + \sigma'_{ff} \tan(\phi')$$
$$\tau_{ff} = c + \sigma_{ff} \tan(\phi)$$

Where:
c', c = effective and total stress cohesion intercepts

ϕ', ϕ = effective and total stress friction angles

τ_{ff} = shear strength on the failure surface at failure

σ'_{ff}, σ_{ff} = effective and total normal stresses on the failure surface at failure

Stress Path Space:

$$q = \frac{\sigma_1 - \sigma_3}{2} \qquad p' = \frac{\sigma'_1 + \sigma'_3}{2} \qquad p = \frac{\sigma_1 + \sigma_3}{2}$$

Where:
q = maximum shear stress

p', p = mean effective and total stresses
σ'_1, σ_1 = effective and total axial stresses

σ'_3, σ_3 = effective and total confining stresses

Stress Path Failure Criteria:

$$q = a' + p' \tan(\psi')$$
$$q = a + (p - u_0) \tan(\psi)$$

Where:
a', a = intercepts of the q-axis in effective stress and total stress spaces

ψ', ψ = angles of the failure envelopes in effective stress and total stress spaces

q = maximum shear stress at failure

p' = mean effective stress at failure

$p - u_0$ = mean total stress at failure minus the initial pore pressure

The relationships between ψ and ϕ and a and c are as follows:

$$\tan(\psi) = \sin(\phi)$$
$$a = c \cos(\phi)$$

The relationships between ψ' and ϕ' and a' and c' are as follows:

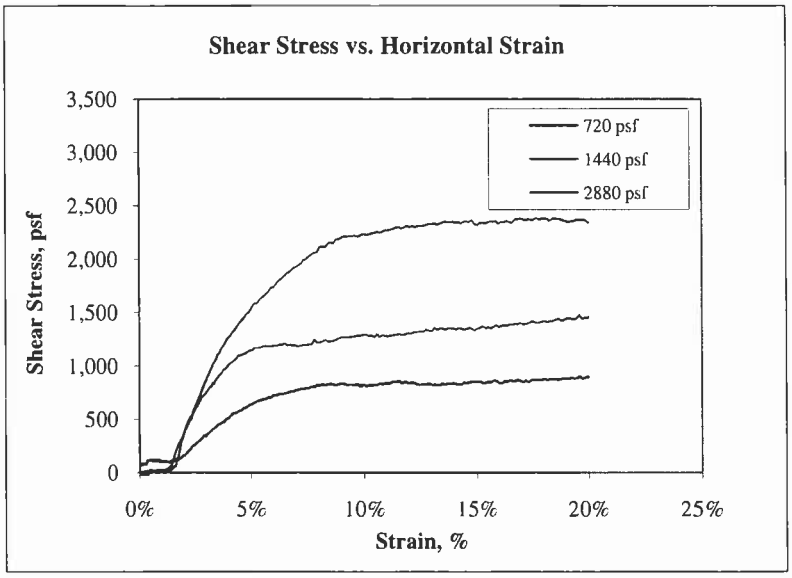
$$\tan(\psi') = \sin(\phi')$$
$$a' = c' \cos(\phi')$$

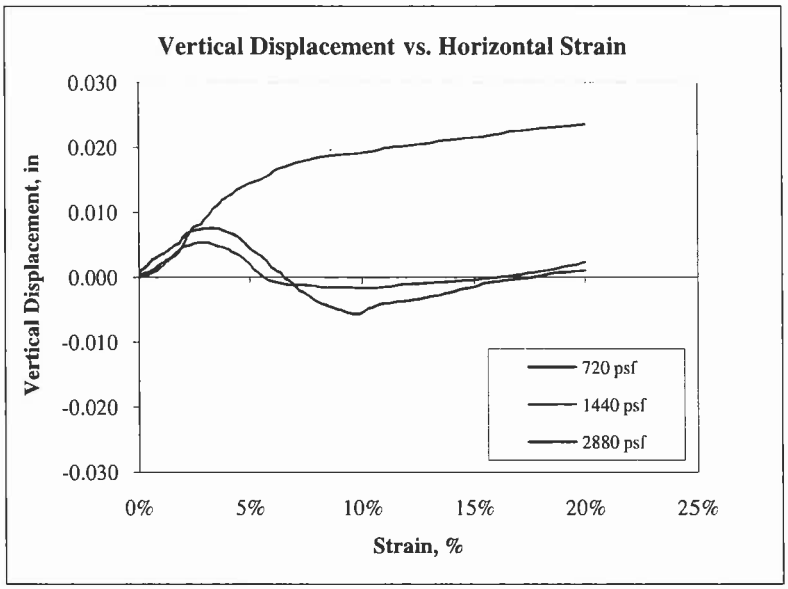
Golder Associates
Denver, Colorado
RCML-Reactive Rock Study
083-92589
BH-04 Sample 2 @10ft
Staged Triax Specimen

Sample # =	BH-01 #8 @ 40'		Sample # =	BH-01 #8 @ 40'		Sample # =	BH-01 #8 @ 40'	
Point #	1		Point #	2		Point #	3	
Load =	5	psi	Load =	10	psi	Load =	20	psi
	Initial			**Initial**			**Initial**	
Height =	2.949	cm	Height =	2.949	cm	Height =	2.949	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	225.30	g	Wet Weight =	225.30	g	Wet Weight =	225.30	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	93.4	cm^3	Volume =	93.4	cm^3	Volume =	93.4	cm^3
Moisture Content =	22.2%		Moisture Content =	23.0%		Moisture Content =	28.9%	
Specific Gravity =	2.70		Specific Gravity =	2.70		Specific Gravity =	2.70	
Dry Weight of Solids =	184.37	g	Dry Weight of Solids =	183.17	g	Dry Weight of Solids =	174.79	g
Wet Density =	2.41	g/cm^3	Wet Density =	2.41	g/cm^3	Wet Density =	2.41	g/cm^3
Dry Density =	1.97	g/cm^3	Dry Density =	1.96	g/cm^3	Dry Density =	1.87	g/cm^3
Wet Density =	150.5	pcf	Wet Density =	150.5	pcf	Wet Density =	150.5	pcf
Dry Density =	123.2	pcf	Dry Density =	122.4	pcf	Dry Density =	116.8	pcf
Initial Normal Stress =	720	psf	Initial Normal Stress =	1440	psf	Initial Normal Stress =	2880	psf
Failure Normal Stress =	812	psf	Failure Normal Stress =	1,653	psf	Failure Normal Stress =	3,299	psf
Failure Shear Stress =	833	psf	Failure Shear Stress =	1,292	psf	Failure Shear Stress =	2,234	psf
Failure Strain =	15.0%		Failure Strain =	15.0%		Failure Strain =	15.0%	
Normal Stress at Large Disp. =	963	psf	Normal Stress at Large Disp. =	1,926	psf	Normal Stress at Large Disp. =	3,855	psf
Large-Disp. Shear Stress =	891	psf	Large-Disp. Shear Stress =	1,457	psf	Large-Disp. Shear Stress =	2,342	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

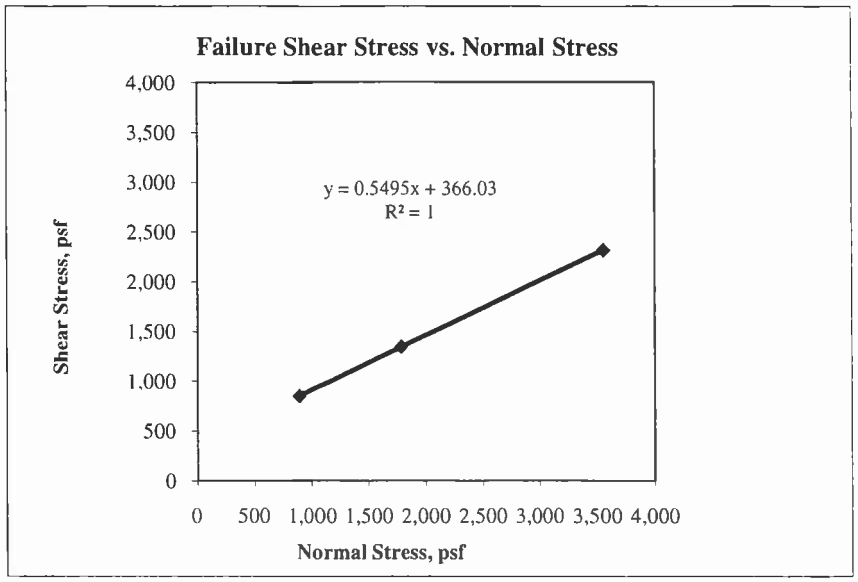
Notes: Samples were indundated after consolidation and prior to shearing.
Failure shear stress is defined as the shear stress at 15% strain.

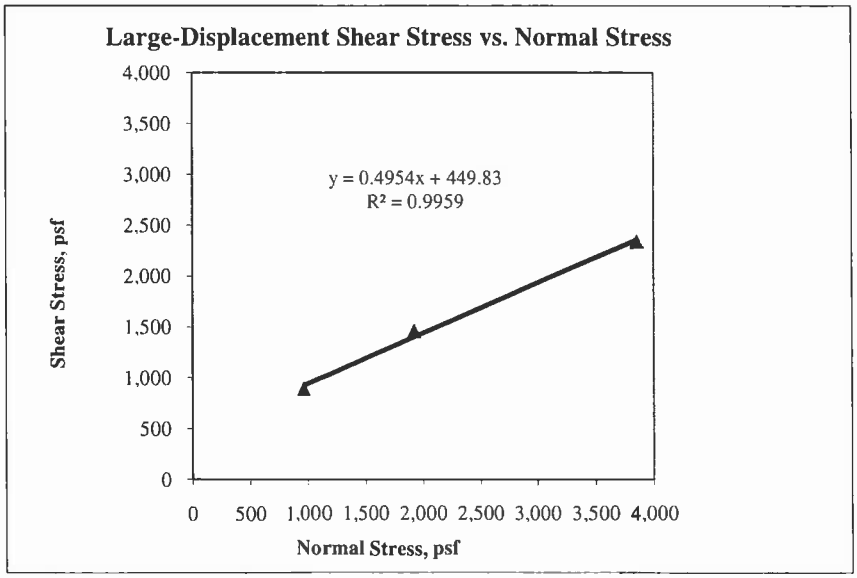
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**				
Job Short Title: RCML/Revised Reactive Rock Study/AZ					
Sample Number: **BH-01 #8 @40'**	**Reviewed:** **JEO**	**Date:** **8/14/2009**	**Job Number:** **083-92589**	**Figure:** **1**	





Golder Associates, Inc. Denver, Colorado	Title: STRESS AND VERTICAL DISPLACEMENT VS. STRAIN			
Job Short Title: RCML/Revised Reactive Rock Study/AZ				
Sample Number: BH-01 #8 @40'	Reviewed: JEO	Date: 8/14/2009	Job Number: 083-92589	Figure: 2





	Failure		Large-Displacement
ϕ =	28.8 degrees	ϕ =	26.4 degrees
c =	366 psf	c =	450 psf

Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**
Job Short Title: RCML/Revised Reactive Rock Study/AZ	

Sample Number:	Reviewed:	Date:	Job Number:	Figure:
BH-01 #8 @40'	JEO	8/14/2009	083-92589	3

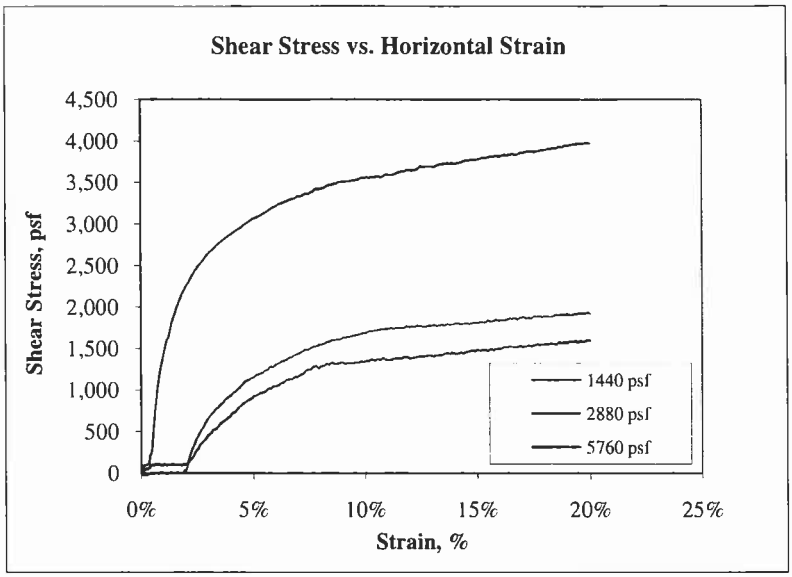
Sample # =	5	
Point #	1	
Load =	10	psi
	Initial	
Height =	2.949	cm
Diameter =	6.342	cm
Wet Weight =	225.70	g
Area =	31.6	cm^2
Sample Area =	4.90	in^2
Sample Area =	0.03	ft^2
Volume =	93.2	cm^3
Moisture Content =	21.2%	
Specific Gravity =	-	
Dry Weight of Solids =	186.22	g
Wet Density =	2.42	g/cm^3
Dry Density =	2.00	g/cm^3
Wet Density =	151.2	pcf
Dry Density =	124.7	pcf
Initial Normal Stress =	1440	psf
Failure Normal Stress =	1,927	psf
Failure Shear Stress =	1,602	psf
Failure Strain =	15.0%	
Normal Stress at Large Disp. =	1,924	psf
Large-Disp. Shear Stress =	1,593	psf
Strain at Large Disp.=	20.0%	

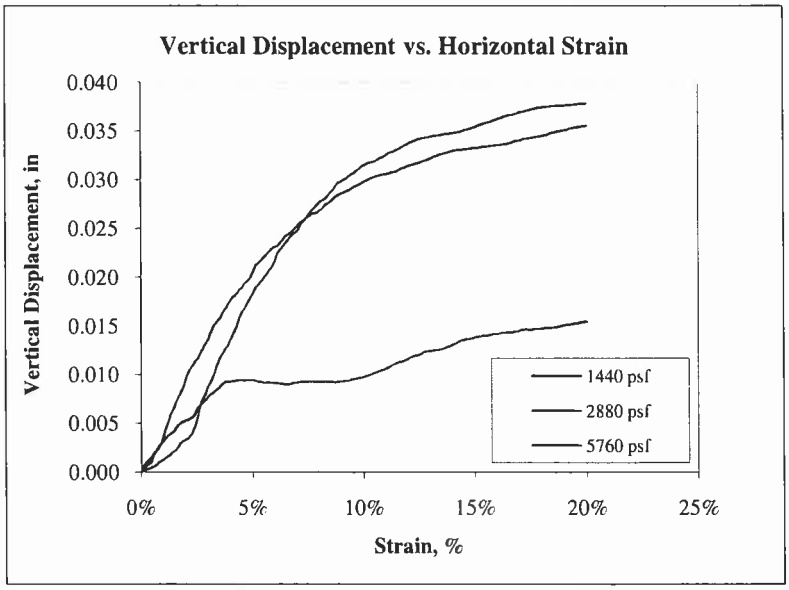
Sample # =	5	
Point #	2	
Load =	20	psi
	Initial	
Height =	2.949	cm
Diameter =	6.342	cm
Wet Weight =	198.80	g
Area =	31.6	cm^2
Sample Area =	4.90	in^2
Sample Area =	0.03	ft^2
Volume =	93.2	cm^3
Moisture Content =	31.7%	
Specific Gravity =	-	
Dry Weight of Solids =	150.95	g
Wet Density =	2.13	g/cm^3
Dry Density =	1.62	g/cm^3
Wet Density =	133.2	pcf
Dry Density =	101.1	pcf
Initial Normal Stress =	2880	psf
Failure Normal Stress =	3,849	psf
Failure Shear Stress =	1,935	psf
Failure Strain =	15.0%	
Normal Stress at Large Disp. =	3,855	psf
Large-Disp. Shear Stress =	1,918	psf
Strain at Large Disp.=	20.0%	

Sample # =	5	
Point #	3	
Load =	40	psi
	Initial	
Height =	2.949	cm
Diameter =	6.342	cm
Wet Weight =	208.50	g
Area =	31.6	cm^2
Sample Area =	4.90	in^2
Sample Area =	0.03	ft^2
Volume =	93.2	cm^3
Moisture Content =	31.8%	
Specific Gravity =	-	
Dry Weight of Solids =	158.19	g
Wet Density =	2.24	g/cm^3
Dry Density =	1.70	g/cm^3
Wet Density =	139.7	pcf
Dry Density =	106.0	pcf
Initial Normal Stress =	5760	psf
Failure Normal Stress =	7,694	psf
Failure Shear Stress =	3,981	psf
Failure Strain =	15.0%	
Normal Stress at Large Disp. =	7,711	psf
Large-Disp. Shear Stress =	3,974	psf
Strain at Large Disp.=	20.0%	

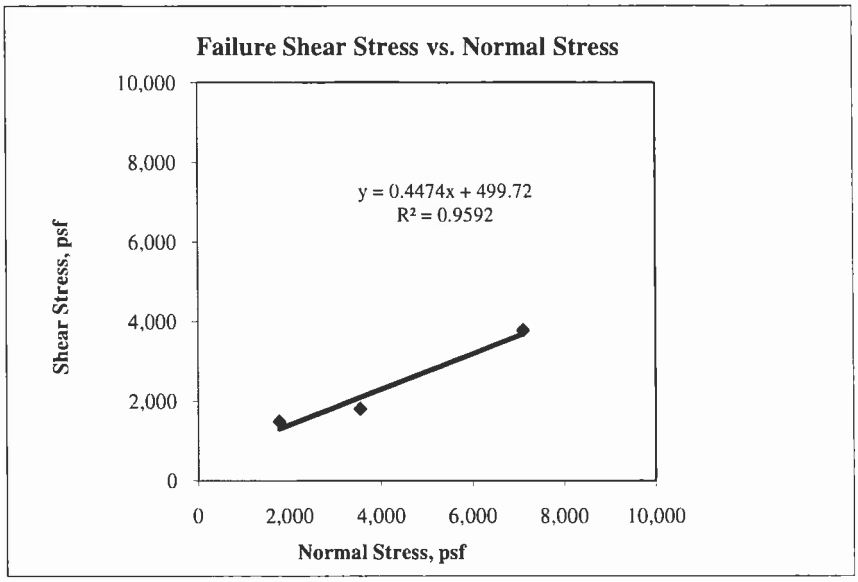
Note: Samples were inundated after consolidation and prior to shearing.
Failure shear stress is defined as the shear stress at 15% strain.

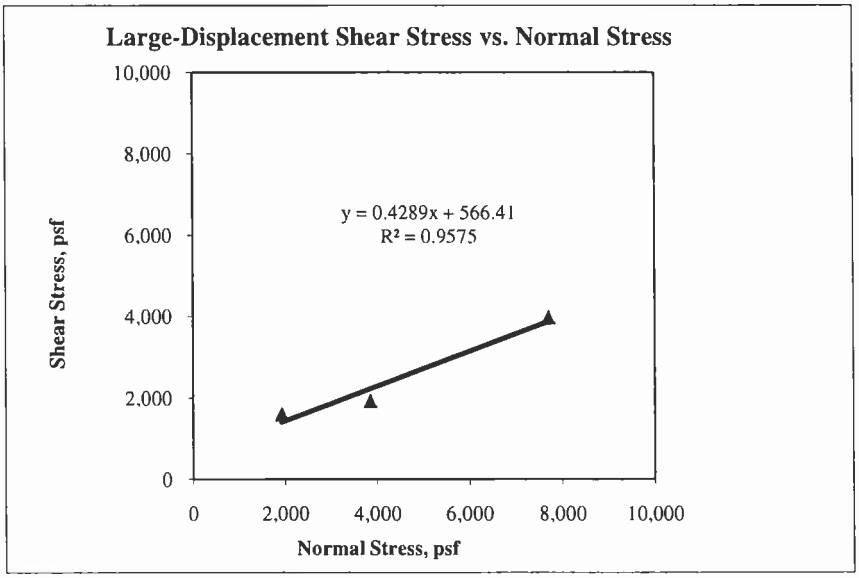
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**				
Job Short Title: RCML/Revised Reactive Rock Study/AZ					
Sample Number: **BH-03 #5 @25'**	**Reviewed:** **JEO**	**Date:** **8/18/2009**	**Job Number:** **083-92589**	**Figure:** **1**	





Golder Associates, Inc. Denver, Colorado				Title: STRESS AND VERTICAL DISPLACEMENT VS. STRAIN
Job Short Title: RCML/Revised Reactive Rock Study/AZ				
Sample Number: BH-03 #5 @25'	Reviewed: JEO	Date: 8/18/2009	Job Number: 083-92589	Figure: 2





Failure		Large-Displacement	
ϕ =	24.1 degrees	ϕ =	23.2 degrees
c =	500 psf	c =	566 psf

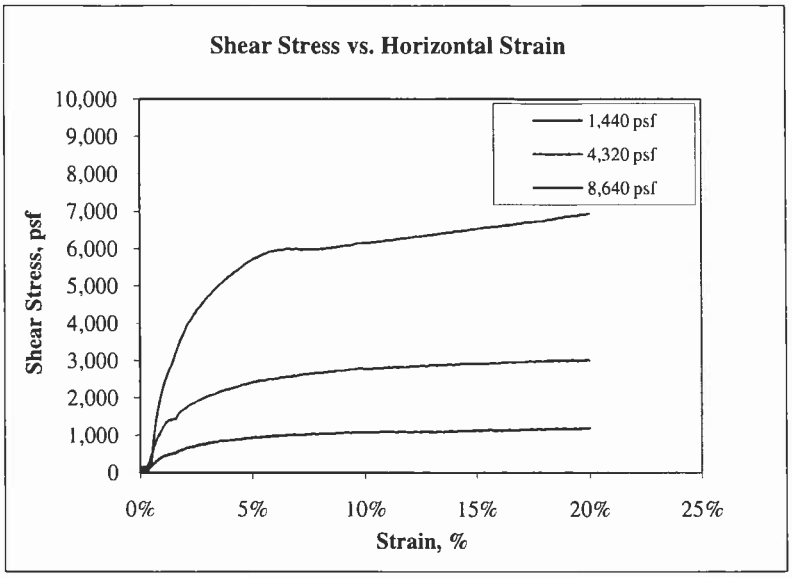
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**
Job Short Title: RCML/Revised Reactive Rock Study/AZ	

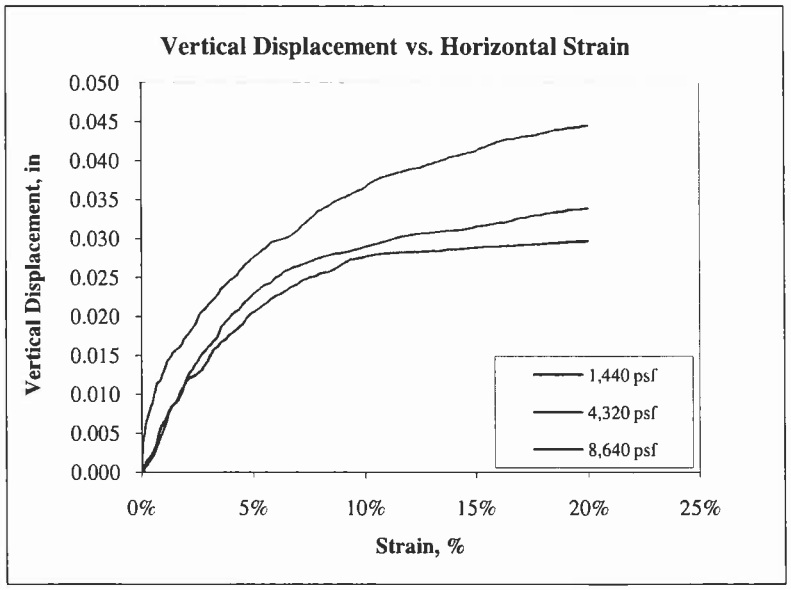
Sample Number:	Reviewed:	Date:	Job Number:	Figure:
BH-03 #5 @25'	JEO	8/18/2009	083-92589	3

Sample # =	BH-04 #2 @10'		Sample # =	BH-04 #2 @10'		Sample # =	BH-04 #2 @10'	
Point #	1		Point #	2		Point #	3	
Load =	10	psi	Load =	30	psi	Load =	60	psi
	Initial			**Initial**			**Initial**	
Height =	2.949	cm	Height =	2.949	cm	Height =	2.949	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	192.20	g	Wet Weight =	182.00	g	Wet Weight =	174.70	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	93.4	cm^3	Volume =	93.4	cm^3	Volume =	93.4	cm^3
Moisture Content =	41.4%		Moisture Content =	32.7%		Moisture Content =	46.6%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	135.93	g	Dry Weight of Solids =	137.15	g	Dry Weight of Solids =	119.17	g
Wet Density =	2.06	g/cm^3	Wet Density =	1.95	g/cm^3	Wet Density =	1.87	g/cm^3
Dry Density =	1.46	g/cm^3	Dry Density =	1.47	g/cm^3	Dry Density =	1.28	g/cm^3
Wet Density =	128.4	pcf	Wet Density =	121.6	pcf	Wet Density =	116.7	pcf
Dry Density =	90.8	pcf	Dry Density =	91.6	pcf	Dry Density =	79.6	pcf
Initial Normal Stress =	1,440	psf	Initial Normal Stress =	4,320	psf	Initial Normal Stress =	8,640	psf
Failure Normal Stress =	1,599	psf	Failure Normal Stress =	4,801	psf	Failure Normal Stress =	9,432	psf
Failure Shear Stress =	1,044	psf	Failure Shear Stress =	2,676	psf	Failure Shear Stress =	5,998	psf
Failure Strain =	15.0%		Failure Strain =	15.0%		Failure Strain =	15.0%	
Normal Stress at Large Disp. =	1,927	psf	Normal Stress at Large Disp. =	5,783	psf	Normal Stress at Large Disp. =	11,559	psf
Large-Disp. Shear Stress =	1,193	psf	Large-Disp. Shear Stress =	3,001	psf	Large-Disp. Shear Stress =	6,934	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

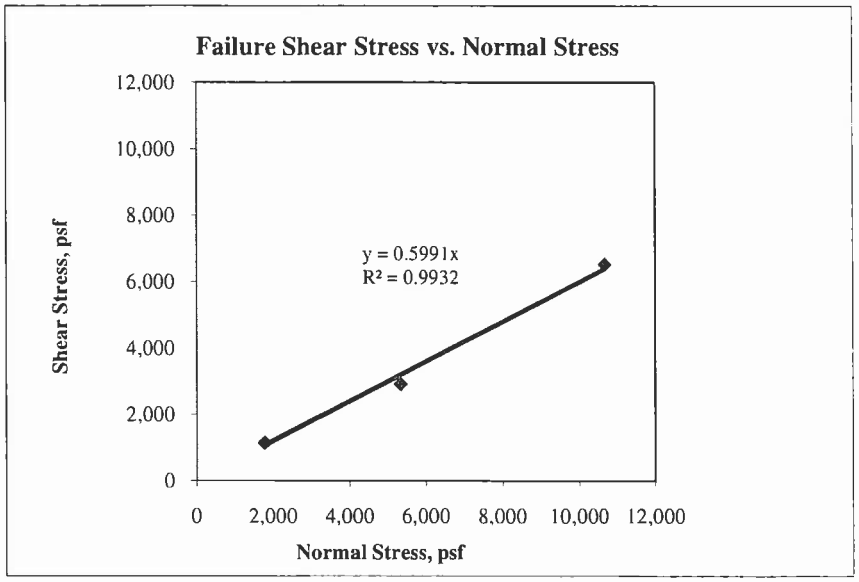
Note: Specimens were inundated after consolidation and prior to shearing.
Failure shear stress is defined as the shear stress at 15% strain.

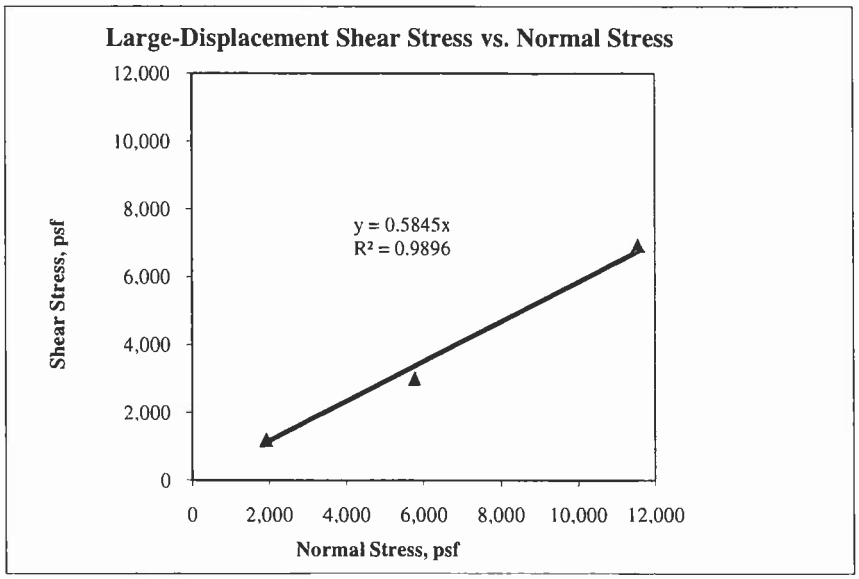
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**				
Job Short Title: RCML/Revised Reactive Rock Study/AZ					
Sample Number: **BH-04 #2 @10'**	**Reviewed:** **JEO**	**Date:** **8/25/2009**	**Job Number:** **083-92589**	**Figure:** **1**	





Golder Associates, Inc. Denver, Colorado				Title: STRESS AND VERTICAL DISPLACEMENT VS. STRAIN
Job Short Title: RCML/Revised Reactive Rock Study/AZ				
Sample Number: BH-04 #2 @10'	Reviewed: JEO	Date: 8/25/2009	Job Number: 083-92589	Figure: 2





	Failure		Large-Displacement
ϕ =	30.9 degrees	ϕ =	30.3 degrees
c =	0 psf	c =	0 psf

Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TESTING FAILURE ENVELOPES**
Job Short Title: RCML/Revised Reactive Rock Study/AZ	

Sample Number:	Reviewed:	Date:	Job Number:	Figure:
BH-04 #2 @10'	JEO	8/25/2009	083-92589	3

ONE-DIMENSIONAL CONSOLIDATION

ASTM D 2435

RCML/Revised Reactive Rock Study/AZ	**BH-01 #8 @ 40'**	DATE	8/24/2009
083-92589		TECH	MKS
		REVIEW	JEO

SAMPLE DATA, GENERAL

height (in)	0.9900
diameter (in)	2.502
area (in^2)	4.917
volume (in^3)	4.867
specimen weight,wet (g)	190.02
specimen weight,dry (g)	157.67
water weight (g)	32.35

SAMPLE DATA, INITIAL

total height (in)	0.9900
height of solids (in)	0.5286
height of voids (in)	0.4614
void ratio	0.873
dry density (pcf)	123.1
moist density (pcf)	148.7

SAMPLE DATA, FINAL

total height (in)	0.9273
height of solids (in)	0.5286
height of voids (in)	0.3987
void ratio	0.754
dry density (pcf)	131.7
moist density (pcf)	160.7

DESCRIPTION

Dark reddish gray

LL:	-	
PL:	-	
PI:	-	
Gs:	3.70	*Per client*

MOISTURE CONTENT, INITIAL

tare #	TARE
wt soil&tare,moist	285.40
wt soil&tare,dry	241.59
wt tare	28.06
wt moisture	43.81
wt dry soil	213.53
% moisture	20.52%

MOISTURE CONTENT, FINAL

tare #	TARE
wt soil&tare,moist	214.31
wt soil&tare,dry	180.78
wt tare	28.47
wt moisture	33.53
wt dry soil	152.31
% moisture	22.01%

PRESSURE (ksf)	h100 Sample Height	D50 Sample Height	t50 TIME (min)	Sample Density (pcf)	VOID RATIO e	DRAINAGE PATH (DOUBLE DRAINAGE) H (in)	DRAINAGE PATH (DOUBLE DRAINAGE) H (cm)	DRAINAGE PATH (DOUBLE DRAINAGE) H^2 (in^2)	DRAINAGE PATH (DOUBLE DRAINAGE) H^2 (cm^2)	COEFFICIENT OF CONSOLIDATION Cv (cm^2/sec)	COEFFICIENT OF CONSOLIDATION (ft^2/day)	Cc
0.100	0.9898	-	-	123.2	0.875	-	-	-	-	-	-	-
0.250	0.9878	0.9887	0.2916	123.4	0.871	0.4944	1.2557	0.2444	1.5768	1.78E-02	1.66E+00	0.010
0.500	0.9835	0.9857	0.3216	123.9	0.863	0.4928	1.2518	0.2429	1.5671	1.60E-02	1.49E+00	0.027
1.0	0.9774	0.9807	0.1767	124.7	0.851	0.4903	1.2455	0.2404	1.5512	2.88E-02	2.69E+00	0.039
2.0	0.9686	0.9727	0.2589	125.9	0.835	0.4864	1.2354	0.2366	1.5262	1.94E-02	1.81E+00	0.055
4.0	0.9566	0.9627	0.1930	127.4	0.812	0.4813	1.2226	0.2317	1.4948	2.54E-02	2.37E+00	0.075
8.0	0.9400	0.9473	0.1945	129.7	0.780	0.4736	1.2030	0.2243	1.4473	2.44E-02	2.28E+00	0.105
16.0	0.9177	0.9283	0.1803	132.8	0.738	0.4642	1.1790	0.2154	1.3900	2.53E-02	2.36E+00	0.140
4.0	0.9190	-	-	132.6	0.741	-	-	-	-	-	-	-
1.0	0.9224	-	-	132.2	0.747	-	-	-	-	-	-	-
0.250	0.9273	-	-	131.5	0.756	-	-	-	-	-	-	-

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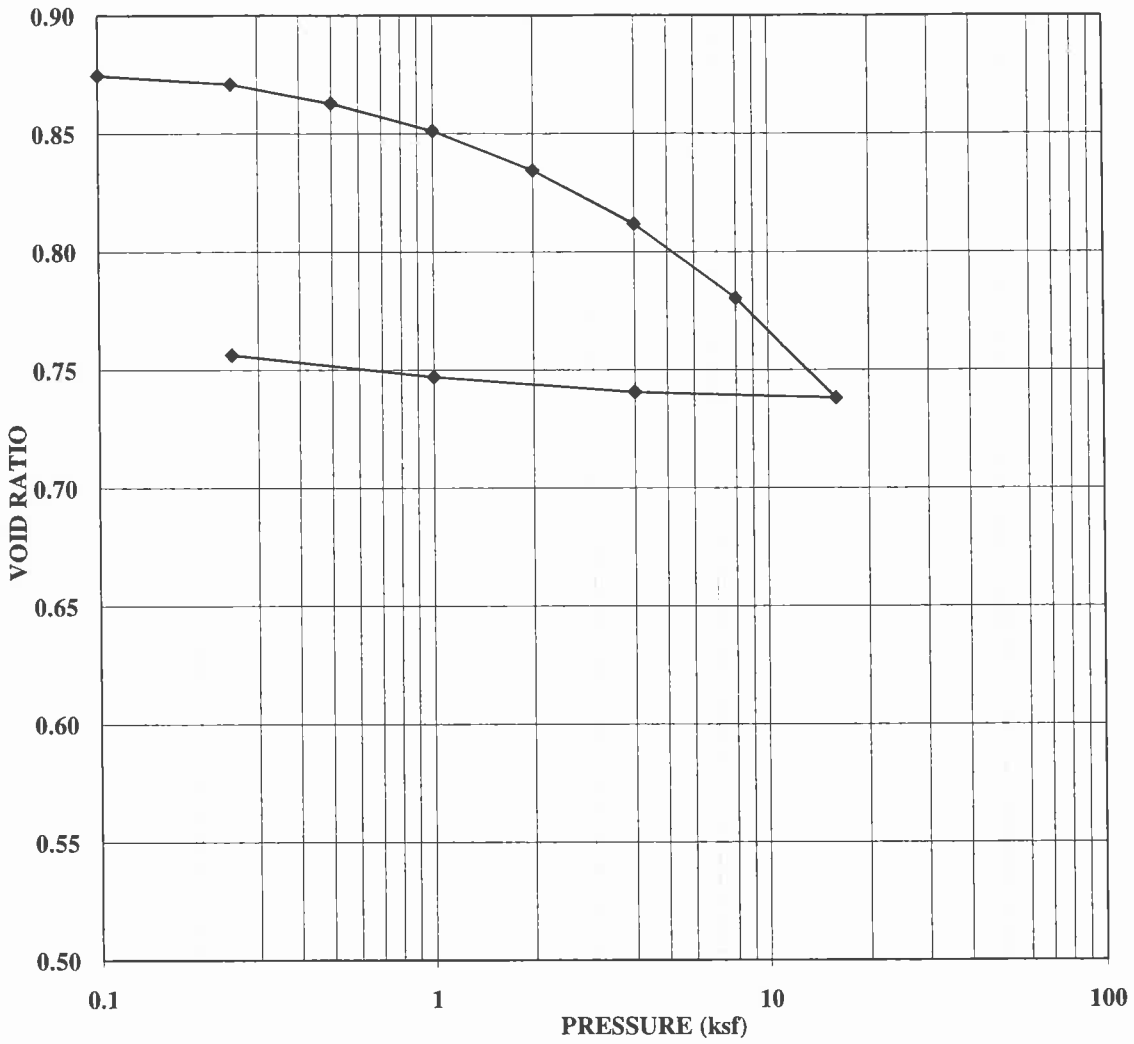
LAKEWOOD, COLORADO

ONE-DIMENSIONAL CONSOLIDATION



SAMPLE #: **BH-01 #8 @ 40'**

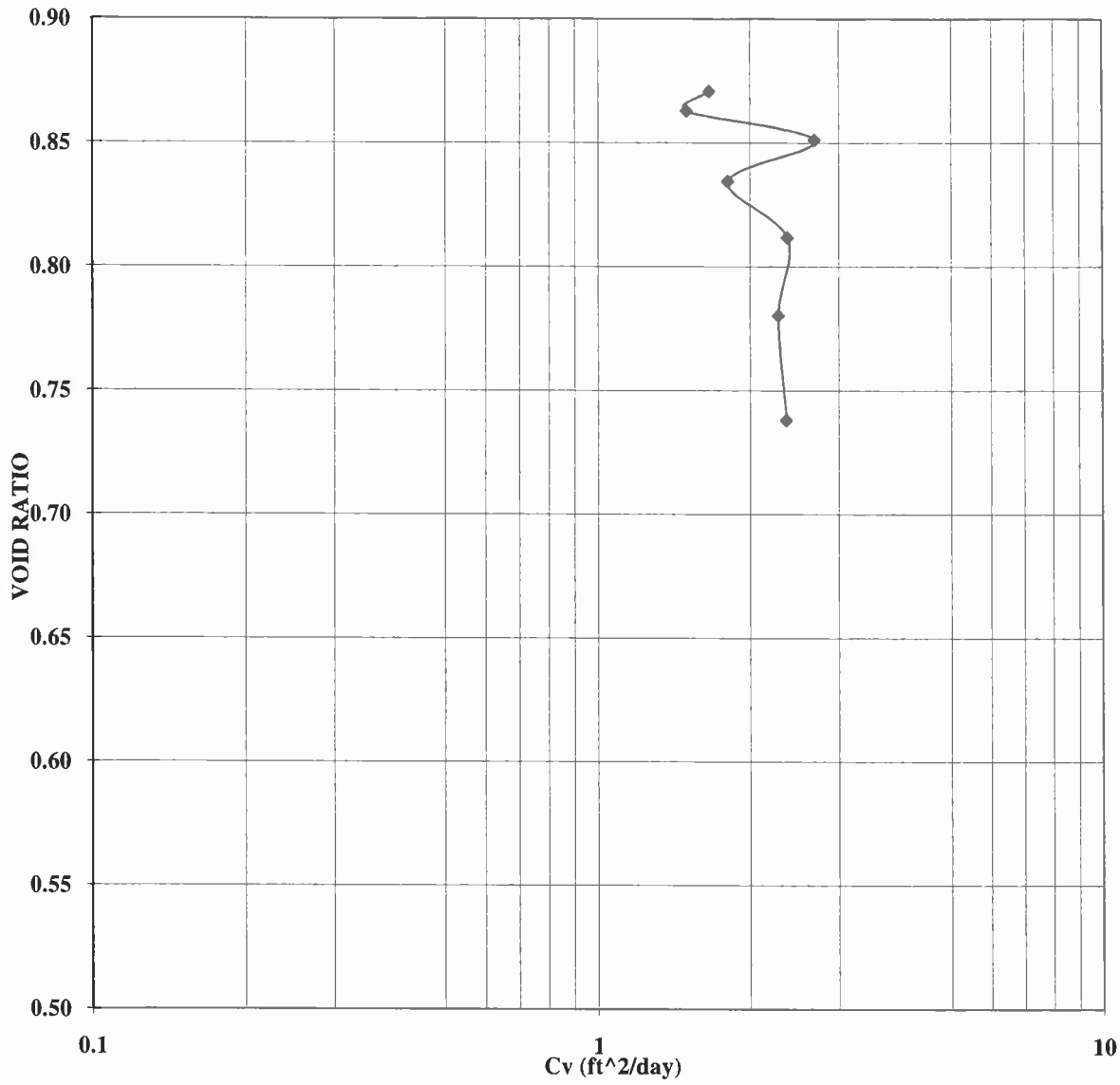
DESCRIPTION: Dark reddish gray

DATE	8/24/2009
TECH	MKS
REVIEW	JEO

RCML/Revised Reactive Rock Study/AZ
083-92589

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

ONE-DIMENSIONAL CONSOLIDATION



SAMPLE #: BH-01 #8 @ 40'

DESCRIPTION: Dark reddish gray

DATE	8/24/2009
TECH	MKS
REVIEW	JEO

RCML/Revised Reactive Rock Study/AZ
083-92589

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

ONE-DIMENSIONAL CONSOLIDATION

ASTM D 2435

RCML/Revised Reactive Rock Study/AZ 083-92589	BH-03 #5 @ 25'	DATE	8/24/2009
		TECH	MKS
		REVIEW	JEO

SAMPLE DATA, GENERAL

height (in)	0.9900
diameter (in)	2.500
area (in^2)	4.909
volume (in^3)	4.860
specimen weight,wet (g)	173.52
specimen weight,dry (g)	134.77
water weight (g)	38.75

SAMPLE DATA, INITIAL

total height (in)	0.9900
height of solids (in)	0.4526
height of voids (in)	0.5374
void ratio	1.187
dry density (pcf)	105.4
moist density (pcf)	136.0

SAMPLE DATA, FINAL

total height (in)	0.8586
height of solids (in)	0.4526
height of voids (in)	0.4060
void ratio	0.897
dry density (pcf)	121.8
moist density (pcf)	154.8

DESCRIPTION

Dark reddish-gray lean clay

LL:	-	
PL:	-	
PI:	-	
Gs:	3.70	*Per client*

MOISTURE CONTENT, INITIAL

tare #	TARE
wt soil&tare,moist	242.54
wt soil&tare,dry	194.91
wt tare	29.25
wt moisture	47.63
wt dry soil	165.66
% moisture	28.75%

MOISTURE CONTENT, FINAL

tare #	TARE
wt soil&tare,moist	190.70
wt soil&tare,dry	156.08
wt tare	28.22
wt moisture	34.62
wt dry soil	127.86
% moisture	27.08%

PRESSURE (ksf)	h100 Sample Height	D50 Sample Height	t50 TIME (min)	Sample Density (pcf)	VOID RATIO e	DRAINAGE PATH (DOUBLE DRAINAGE) H (in)	DRAINAGE PATH (DOUBLE DRAINAGE) H (cm)	DRAINAGE PATH (DOUBLE DRAINAGE) H^2 (in^2)	DRAINAGE PATH (DOUBLE DRAINAGE) H^2 (cm^2)	COEFFICIENT OF CONSOLIDATION Cv (cm^2/sec)	COEFFICIENT OF CONSOLIDATION (ft^2/day)	Cc
0.100	0.9880	-	-	105.6	1.186	-	-	-	-	-	-	-
0.250	0.9786	0.9835	0.5891	106.6	1.165	0.4918	1.2491	0.2418	1.5602	8.70E-03	8.11E-01	0.052
0.500	0.9660	0.9735	0.5732	108.0	1.137	0.4868	1.2364	0.2369	1.5286	8.76E-03	8.17E-01	0.093
1.0	0.9492	0.9597	0.3773	109.9	1.100	0.4798	1.2188	0.2302	1.4855	1.29E-02	1.21E+00	0.123
2.0	0.9275	0.9407	0.3127	112.5	1.052	0.4703	1.1947	0.2212	1.4272	1.50E-02	1.40E+00	0.159
4.0	0.9001	0.9171	0.3052	115.9	0.991	0.4585	1.1647	0.2103	1.3566	1.46E-02	1.36E+00	0.202
8.0	0.8678	0.8866	0.2917	120.3	0.920	0.4433	1.1260	0.1965	1.2678	1.43E-02	1.33E+00	0.237
16.0	0.8296	0.8520	0.2798	125.8	0.835	0.4260	1.0820	0.1815	1.1707	1.37E-02	1.28E+00	0.281
4.0	0.8341	-	-	125.1	0.845	-	-	-	-	-	-	-
1.0	0.8452	-	-	123.5	0.870	-	-	-	-	-	-	-
0.250	0.8586	-	-	121.5	0.90	-	-	-	-	-	-	-

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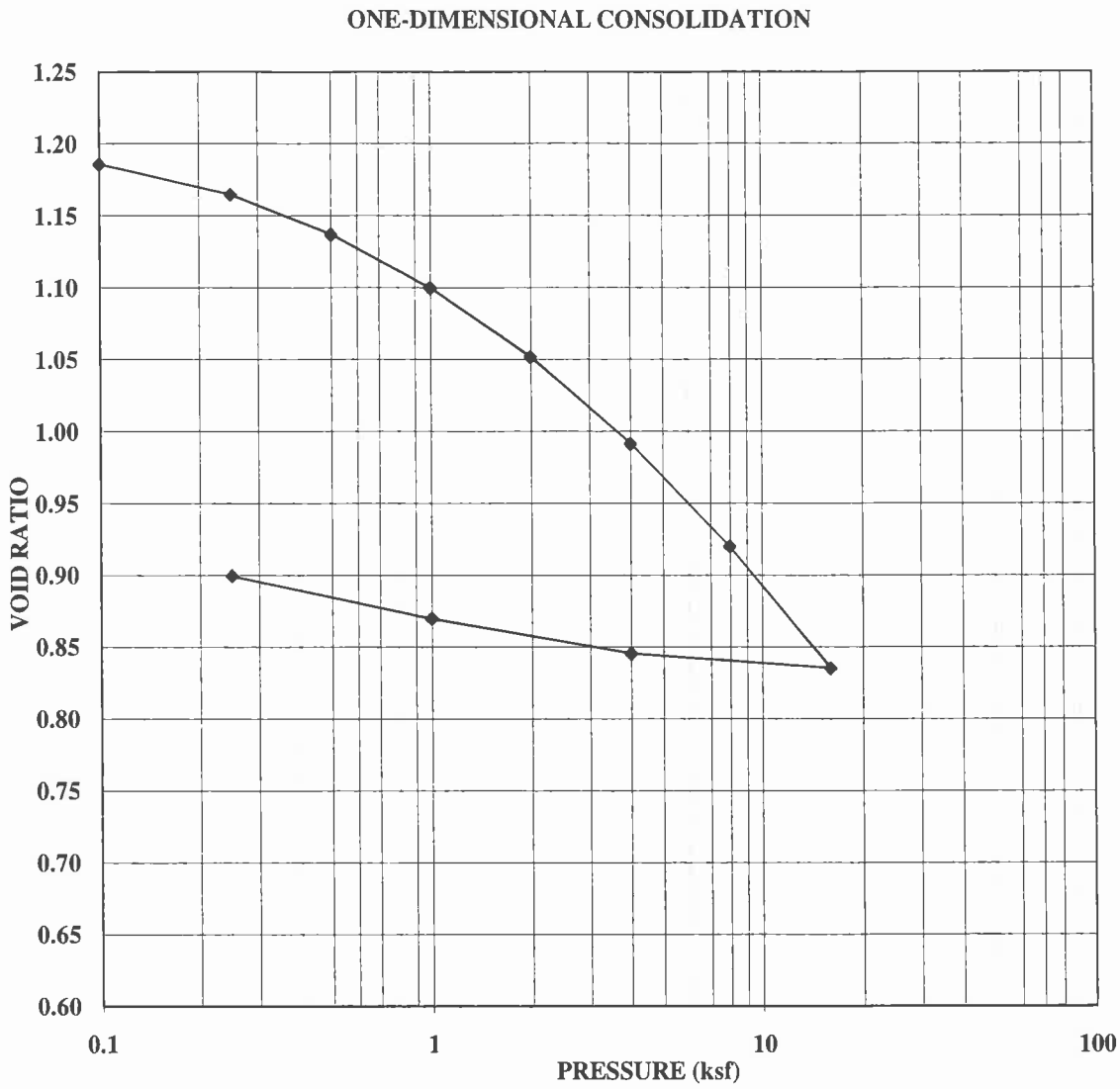

SAMPLE #: BH-03 #5 @ 25'

DESCRIPTION: Dark reddish-gray lean clay

DATE	8/24/2009
TECH	MKS
REVIEW	JEO

RCML/Revised Reactive Rock Study/AZ
083-92589

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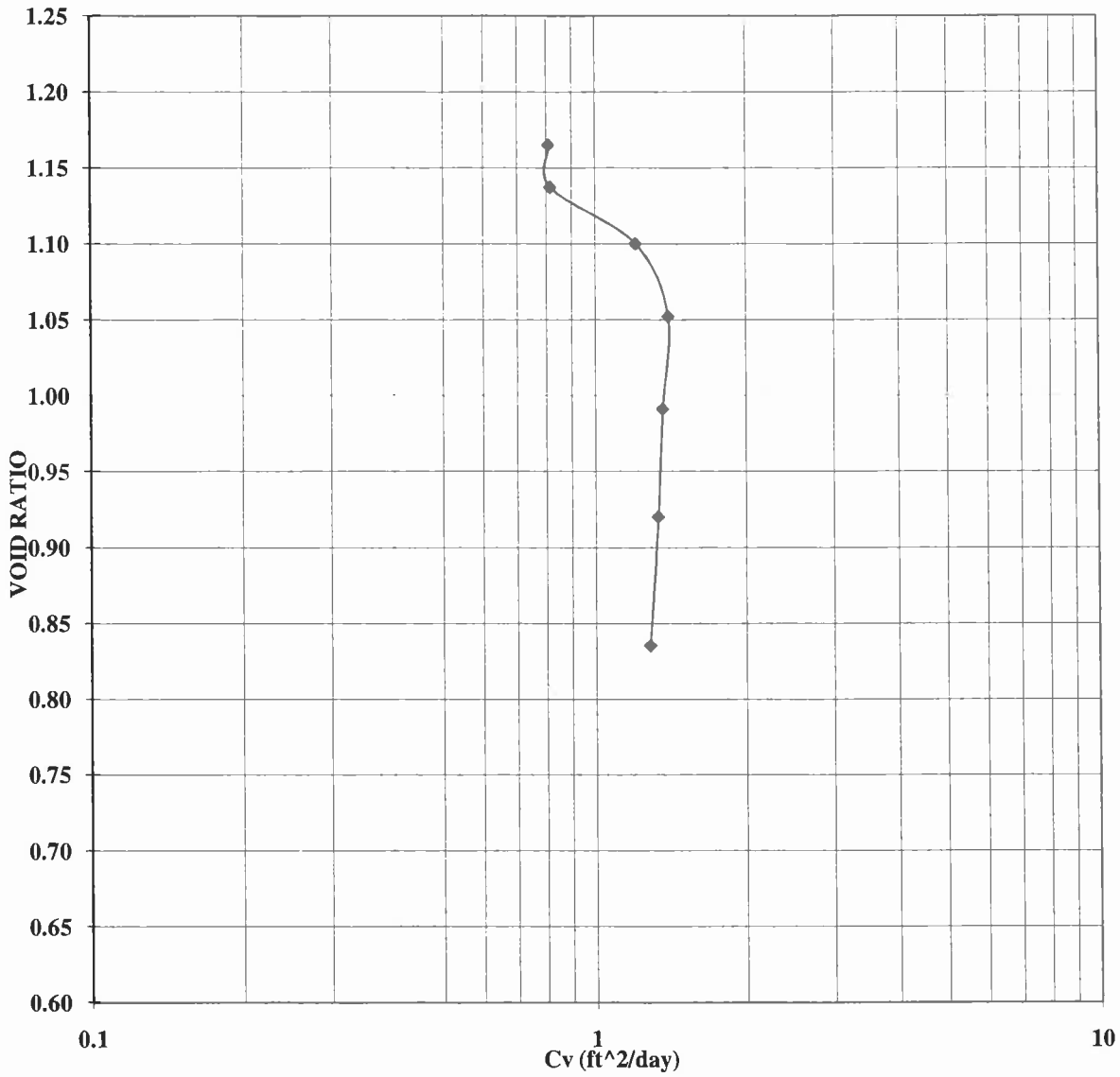
LAKEWOOD, COLORADO

ONE-DIMENSIONAL CONSOLIDATION



SAMPLE #: BH-03 #5 @ 25'

DESCRIPTION: Dark reddish-gray lean clay

DATE	8/24/2009
TECH	MKS
REVIEW	JEO

RCML/Revised Reactive Rock Study/AZ
083-92589

GOLDER ASSOCIATES INC.
LAKEWOOD, COLORADO

APPENDIX D
STORMWATER HYDROLOGY AND HYDRAULICS

APPENDIX D-1
APEX WASH BERM AND TUNNEL

Objective:

Perform a hydrologic/hydraulic analysis of the Apex Tunnel for 4 different precipitation events and review the existing berm design.

Methods:

Sub-basin area was determined using topography provided by Resolution Copper Mining LLC, 2004 (5' contours) - see Hydro Basins on Figure 3-3.

SCS lag equation was used to determine the time of concentration.

SCS curve number (CN) method.

Peak discharges at concentration point for 4 different unit hydrographs.

- 100-year, 24-hour (obtained from NOAA Atlas 14)
- Maximum Saturation Event (MSE) was extracted from Malcolm Pirnie drainage study
- ½ Probable Maximum Precipitation (PMP) 6-hour event (developed using the methods described in Hydrometeorological Report No. 49, NOAA, 1977)
- ½ PMP 24-hour event (developed using the methods described in Hydrometeorological Report No. 49, NOAA, 1977)
- Peak discharge values were calculated using HEC-HMS computer model

Stage-storage curve by average end area method.

Stage-discharge curve developed using HY-8 computer model.

Assumptions:

Hydraulic length and slope extracted from topographic map

Time of concentration was calculated using SCS lag equation.

100 year – 24-hour precipitation (NOAA 14 Atlas)

- Type II SCS precipitation distribution
- Precipitation = 5.4 inches
- Antecedent Moisture Condition II
- Weighted CN = 89

Maximum Saturation Event (Malcolm Pirnie, 1994)

- 5 successive storms recorded between august 12 through 16, 1990
- Storm Duration 120 hours
- Precipitation = 8.75 inches
- Antecedent Moisture Condition III
- Weighted CN = 95

½ PMP 6-hour event (NOAA ,1984)

- Synthetic Hyetograph developed from methods described in Hydrometrological Report No. 49
- Precipitation = 6.95 inches
- Antecedent Moisture Condition II
- Weighted CN = 89

½ PMP 24-hour event (NOAA 1984)

- Synthetic Hyetograph developed from methods described in Hydrometrological Report No. 49
- Precipitation = 11.25 inches
- Antecedent Moisture Condition II
- Weighted CN = 89

HY-8 (Federal Highway Administration, 2007)

- Apex Tunnel and berm geometry obtained from as-built topography
- Tunnel considered to be a concrete box culvert 900-ft long
- Unblocked tunnel area approximately 8 ft x 9 ft (72 ft2)
- Partial Blockage of approximately 40% - 6 ft x 7 ft (42 ft2)
- Berm considered to be a roadway 20 feet wide, constant elevation

Calculations:

Lag time was calculated for the Apex Wash Sub-basin. Lag time is the time from the center of mass of excess rainfall to the hydrograph peak (page 5)

$$t_L = 0.6 * t_C$$

Weighted Curve numbers were calculated for each AMC (pages 6-7). Soil types for curve numbers reviewed and revised by The Mines Group, Inc., 2004.

SCS method was used to determine peak flow and volume of runoff for the different precipitation events.

Conclusions/results:

See Figure D-1 for topographic map depicting Design Storm water-surface elevations.

Design Storm	Peak Outflow (cfs)	Freeboard on Berm (ft)	Ponding Depth (ft)	Time-to-Drain (hrs)
100-yr 24-hr	645	11.6	13.7	7
MSE	603	13.2	12.1	99
½ PMF 6-hr	892	0.3	25.0	5
½ PMF 24-hr	805	4.9	20.4	22

Note: Time-to-Drain is the time from when stormwater begins to pond until its final recession by the end of the storm duration.

References:

Chow, Maidment & Mays. 1988. Applied Hydrology.

Federal Highway Administration, Office of Engineering, Bridge Division. "Hydrain – Integrated Drainage Design Computer System Volume V. HY8 – Culverts, version 7.0 ", Washington, DC (March 2007)

Malcolm Pirnie, 1994. drainage study for Magma Copper Co.

The Mines Group, Inc., 2004. *Peer Review of Hydrologic Estimates.* Report submitted to Resolution Copper Company. June 8, 2004.

National Oceanic and Atmospheric Administration (NOAA), 1973. "Precipitation-Frequency Atlas of the United States" NOAA Atlas 2, Volume 4, J. F. Miller, R.H. Frederick, and R.J. Tracy. NOAA, National Weather Service, Silver Spring, Maryland, 1973.

NOAA. (1984), Hydrometrological Report No. 49, " Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages", E.M. Hansen, F.K. Schwartz, and J.T. Reidel. Office of Hydrology, National Weather Service, Silver Spring, Maryland, Reprinted 1984.

Natural Resources Conservation Service (NRCS 1972), National Engineering Handbook, Section 4, Hydrology, United States Department of Agriculture, reprinted 1972.

U.S. Army Corps of Engineers, 2008. *Hydrologic Modeling System, Version 3.3.0*, Hydrologic Engineering Center (USACE). October, 2008

AMC II										
Area (mi^2)	Sub-basin	Segment ID	Type of flow	Flow length (ft)	Slope (%)	CN	S	Lag Time (hr)	Lag Time (minutes)	Tc (min)
0.56	1	1-1	- - -	1220	47	89	1.24	0.04	2.38	3.97
		1-2	- - -	1670	20	89	1.24	0.08	4.70	7.83
		1-3	- - -	2100	9	89	1.24	0.14	8.41	14.01
		1-4	- - -	1600	4.3	89	1.24	0.16	9.79	16.31
							Total	0.421189	25.27132	42.119

AMC III										
Area (mi^2)	Sub-basin	Segment ID	Type of flow	Flow length (ft)	Slope (%)	CN	S	Lag Time (hr)	Lag Time (minutes)	Tc (min)
0.56	1	1-1	- - -	1220	47	95	0.53	0.03	1.82	3.04
		1-2	- - -	1670	20	95	0.53	0.06	3.59	5.99
		1-3	- - -	2100	9	95	0.53	0.11	6.44	10.73
		1-4	- - -	1600	4.3	95	0.53	0.12	7.49	12.48
							Total	0.322406	19.34438	32.241

Soil Type

Soils were categorized by their runoff potential, per the SCS soil classification system, into hydraulic soil groups A, B, C, or D, as listed in *Hydraulic Soil Groups* of SCS Technical Release (TR) No. 55. The distribution of these soils in Arizona was extracted from GENERALIZED HYDROLOGIC SOIL MAP done in 1969 by the Department of Agriculture Soil Conservation Service Phoenix, Arizona shown in Figure 1 (Figure 2.1, Hydrologic Design for Highway Drainage in Arizona, Arizona Highway Department Bridge Division).

Soil group of the drainage basin was determined to be Group D, soils with high runoff potential and low infiltration rates when thoroughly wetted.

Land Use Categories

Analysis of the site during Golder's field visit determined land use and cover. The classification of current land use throughout the watershed is as follows:

- Undisturbed desert shrub in good hydrologic conditions
- Disturbed desert shrub in poor hydrologic conditions; and
- Impervious areas at the top of the mountains.

NRCS Curve Number Computation

The present weighted curve number calculations for each sub-basin were calculated using the soil types and land use categories previously discussed. Land uses were further categorized by soil type and the curve numbers for each land use area and soil type was developed. Weighted curve numbers were then computed for AMC-II conditions. Using equation 1, the curve numbers were adjusted for AMC-III conditions for the MSE and ½ PMF.

to determine peak flow and volume of runoff for the different precipitation events.

The calculated Curve Numbers will be used in the hydrologic analyses. SCS curve number computations for sub-basin 1 are presented as it follows,

$$CN(III) = \frac{23CN(II)}{10+0.13CN(II)} \quad eq.1$$

Golder Associates	Subject: Curve Number	Made by: WK	Job No: 093-92581
	Assignment Sheet	Checked by: KJ	Date: 11/09/2009
	Appendix D-1	Approved by: MJG	Sheet No: 6 of 20

Project: West Plant Site		Date: 02/03/2004
Location: Superior, Arizona	Condition: Present AMC II	CP: 1

Hydrologic Soil Group	Cover Description	CN	Area (acres)	Product of CN x area
D	Undisturbed desert shrub in good hydrologic conditions	88	320.7	28221.6
D	Disturbed desert shrub in poor hydrologic conditions	92	0	0
D	Impervious areas at the top of the mountains	94	35.6	3346.4
		Totals →	356.3	31568

CN (weighted) = total product / total area = $\frac{31568}{356.3}$ CN = 89

AMC III CN = 95
AMC I CN = 78

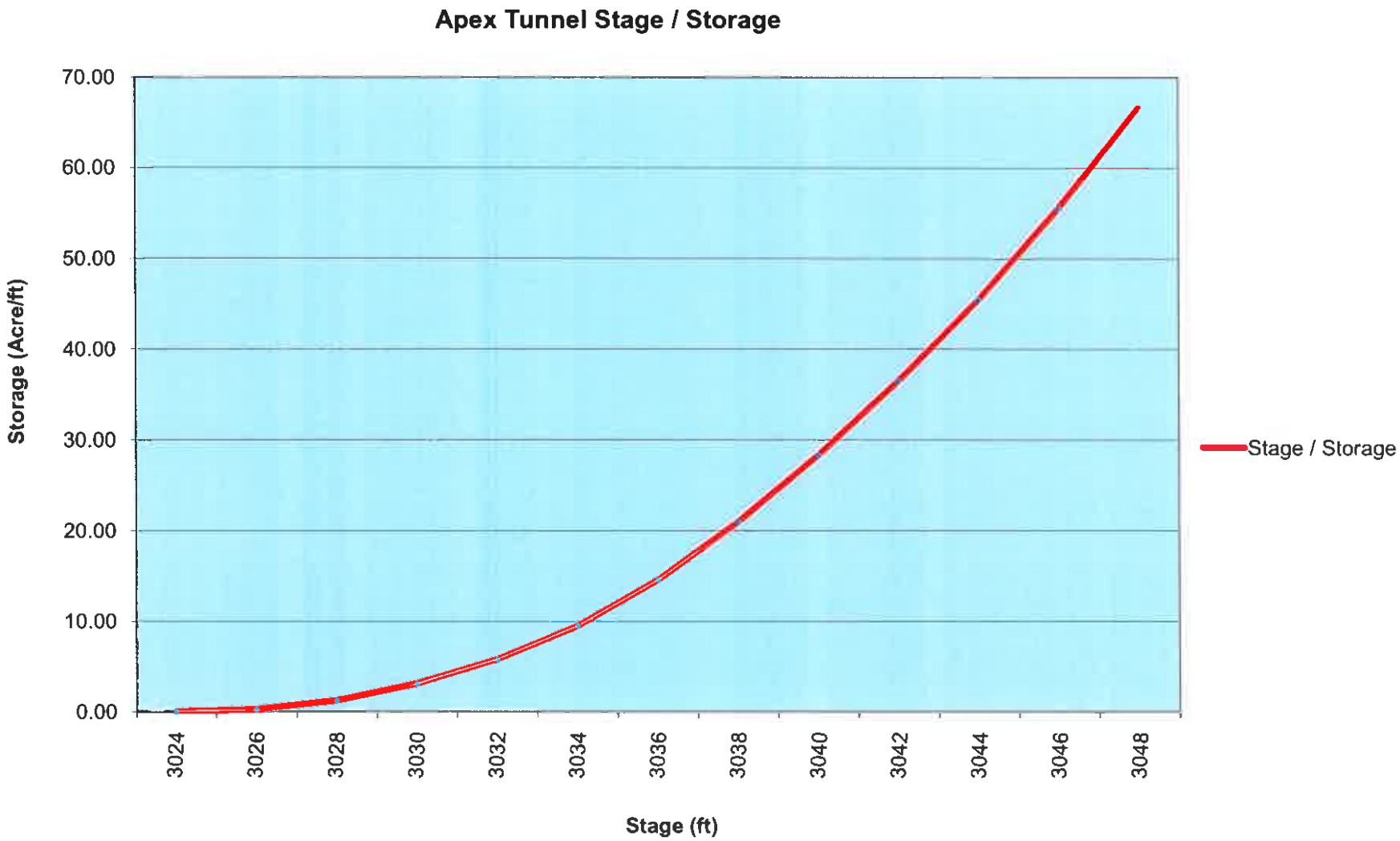
Note: This work was completed prior to a peer review in June, 2004.
The Hydrologic Soil Group was deemed 'C' from the Peer Review Group.
This change in soil group number makes the runoff estimates more conservative.

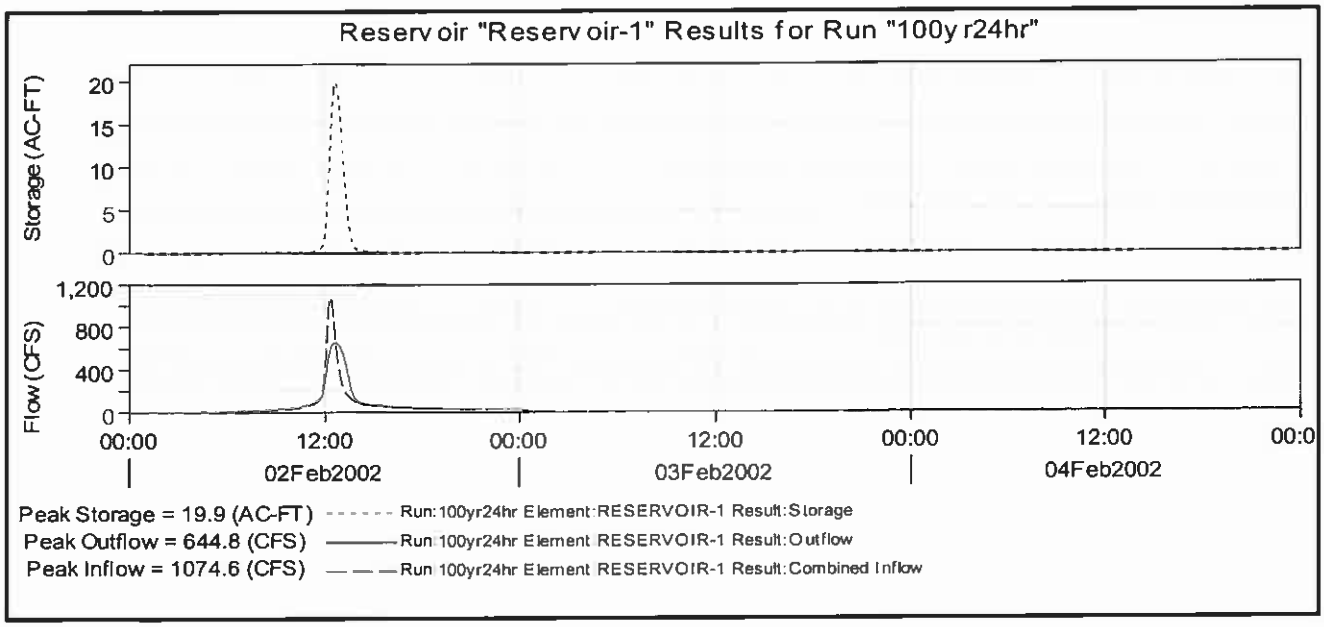
Precipitation Design Values

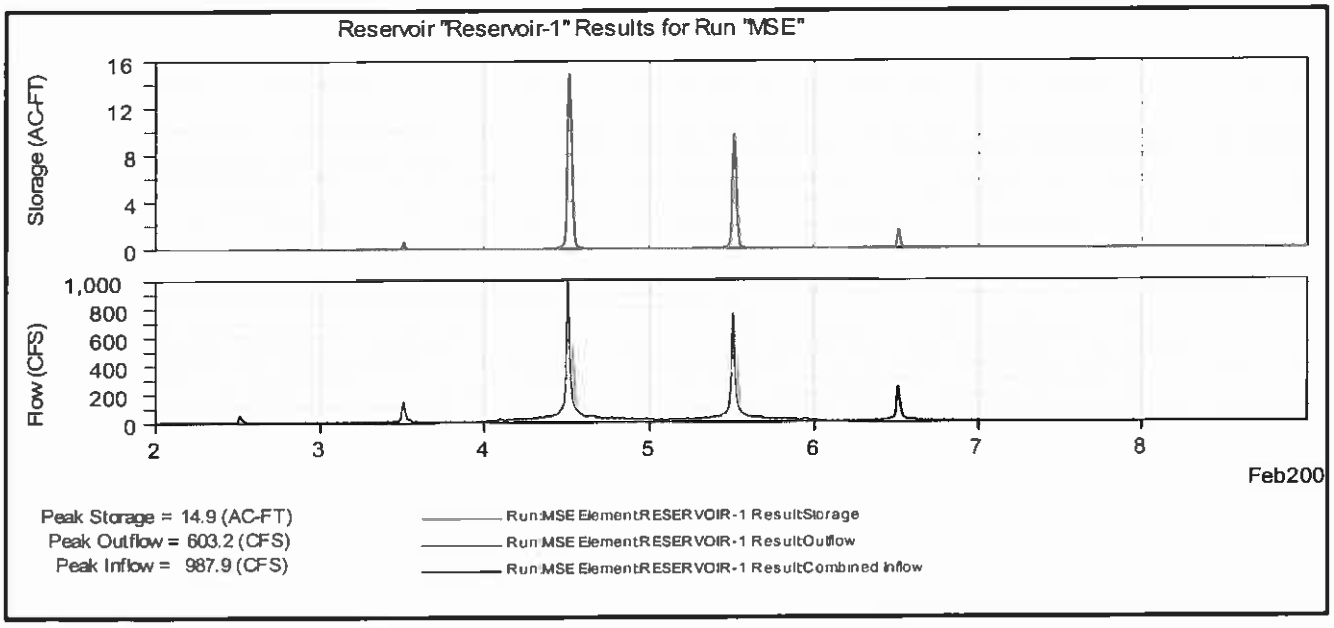
Return Period	Precipitation Frequency (in)		
	1 hour	6 hour	24 hour
10-year	1.85	2.70	3.75
50-year	2.40	3.55	4.85
100-year	2.65	3.90	5.40

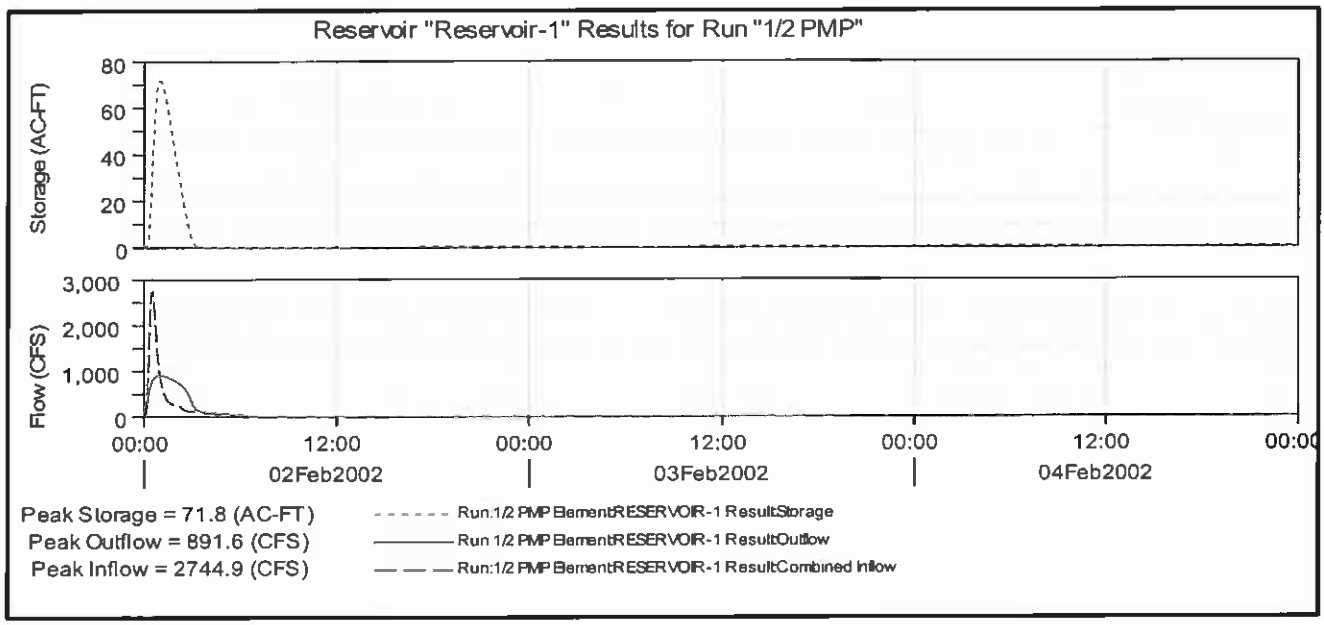
Precipitation Design Values

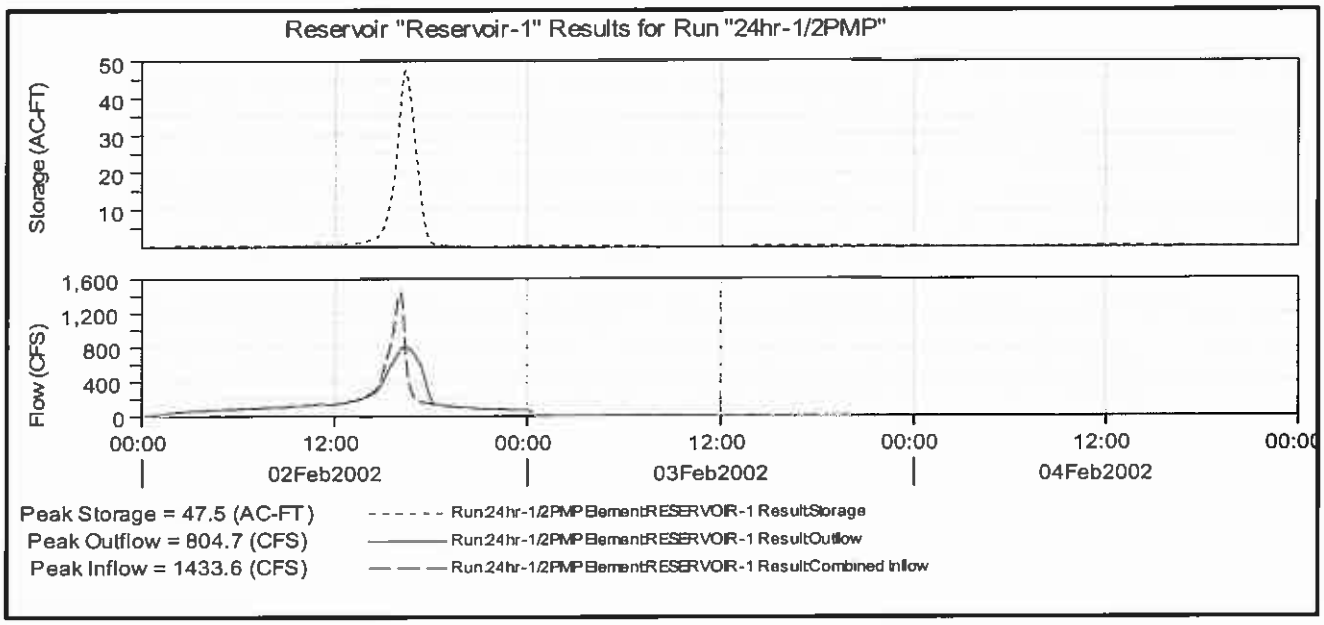
Duration (hrs)	Precipitation (in)					
	Return Period			6hr	24hr	MSE
	10 year	50 year	100 year	1/2 PMF	1/2 PMF	
1	1.85"	2.40"	2.65"	----------	----------	----------
6	2.70"	3.55"	3.90"	6.95	----------	----------
24	3.75"	4.85"	5.40"	----------	11.25	----------
120	----------	----------	----------	----------	----------	8.75"

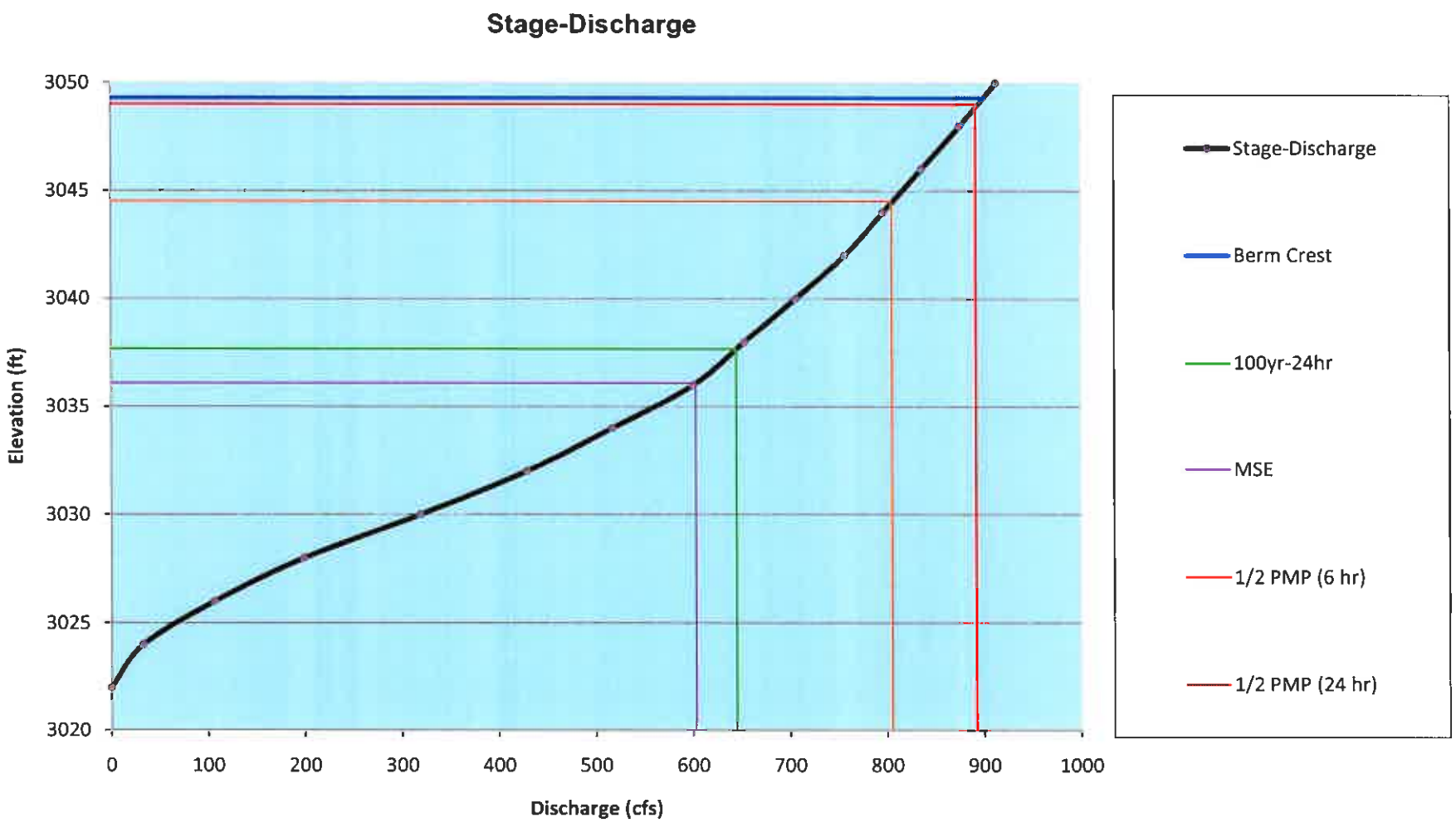

Apex Tunnel Stage / Storage
Storage (Acre/ft)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
3024
3026
3028
3030
3032
3034
3036
3038
3040
3042
3044
3046
3048
Stage (ft)
Stage / Storage


Reservoir "Reservoir-1" Results for Run "100yr24hr"
Storage (AC-FT)
20
15
10
5
0
Flow (CFS)
1,200
800
400
0
00:00
12:00
00:00
12:00
00:00
12:00
00:0
02Feb2002
03Feb2002
04Feb2002
Peak Storage = 19.9 (AC-FT)
Peak Outflow = 644.8 (CFS)
Peak Inflow = 1074.6 (CFS)
Run:100yr24hr Element:RESERVOIR-1 Result:Storage
Run:100yr24hr Element:RESERVOIR-1 Result:Outflow
Run:100yr24hr Element:RESERVOIR-1 Result:Combined Inflow


Reservoir "Reservoir-1" Results for Run "MSE"
Storage (AC-FT)
16
12
8
4
0
Flow (CFS)
1,000
800
600
400
200
0
2
3
4
5
6
7
8
Feb200
Peak Storage = 14.9 (AC-FT)
Peak Outflow = 603.2 (CFS)
Peak Inflow = 987.9 (CFS)
Run:MSE Element:RESERVOIR-1 Result:Storage
Run:MSE Element:RESERVOIR-1 Result:Outflow
Run:MSE Element:RESERVOIR-1 Result:Combined Inflow


Reservoir "Reservoir-1" Results for Run "1/2 PMP"
Storage (AC-FT)
80
60
40
20
0
Flow (CFS)
3,000
2,000
1,000
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
02Feb2002
03Feb2002
04Feb2002
Peak Storage = 71.8 (AC-FT)
Peak Outflow = 891.6 (CFS)
Peak Inflow = 2744.9 (CFS)
Run:1/2 PMP ElementRESERVOIR-1 ResultStorage
Run 1/2 PMP ElementRESERVOIR-1 ResultOutflow
Run:1/2 PMP ElementRESERVOIR-1 ResultCombined Inflow


Reservoir "Reservoir-1" Results for Run "24hr-1/2PMP"
Storage (AC-FT)
50
40
30
20
10
Flow (CFS)
1,600
1,200
800
400
0
00:00
12:00
00:00
12:00
00:00
12:00
00:00
02Feb2002
03Feb2002
04Feb2002
Peak Storage = 47.5 (AC-FT)
Peak Outflow = 804.7 (CFS)
Peak Inflow = 1433.6 (CFS)
Run:24hr-1/2PMP ElementRESERVOIR-1 ResultStorage
Run:24hr-1/2PMP ElementRESERVOIR-1 ResultOutflow
Run:24hr-1/2PMP ElementRESERVOIR-1 ResultCombined Inflow


Stage-Discharge
Elevation (ft)
3050
3045
3040
3035
3030
3025
3020
0
100
200
300
400
500
600
700
800
900
1000
Discharge (cfs)
Stage-Discharge
Berm Crest
100yr-24hr
MSE
1/2 PMP (6 hr)
1/2 PMP (24 hr)

HY-8 Culvert Analysis Report

Site Data - Apex Tunnel (user input)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 3023.10 ft

Outlet Station: 900.00 ft

Outlet Elevation: 3018.40 ft

Number of Barrels: 1

Culvert Data Summary - Apex Tunnel (user input)

Barrel Shape: Concrete Box

Barrel Span: 7.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90º) Headwall

Inlet Depression: None

Table 1 - Culvert Summary Table: Apex Tunnel (user input)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	3023.10	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
105.00	105.00	3026.36	3.258	0.000	1-S2n	1.570	1.916	1.576	0.929	9.518	2.825
210.00	210.00	3028.22	5.119	0.000	1-S2n	2.569	3.041	2.575	1.420	11.649	3.696
315.00	315.00	3029.91	6.810	0.000	5-S2n	3.465	3.985	3.475	1.826	12.949	4.313
420.00	420.00	3031.78	8.681	0.000	5-S2n	4.312	4.828	4.318	2.184	13.896	4.809
525.00	525.00	3034.05	10.953	0.000	5-S2n	5.130	5.602	5.132	2.511	14.614	5.226
630.00	630.00	3036.84	13.741	13.469	5-S2n	6.000	6.000	6.000	2.817	15.000	5.592
735.00	735.00	3040.96	17.087	17.863	6-FFc	6.000	6.000	6.000	3.105	17.500	5.918
840.00	840.00	3046.03	21.278	22.933	6-FFc	6.000	6.000	6.000	3.379	20.000	6.214
945.00	904.48	3049.48	24.191	26.382	6-FFc	6.000	6.000	6.000	3.644	21.535	6.483
1050.00	908.62	3049.71	24.386	26.612	6-FFc	6.000	6.000	6.000	3.898	21.634	6.734

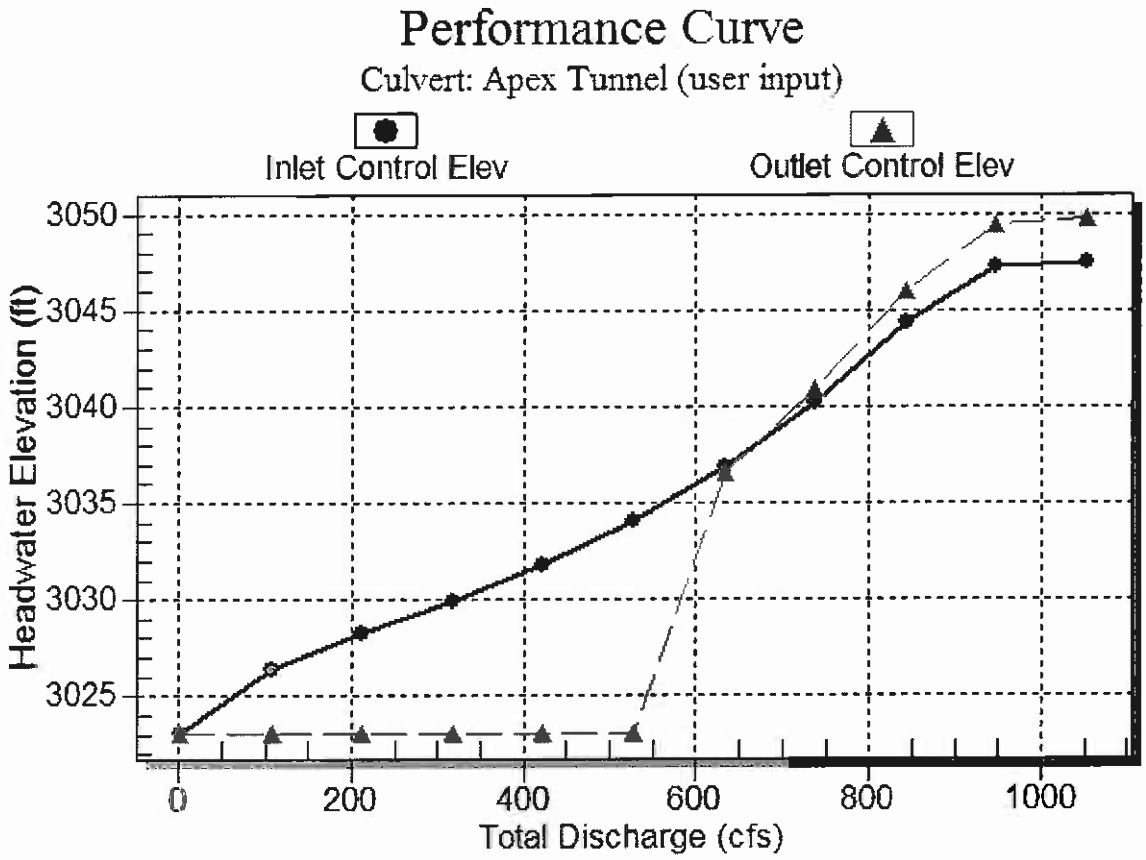
****

Inlet Elevation (invert): 3023.10 ft, Outlet Elevation (invert): 3018.40 ft

Culvert Length: 900.01 ft, Culvert Slope: 0.0052

****

Culvert Performance Curve Plot: Apex Tunnel (user input)



Water Surface Profile Plot for Culvert: Apex Tunnel (user input)

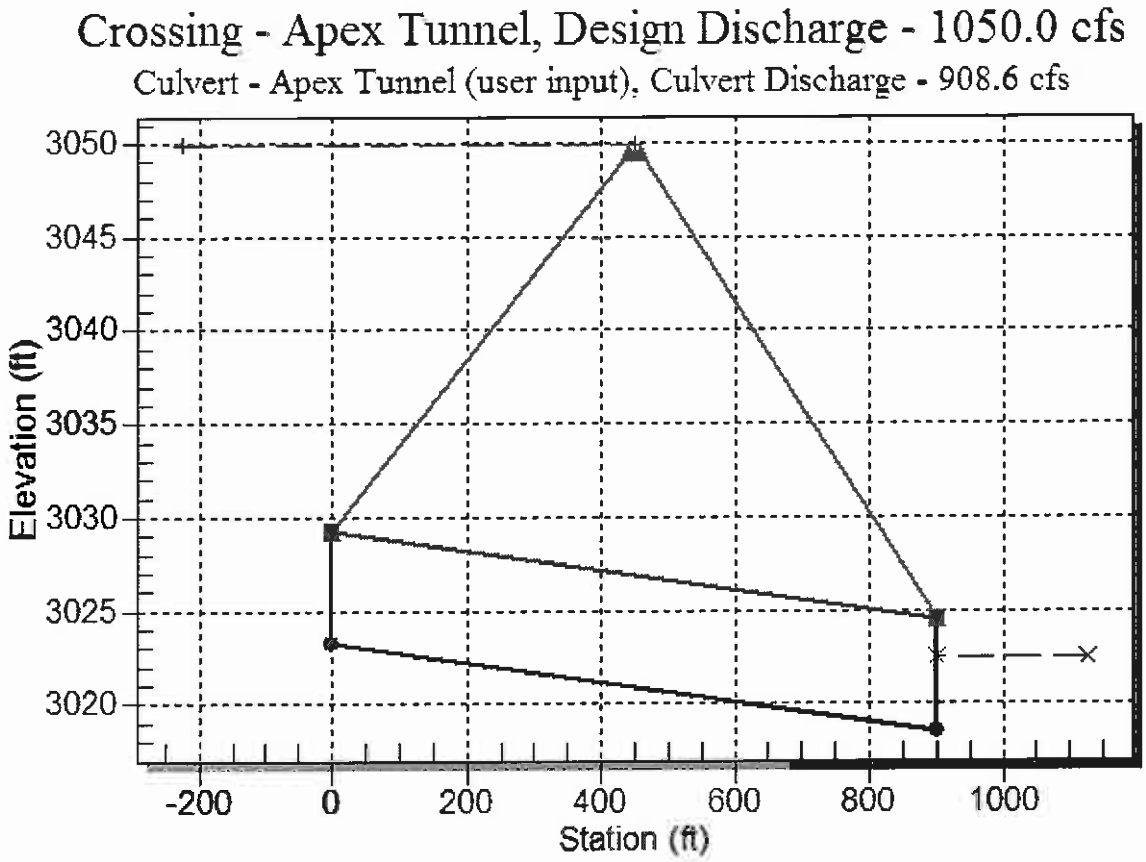


Table 2 - Downstream Channel Rating Curve (Crossing: Apex Tunnel)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	3018.40	0.00	0.00	0.00	0.00
105.00	3019.33	0.93	2.83	0.30	0.52
210.00	3019.82	1.42	3.70	0.46	0.55
315.00	3020.23	1.83	4.31	0.59	0.56
420.00	3020.58	2.18	4.81	0.71	0.57
525.00	3020.91	2.51	5.23	0.81	0.58
630.00	3021.22	2.82	5.59	0.91	0.59
735.00	3021.51	3.11	5.92	1.01	0.59
840.00	3021.78	3.38	6.21	1.10	0.60
945.00	3022.04	3.64	6.48	1.18	0.60
1050.00	3022.30	3.90	6.73	1.26	0.60

Tailwater Channel Data - Apex Tunnel

Tailwater Channel Option: Rectangular Channel

Bottom Width: 40.00 ft

Channel Slope: 0.0052

Channel Manning's n: 0.0350

Channel Invert Elevation: 3018.40 ft

Roadway Data for Crossing: Apex Tunnel

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 3049.30 ft

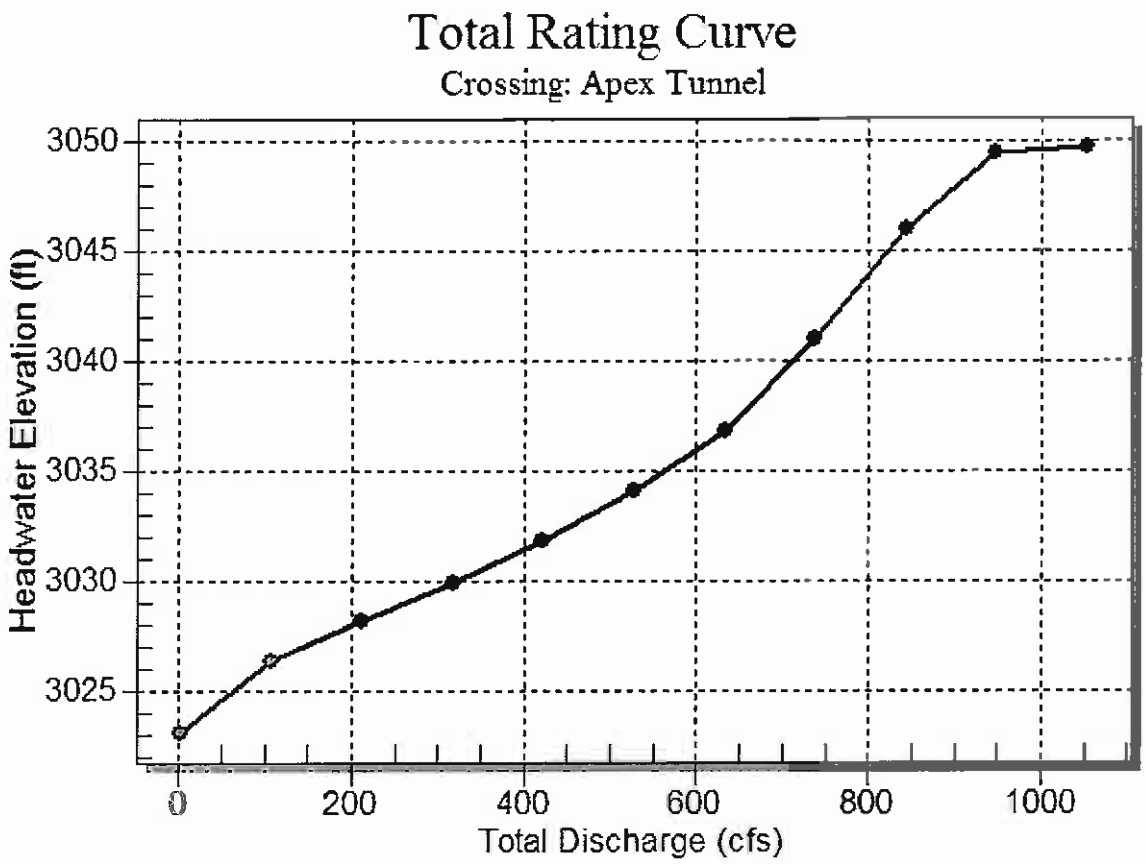
Roadway Surface: Gravel

Roadway Top Width: 20.00 ft

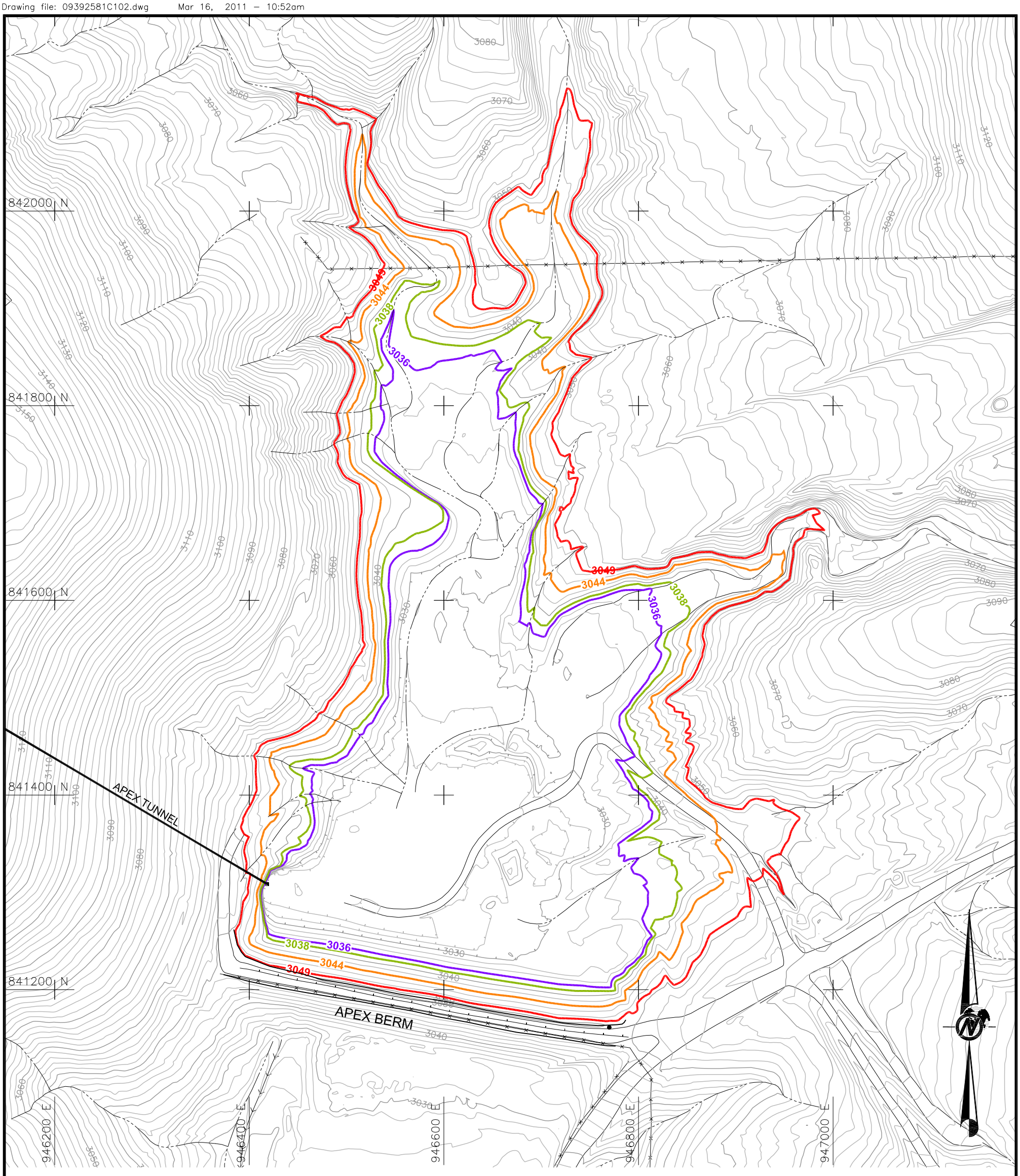
Table 3 - Summary of Culvert Flows at Crossing: Apex Tunnel

Headwater Elevation (ft)	Total Discharge (cfs)	Apex Tunnel (user input) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3023.10	0.00	0.00	0.00	1
3026.36	105.00	105.00	0.00	1
3028.22	210.00	210.00	0.00	1
3029.91	315.00	315.00	0.00	1
3031.78	420.00	420.00	0.00	1
3034.05	525.00	525.00	0.00	1
3036.84	630.00	630.00	0.00	1
3040.96	735.00	735.00	0.00	1
3046.03	840.00	840.00	0.00	1
3049.48	945.00	904.48	40.13	12
3049.71	1050.00	908.62	140.97	6

Rating Curve Plot for Crossing: Apex Tunnel



Drawing file: 09392581C102.dwg Mar 16, 2011 – 10:52am



LEGEND

3000	EXISTING SURFACE CONTOURS	3036	MAXIMUM SATURATION EVENT WSE
	EXISTING ROADS	3038	100 YR-24 HR WSE
	DAM CREST	3044	1/2 PMP (24 HR) WSE
	APEX TUNNEL	3049	1/2 PMP (6 HR) WSE

100 0 100
SCALE 1" to 100' FEET

NOTES

1.) WATER SURFACE ELEVATION (WSE) CONTOUR ELEVATIONS ROUNDED TO THE NEAREST FOOT.

REFERENCES

1.) 2 FT INTERVAL, 2008 TOPOGRAPHY PROVIDED BY RESOLUTION COPPER MINING, IN RCMCS.

PROJECT
Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

DESIGN STORM WATER SURFACE ELEVATIONS

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C102
DESIGN	WK	11/12/09	SCALE AS SHOWN	REV. A
CADD	NIL	11/13/09		
CHECK	KRJ	11/13/09		
REVIEW	MJG	03/16/11		

FIGURE D-1

APPENDIX D-2
DIVERSION CHANNELS

Objective:

Evaluate peak runoff values (100-yr, 24-hr storm event) for 5 potential stormwater diversions around the proposed Superior stockpile, and design the diversion channels themselves.

Methods:

Sub-basin area was determined using topography provided by Resolution Copper Mining LLC, 2008 (2' contours) - see Hydrologic Basin Map on Figure 3-3.

SCS lag equation was used to determine the time of concentration.

SCS curve number (CN) method.

Peak discharges at 5 concentration points calculated using HEC-HMS software (see basin model, inputs, and results page 4).

Assumptions:

Hydraulic length and slope extracted from topographic map

Time of concentration was calculated using SCS lag equation.

100 year – 24-hour precipitation (obtained from NOAA 14 Atlas)

- Type II SCS precipitation distribution
- Precipitation = 5.4 inches
- Antecedent Moisture Condition II
- Curve Number (CN) = 89

Calculations:

Lag time was calculated for the Stockpile's sub-basins. Lag time is the time from the center of mass of excess rainfall to the hydrograph peak (page 3)

$$t_L = 0.6 * t_C$$

A conservative CN of 89 was assigned to each sub-basin. Soil types and curve numbers for the West Plant Site have been reviewed and revised by The Mines Group, Inc., 2004.

SCS method was used to determine peak flow and volume of runoff for the design precipitation events.

FlowMaster uses Manning's Formula to calculate normal water depth for peak discharge values for 5 different proposed diversions (See FlowMaster input and output data pages 5 and 6.

Conclusions/results:

Sub-Basin ID	Downstream Recipient of Diversion	Peak Outflow (cfs)	Depth of Channel[1] (ft)	Flow Area (ft^2)	Velocity (ft/s)	Slope (ft/ft)
NW	Apex Wash	15.0	1.04	2.16	6.94	0.07430
W	TP-6	3.5	2.02	8.18	5.11	0.01656
NE	Apex Wash	175.9	2.79	15.61	11.27	0.05234
SE	TP-6	41.8	1.26	3.19	13.10	0.20370
SW	TP-6	15.0	0.98	1.91	7.85	0.10290

1. Assuming triangular channel with 2H: 1V side slopes. Freeboard is NOT included with these calculations.

References:

Bentley FlowMaster, Bentley Systems, Inc., Version 8i, 2009

Chow, Maidment & Mays. 1988. Applied Hydrology.

Federal Highway Administration, Office of Engineering, Bridge Division. "Hydrain – Integrated Drainage Design Computer System Volume V. HY8 – Culverts, version 7.0 ", Washington, DC (March 2007)

Malcolm Pirnie, 1994. drainage study for Magma Copper Co.

The Mines Group, Inc., 2004. *Peer Review of Hydrologic Estimates.* Report submitted to Resolution Copper Company. June 8, 2004.

National Oceanic and Atmospheric Administration (NOAA), 1973. "Precipitation-Frequency Atlas of the United States" NOAA Atlas 2, Volume 4, J. F. Miller, R.H. Frederick, and R.J. Tracy. NOAA, National Weather Service, Silver Spring, Maryland, 1973.

NOAA. (1984), Hydrometrological Report No. 49, " Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages", E.M. Hansen, F.K. Schwartz, and J.T. Reidel. Office of Hydrology, National Weather Service, Silver Spring, Maryland, Reprinted 1984.

Natural Resources Conservation Service (NRCS 1972), National Engineering Handbook, Section 4, Hydrology, United States Department of Agriculture, reprinted 1972.

U.S. Army Corps of Engineers, 2008. *Hydrologic Modeling System, Version 3.3.0*, Hydrologic Engineering Center (USACE). October, 2008

CALCULATION OF TIME OF CONCENTRATION (t_c)

AMC II MOISTURE CONDITIONS

	Undisturbed		Waste Rock		Dev. Urban		Roads and Roofs												
Area	Area (ac)	CN	Area (ac)	CN	Area (ac)	CN	Area (ac)	CN	Wt. CN	S	L (ft)	H1 (ft)	H2 (ft)	Y (%)	Lag (hr)	t_c (hr)	t_c (min)	Lag (min)	Area (mi^2)
NW	2.67	89	0.00	70	0.00	92	0.00	95	89	1.236	1,319	3,148	3,040	8.19	0.10	0.17	10.1	6	0.004
W	0.39	89	0.00	70	0.00	92	0.00	95	89	1.236	1,547	3,148	3,042	6.85	0.13	0.21	12.6	8	0.001
NE	33.62	89	0.00	70	0.00	92	0.00	95	89	1.236	3,644	3,684	3,042	17.62	0.16	0.26	15.6	9	0.053
SE	6.23	89	0.00	70	0.00	92	0.00	95	89	1.236	941	3,156	3,004	16.15	0.06	0.09	5.5	3	0.010
SW	2.40	89	0.00	70	0.00	92	0.00	95	89	1.236	1,543	3,148	2,950	12.83	0.09	0.15	9.2	6	0.004

Curve Number Estimation:

Undisturbed
Arid and semiarid rangelands

Cover type =	Desert Shrub
Antecedent condition =	II
Hydrologic condition =	Poor
Hydrologic soil group =	D
Curve number =	**89**

Waste Rock
Vegetated Cover

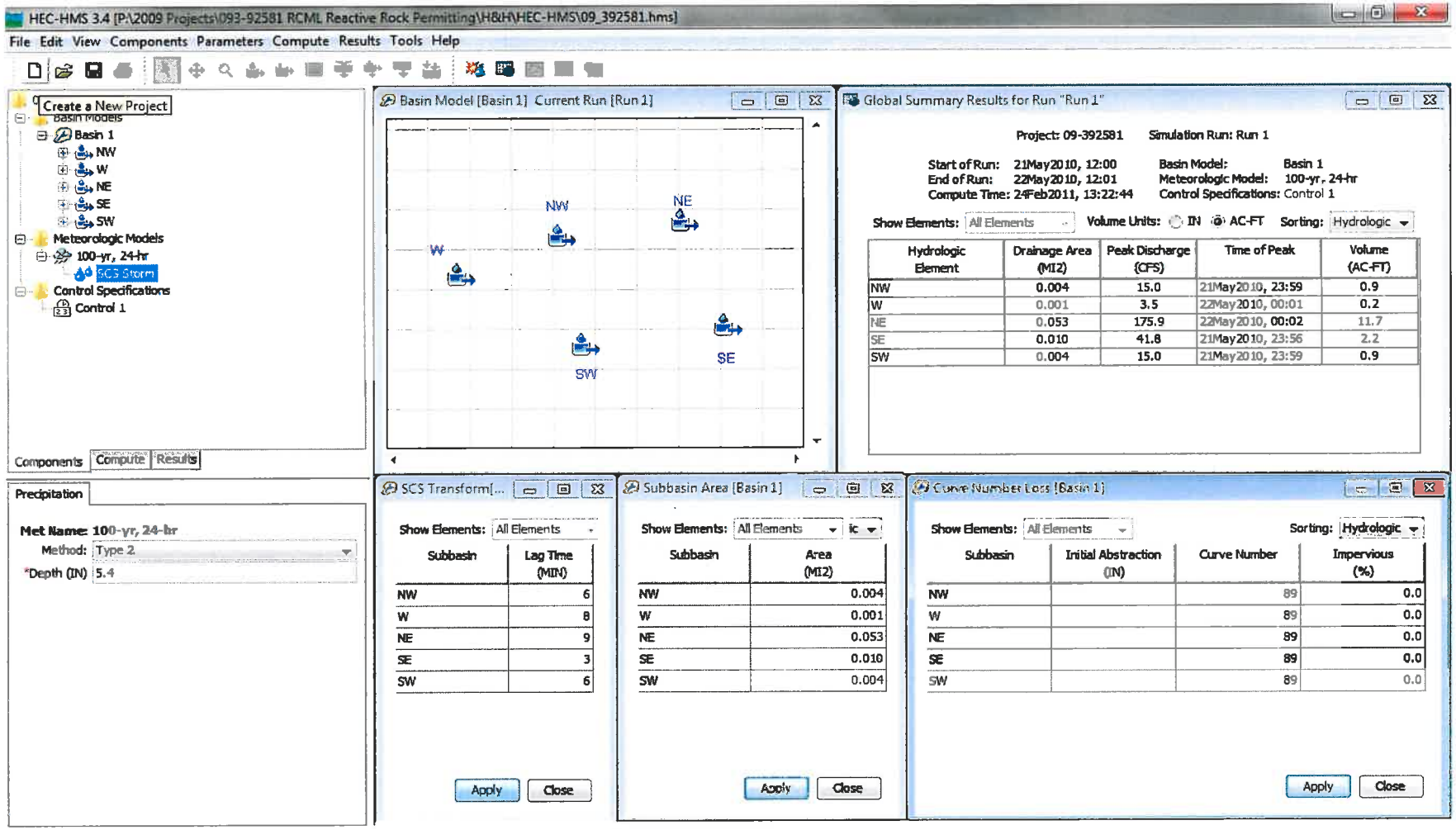
Cover type =	Development Rock
Antecedent condition =	II
Hydrologic condition =	Poor
Hydrologic soil group =	D
Curve number =	**70**

Notes:

ac	= acres
CN	= curve number
Wt. CN	=weighted curve number
S	= soil and cover parameter
L	= length of longest flow path (feet)
H1	= elevation at top of longest flow path (feet)
H2	= elevation at bottom of longest flow path (feet)
Y	= H1-H2/L x 100 = slope (%)
Lag	= Lag time (hours)
t_c	= time of concentration (hr or min)

Hydrologic Condition:
Poor: <30% ground cover
Fair: 30 to 70% ground cover
Good: >70% ground cover

HEC-HMS
INPUTS AND RESULTS



Development Rock Stockpile (093-92581.fm8) Report

Label	Solve For	Friction Method	Roughness Coefficient
Triangular Channel - NW	Normal Depth	Manning Formula	0.035
Triangular Channel - NE	Normal Depth	Manning Formula	0.035
Triangular Channel - SE	Normal Depth	Manning Formula	0.035
Triangular Channel - SW	Normal Depth	Manning Formula	0.035
Triangular Channel - W	Normal Depth	Manning Formula	0.035

Channel Slope (ft/ft)	Normal Depth (ft)	Left Side Slope (ft/ft (H:V))	Right Side Slope (ft/ft (H:V))
0.07430	1.04	2.00	2.00
0.05234	2.79	2.00	2.00
0.20370	1.26	2.00	2.00
0.10290	0.98	2.00	2.00
0.01656	2.02	2.00	2.00

Discharge (ft^3/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Hydraulic Radius (ft)
15.00	2.16	4.65	0.46
175.90	15.61	12.49	1.25
41.80	3.19	5.65	0.56
15.00	1.91	4.37	0.44
41.80	8.18	9.05	0.90

Top Width (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)
4.16	1.28	0.02401	6.94
11.18	3.44	0.01729	11.27
5.05	1.94	0.02094	13.10

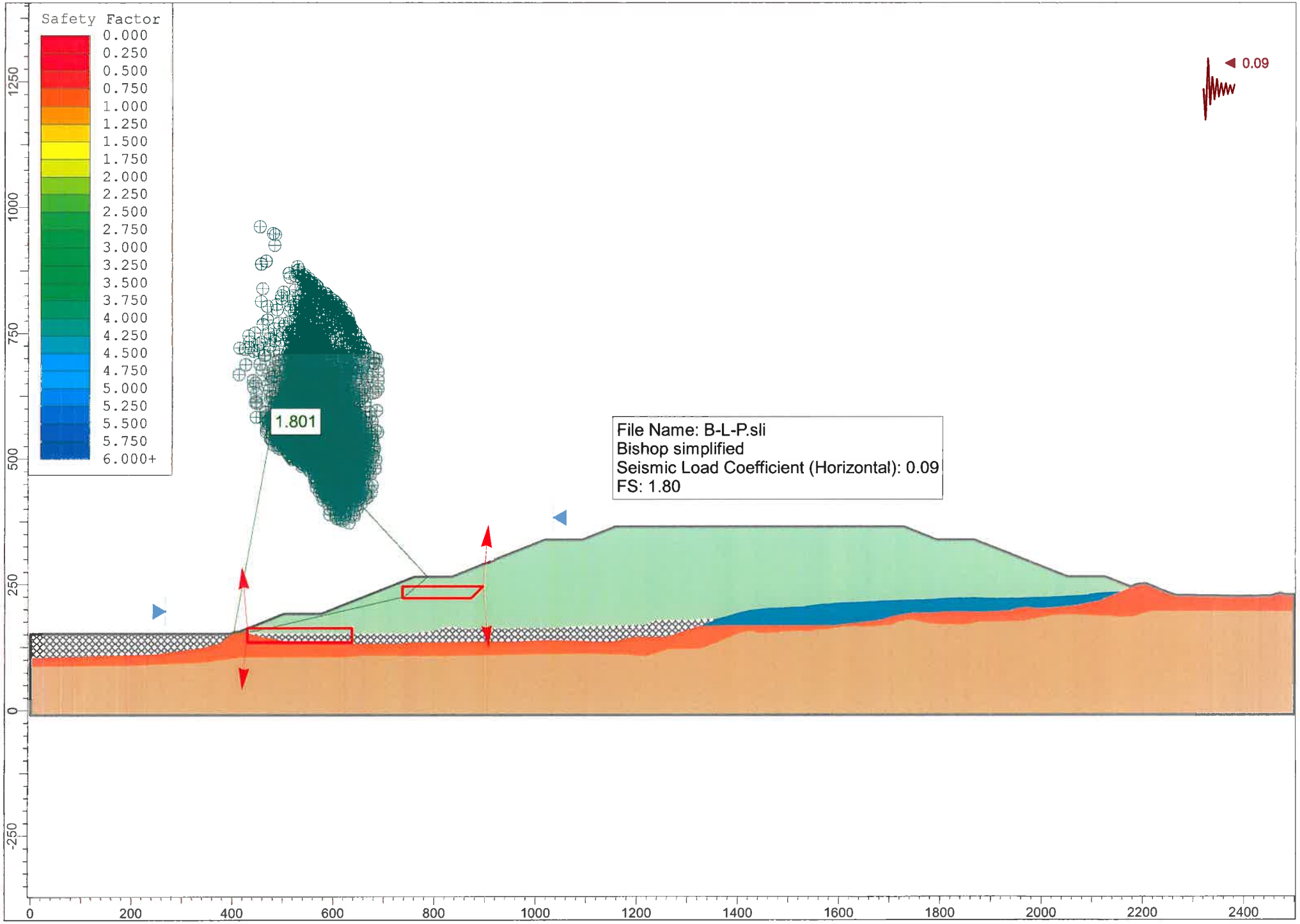
Development Rock Stockpile (093-92581.fm8) Report

Top Width (ft)	Critical Depth (ft)	Critical Slope (ft/ft)	Velocity (ft/s)
3.91	1.28	0.02401	7.85
8.09	1.94	0.02094	5.11

Velocity Head (ft)	Specific Energy (ft)	Froude Number	Flow Type
0.75	1.79	1.70	Supercritical
1.97	4.77	1.68	Supercritical
2.66	3.93	2.90	Supercritical
0.96	1.93	1.98	Supercritical
0.41	2.43	0.90	Subcritical

Notes	Messages

APPENDIX E
SLOPE STABILITY RESULTS


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
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3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.801
File Name: B-L-P.sli
Bishop simplified
Seismic Load Coefficient (Horizontal): 0.09
FS: 1.80
0.09
1250
1000
750
500
250
0
-250
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

Slide Analysis Information

Document Name

File Name: B-L-P.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.09

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf

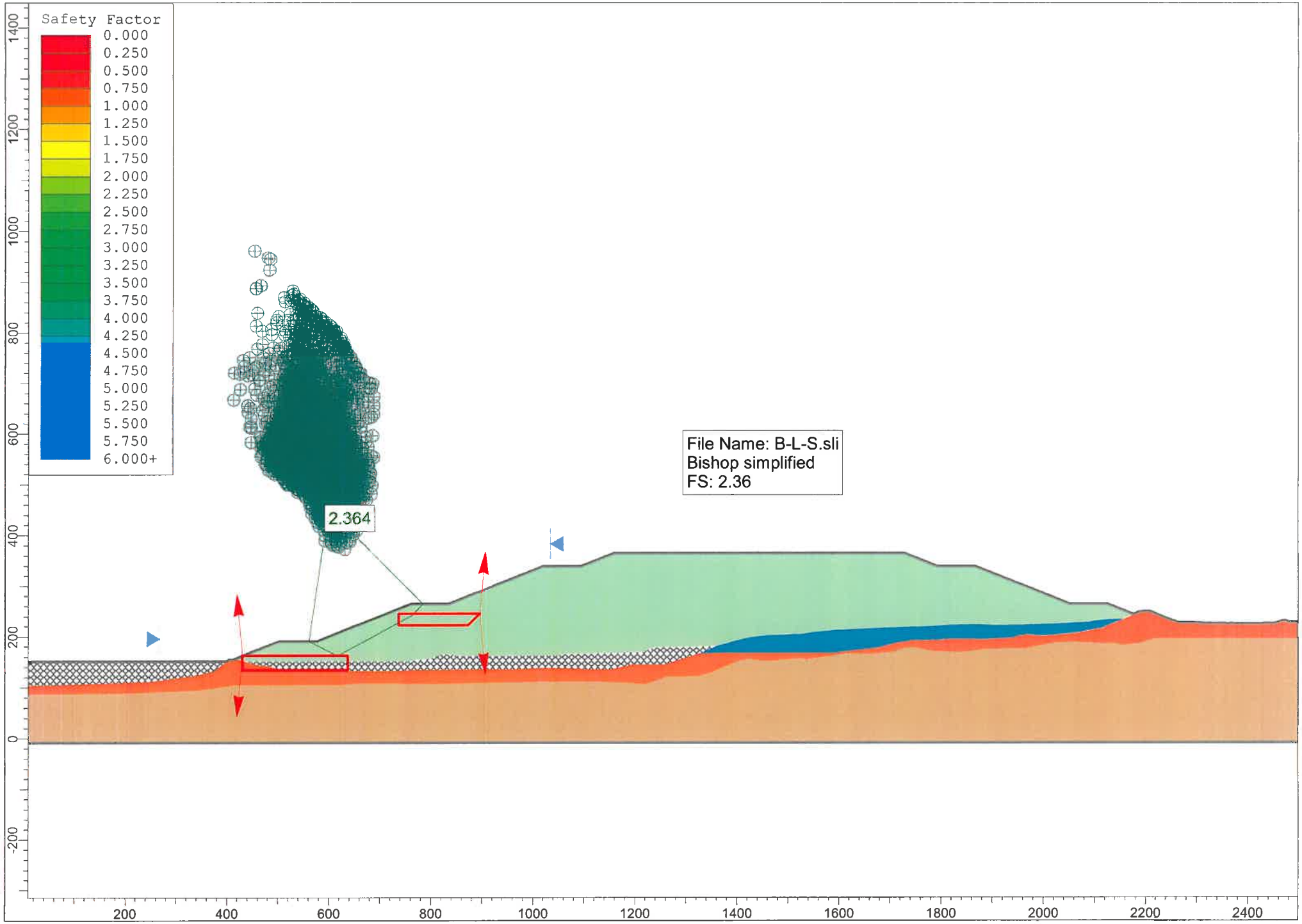
Friction Angle: 35 degrees
Water Surface: None

Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

Document Name

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Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
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Number of slices: 25
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Surface Options

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Minimum Depth: Not Defined

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

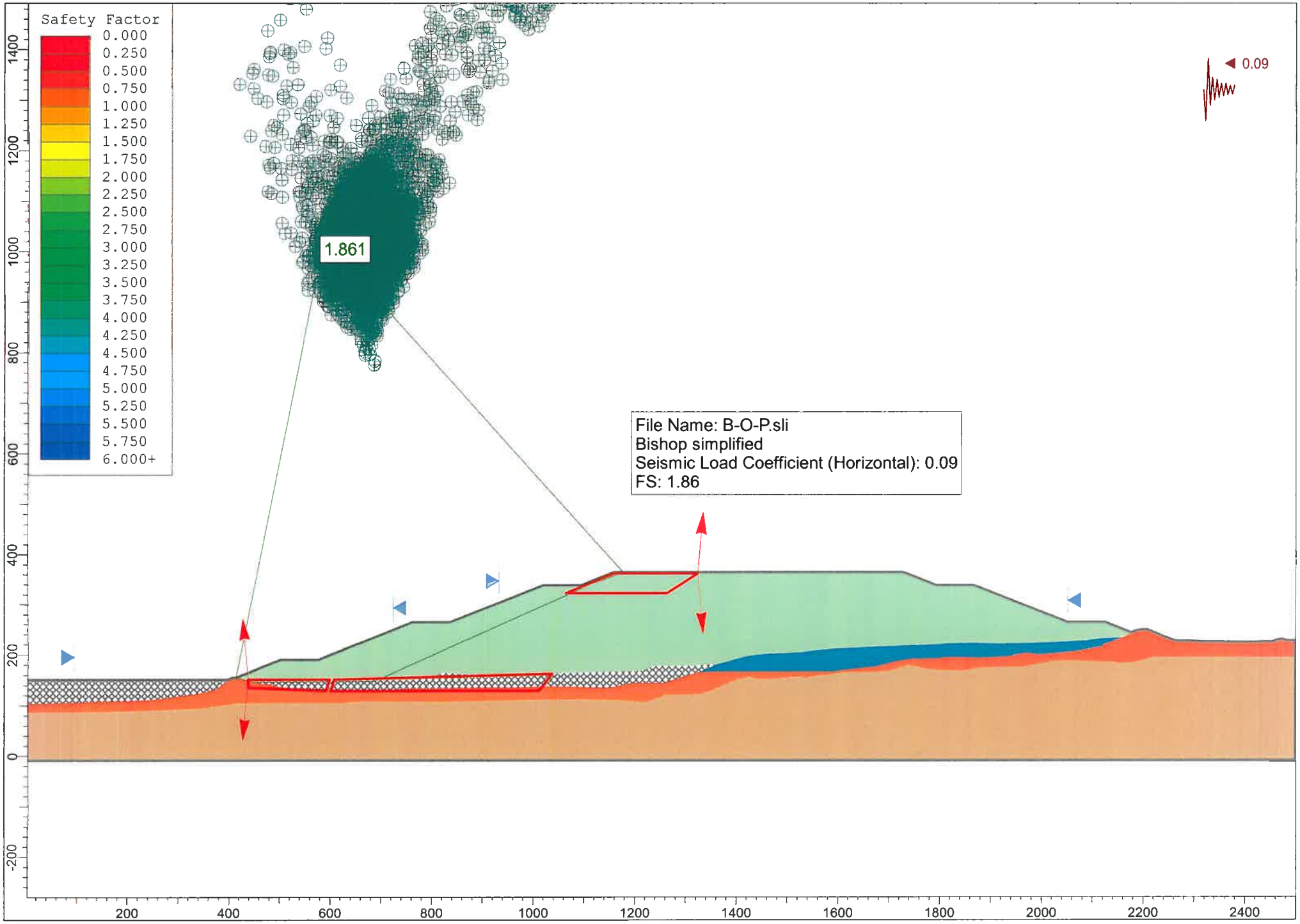
Material: Landfill Material

Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

Document Name

File Name: B-O-P.sli

Project Settings

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Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
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Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
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Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.09

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf

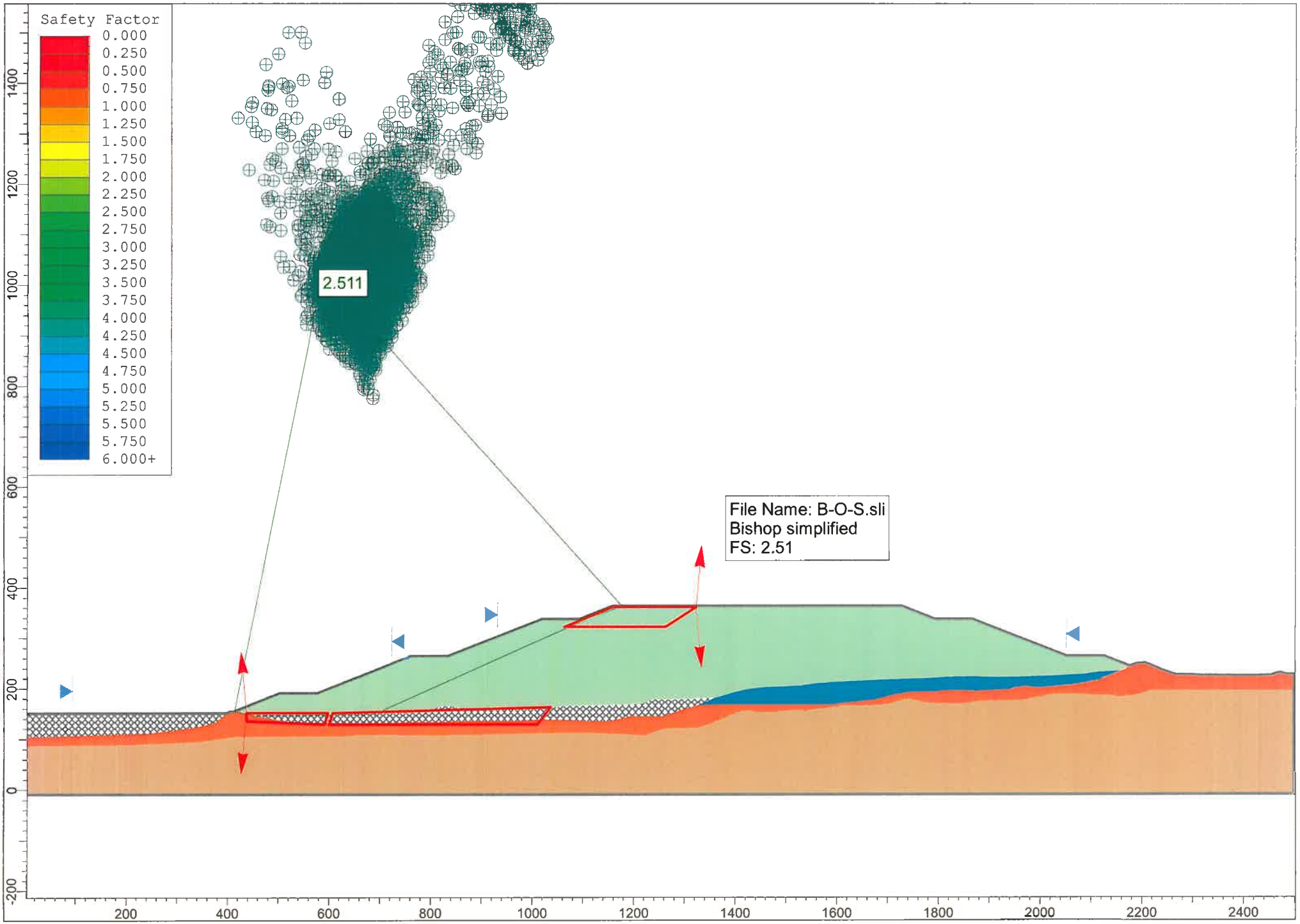
Friction Angle: 35 degrees
Water Surface: None

Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

Document Name

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Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
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Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
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Left Projection Angle (End Angle): 265
Right Projection Angle (Start Angle): 85
Right Projection Angle (End Angle): -85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

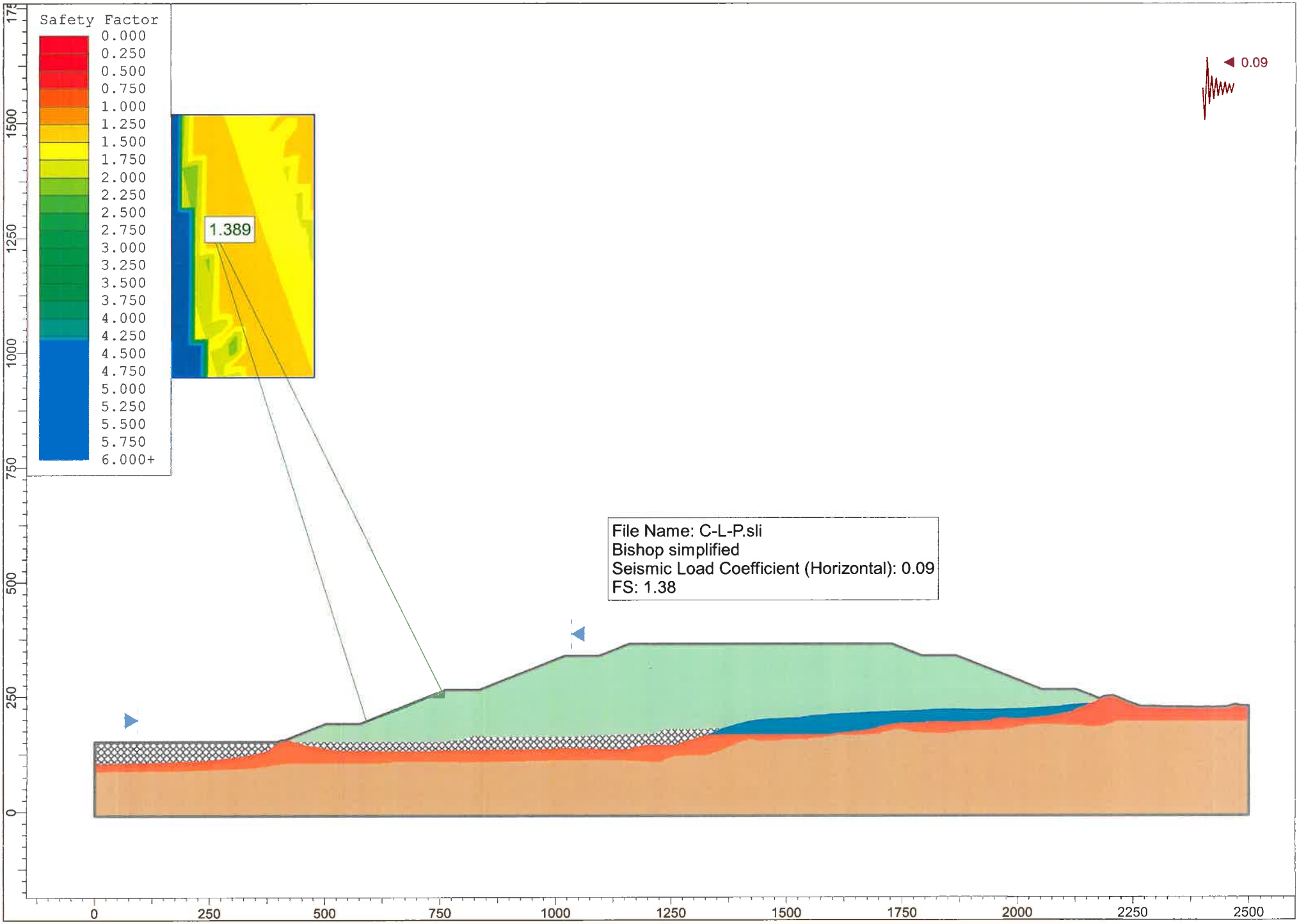
Material: Landfill Material

Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

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File Name: C-L-P.sli

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Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
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Seismic Load Coefficient (Horizontal): 0.09

Material Properties

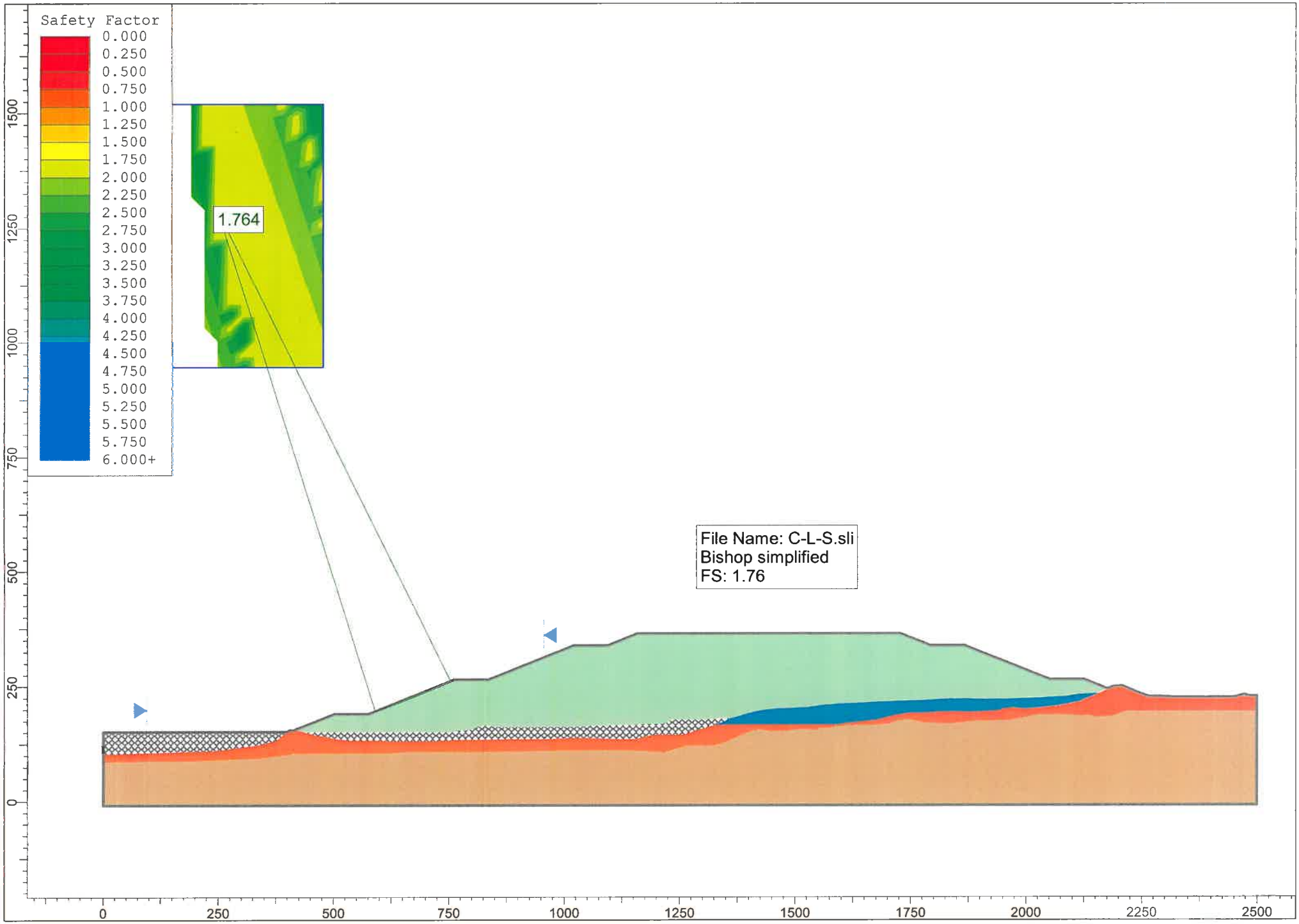
Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

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Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
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Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
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Number of slices: 25
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Surface Options

Surface Type: Circular
Search Method: Grid Search
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Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

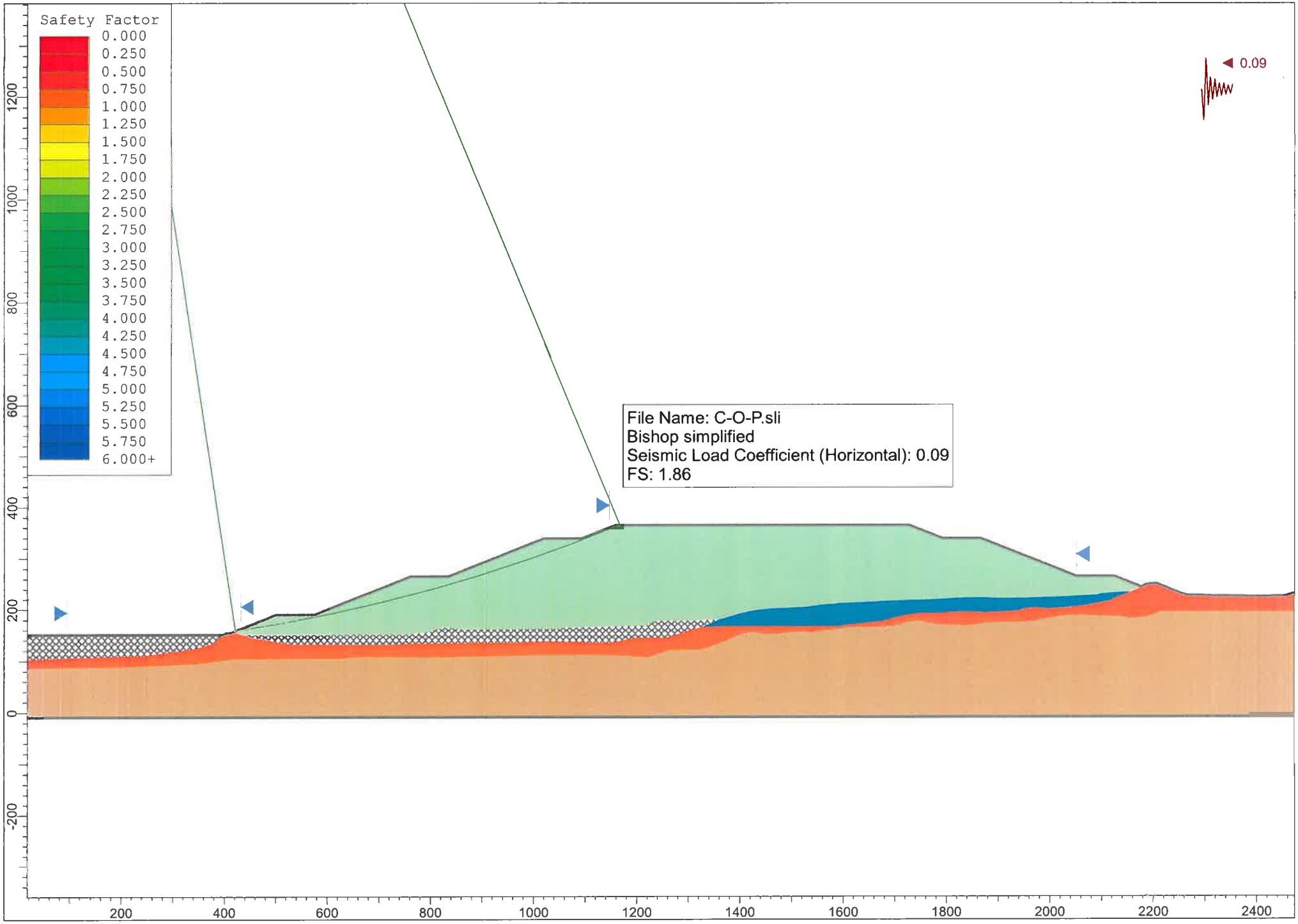
Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf

Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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File Name: C-O-P.sli
Bishop simplified
Seismic Load Coefficient (Horizontal): 0.09
FS: 1.86
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Slide Analysis Information

Document Name

File Name: C-O-P.sli

Project Settings

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Allow Ru with Water Surfaces or Grids: Off
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Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
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Number of slices: 25
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Surface Options

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Loading

Seismic Load Coefficient (Horizontal): 0.09

Material Properties

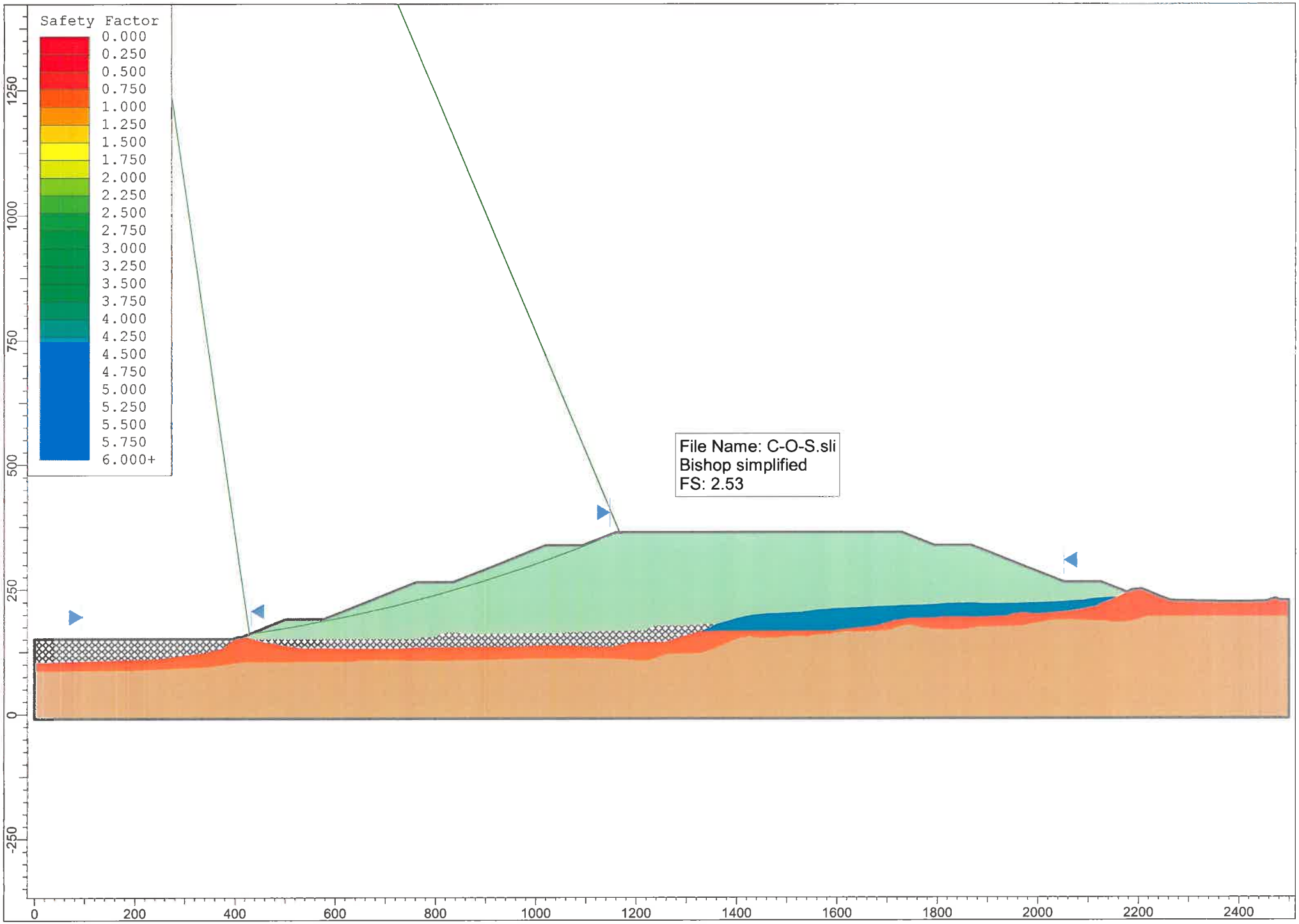
Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None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Slide Analysis Information

Document Name

File Name: C-O-S.sli

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Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
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Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Development Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 1 psf
Friction Angle: 35 degrees
Water Surface: None

Material: Landfill Material
Strength Type: Mohr-Coulomb
Unit Weight: 100 lb/ft3
Cohesion: 20 psf

Friction Angle: 30 degrees
Water Surface: None

Material: Bedrock (Gila Conglomerate)
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 20000 psf
Friction Angle: 38 degrees
Water Surface: None

Material: Tailings
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 100 psf
Friction Angle: 30 degrees
Water Surface: None

Material: Alluvium/Embankment
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 100 psf
Friction Angle: 36 degrees
Water Surface: None

APPENDIX F
DEVELOPMENT ROCK CHARACTERIZATION

TECHNICAL MEMORANDUM

DATE: 31 January 2007

TO: **Casey McKeon, Ph.D. (RCM)**

FROM: Mark J. Logsdon (Geochimica)

SUBJECT: **GEOCHEMICAL CHARACTERIZATION OF DEVELOPMENT ROCK FOR PROPOSED SHAFT NO. 10, RESOLUTION PROJECT: ADEQ Tier 1 Results and Inertness Analysis**

1.0 BACKGROUND

Resolution Copper Mining, LLC (RCM) requires underground access to accurately and completely characterize the nature of the porphyry copper prospect near Superior, Arizona that they are evaluating. The first necessary step in developing the required underground access is to sink a new shaft, collared at the East Plant Site, to an expected total depth of 2,191 m (7,188 ft) below ground surface (bgs). The rock removed during the shaft sinking will be entirely non-ore-grade; as is traditional in mining, this rock is called "development rock", to reflect its origin as rock that must be moved to develop an underground mine. Shaft sinking for Resolution follows a numbered sequence that was initiated during mining the Superior ore body. The last Superior shaft was No. 9, so the first RCM shaft will be designated as Shaft No 10. Long-term RCM plans anticipate future shafts in additional locations, but this study deals only with Shaft No. 10. RCM will execute additional technical studies for other shafts and other parts of the underground development program, but these cannot yet be anticipated.

Based on detailed engineering plans and calculations by RCM, the sinking of Shaft No. 10 will generate 0.4 Million tonnes[1] of development rock. RCM's current schedule anticipates producing the initial rock from Shaft No. 10 in the 1st Quarter of 2008, and shaft-sinking would continue to mid-year 2011. (The entire mine development program assuming RCM's project proceeds as anticipated would extend to 2015. As stated above, additional technical studies, including geochemical testing, will be developed as the other projects are planned.)

Most of the development rock will be Tertiary Apache Leap Tuff and Whitetail Conglomerate that are much younger than and not associated with the target mineralization. [Traces of native copper have been observed in drill core from the basal portion of the Whitetail Conglomerate.] Once the shaft reaches approximately 1,000 m below ground surface (BGS), development rock will encounter propylitically altered Cretaceous rocks, and below approximately 1,750 m BGS, development rock will be in quartz-sericite-pyrite (QSP) alteration with sulfide-sulfur concentrations that exceed 0.5 wt%. In the underlying

[1] Assuming a specific gravity of 2.7 for low-sulfide rock and 2.8 for sulfide-rich rock and a conservative swell factor of 1.5, the anticipated volume of total development rock is 0.25 Million cubic yards (GAI, 2007).

Precambrian to Mississippian sequence, sulfide-sulfur concentrations are expected to be above 1%. The development rock from shaft sinking will be stockpiled at one or more locations on RCC property. This will constitute "waste rock" as described in the APP Guidance, and its potential impacts on water resources must be considered in order to obtain an Aquifer Protection Permit (APP).

1.1 Purpose and Objectives

The purpose of this Technical Memorandum is to describe and present the results of an ADEQ Tier 1 geochemical characterization program of development rock for proposed Shaft No. 10 based on detailed sampling and analysis of samples from a pilot drill hole along the entire vertical section of the proposed shaft. Specific objectives of the report include:

- Describing the important geologic controls of the rocks that Shaft No. 10 will encounter
- Describing the sampling and analysis program executed by the RCM team
- Presenting the geochemical results of the test work
- Evaluating the geochemical results within the context of the ADEQ guidance for the APP program
- Recommending that there is a reliable technical basis for determining that the upper 1,633 m of the section meet ADEQ criteria for "inert rock" (ADEQ, 2006b[2]).
- Describing the technical approach that RCM intends to implement for further development-rock characterization (i.e., from other shafts and underground developments)

1.2 Terms of Reference

RCM asked Mark Logsdon (Geochimica, Inc, Aptos, CA) to prepare and execute a plan to geochemically characterize development rock from shaft sinking. The test work must meet requirements for material characterization under the Arizona Department of Environmental Quality's Aquifer Protection Permit Program (ADEQ-APP). In addition, the test work must be consistent with internal Rio Tinto standards and applicable guidance.

In preparing the program, we have:

- Consulted the relevant ADEQ guidance documents.
- Reviewed available data and reports on the geology, mineralogy and geochemistry of the deposit.
- Reviewed background information on the geology and geochemistry of the Superior District and porphyry copper deposits in Arizona (and elsewhere)
- Obtained data and information from RCM mine planners and engineers working for RCM on development of the No. 10 Shaft.

[2] The ADEQ guidance specifies that the mined rock shall not be acid generating nor leach constituents at concentrations that exceed AWQS criteria. Test methods are described and are consistent with those identified in ADEQ 2006a)

- Reviewed the internal Rio Tinto guidance on geochemical characterization of sulfide-bearing rock.
- Developed a sampling-and-analysis plan.
- Researched and recommended to RCM a testing and analytical facility.
- Reviewed and evaluated the geochemical data developed by the testing laboratory, both with respect to specific geochemical issues and in the context of the APP guidance. This technical memorandum is the report of those investigations.
- Asked that a third-party expert, Dr. Rens Verburg (Golder Associates, Inc., Redmond, Washington) review the plans and reports of the project.

Samples for testing, based on the Sampling and Analysis Plan developed by Geochimica, were provided by RCM geologists, who arranged for the samples to be delivered directly from the RCM core archive to the analytical laboratory for testing and analysis.

The geochemical test work was performed by ACZ Laboratories, Inc. (Steamboat Springs, CO). ACZ is pre-qualified for the geochemical analyses required by ADEQ for the APP program.

2.0 ISSUES

RCM asked for specific evaluation of the following three issues:

1. What is the potential for geochemical reactivity in rocks of the pilot-hole for Shaft No. 10?
2. What are the geochemical controls on reactivity?
3. Is there a well-defined geologic or elevation break between "inert" (in the ADEQ sense) and reactive rock in the Shaft No. 10 materials?

3.0 TECHNICAL APPROACH

Geochimica adopted the phased approach to geochemical characterization that is described in detail in the APP Guidance (ADEQ, 2006). Firstly, we developed a sampling and analysis plan (Geochimica, 2006) organized around RCM's geologic data for pilot-hole core for Shaft No. 10 and detailed conceptual models for the geology and mineralogy of Resolution and other Arizona porphyry copper deposits (e.g., Manske and Paul, 2002; Lowell and Gilbert, 1970; Meyer and Hemley, 1967; Titley and Hicks, 1966; Titley, 1983a; and references in these sources). ADEQ Tier #1 (static) tests were used to scope the general risk of acid-rock drainage and metals leaching with adequate spatial and statistical characterization. The Tier #1 steps included:

- Evaluation of geology, stratigraphy, and mineralogy of the samples
- Static acid-base accounting using the EPA methods (Sobek et al., 1978)
- Static leach testing using EPA Method 1312 (Synthetic Precipitation Leaching Procedure, SPLP)

The geology and mineralogy of the rocks was evaluated within the general approach of "geo-environmental models" developed by the US Geological Survey (du Bray, 1995; Plumlee, 1999) and specifically in light of the models and data for porphyry copper systems (Cox et al., 1995; Plumlee, 1999; Plumlee et al. 1999). In addition to the Tier #1 tests stipulated by ADEQ, samples were tested for total metals concentrations (a Tier #2 step). The Method 1312 leachates were analyzed for Gross Alpha and Gross Beta activities and also for dissolved Uranium. The Sobek-style static acid-base accounting approach was supplemented with another geochemical test called Net Acid Generation Potential (Miller et al., 1990; Tran, 2003) that provides an independent assessment of acid-generation potential.

4.0 METHODS AND PROCEDURES

RCM divides its drill-core into nominal 3 m intervals for description and evaluation. All geochemical testing has been done on single lithologies within 3 m intervals. To avoid "smearing" of material and therefore geochemical properties, there has been no compositing across intervals or of lithologies that range within a 3-m interval.

Tier #1 geochemical tests (ABA and SPLP leaching) have been performed by the methods and procedures listed in ADEQ guidance (Sobek et al., 1978), as certified by ACZ. An independent review of the methodologies for acid-rock drainage estimation is provided in White et al. (1999) and has recently been summarized again by Maest et al. (2006). The whole-rock chemical analyses were performed by a subcontractor laboratory (ALS Chemex) using standard EPA methods for extractions (crushing and dissolution) and analyses (ICP preparation with analysis by emission spectroscopy or mass spectrometry, depending on the EPA designated finish. The results are reported in units of mg/kg or ug/kg of solids. In addition, as is standard in geologic materials, the major rock-forming components were tested separately by whole-rock X-ray fluorescence and the results reported as the standard oxides (e.g., Al as Al_2O_3 in wt%). Quality assurance/quality control checks and discussion are included in the laboratory reports.

The principal concern for water-quality impacts in a porphyry copper deposit such as Resolution is that the sulfide minerals (predominantly pyrite, FeS_2) will oxidize, producing acidic drainage that solubilizes trace metals. Therefore the first geochemical step in the Tier #1 process is to determine the amount of sulfide-sulfur present in samples (in this case as a function of rock type and depth). Sulfur values in the ABA analysis are determined by full pyrolysis in a Leco induction furnace. The sulfur-bearing phases generate SO_2 gas that is analyzed by infra-red spectroscopy and reported as wt% of the solid mass. Sulfate concentrations (e.g., gypsum ($CaSO_4.2H_20$) or barite ($BaSO_4$) are determined by acid-leaching of the sample to dissolve sulfate minerals and a second Leco/IR analysis, with the sulfate given by difference. These sulfate minerals are not acid generating, so the sulfide-sulfur value is taken to be the difference between total sulfur and sulfate-sulfur. This is the most conservative way to estimate sulfide-sulfur concentrations.

Neutralization potentials are determined on separate sample splits. The sample is reacted with known, but excess strong sulfuric acid, and the resulting solution is back-titrated with a strong base to determine how much of strong acid was neutralized by the rock.

The two basic measurements, sulfide-sulfur concentration and titrated neutralization potential, are converted to common units of kg $CaCO_3$ eq/tonne[3] rock to allow comparison in consistent units. The procedure for the conversion is standard in the EPA protocol (Sobek et al., 1978), based on the stoichiometries of two model reactions:

[1] $FeS_2 + 15/4\ O_2 + 7/2\ H_2O \rightarrow Fe(OH)3 + 2\ SO_4^{2-} + 4\ H^+$

[i.e., the oxidation of pyrite by oxygen in the presence of water to produce ferric hydroxide (solids) plus dissociated sulfuric acid, H2SO4]

[2] $H_2SO_4 + CaCO_3 \rightarrow H_2CO_3 + CaSO_4$

[i.e., the neutralization of the strong acid, sulfuric acid by calcite (CaCO3) to produce a solution of weak acid (carbonic, H_2CO_3, the specific form of which depends on solution pH, e.g., Holland, 1978) and calcium sulfate (gypsum when there is excess water and T< 50C.]

The calculation is entirely stoichiometric; all sulfide minerals are treated as pyrite (the most acid generating), and there is no necessary implication that calcite is the neutralizing mineral, which is why it is called "equivalent" $CaCO_3$ in the ABA units.

The sulfide-sulfur values are used to estimate the Acid Generation Potential (AGP or AP). In some jurisdictions, this is called Maximum Potential Acidity, MPA, to emphasize that the manner of its calculation is highly conservative, assuming that all pyritic sulfur oxidizes essentially instantaneously. The neutralization values are called Acid Neutralization Potentials (ANP or NP). When presented in consistent units, the values can be compared using a "factor of safety" approach) as either a difference, Net Neutralization Potential [NNP = NP-AP] or as a Neutralization Potential Ratio, [NPR = NP/AP]. A NNP > 0 or an NPR > 1 implies that the rock sample has more Neutralization Potential than Acid Generation Potential; NNP<0 or NPR < 1, implies that the acid generation potential is greater. Conventions for considering the ABA values for decision-making are discussed below, after presentation of the results.

The Net Acid Generation (NAG) test, widely used in Australasia and increasingly in North America, is a different analytical scheme. Rather than test the AP and NP separately, as is done with the Sobek methods, the NAG test uses a strong oxidant, hydrogen peroxide, to rapidly oxidize the sulfides in a sample and then allow the residual rock-mass itself to neutralize as much of the acid as it can. The reactions occur quickly (typically in 4-6 hours, although the test generally runs for 12-24 hours for convenience and to ensure full reaction). The pH of the spent peroxide solution (a normal aqueous solution) is then measured; the result is called the NAGpH. If NAGpH is < 4.5, the solution is titrated for acidity, and that is reported as the NAG value. (At pH > 4.5, the solution will have net titratable alkalinity, so an acidity titration makes no sense). At a screening level, NAGpH values < 4.5 indicate

[3] "$CaCO_3$ eq", read "calcium carbonate equivalent" is the amount of calcite (chemical formula $CaCO_3$) that would be the chemical equivalent of the neutralization value calculated as described in the text. The strong base used in the titration test is usually NaOH, but sodium hydroxide does not exist as a rock-forming mineral, so its neutralization effect has to be determined in terms of a rock-forming mineral that is significant in the context, and calcite is the standard choice.

that the rock, under weathering, is likely to become acid-generating, whereas NAGpH values > 4.5 signify that the rock is very unlikely to be acid generating (Miller et al., 1990; Tran, 2003). The levels of titratable acidity for low-pH solutions indicate the general nature of the acid-buffer; the higher the NAG value, the stronger will be the acidity that the rocks may generate during weathering.

Because the underlying physical bases for the Sobek and NAG tests are different, their results provide a confirmation of each other. Tran (2003) illustrates the combined use of NNP and NAGpH values via a graphical technique that is used below.

The geochemical data (sulfur analyses, leaching and whole rock) are evaluated both spatially and statistically. The No. 10 Shaft will be effectively one-dimensional (vertical), and the pilot hole that provided the samples for testing is oriented along the axis of the shaft, so the only spatial analysis needed is in the vertical sense (i.e., depth bgs). In addition to depth, the samples are distinguished by their geologic (lithologic) units and by the hydrothermal alteration that overprints the proto-lithologies in the units below the Tertiary Whitetail Conglomerate.

The statistical analysis of samples is organized primarily through standard descriptive statistics, as presented below. Many tested materials had measured value slower than the detection limits for the methods. These are clearly distinguished in the reports and in the summaries in the following text. The analysis of values that are less than the analytical limit of detection offers some special challenges. In this investigation, we summarize the numbers of samples less than detection limits. In graphical analyses, the (< detection) values are set arbitrarily at ½ the detection limit, a standard approach that graphically introduces no bias. But for mathematically-defined summary statistics, assuming all values at one-half the detection limit biases the variance and is not a well-posed functional estimate.

To develop statistics for complete data sets, we take advantage of the understanding of analytical chemistry as applied to values less than detection limits. An analytical chemist views values less than detection limits as matters on which no point estimate is justified. Logically, the value must be somewhere between truly zero and the analytical limit of detection. To capture the uncertainty, we impute values in that interval using a random-number generator on a uniform distribution between zero and one, multiplying that random number by the limit of detection. [Note that the limit of the mean calculated in this manner will be one-half the detection limit, but individual estimates will range randomly between zero and the detection limit, and it is not necessary that any simple sample so imputed have the exact value of one-half the detection limit.] This permits all standard statistical functions to be calculated, using the least biased estimator (i.e., random sampling from the uniform distribution). Once the values have been calculated in this manner, the ensemble results can be re-transformed to the detection limit for those statistics that have calculated values below the limit for that parameter.

5.0 RESULTS

Appendix A is an Excel workbook that identifies all geologic and mineralogical data for the pilot hole; sample intervals selected for testing are identified. A total of 96 samples have been tested, 20 in a preliminary survey in 2005 and another 76 (17 of which replicate the earlier intervals as a QA check) in the most recent program. A summary worksheet identifies samples and briefly summarizes their critical geologic and mineralogical characteristics. The additional worksheets provide additional detail on lithology, alteration mineralogy, and copper mineralization.

Figures and additional appendices are arranged as follows:

- Figure 1 is a generalized stratigraphic section for the Project area. The ore body is (schematically) in the right-hand portion of the section, east of the major sub-vertical fault that down-drops Cretaceous sedimentary and volcaniclastic rock (Kvs on the figure).

- Figure 2 is a cross-sectional view of the alignment of Shaft No. 10 and the subsequent underground drives toward the resolution ore body, shown in relationship to the underground geology.

- Analytical reports from ACZ laboratories are presented verbatim in Attachment 1.

- Appendix B compiles the Acid-Base data (Sobek and NAG).

- Appendix C compiles the SPLP (Method 1312) leachates, as well as chemical analyses of the leachates from all the NAG tests.

- Appendix D compiles the whole-rock chemistry, including trace metals.

- Appendices A-D and Attachment 1 are presented in large electronic files on the CD in the pocket to this report.

Key results are displayed in the following figures, each of which will be discussed in the following section:

- Figure 3. Vertical section showing the spatial distribution of Sulfide-Sulfur concentrations in relation to the depth and geology (lithologies, alteration zones) of Shaft No. 10.

- Figure 4. Vertical section showing the spatial distribution of Neutralization Potentials in relationship to depth and the geology (lithologies, alteration zones) of Shaft No. 10.

- Figure 5. Vertical section showing the spatial distribution of NPR (ratio of NP/AP) related to the depth and geology (lithologies, alteration zones) of Shaft No. 10.

- Figure 6. Bivariate plot of NP vs. AP, with samples distinguished by geologic unit in stratigraphic order.

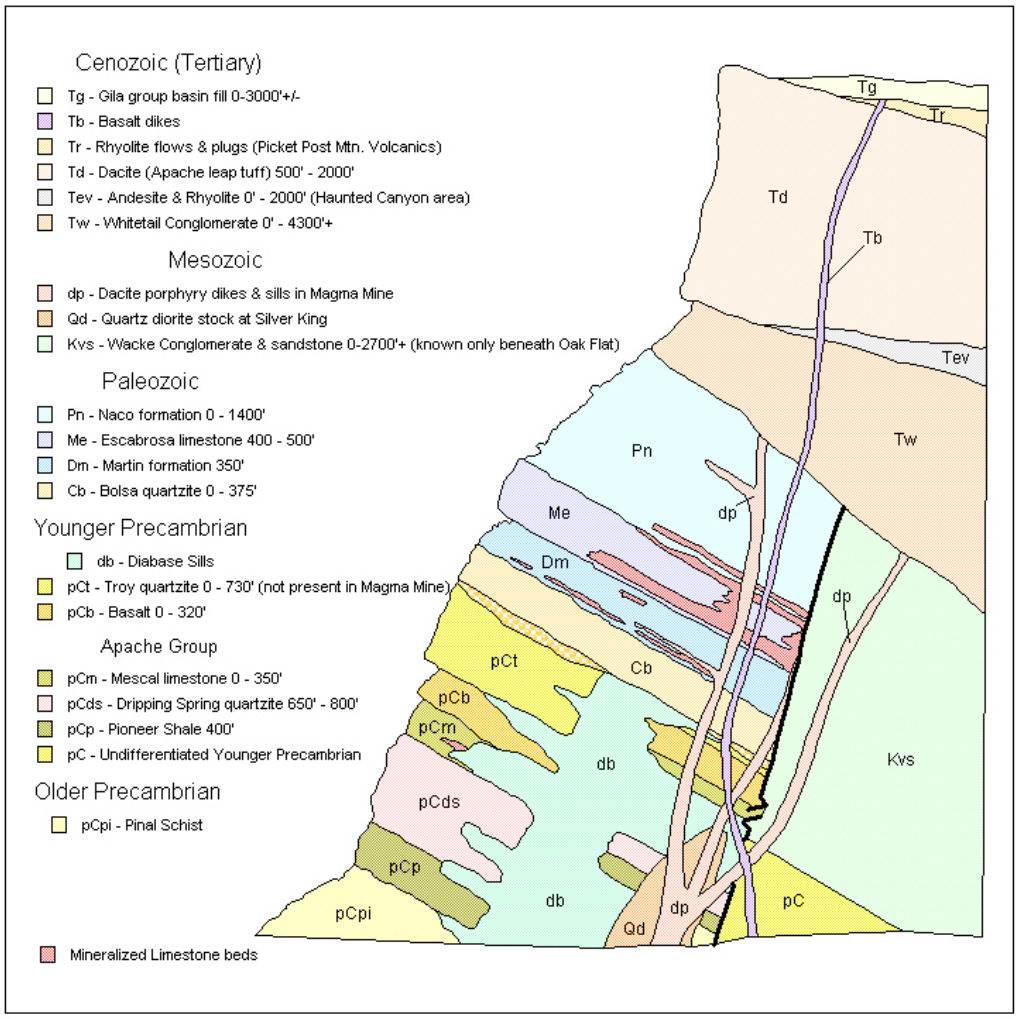
- Figure 7. Vertical section showing the spatial distribution of NAGpH in relation to the depth and geology (lithologies, alteration zones) of Shaft No. 10.

- Figure 8. Bivariate plot of Net Neutralization Potential vs. NAGpH, with samples distinguished by geologic unit in stratigraphic order.

- Figure 9. Vertical section showing the spatial distribution of Method 1312 and NAG leachate concentrations for SO4 and Fe in relation to the depth and geology (lithologies, alteration zones) of Shaft No. 10.

- Figure 10. Vertical section showing the spatial distribution of total metals concentrations for Cu and Zn in relationship to depth and the geology (lithologies, alteration zones) of Shaft No. 10.

Figure 1 Generalized Stratigraphic Section in the Superior Area



Generalized Stratigraphic Section

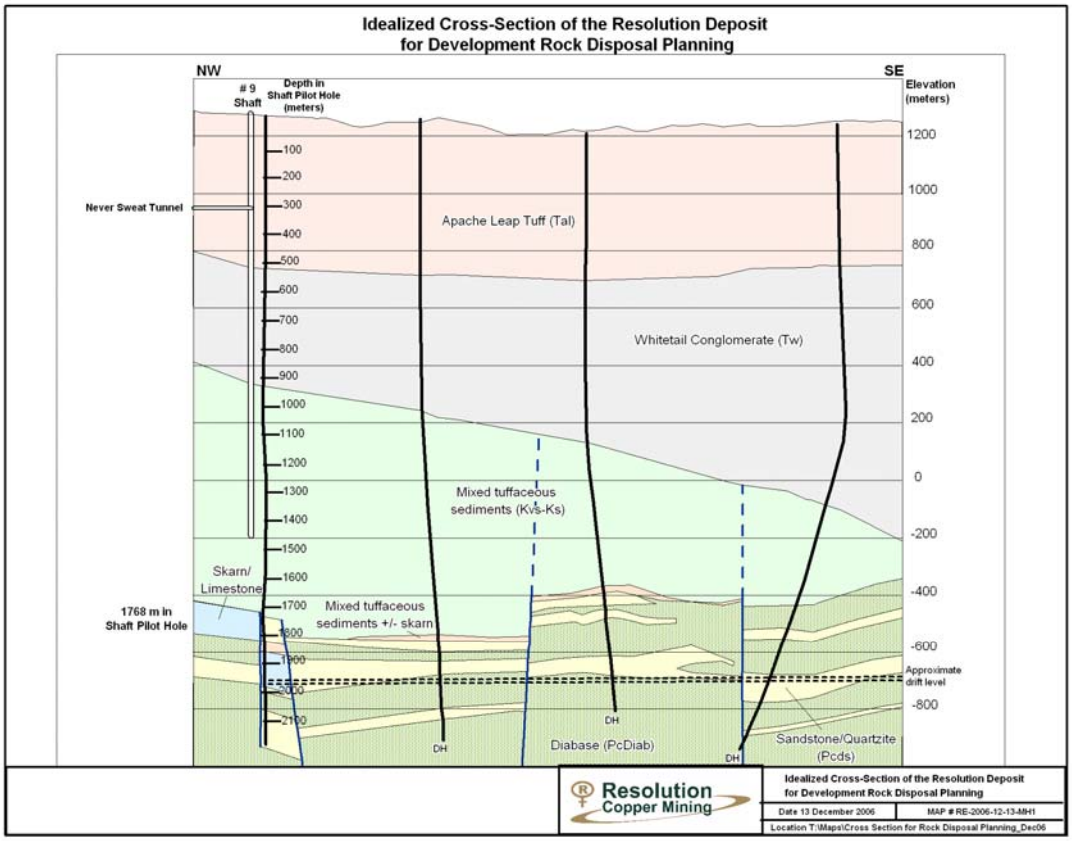
Showing

Rocks of the Superior Area

By Don Hammer (Magma) - May 1973

Modified 2002 - D. Andrews
Digitized 2002 - M. Hart

Figure 2 Geologic Cross-Section of Resolution Deposit Showing Pilot Hole for No. 10 Shaft and Drift Level (prepared by M. Hart, RCM)



Legend – Figures 3 to 10

Lithologies:

Tal: Tertiary Apache Leap Tuff
Tw: Tertiary Whitetail Conglomerate
Kvs-Ks: Cretaceous volcaniclastic and detrital sediments
Skn: Skarn developed in Paleozoic carbonate rocks
Cb-Pcms: Cambrian Bolsa quartzite and Precambrian quartzite and limestone
Pcdiab: Precambrian diabase
Pcds: Precambrian Dripping Springs quartzite

Hydrothermal Alteration (Indicator Minerals):

Unaltered: No hydrothermal alteration; secondary calcite locally present, especially in Tw
Propylitic: Epidote, Chlorite, Calcite
Phyllic: Quartz, Sericite, Pyrite (QSP)
Skarn: Pyroxene, Garnet, Calcite, local Amphibole

Figure 3 Vertical Profile of Pilot Hole: Sulfide-Sulfur (wt%) versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.

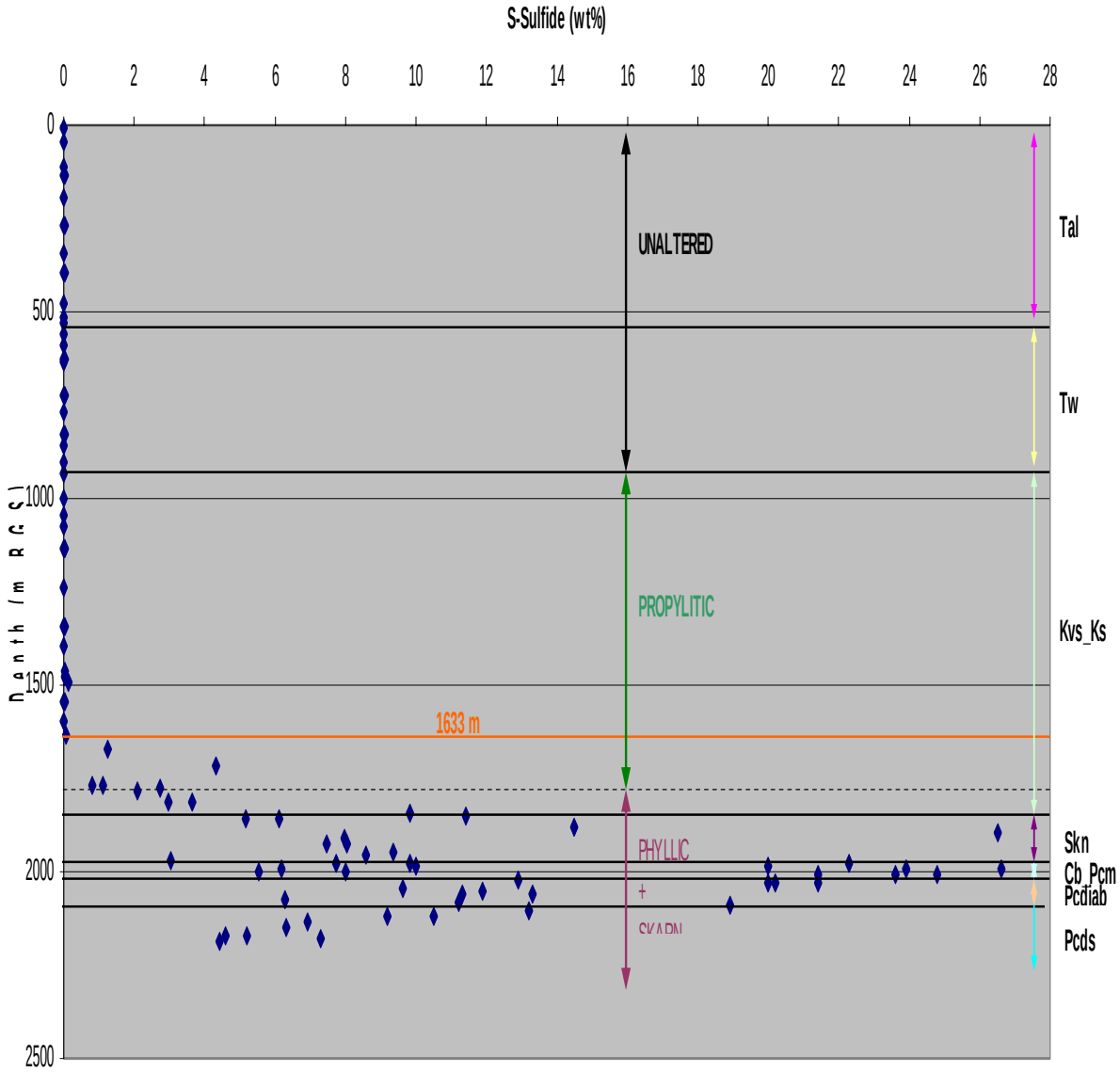


Figure 4 Vertical Profile of Pilot Hole: Neutralization Potential (t CaCO3 eq/kt) versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.

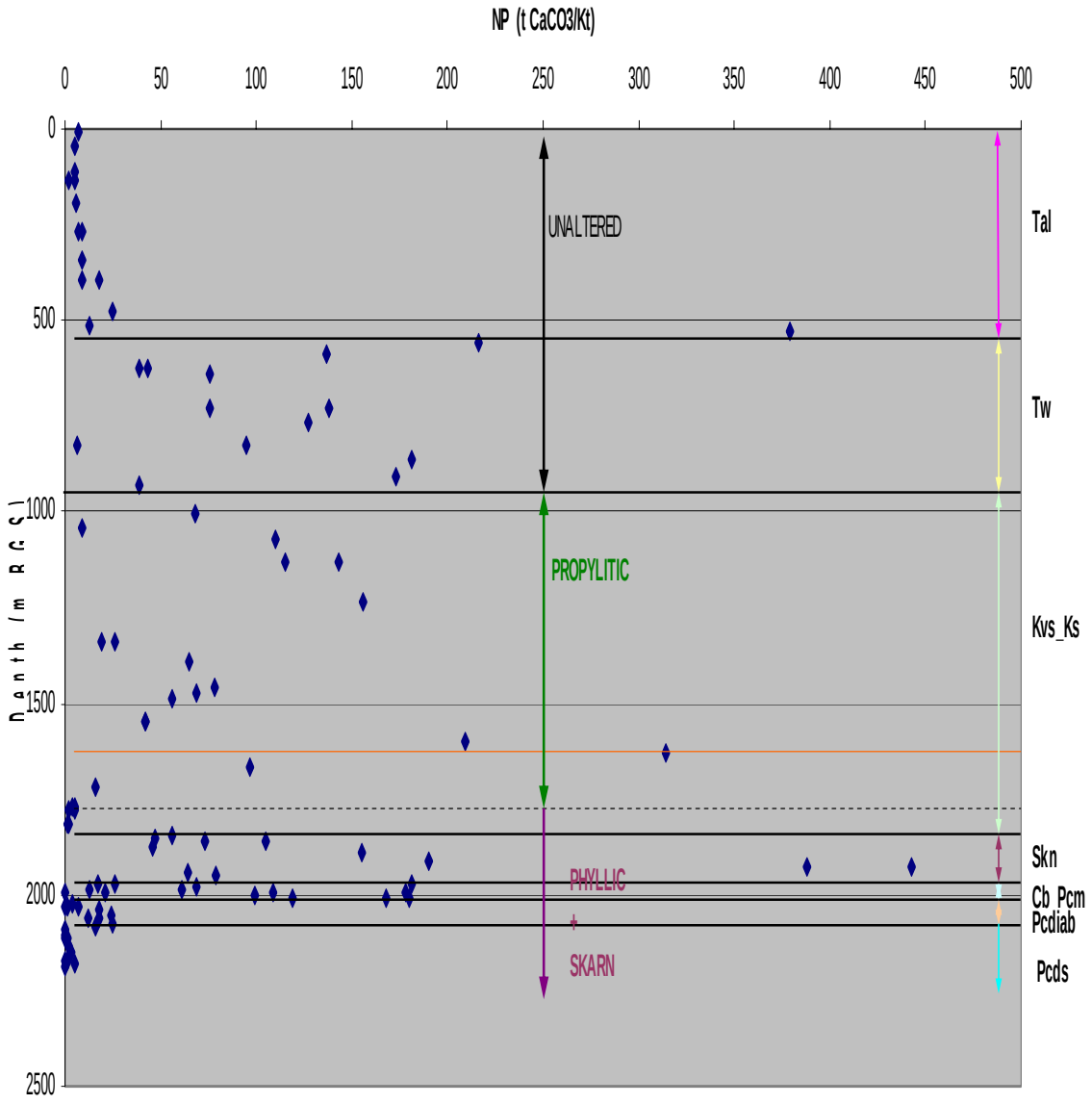


Figure 5 Vertical Profile of Pilot Hole: Neutralization Potential Ratio (NP/AP) versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.

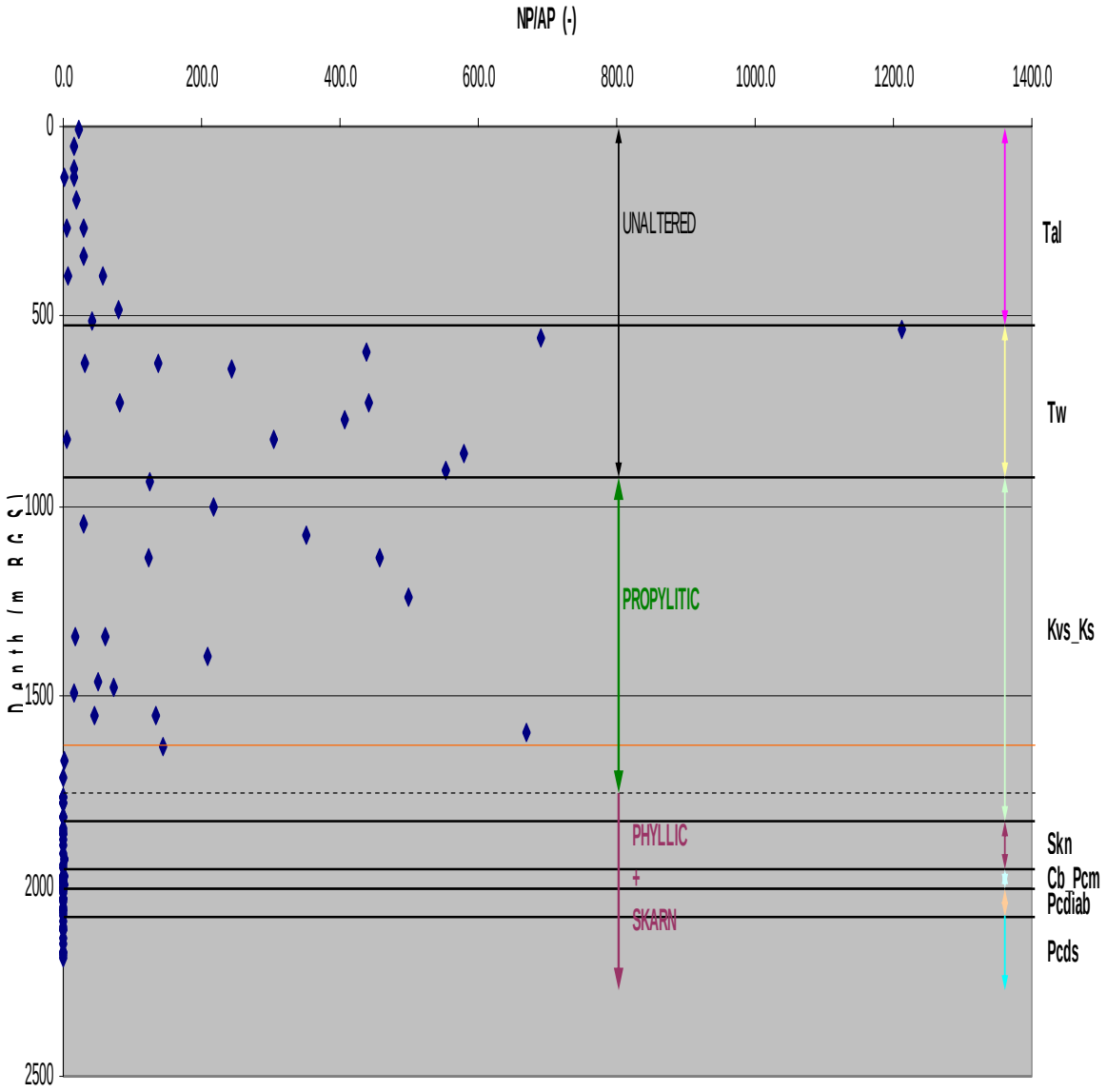


Figure 6 Bivariate plot of Neutralization Potential (NP) versus Acid Generation Potential (AP or MPA). Geologic legend below figure; for full descriptions, see Appendix A.

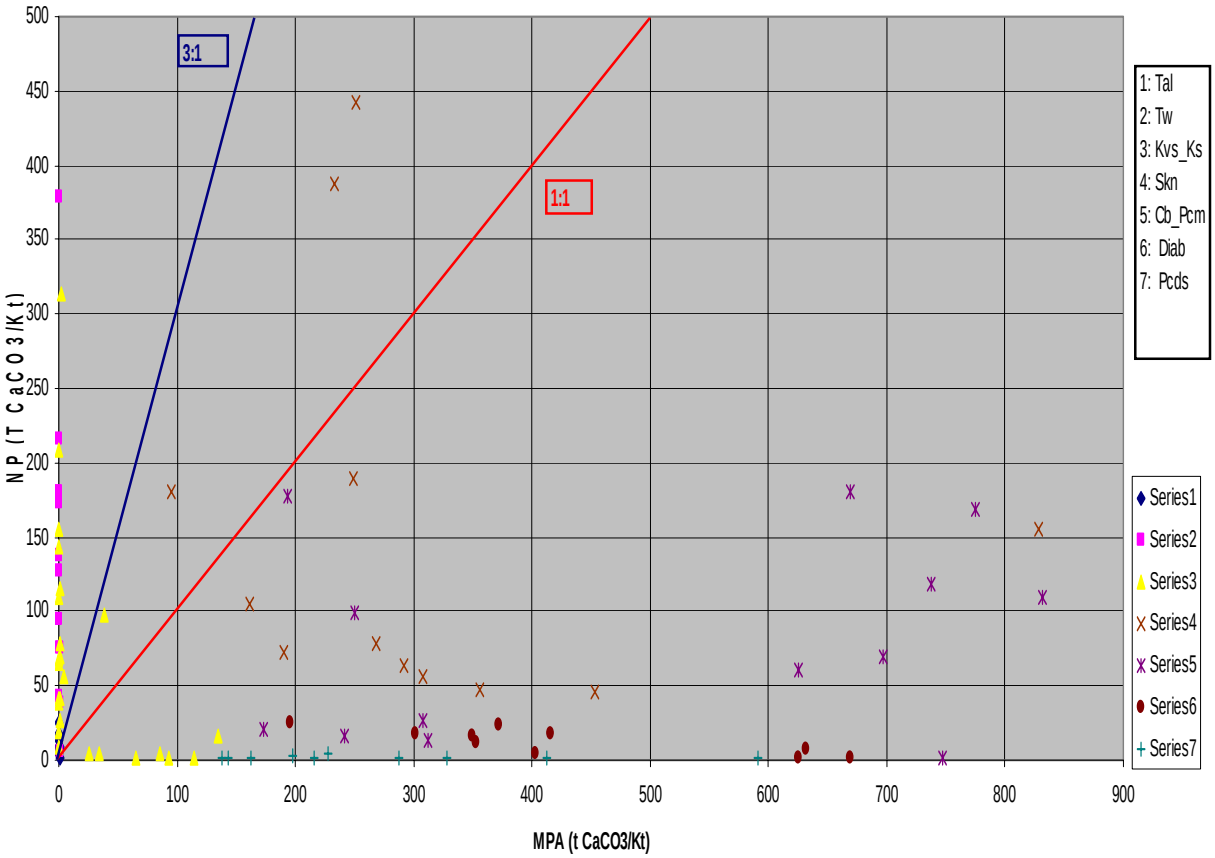


Figure 7 Vertical Profile of Pilot Hole: NAGpH (su) versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.

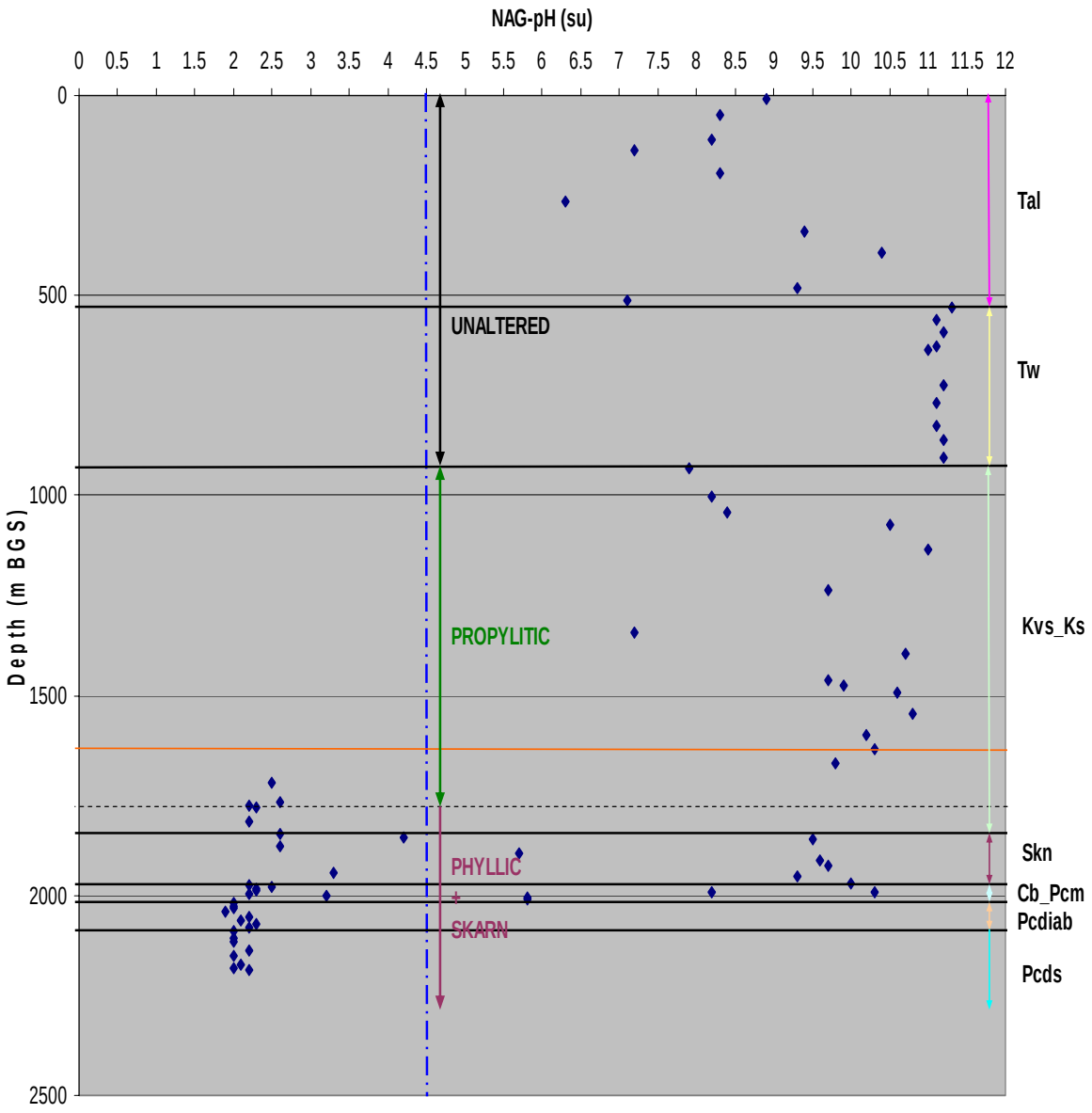


Figure 8 Bivariate plot of Net Neutralization Potential (NNP) versus NAGpH. Geologic legend below Figure 2; for full descriptions, see Appendix A.

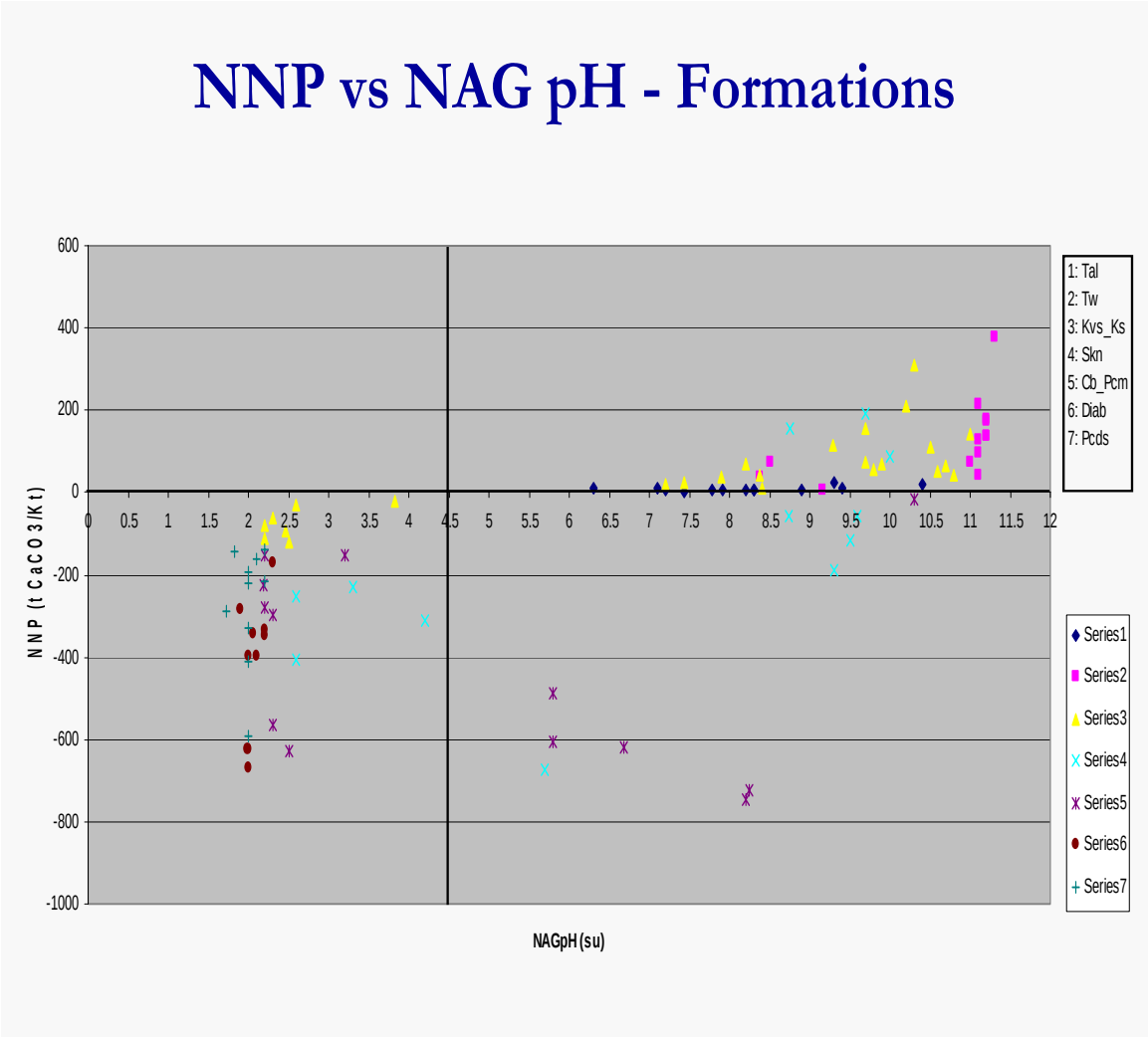


Figure 9 Vertical Profile of Pilot Hole: Method 1312 and NAG leachate concentrations (SO_4 and Fe, mg/L) as well as NAGpH versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.

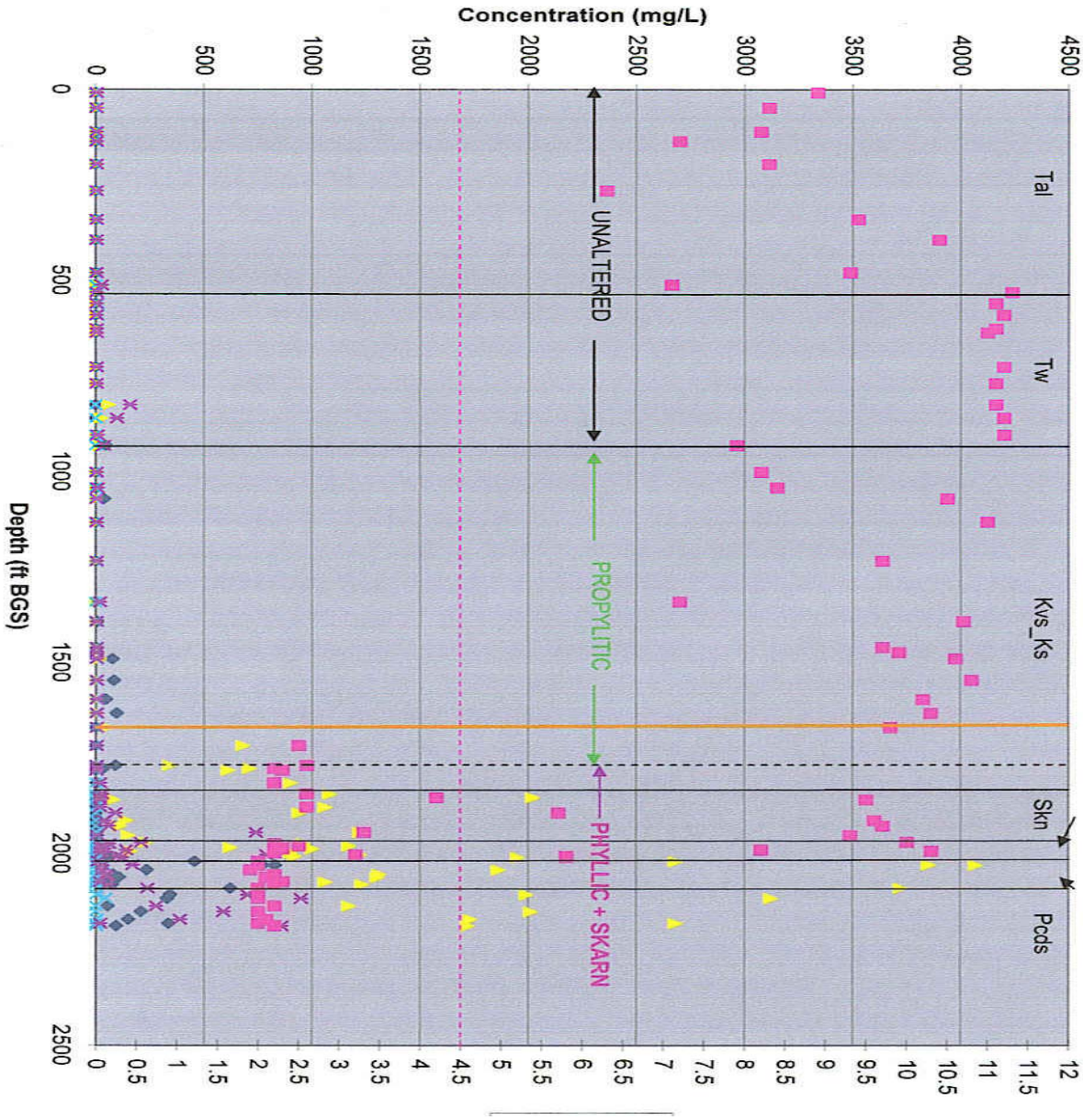
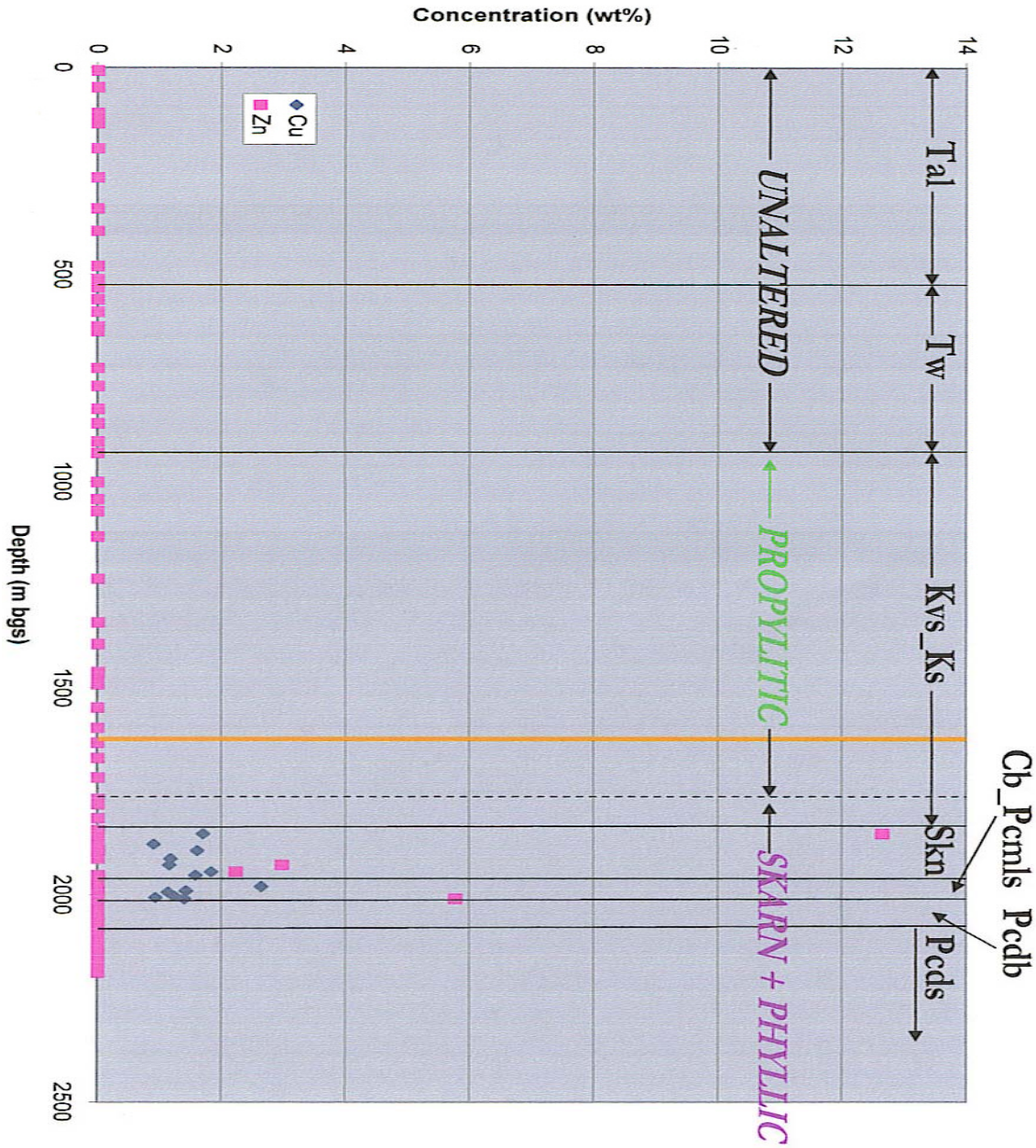


Figure 10 Vertical Profile of Pilot Hole: Total metals concentrations (Cu and Zn, wt%) versus depth (m bgs). The orange horizontal line at 1,633 m bgs is a visual marker by Geochimica of a fundamental change in the nature of the sulfide content of the rocks. Geologic legend below Figure 2; for full descriptions, see Appendix A.



6.0 DISCUSSION

6.1 Post-Mineral Geology: Apache Leap Tuff and Whitetail Conglomerate

An essential feature of the Apache Leap area and the Resolution ore deposit is that the mineralized rock is overlain unconformably by 1,000 m of post-mineral, Tertiary rocks that contain no sulfide mineralization. The Tertiary Whitetail Conglomerate is a moderately to poorly consolidated sedimentary unit that contains abundant secondary calcite. The Whitetail Conglomerate is overlain by a yet younger series of rhyolitic to dacitic extrusive rocks, the Apache Leap Tuff. The Whitetail and Apache Leap units are much younger than, and not associated with the hydrothermal alteration and mineralization.

6.2 Mineralogical Structure of Porphyry Coppers: A Geo-Environmental Model

Groundwater impacts from mined rock occur because ambient meteoric precipitation infiltrates through the rock. Average-ambient precipitation in areas unaffected by industrial air pollution is a very dilute (low ionic-strength) solution that is unbuffered with respect to pH (Table 1).

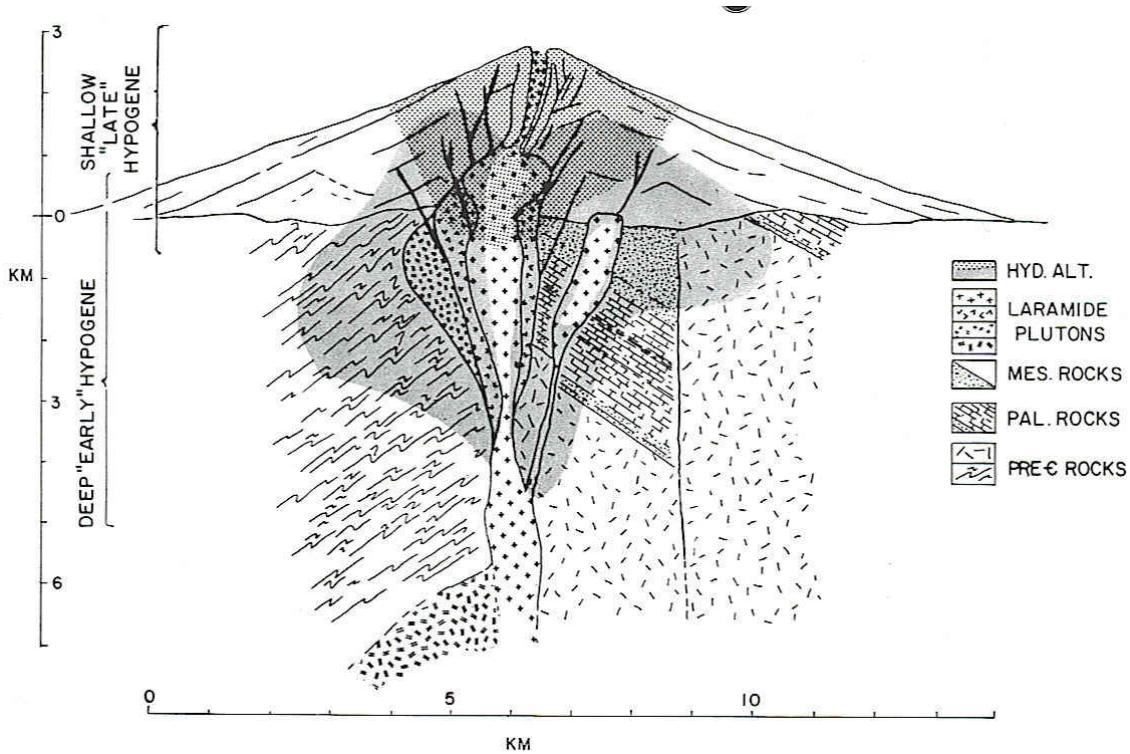
Table 1 Composition of Precipitation, Inland Western United States. Values in mg/L except pH in su. Inland US value for pH is median of western US stations, "na": no analysis. (Berner and Berner, 1996)

	Na	K	Mg	Ca	Cl	SO_4	pH
Grand Junction, CO	0.26	0.17	na	3.41	0.28	4.76	na
Amarillo, TX	0.22	0.23	na	2.7	0.14	1.86	na
Bishop, CA	0.84	0.42	0.08	0.67	0.64	2.26	6.1
Albuquerque, NM	0.24	0.18	na	4.74	0.09	2.39	na
Santa Fe, NM	0.06	0.08	0.15	3.62	0.33	2.95	6.7
Average Inland US	0.40	0.20	0.10	1.4	0.41	3.0	5.51

Clearly, if such waters moved through a rock pile by simple physical processes, severely adverse water quality impacts would not exist. It is well known that some mine waters are acidic and contain elevated concentrations of many parameters. The only source for such solutes must be the minerals of the rock pile, undergoing irreversible, heterogeneous chemical reactions with the infiltrating water.

Based on very detailed studies of porphyry copper deposits (particularly the porphyry copper deposits of Arizona) during the 1960s and 1970s, the ore-genesis community developed a specific conceptual model for the origin of porphyry systems that has proven enormously robust as an exploration and operational tool. Figure 11 is a schematic diagram of the geologic nature of porphyry copper systems in Arizona.

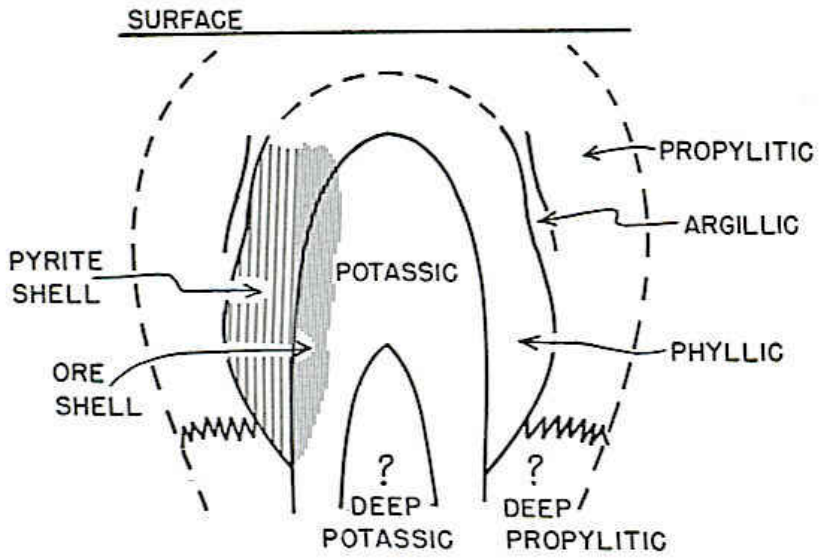
Figure 11 Generalized geologic cross-section of porphyry copper systems in southeastern Arizona (Titley, 1983b).



The central feature of the Arizona model is that intermediate igneous intrusive rocks interact with pre-existing rocks, the nature of which is site-specific. At Resolution, the host rocks include Precambrian, Paleozoic and Mesozoic rocks (Figures 1 and 2), consistent with the Titley model. The essentially symmetric nature of the system is well shown in the Titley figure. This symmetry of alteration and mineralization derives from the establishment of forced convection of hydrothermal fluids as the hot igneous rocks intrude the pre-existing system. The hydrothermal waters probably include a portion of truly primitive igneous water expelled from the magma as it cools, but are predominantly re-circulating meteoric water (e.g., Burnham, 1997; Cathles, 1997).

The heated and mineralized waters circulate around the intrusive heat source for some few millions of years, with the convective cells gradually decaying with time (Cathles, 1997). The nature of the convective flow over long times redistributes mass in a quite regular manner, with most of the sulfide mineralization occurring near the contact of the intrusive and the country rocks, often more in the country rock. The essential symmetry of sulfide mineralization and hydrothermal alteration is emphasized in the classic figure from Lowell and Guilbert (1970), Figure 12. The zonation of hydrothermal alteration, the reaction products of the hydrothermal solutions and the country rocks, has a traditional set of names and a spatial sequence, ranging from Potassic alteration in the core outward through Phyllic (or Quartz-Sericite-Pyrite, QSP), to Propylitic zones. If (as shown schematically in Figure 11) the hydrothermal system encounters carbonate rocks, which are both more permeable and more chemically reactive than other host rocks, Skarn mineralization forms.

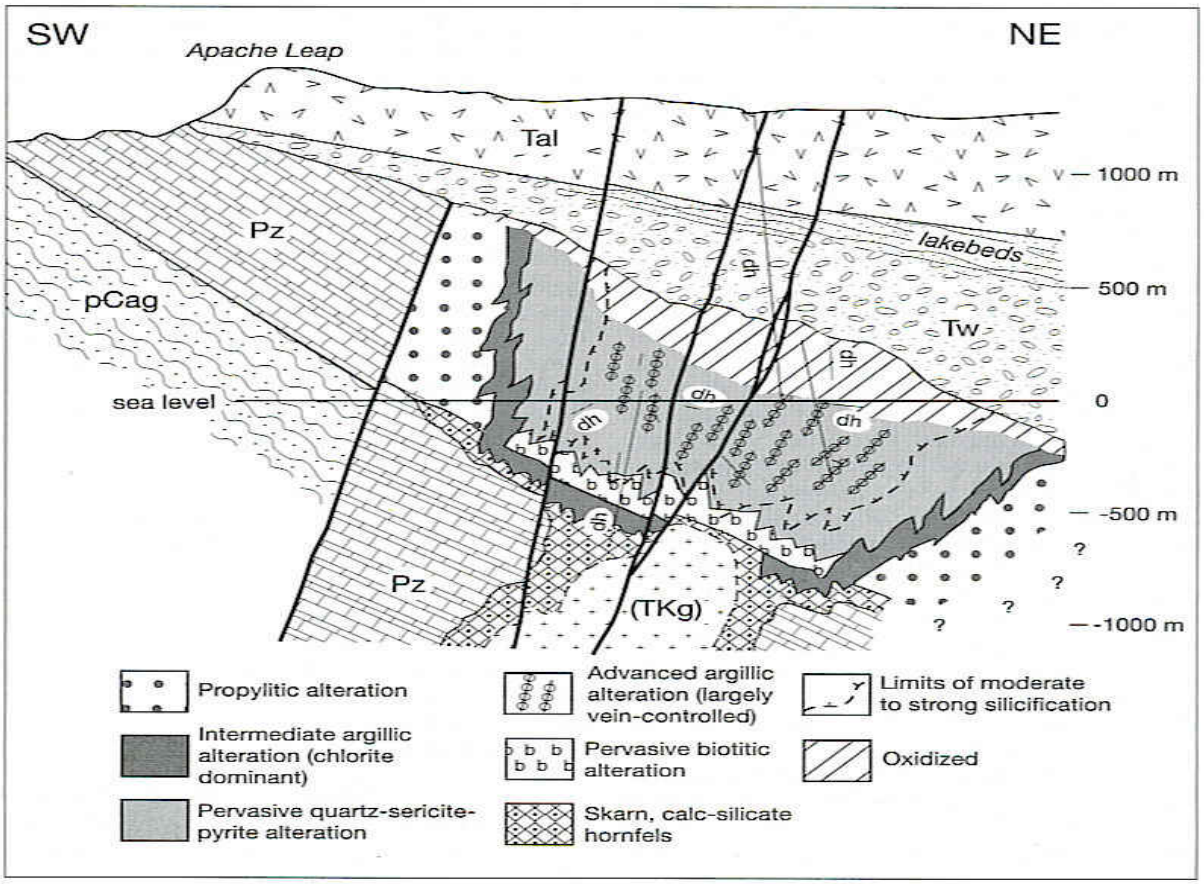
Figure 12 Symmetrical Zonation of Arizona-Type Porphyry Copper Mineralization (Lowell and Guilbert, 1970).



The No. 10 Shaft will not encounter any Potassic alteration, but does show Phyllic, Propylitic and Skarn zones, depending on elevation and host lithology. The indicator minerals for the observed alteration zones are shown in the legend for Figures 3 to 5. Phyllic and Skarn zones are especially high in sulfide minerals (see Appendix A, Worksheet Mineralization, and Appendix B for sulfur concentrations). Propylitically altered rocks (which Shaft No. 10 will encounter in the upper portion of the Cretaceous sedimentary sequence) typically have significant amounts of calcite, $CaCO_3$ to provide available neutralization potential (see Appendix A, Worksheet Alteration and Figure 4).

Shaft No. 10 will encounter (at depth) sulfide-mineralized, but not ore-grade rocks, because it accesses the Resolution system from the outside. The typically zoned nature of the Resolution ore deposit is consistent with the Titley and Lowell and Guilbert models, as shown in Figure 13.

Figure 13 Schematic cross-section of Resolution ore body, showing symmetrical zonation of hydrothermal alteration, consistent with prior conceptual models of Arizona porphyry copper systems (Manske and Paul, 2002)



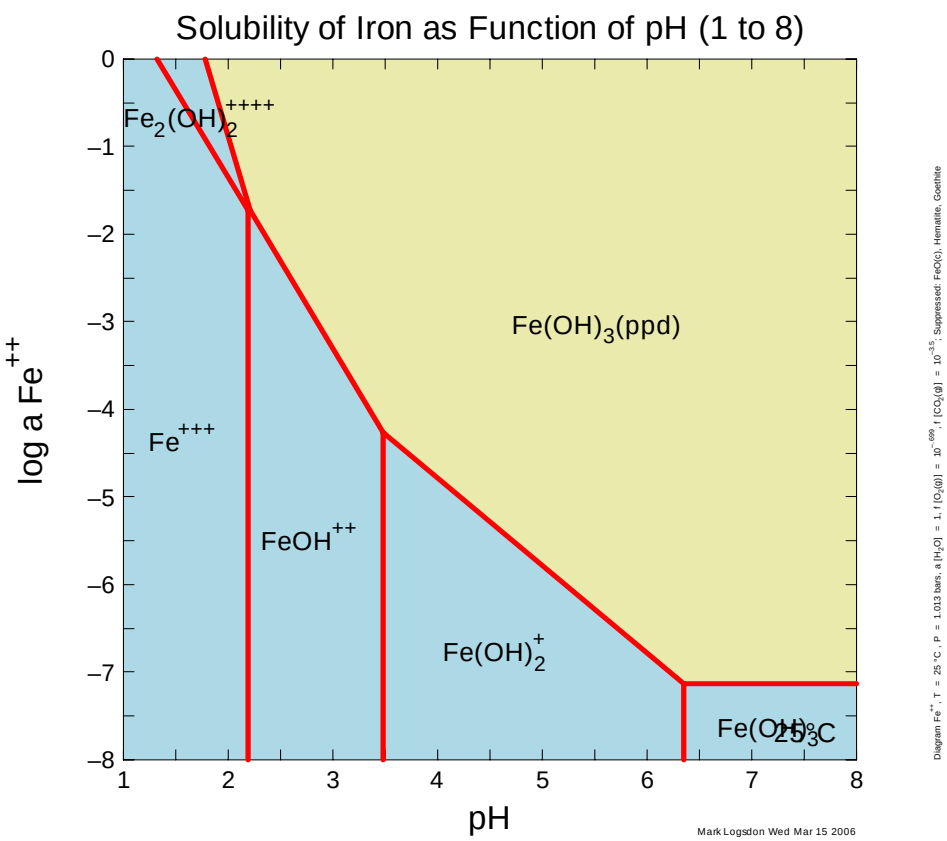
Note the large-scale zonal structure of propylitic alteration outside the pervasive QSP (or phyllic) alteration, with a marginal argillic zone, just as shown in Lowell and Guilbert (Figure 12). Skarn, including calc-silicate hornfels (see Appendix A, Worksheet Summary), is associated with the interaction of the hydrothermal system with the Paleozoic carbonate section. The orientation of the alteration halo with respect to the intrusive body (TKg in Manske and Paul's figure) is that shown by Titley (Figure 11).

Resolution is, in all these controlling features, a classic Arizona porphyry copper. We may, therefore, use the very large body of data concerning Arizona porphyries developed over the last 40 years to evaluate the likely geologic and geochemical behavior of the resolution ore deposit, including the rocks that will be developed for Shaft No. 10.

6.3 Relationship of Acid Generation to Metals Mobility

More than 90% of the sulfide minerals in development rock for Resolution will be the simple sulfide, Pyrite (FeS_2). The oxidation of pyrite[4] is therefore the dominant reaction capable of producing acidic solution (per Equation [1], section 4.0 above). The significance of acid drainage, were it to occur, is that trace metals are mobile under acidic conditions Figure 14).

Figure 14 The effect of pH on metal solubility, illustrated using Iron (Fe). Figure calculated by Geochimica for this study using Act2 (Bethke, 1997, 2006). Brown field is range of insoluble solids; blue colors the aqueous fields. Between pH 3 and 6 (the common range for effluents form porphyry copper deposits) the solubility of iron falls by four orders of magnitude. Text to right of figure summarizes formal constraints for calculation of the activity diagram[5].



[4] It sometimes is thought (and some elementary texts state) that bacteria are needed to oxidize sulfides. This is not correct. Pyrite oxidation in rock piles always is initiated by molecular oxygen (O_2). If the pH of the system falls to the point where Fe(III) is present in solution, it may also oxidize pyrite with or without O_2. Essentially all bacteria involved in acid-rock drainage function to catalyze the oxidation of Fe(II) to Fe(III), which is the rate-determining step in stoichiometric reaction [1] above. Therefore, appropriate bacteria may catalyze the rates of ARD production, but they are not necessary to pyrite oxidation, and they do not themselves oxidize the pyrite that leads to ARD (Stumm and Morgan, 1996; Nordstrom, 2003).

[5] "Diagram Fe^{++}, T= 25° C, P = 1.013 bars; a [H_2O] = 1, f[O_2(g)] = $10^{-0.699}$, f[CO_2(g) = $10^{-3.5}$; suppressed FeO(c), Hematite. Goethite."

Between pH 3 and 6 (the common range for effluents from porphyry copper deposits) the solubility of iron falls by four order of magnitude; similar solubility curves exist for all transition metals. Metal attenuation by surface reactions ("sorption") also is pH-sensitive, with sorption of cationic species generally increasing as conditions become less acidic (Bethke, 1997; Smith, 1999).

Therefore, the fundamental geochemistry of metals, the principal source of risk to human health and the environmental in contaminated mining waters, is related to the risk of acid generation.

6.4 Acid-Base Balance in Shaft No. 10

The fundamentals of acid-base chemistry for the Shaft No. 10 rocks are summarized in Figures 3 to 6. To recapitulate, the two fundamental chemical reactions that summarize acid-base accounting are reaction [1] and [2] in Section 4.0 above:

[1] $FeS_2 + 15/4\ O_2 + 7/2\ H_2O \rightarrow Fe(OH)3 + 2\ SO_4^{2-} + 4\ H^+$

[2] $H_2SO_4 + CaCO_3 \rightarrow H_2CO_3 + CaSO_4$

The two reactions are written as unidirectional (not as reversible equilibria) to emphasize that in the rock-pile environment, the flow of water through the piles generates an irreversible reaction system.

Reaction [1] is written, as is conventional for ABA calculations (e.g. Sobek et al., 1978; White et al, 1999), with the reaction product being ferric hydroxide, $Fe(OH)_3$. Depending on details of the rocks and their chemical evolution, especially if (as is common in porphyry copper systems) there is labile K+ in the system, the actual product phase may be jarosite, $KFe_3(SO_4)_2(OH)_6$. Figure 15, a photomicrograph of porphyry copper undergoing weathering in southwestern United States, and Figure 16, a field-scale photograph of jarosite precipitating in phyllically-altered rock pile at a porphyry copper, demonstrate that the hypothesized reactions do in fact occur.

Figure 3 above shows that there is a decided spatial structure to the distribution of Sulfide-sulfur. Above 1,633 m bgs, sulfide concentrations are extremely low, whereas below 1,633 m bgs, sulfide concentrations typically exceed 1% and may range above 20% by weight. As shown by Reaction [1], the <u>hazard</u> associated with acid-rock drainage is sulfide sulfur (as pyrite at Resolution as well as at other porphyry copper deposits). The statistical data for Sulfide-sulfur in the geologic units of the Pilot Hole confirm the spatial analysis of Figure 3, as shown by Figure 17, a box-and-whiskers plot (Tukey, 1977).

Figure 4 shows that there is Neutralization Potential widely, but not universally, distributed in the section. Note the high values in the Whitetail Conglomerate (Tw). Figure 5, the distribution of Neutralization Potential Ratio (NPR) with depth, shows the same spatial structure as does Figure 3, which implies that the risk of acid-generation is driven by the

Figure 15 Altered pyrite in QSP-altered porphyry-copper. The bright white mineral is pyrite; light-grayish rim is hydronium jarosite, which also cements fragments at right. (Reflected light; Field of view 3 cm. Jambor 2005)

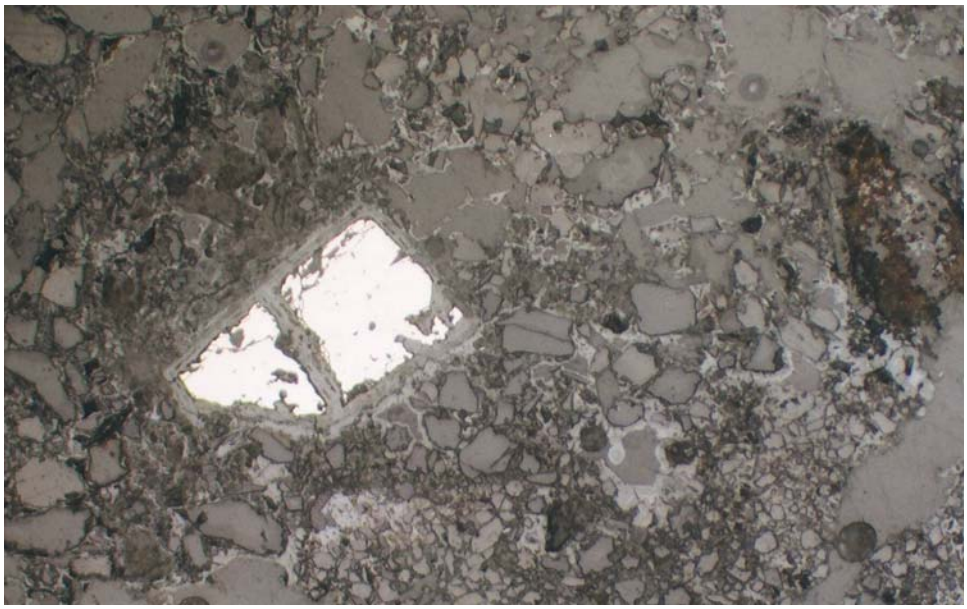
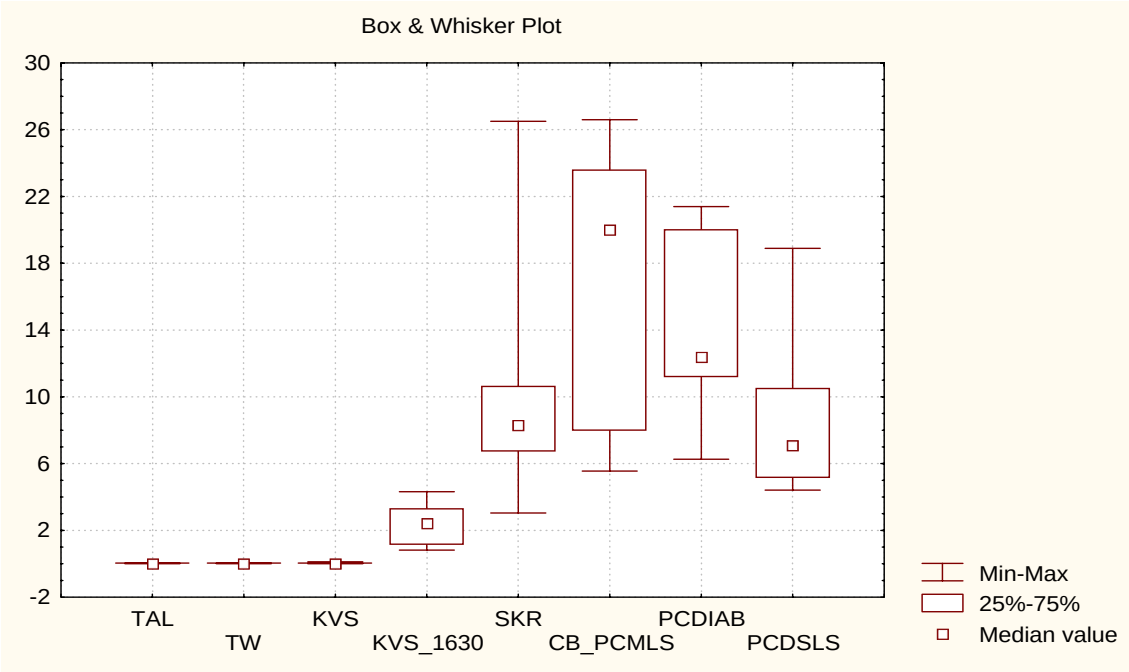


Figure 16 Dipping, very coarse grained layer surrounded by finer grained layers, ca. 6 m below dump crest. Yellowish discoloration of the coarse later, extending laterally into the finer grained layers, is secondary jarosite. Field of view is approximately 1.5 m in each dimension. Photo April, 2005.

amount of sulfide-sulfur present (Figures 3 and 17). Even though there is abundant residual NP in some of the deep carbonate formations (Figure 4), in those units it is not adequate to offset the Acid Generation Potential derived from the very high sulfide-sulfur values in those units (see medians and inter-quartile ranges in Figure 17).

Figure 17 Statistical data summary, Sulfide-Sulfur. Data for Kvs-Ks is divided into those at or above 1,633m bgs ("Kvs") and those below 1,633m ("Kvs_1,633"). Y-axis in wt% Sulfur.



TAL: Apache Leap Tuff; TW" Whitetail Conglomerate; KVS: Cretaceous volcaniclastics and sediments; Skr: Skarns in Paleozoic carbonates; CB_PCMLS: Bolsa Quartzite and upper Precambrian sedimentary rocks; PCDIAB: Precambrian diabase; PCDSLS: Precambrian Drippings Springs Formation

Figure 6, the NP and AP (MPA) relationship, and Figure 8, the relationship of NNP to NAGpH, confirm that almost all samples fall into classes that are clearly expected to be acid-generating or clearly non-acid-generating. When the plots include (as do Figures 6 and 8) identifications of the geologic units, it is clear that these figures also express the shallow-deep division seen in Figures 3, 5 and 17. The few (~5% of total tested intervals) that are classified on these plots as "uncertain" are easily explained as being samples from the skarnified units that contain residual calcite. In such samples the single-addition NAG test used for this study may be dominated by the short-range reactivity of the carbonates and not reflect the full acidification potential of the massive sulfide portion of the skarn (Miller et al., 1990). Geochemical and industry experience dictate that the very high sulfide contents would generate high TDS (dominated by dissolved sulfate) waters, capable of adversely affecting groundwater, even before the samples became acid generating. In light of this and also their position in the mining sequence, RCM would treat all such "uncertain" samples as if they would become acid-generating.

The data clearly show that, because they contain *de minimis* levels of sulfide-sulfur, rocks above 1,633m bgs have no risk of generating acidic leachates to ground water.

6.5 Leachable Metals in Shaft No. 10

Leaching the Pilot Hole samples with synthetic precipitation (US EPA Method 1312) produces a spatial pattern (Figure 9) that is entirely consistent with expectation based on the ARD potential discussed in Section 6.4 above. Key statistics for the Method 1312 leachates are summarized in Table 2 for all samples < 1,633 m bgs. All data and statistics are presented in Appendix C.

Table 2a Method 1312 Data, ***samples from Surface to 1,633 m bgs*** - Parameters with AWQS values (Concentrations and AWQS values in mg/L; Cu has no AWQS, the 1.3 mg/L value is Federal SDWA "action level"; Be, Cr, F, Hg, and Ag all < limit of detection (lod) for all values where lod < AWQS, thus omitted)

	Sb	**As**	**Ba**	**Cd**	**Cu**	**Pb**	**Se**	**Tl**
n	34	34	34	34	34	34	34	34
n>lod	2	20	22	1	6	21	12	4
%>lod	6%	59%	65%	3%	18%	62%	35%	12%
Min	<0.0002	<0.0005	<0.003	<0.00005	<0.01	<0.0001	<0.0001	<0.0001
10%	<0.0002	<0.0005	<0.003	<0.00005	<0.01	<0.0001	<0.0001	<0.0001
25%	<0.0002	<0.0005	<0.003	<0.00005	<0.01	<0.0001	<0.0001	<0.0001
Median	<0.0002	0.00065	0.025	<0.00005	<0.01	0.0006	<0.0001	<0.0001
75%	<0.0002	0.0013	0.25	<0.00005	<0.01	0.0016	0.00087	<0.0001
90%	<0.0002	0.0026	0.45	<0.00005	0.02	0.0029	0.003	<0.0001
Max	0.0007	0.046	1.05	0.0002	0.044	0.007	0.0036	0.0004
AWQS	0.006	0.05	2	0.005	1.3	0.05	0.05	0.002
100xAWQS	**0.6**	**5**	**200**	**0.5**	**130**	**5**	**5**	**0.2**

Table 2b Method 1312 Data, ***samples from Surface to 1,633 m bgs*** – Additional Parameters of Interest (concentrations in mg/L except Gross α in pCi/L). These parameters have no AWQS criteria; Gross α and U have MCL values, as shown.

	Gross α	**Fe**	**Mn**	**Mo**	**SO_4**	**U**	**Zn**
n	34	34	34	34	34	34	34
n>lod	31	30	21	3	7	7	21
%>lod	91%	88%	62%	9%	21%	21%	62%
Min	0	<0.02	<0.005	<0.01	<10	<0.0001	<0.01
10%	0.569	<0.02	<0.005	<0.01	<10	<0.0001	<0.01
25%	0.957	0.05	<0.005	<0.01	<10	<0.0001	<0.01
Median	1.85	0.16	0.027	<0.01	<10	<0.0001	0.035
75%	3.425	1.23	0.385	<0.01	<10	<0.0001	0.077
90%	5.61	4.84	0.059	<0.01	27	0.0004	0.11
Max	34	9.55	0.12	0.07	160	0.00057	0.26
MCL	15					0.03	
100 x MCL	**150**					**3**	

Rocks on the no. 10 Shaft at and above 1,633m do not leach concentrations of solutes in the SPLP test that reach levels of significance. The statistics assembled in Table 2 explain why

Figure 9 plots only Fe and SO4 concentrations. All other metals and metalloids are at or close to detection levels and below water-quality standards in all tests.

Although it is not a standard regulatory test, this program also evaluated the metals concentrations in the NAG leachates. Those data are included in Appendix C, and the Fe and SO_4 values also are shown on Figure 9, matching the spatial pattern of the Method 1312 leachates.

6.6 Total Metals in Shaft No. 10

All data on total metals concentrations are provided in Appendix D.

As shown in Figure 10, the only samples in which any metals approach or exceed 1 wt% are in the section below 1,633 m bgs, and only Cu and Zn (among trace metals) exceed 1% in any sample. These two metals are elevated in the skarn zones, which is expected for the reactivity of carbonate-bearing sequences and fully consistent with other Arizona porphyry copper systems (E.g., Einaudi, 1983).

Measurable concentrations of metals and other species exist in most of the samples, but the leachability, discussed in Section 6.5 above, is extremely limited.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Geochemical Reactivity

Geochemical reactivity that could adversely affect water quality in rocks to be mined during sinking of Shaft No. 10 is limited to rocks below 1,633 m bgs. At and above 1,633 m bgs, there is no discernible risk of acid generation, leachable metals (by Method 1312) are not a risk, and total metal concentrations are very low. Below 1,633 m bgs, sulfide concentrations are elevated (> 1 wt%), there are elevated total metals present, and metals and some metalloids are leachable under synthetic precipitation testing (Appendix C and Figure 9).

7.2 Controls on Geochemical Reactivity

The controls on geochemical reactivity are very clear: sulfide mineralization and hydrothermal alteration that has depleted the Neutralization Potential compared to the Acid-Generation Potential. This is entirely consistent with other porphyry-copper systems in Arizona and around the world, and is expected for a geo-environmental model of porphyry coppers (e.g., du Bray, 1995, Plumlee et al., 1999).

The upper 1,000 m of the system is unmineralized rock deposited millions of years after the ore-forming event. The Whitetail Conglomerate, particularly, contains substantial secondary carbonate, but neither it nor the Apache Leap Tuff have sulfide-sulfur at more than de minimis levels. Because Shaft No. 10 will be peripheral to the ore deposit (by more than a kilometer), the observed hydrothermal alteration and mineralization is very low compared to the rocks of the ore deposit itself. Therefore, the initial 600 m of the Cretaceous rock encountered in shaft sinking will be propylitized (adding Neutralization Potential), but very

low in sulfide-sulfur. The empirical data are completely consistent with the largely symmetrical nature of porphyry-copper systems, as discussed in detail in Section 6.2 above.

7.3 "Inert" Material

Based on the geochemical test work, and evaluated in terms of the geologic and geo-environmental model for a porphyry copper system, Geochimica recommends that development rock from ground surface to 1,633 m bgs in Shaft No. 10 be considered "inert" in the sense of ADEQ 2006 guidance. Because of the very clear geologic and mineralogical break that distinguishes the upper, inert section from the lower reactive section, visual observation by a trained geologist or geological technician would be adequate to confirm that mined rock from ground surface to 1,633m bgs in fact corresponds to the rock tested in the Pilot Hole.

We recommend that rocks below 1,633 m bgs in Shaft No. 120 and in break-out zones from the base of the shaft that are in equivalent lithologies should be treated as geochemically reactive with respect to potential impacts to groundwater were they placed in rock piles at the ground surface. A separate APP application will be prepared for reactive rock below 1,633 m bgs in Shaft No. 10. Such rock will not be encountered for at least two years after shaft-sinking commences, and so does not need to be addressed at this time.

7.4 Application of This Methodology to Future RCM Excavations

The identification of 1,633 m bgs as a reliable boundary for distinguishing inert rock from geochemically reactive rock that needs to be managed under the Aquifer Protection Permitting Program is specific to Shaft No. 10. The geology of the overall Resolution Project site is reasonably consistent, but not identical in all respects at all places.

Therefore Geochimica recommends, and understands that RCM agrees, that future shafts and other excavations will require project-specific geochemical characterization analogous to the approach used for the Shaft No. 10 characterization.

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APPENDIX G
HUMIDITY CELL TEST RESULTS

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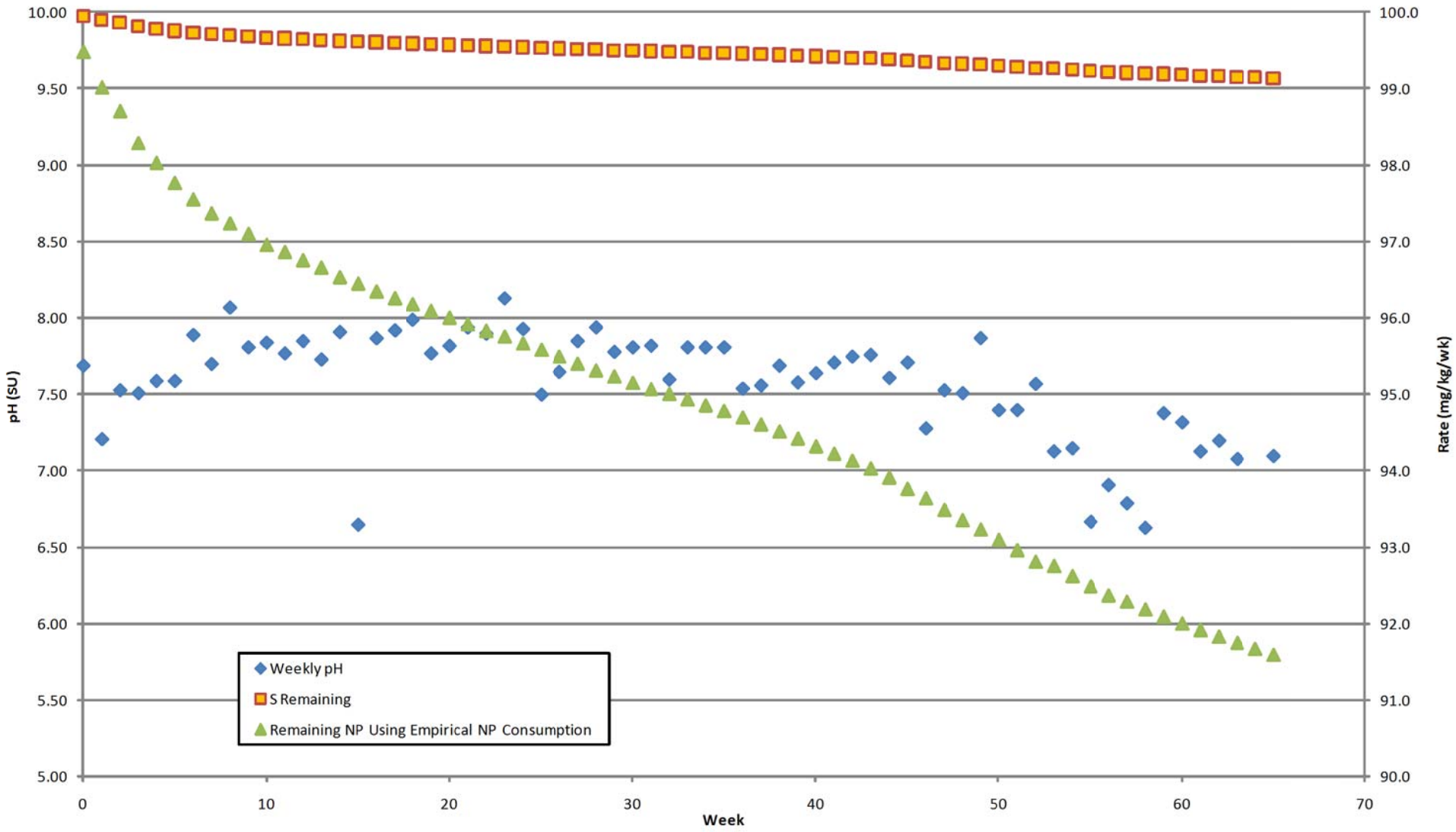

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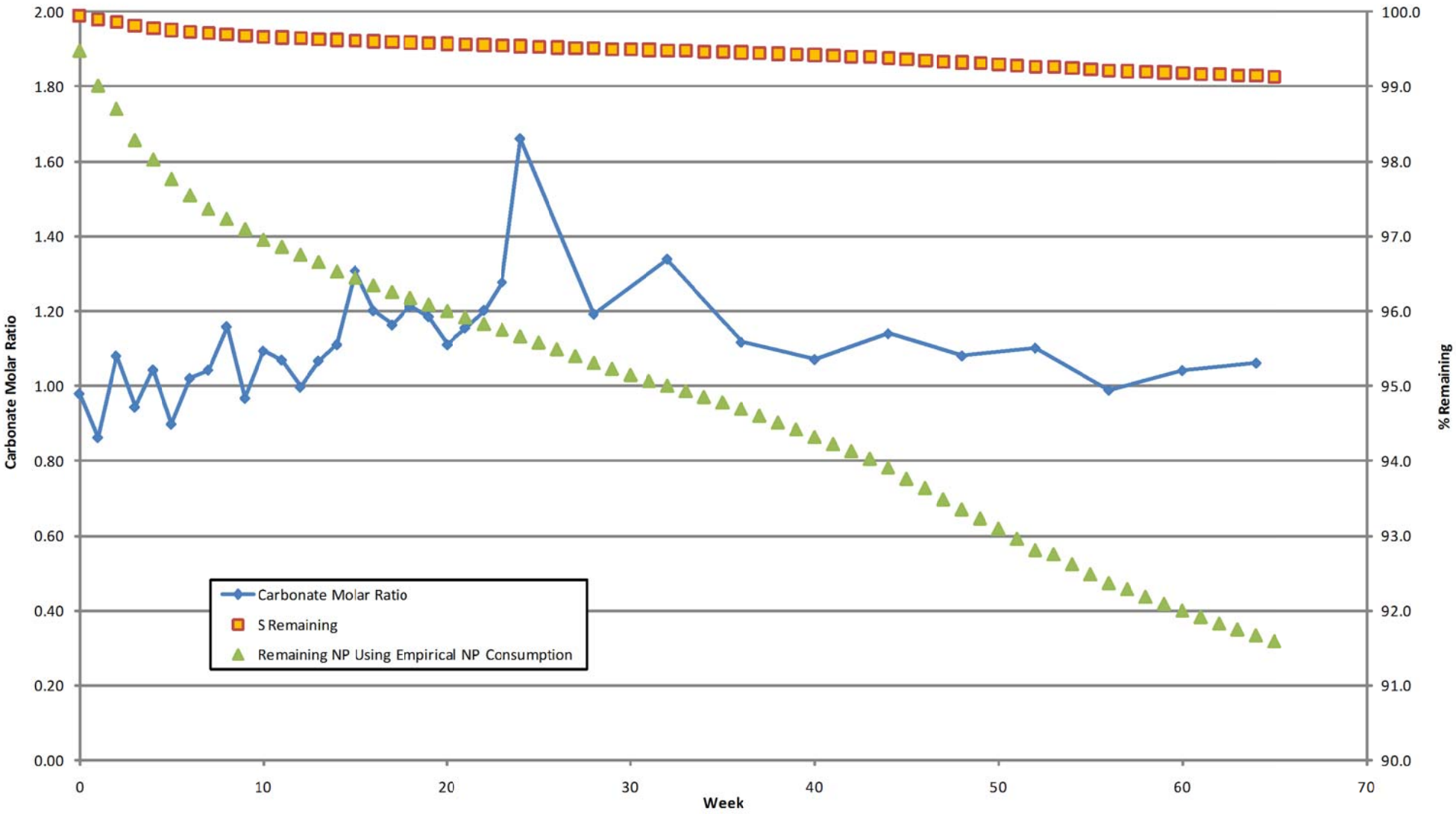

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

HUMIDITY CELL TEST 34
CARBONATE MOLAR RATIO
CRETACEOUS VOLCANICLASTICS

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C101
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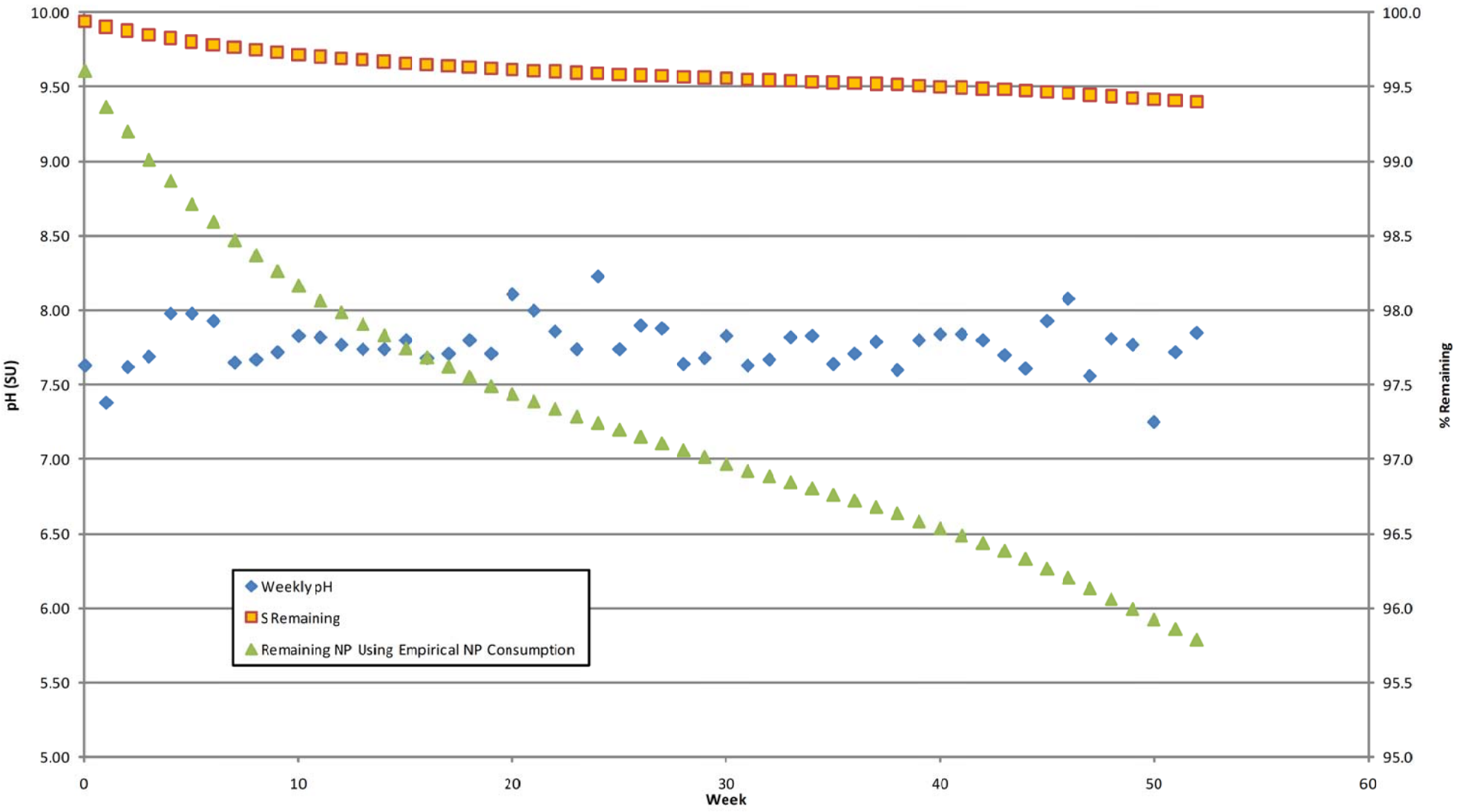

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

HUMIDITY CELL TEST 35
WEEKLY pH
CRETACEOUS DETRITAL SEDS/TOP OF SKARN DEVELOPED IN PALEOZOIC CARBONATES

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C101
DESIGN	MJG	02/18/11	SCALE NA	REV. A
CADD	NIL	02/18/11		
CHECK	OM	02/21/11		
REVIEW	MJG	03/16/11		

FIGURE G-3

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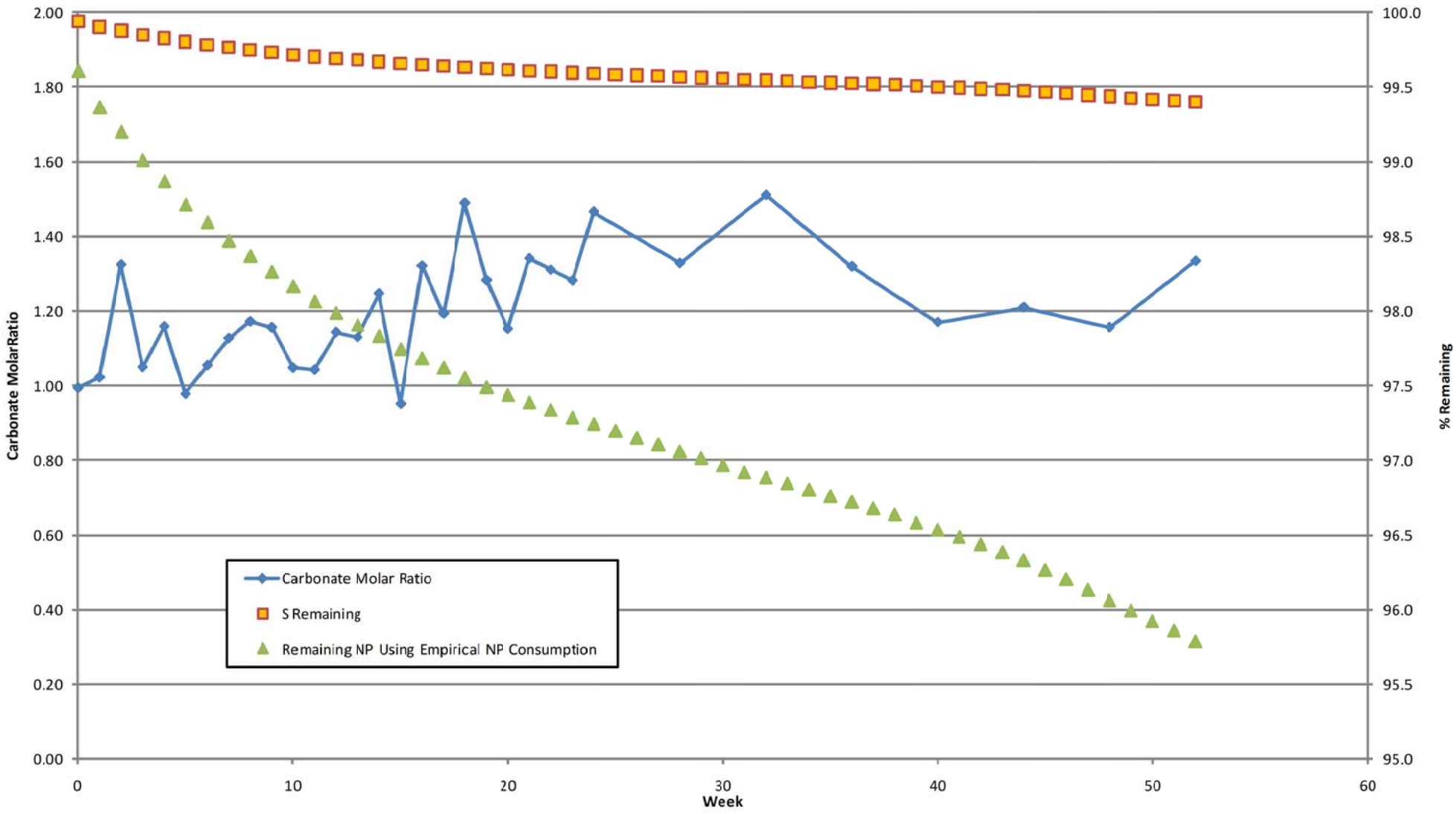

PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

TITLE

HUMIDITY CELL TEST 35
CARBONATE MOLAR RATIO
CRETACEOUS DETRITAL SEDS/TOP OF SKARN DEVELOPED IN PALEOZOIC CARBONATES

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C101
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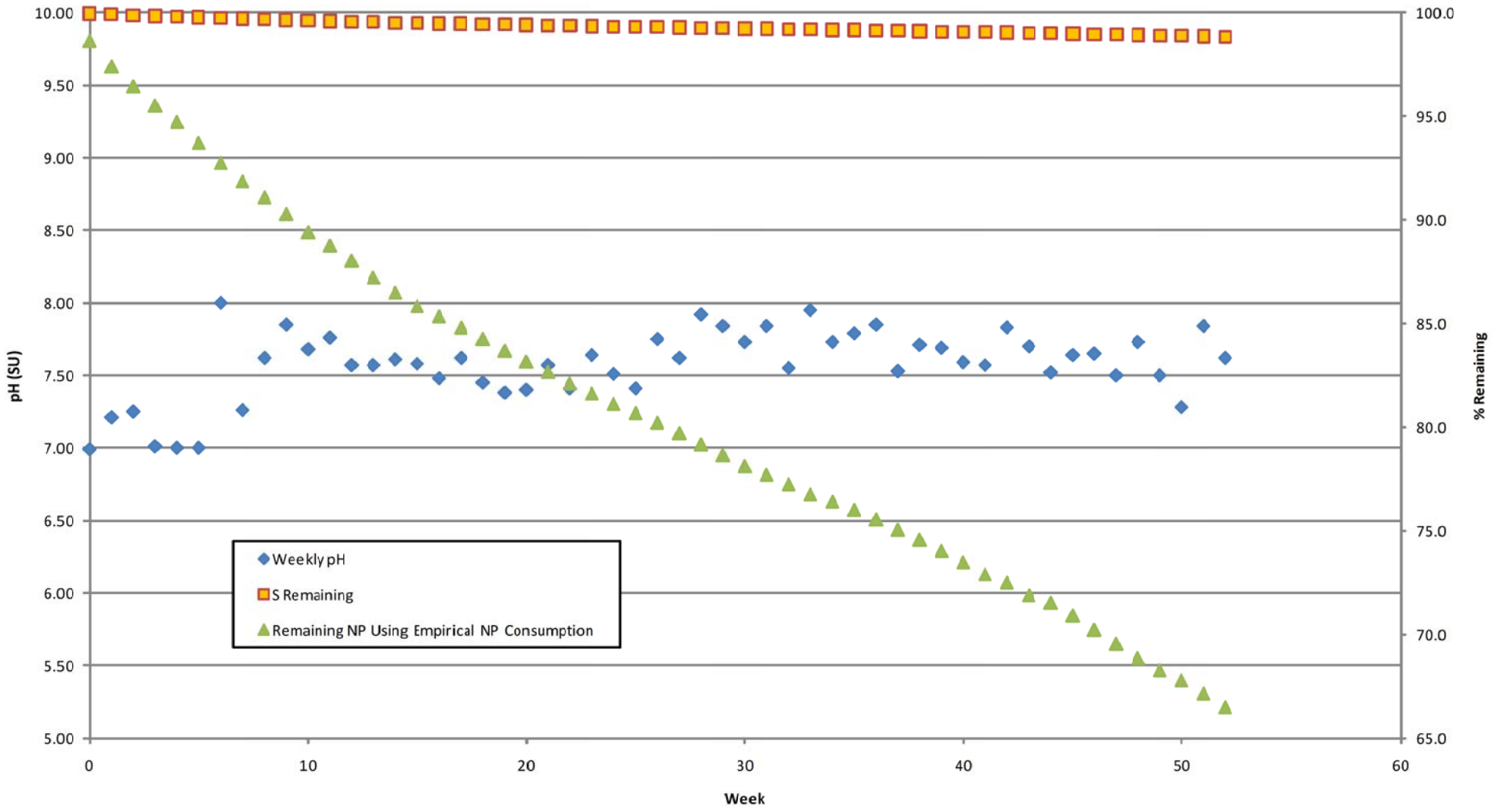

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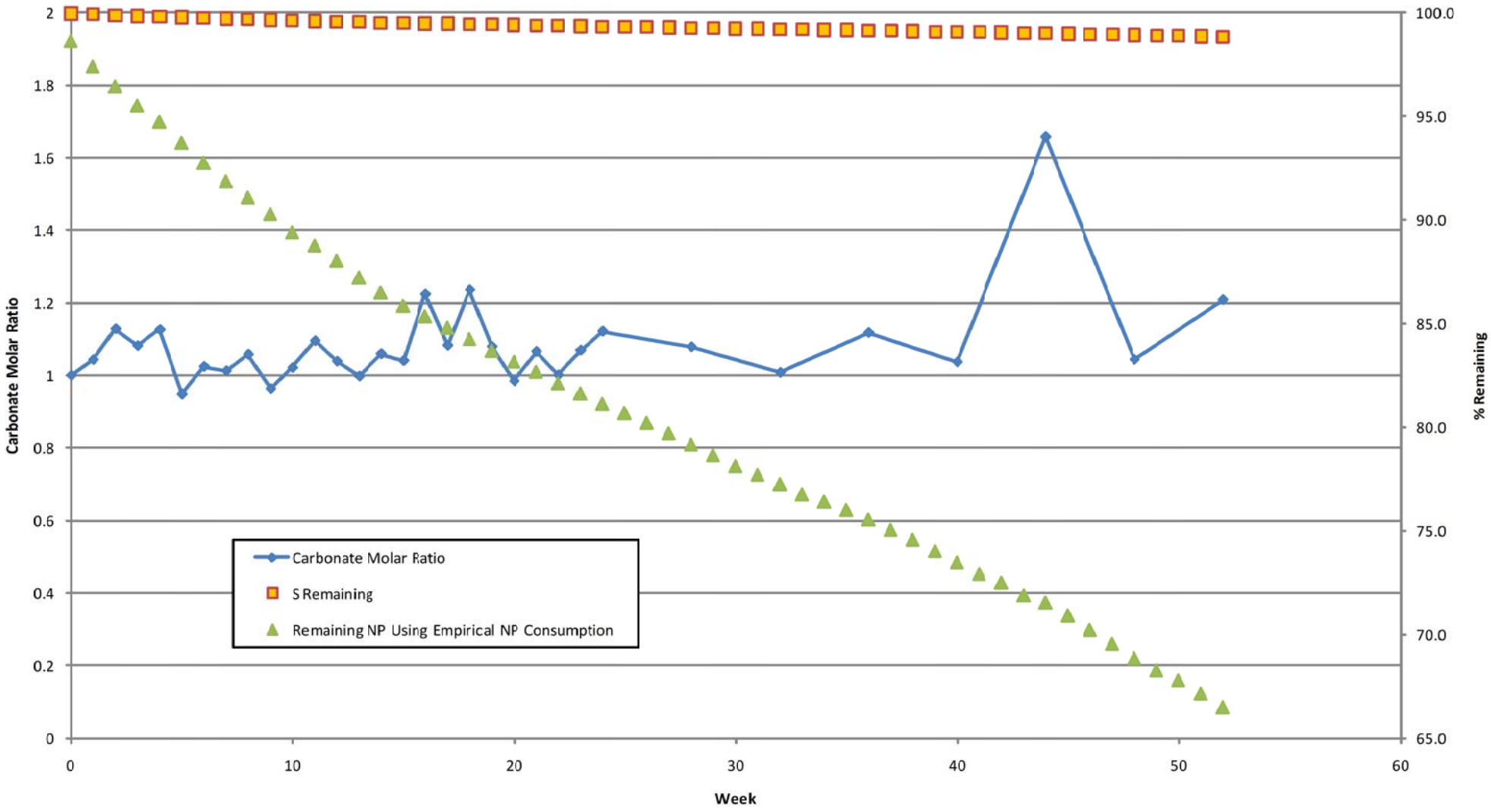
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**HUMIDITY CELL TEST 36** **WEEKLY pH** **ANNEALED FAULT BRECCIA/** **CAMBRIAN BOLSA QUARTZITE**	Golder Associates	PROJECT No. 093-92581 DESIGN MJG 02/18/11 CADD NIL 02/18/11 CHECK OM 02/21/11 REVIEW MJG 03/16/11	FILE No. 09392581C101 SCALE NA REV. A **FIGURE G-5**

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 10:58am



PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

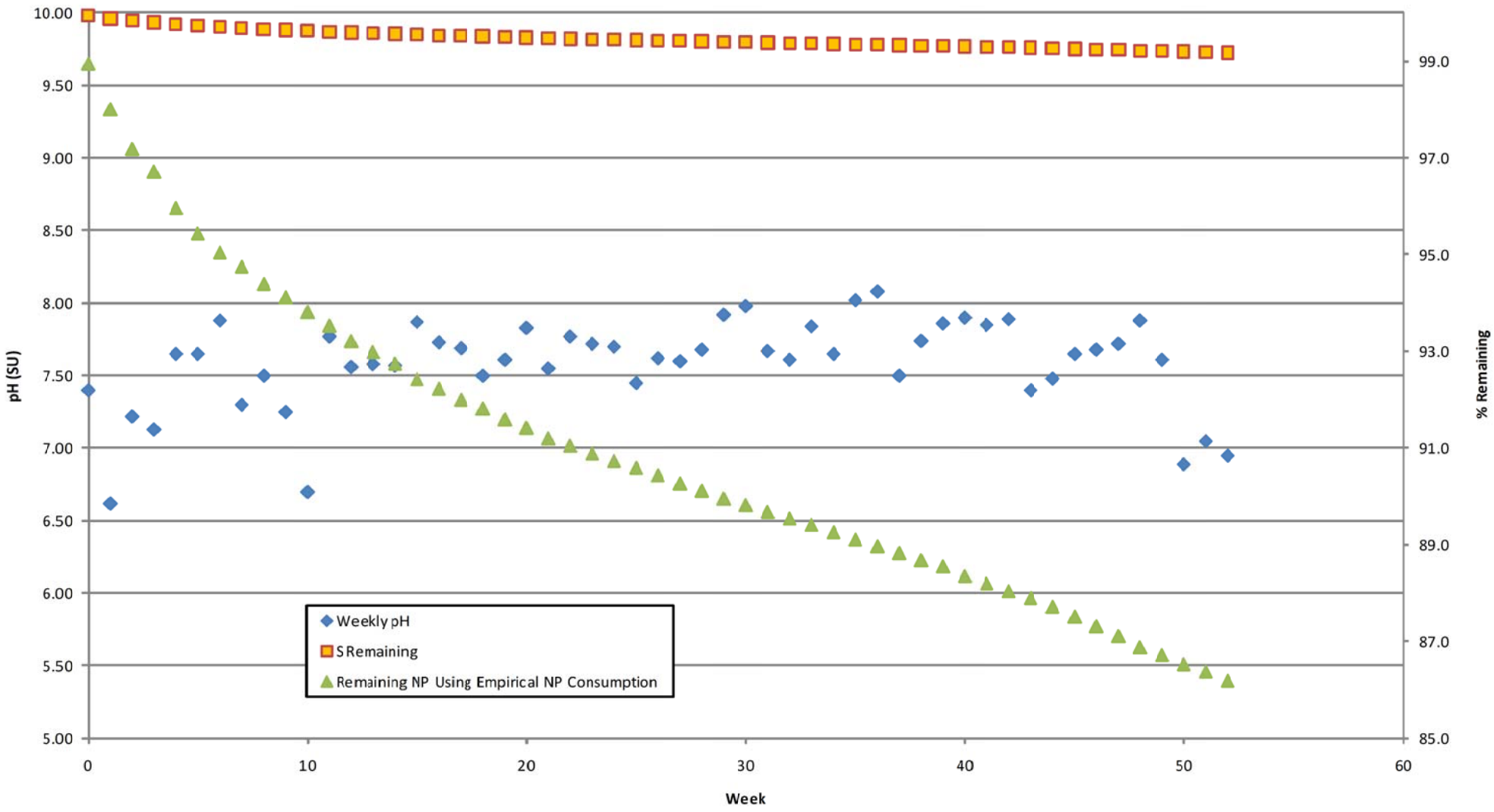
TITLE

HUMIDITY CELL TEST 36
CARBONATE MOLAR RATIO
ANNEALED FAULT BRECCIA/
CAMBRIAN BOLSA QUARTZITE

Golder Associates

PROJECT No.	093-92581		FILE No.	09392581C101
DESIGN	MJG	02/18/11	SCALE NA	REV. A
CADD	NIL	02/18/11	**FIGURE G-6**	
CHECK	OM	02/21/11		
REVIEW	MJG	03/16/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 10:58am



PROJECT

Resolution Copper Mining

DEVELOPMENT ROCK STOCKPILE
AQUIFER PROTECTION PERMIT APPLICATION
WEST PLANT SITE, SUPERIOR MINE
SUPERIOR, ARIZONA

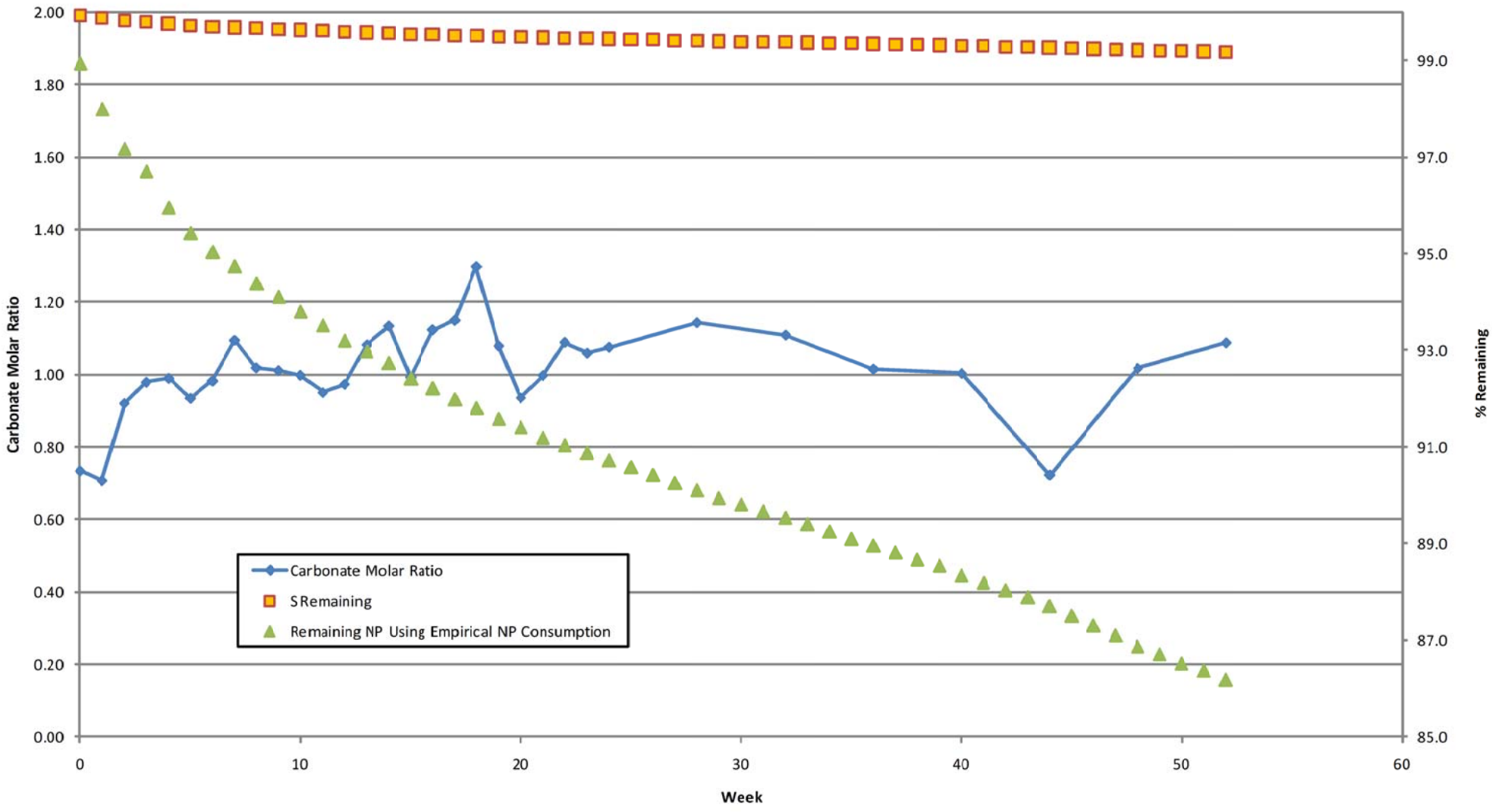
TITLE

HUMIDITY CELL TEST 37
WEEKLY pH
PRECAMBRIAN DIABASE

Golder Associates

PROJECT No.		093-92581	FILE No.	09392581C101
DESIGN	MJG	02/18/11	SCALE NA	REV. A
CADD	NIL	02/18/11	**FIGURE G-7**	
CHECK	OM	02/21/11		
REVIEW	MJG	03/16/11		

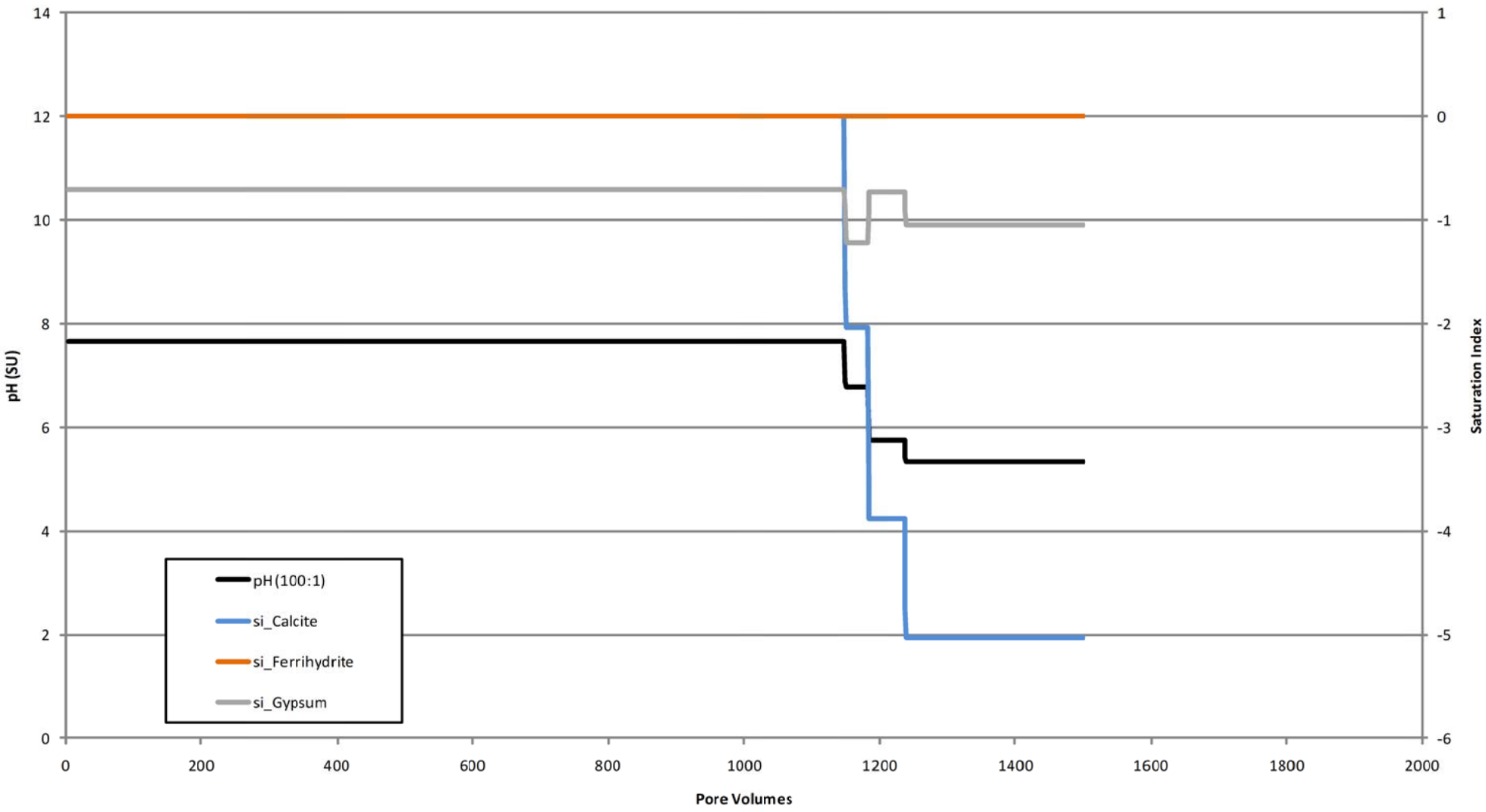
Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 11:00am



PROJECT	TITLE		
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**HUMIDITY CELL TEST 37** **CARBONATE MOLAR RATIO** **PRECAMBRIAN DIABASE**	Golder Associates	

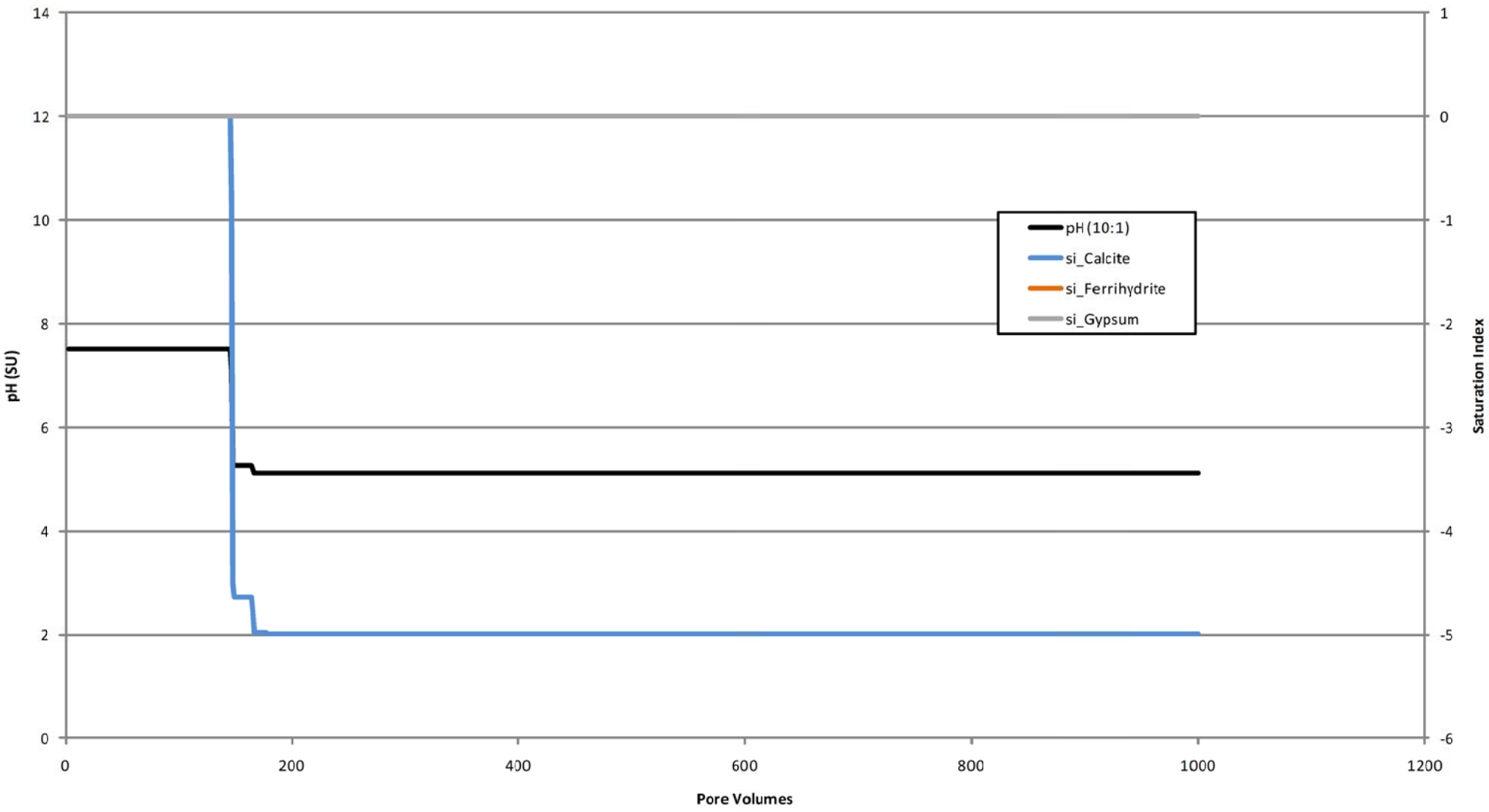
PROJECT No.	093-92581	FILE No.	09392581C101	
DESIGN	MJG	02/18/11	SCALE NA	REV. A
CADD	NIL	02/18/11	**FIGURE G-8**	
CHECK	OM	02/21/11		
REVIEW	MJG	03/16/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 11:00am



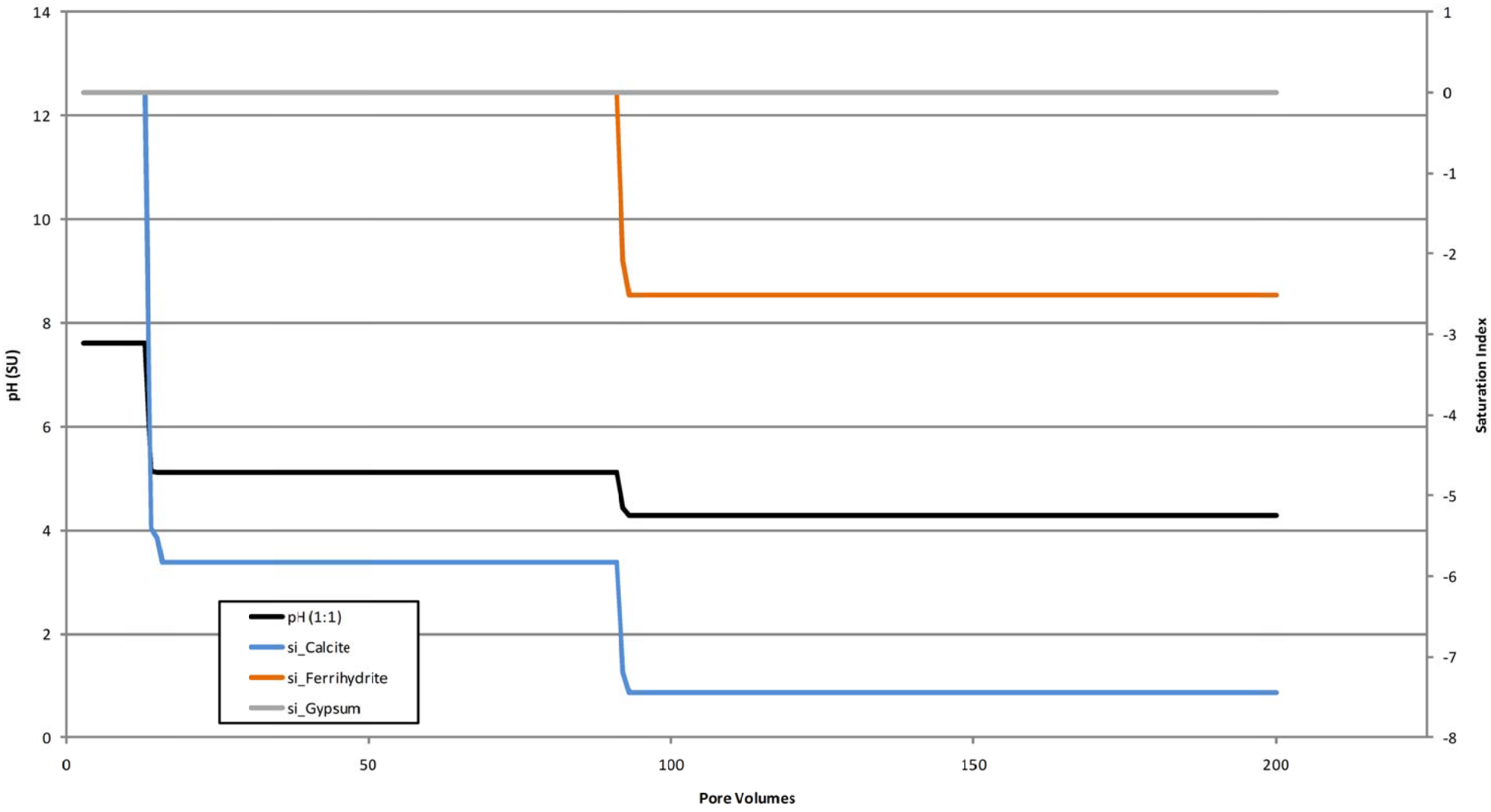
PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**ADVECTION OF WEIGHTED AVERAGE NAG (100:1 H_2O:ROCK)**	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C101	
			DESIGN MJG 02/18/11	SCALE NA REV. A	
			CADD NIL 02/18/11	**FIGURE G-9**	
			CHECK OM 02/21/11		
			REVIEW MJG 03/16/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 11:01am



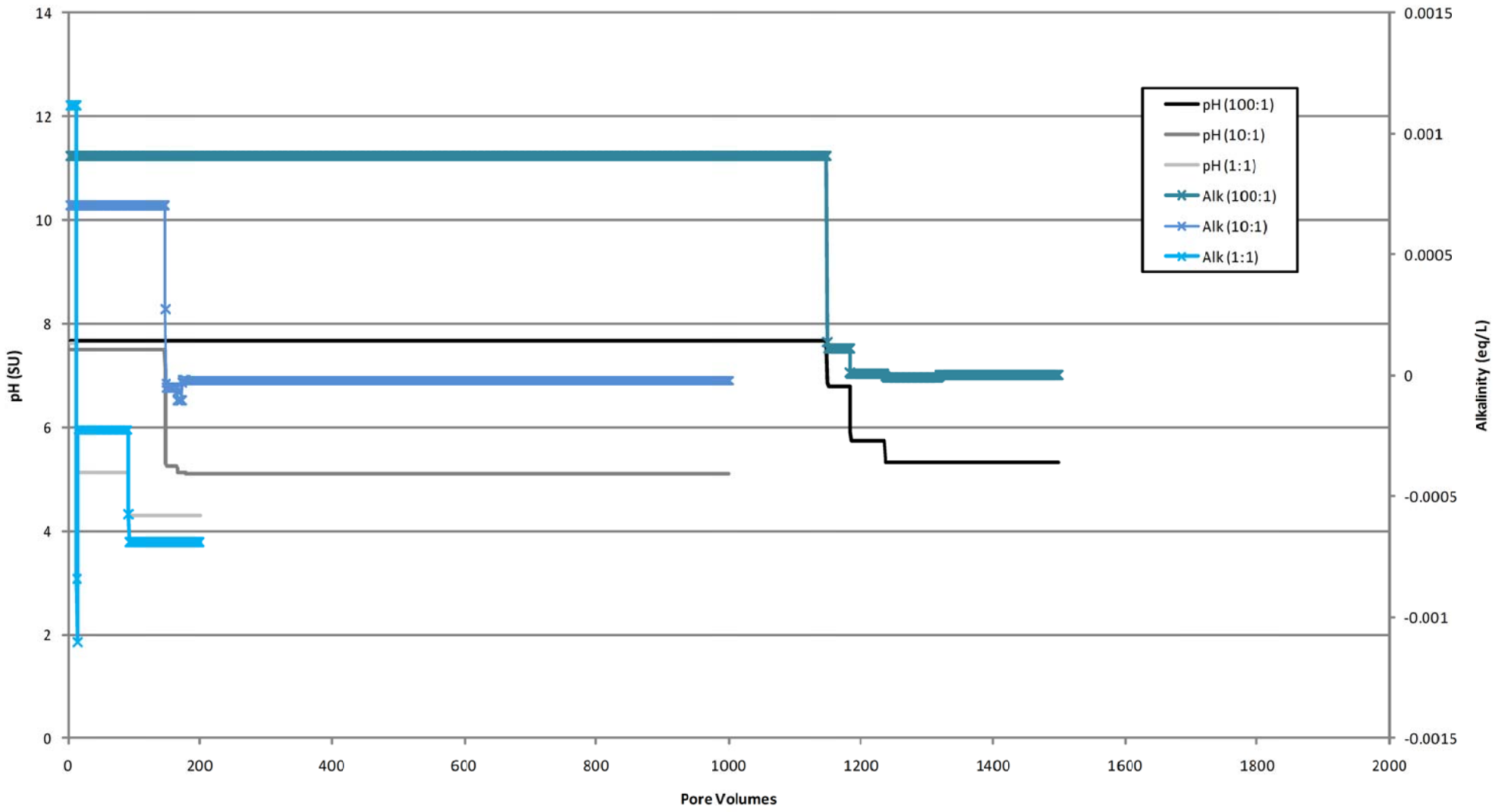
PROJECT	TITLE			
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**ADVECTION OF CONCENTRATED WEIGHTED AVERAGE NAG ($10:1\ H_2O$:ROCK)**	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C101
			DESIGN MJG 02/18/11	SCALE NA REV. A
			CADD NIL 02/18/11	**FIGURE G-10**
			CHECK OM 02/21/11	
			REVIEW MJG 03/16/11	

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 11:05am



PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	**ADVECTION OF CONCENTRATED WEIGHTED AVERAGE NAG (1:1 H_2O:ROCK)**	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C101	
			DESIGN MJG 02/18/11	SCALE NA REV. A	
			CADD NIL 02/18/11	**FIGURE G-11**	
			CHECK OM 02/21/11		
			REVIEW MJG 03/16/11		

Drawing file: K:\2009 Projects\093-92581 RCML Reactive Rock Permitting\C - APP\09392581C101.dwg Mar 16, 2011 - 11:05am



PROJECT	TITLE				
Resolution Copper Mining DEVELOPMENT ROCK STOCKPILE AQUIFER PROTECTION PERMIT APPLICATION WEST PLANT SITE, SUPERIOR MINE SUPERIOR, ARIZONA	pH vs ALKALINITY	Golder Associates	PROJECT No. 093-92581	FILE No. 09392581C101	
			DESIGN MJG 02/18/11	SCALE NA REV. A	
			CADD NIL 02/18/11	FIGURE G-12	
			CHECK OM 02/21/11		
			REVIEW MJG 03/16/11		

APPENDIX H
DISCHARGE CHARACTERIZATION INPUT FILES

APPENDIX H-1
NAG LEACHATE SPECIATION

```
TITLE RES-008A 1,717-1,720 m bgs core NAG water quality 9/22/09
SOLUTION 1
pH 2.5
temp 25
density 1
units mg/L
Al 22.5
Ba 0.26
Cd 0.0035
Ca 50
Pb 0.0119
Mg 8.0
K 16
Se 0.0065
Si 64
Na 2.0
S(6) 680
U 0.0032
END
```

```
TITLE RES-008A 1,844.1-1,846.6 m bgs core NAG water quality 8/25/09
SOLUTION 1
pH 2.6
temp 25
density 1
units mg/L
Al 16.4
Ba 0.03
Cd 0.031
Ca 137
F 15
Pb 0.0064
Mg 18
Mn 0.14
Hg 0.001
K 9.0
Se 0.0283
Si 27
S(6) 1080
Tl 0.0012
U 0.006
END
```

```
TITLE RES-008A 1,979.9-1,982.9 m bgs core NAG water quality 8/25/09
SOLUTION 1
pH 2.5
temp 25
density 1
units mg/L
Al 23.6
Ba 0.04
Cd 0.0038
Ca 122
F 46
Pb 0.012
Mg 16
Hg 0.002
K 10
Se 0.0399
Si 55
S(6) 1170
Tl 0.0008
U 0.0743
END
```

```
TITLE RES-008A 2,053.8-2,056.8 m bgs core NAG water quality
SOLUTION 1
pH 2.2
temp 25
density 1
units mg/L
Al 21.8
Ba 0.07
Ca 54
Co 0.21
F 2.0
Fe 77.6
Pb 0.0085
Mg 12
Mn 1.21
K 8.0
Se 0.0407
Si 37
S(6) 1310
U 0.0012
END
```

APPENDIX H-2
SEEPAGE ADVECTION SIMULATION

```
TITLE RCML Reactive Rock Stockpile Seepage (1:1 H2O:Rock) Advection into Underlying Gila

SOLUTION 99 Reactive Rock Stockpile seepage evaporated to 1:1 H2O:Rock in PHREEQC
temp 25
pH 2.94
pe 3.4
redox pe
units mg/l
density 1
Al 1030
As 0.3091
Ba 0.0009
Be 0.6181
Cd 11.1
Ca 289
Cl 506
Cr 3.78 #assumes CrO4 2-
Co 26.2
Cu 18.4 # from Plumlee et al. 1999
F 701
Fe 10213 #assumes Fe(III)
Pb 1.24
Mg 512
Mn 89.4
Hg 0.0221
Mo 6.19
Ni 3.7 # from Plumlee et al. 1999
K 651
Se 4.17
Si 42.8
Ag 3.21
Na 166
S(6) 25215 charge
Tl 0.0331
U 0.7065
V 1.83
Zn 2.7 # from Plumlee et al. 1999

PHASES
pe_fix
e-=e-
log_k = 0.0

EQUILIBRIUM_PHASES  1 #list of mineral phases expected in wasterock @ RCML from Jake
Waples
Calcite 0   0
Gypsum 0    0
Barite 0    0
Dolomite(disordered) 0  0
Ferrihydrite 0    0
Al(OH)3(am) 0     0
Smithsonite 0     0
Otavite     0     0
Malachite   0     0
Azurite     0     0
Fluorite    0     0
Al4(OH)10SO4      0     0
#AlOHSO4    0     0
Anglesite   0     0
Witherite   0     0
Rhodochrosite     0     0
Magnesite   0     0
Chalcanthite      0     0
Siderite    0     0
Birnessite  0     0
Manganite   0     0
Cerrusite   0     0
Zn(OH)2(gamma)    0     0
```

```
Cr(OH)3(am)  0    0
Cr(OH)3     0     0
#H-Jarosite       0     0
#K-Jarosite  0    0
#Na-Jarosite      0     0
Cu(OH)2     0     0
Brochantite 0     0
# CoCO3     0     0
Ni(OH)2     0     0
SiO2(am-ppt)      0     0
SbO2  0     0
CO2(g) -3.0
pe_fix -3.4 O2(g)

USE Solution 99

SAVE Solution 0

END

SOLUTION 1 #groundwater in contact with Gila Conglomerate at MCC-6C, data collected
3/21/2007; from Groundwater_NS_BrownandCaldwell:Database (Access 2000).
temp      19
pH        8.29
pe        3.4 #from Jake Waples TP5_model_HC, groundwater in contact with the Gila
Conglomerate at Superior, AZ
redox     pe
units     mg/l
density   1
Alkalinity 200
#TDS  520
As    0.013
Ca    25
Cl    20
F     0.57
K     1.4
Mg    3.6
N     0.18
Na    150
Si    31
S(6)  160 charge
-water    1 # kg

PHASES
pe_fix
e-=e-
log_k = 0.0

EQUILIBRIUM_PHASES 1 #presumed Gila Conglomerate mineralogy from Well Installation Report
for New POC and Alert Wells, 073-92522, 11/21/07 and list of mineral phases expected in
wasterock @ RCML from Jake Waples
Calcite 0 3.28 #calculated from an average of XRD values for Gila aquifer cuttings, per
Well Installation Report for New POC and Alert Wells
Gypsum 0    0
Barite 0    0
Dolomite(disordered) 0  0
Ferrihydrite 0    0
Al(OH)3(am) 0     0
Smithsonite 0     0
Otavite     0     0
Malachite   0     0
Azurite     0     0
Fluorite    0     0
Al4(OH)10SO4      0     0
#AlOHSO4    0     0
Anglesite   0     0
Witherite   0     0
Rhodochrosite     0     0
```

```
Magnesite   0     0
Chalcanthite      0     0
Siderite    0     0
Birnessite  0     0
Manganite   0     0
Cerrusite   0     0
Zn(OH)2(gamma)    0     0
Cr(OH)3(am)  0    0
Cr(OH)3     0     0
#H-Jarosite       0     0
#K-Jarosite  0    0
#Na-Jarosite      0     0
Cu(OH)2     0     0
Brochantite 0     0
# CoCO3     0     0
Ni(OH)2     0     0
SiO2(am-ppt)      0     0
SbO2  0     0
CO2(g) -3.0
pe_fix -3.4 O2(g)

ADVECTION
    -cells  1
    -shifts 200
    -print_frequency 1
    -punch_frequency 1

SELECTED_OUTPUT
    -file                 Reactive Rock Stockpile_Leakage1to1.txt
    -distance             false
    -time                 false
    -pH                   true
    -alkalinity           true
    -percent_error        true
    -totals               Cu S(6) Sb As Ba Be Cd Cr F Pb Hg Ni Se Tl Zn
    -equilibrium_phases   Calcite
    -saturation_indices   CO2(g)  Calcite  Ferrihydrite  Gypsum

END
```

```
TITLE RCML Reactive Rock Stockpile Seepage (10:1 H2O:Rock) Advection into Underlying Gila

SOLUTION 99 Reactive Rock Stockpile seepage evaporated to 10:1 H2O:Rock in PHREEQC
temp 25
pH 3.40
pe 3.4
redox pe
units mg/l
density 1
Al 94.9
As 0.0283
Ba 0.0043
Be 0.0565
Cd 1.02
Ca 524
Cl 46.2
Cr 0.3453 #assumes CrO4 2-
Co 2.40
Cu 18.4 # from Plumlee et al. 1999
F 64.1
Fe 934 #assumes Fe(III)
Pb 0.1131
Mg 46.9
Mn 8.17
Hg 0.002
Mo 0.5663
Ni 3.7 # from Plumlee et al. 1999
K 59.9
Se 0.3816
Si 49.9
Ag 0.2939
Na 15.1
S(6) 3499 charge
Tl 0.003
U 0.0646
V 0.1676
Zn 2.7 # from Plumlee et al. 1999

PHASES
pe_fix
e-=e-
log_k = 0.0

EQUILIBRIUM_PHASES  1 #list of mineral phases expected in wasterock @ RCML from Jake
Waples
Calcite 0   0
Gypsum 0    0
Barite 0    0
Dolomite(disordered) 0  0
Ferrihydrite 0    0
Al(OH)3(am) 0     0
Smithsonite 0     0
Otavite     0     0
Malachite   0     0
Azurite     0     0
Fluorite    0     0
Al4(OH)10SO4      0     0
#AlOHSO4    0     0
Anglesite   0     0
Witherite   0     0
Rhodochrosite     0     0
Magnesite   0     0
Chalcanthite      0     0
Siderite    0     0
Birnessite  0     0
Manganite   0     0
Cerrusite   0     0
Zn(OH)2(gamma)    0     0
```

```
Cr(OH)3(am)  0    0
Cr(OH)3     0     0
#H-Jarosite       0     0
#K-Jarosite  0    0
#Na-Jarosite      0     0
Cu(OH)2     0     0
Brochantite 0     0
# CoCO3     0     0
Ni(OH)2     0     0
SiO2(am-ppt)      0     0
SbO2  0     0
CO2(g) -3.0
pe_fix -3.4 O2(g)

USE Solution 99

SAVE Solution 0

END

SOLUTION 1 #groundwater in contact with Gila Conglomerate at MCC-6C, data collected
3/21/2007; from Groundwater_NS_BrownandCaldwell:Database (Access 2000).
temp      19
pH        8.29
pe        3.4 #from Jake Waples TP5_model_HC, groundwater in contact with the Gila
Conglomerate at Superior, AZ
redox     pe
units     mg/l
density   1
Alkalinity 200
#TDS  520
As    0.013
Ca    25
Cl    20
F     0.57
K     1.4
Mg    3.6
N     0.18
Na    150
Si    31
S(6)  160 charge
-water    1 # kg

PHASES
pe_fix
e-=e-
log_k = 0.0

EQUILIBRIUM_PHASES 1 #presumed Gila Conglomerate mineralogy from Well Installation Report
for New POC and Alert Wells, 073-92522, 11/21/07 and list of mineral phases expected in
wasterock @ RCML from Jake Waples
Calcite 0 3.28 #calculated from an average of XRD values for Gila aquifer cuttings, per
Well Installation Report for New POC and Alert Wells
Gypsum 0    0
Barite 0    0
Dolomite(disordered) 0  0
Ferrihydrite 0    0
Al(OH)3(am) 0     0
Smithsonite 0     0
Otavite     0     0
Malachite   0     0
Azurite     0     0
Fluorite    0     0
Al4(OH)10SO4      0     0
#AlOHSO4    0     0
Anglesite   0     0
Witherite   0     0
Rhodochrosite     0     0
```

```
Magnesite   0     0
Chalcanthite      0     0
Siderite    0     0
Birnessite  0     0
Manganite   0     0
Cerrusite   0     0
Zn(OH)2(gamma)    0     0
Cr(OH)3(am)  0    0
Cr(OH)3     0     0
#H-Jarosite       0     0
#K-Jarosite  0    0
#Na-Jarosite      0     0
Cu(OH)2     0     0
Brochantite 0     0
# CoCO3     0     0
Ni(OH)2     0     0
SiO2(am-ppt)      0     0
SbO2  0     0
CO2(g) -3.0
pe_fix -3.4 O2(g)

ADVECTION
    -cells  1
    -shifts 1000
    -print_frequency 1
    -punch_frequency 1

SELECTED_OUTPUT
    -file                 Reactive Rock Stockpile_Leakage10to1.txt
    -distance             false
    -time                 false
    -pH                   true
    -alkalinity           true
    -percent_error        true
    -totals               Cu S(6) Sb As Ba Be Cd Cr F Pb Hg Ni Se Tl Zn
    -equilibrium_phases   Calcite
    -saturation_indices   CO2(g)  Calcite  Ferrihydrite  Gypsum

END
```

APPENDIX H-3
SEEPAGE WATER TYPE

```
TITLE RCML Concentration of NAG Chemistry to 1:1 ratio of H2O:Rock

SOLUTION 0 Composite NAG based on weighted averages per rock type contribution
temp 25
pH 4.38 #weighted average, 1.90 is worst case scenario pH from Pcdiab & Diab
pe 3.4 # reasonable pe for a groundwater (~Eh of 200mV)
redox pe
units mg/l
density 1
Al 9.93
Sb 0.001
As 0.0028
Ba 0.0512
Be 0.0056
Cd 0.1007
Ca 83.7
Cl 4.58
Cr 0.0342 #assumes CrO4 2-
Co 0.2377
# Cu 18.4 # from Plumlee et al. 1999
F 6.35
Fe 92.5 #assumes Fe(III)
Pb 0.0112
Mg 4.64
Mn 0.8094
Hg 0.0002
Mo 0.0561
# Ni 3.7 # from Plumlee et al. 1999
K 6.19
Se 0.0378
Si 21.3
Ag 0.0291
Na 1.50
S(6) 1081.4 charge
Tl 0.0003
U 0.0064
V 0.0166
# Zn 2.7 # from Plumlee et al. 1999

Selected_Output
-file NAG_Scale_1to1.txt
-state false
-distance false
-time false
-step false
-percent_error true
-totals Al As Ba Be Cd Ca Cl Cr Co Cu F Fe Pb Mg Mn Ni Hg Mo K Se Si Ag Na S(6) Tl U V Zn


EQUILIBRIUM_PHASES 0 # List based on "phreeqc model check 10jul08.xls"
# List modified to include Alunite
# List modified to remove Sr, Cu, Zn, Ni phases due to lack of data
    Al(OH)3(am) 0 0
    Al4(OH)10SO4 0 0
    Alunite 0 0
    Anglesite 0 0
#    Azurite   0 0
    Barite    0 0
    Birnessite 0 0
#    Brochantite 0 0
    Calcite   0 0
#    Celestite 0 0
    Cerrusite 0 0
#    Chalcanthite 0 0
    CoCO3     0 0
    CO2(g)  -2 10
#    Cu(OH)2   0 0
    Dolomite(disordered)  0 0
```

```
    Ferrihydrite 0 0
    Fluorite  0 0
#    Goslarite 0 0
    Gypsum    0 0
    H-Jarosite 0 0
    K-Jarosite 0 0
    Na-Jarosite 0 0
    Magnesite 0 0
#    Malachite 0 0
    Manganite 0 0
#    Ni(OH)2   0 0
    Otavite   0 0
    Rhodochrosite 0 0
    Siderite  0 0
    SiO2(am-ppt)  0 0
#    Smithsonite 0 0
    Witherite 0 0
#    Zn(OH)2(gamma) 0 0

REACTION 0
H2O -1.0
55 moles in 1 steps #evaporate 55 moles of H2O, i.e.~100%, leaving 0.55 moles
END
```

```
TITLE RCML Concentration of NAG Chemistry to 10:1 ratio of H2O:Rock

SOLUTION 0 Composite NAG based on weighted averages per rock type contribution
temp 25
pH 4.38 #weighted average, 1.90 is worst case scenario pH from Pcdiab & Diab
pe 3.4 # reasonable pe for a groundwater (~Eh of 200mV)
redox pe
units mg/l
density 1
Al 9.93
Sb 0.001
As 0.0028
Ba 0.0512
Be 0.0056
Cd 0.1007
Ca 83.7
Cl 4.58
Cr 0.0342 #assumes CrO4 2-
Co 0.2377
# Cu 18.4 # from Plumlee et al. 1999
F 6.35
Fe 92.5 #assumes Fe(III)
Pb 0.0112
Mg 4.64
Mn 0.8094
Hg 0.0002
Mo 0.0561
# Ni 3.7 # from Plumlee et al. 1999
K 6.19
Se 0.0378
Si 21.3
Ag 0.0291
Na 1.50
S(6) 1081.4 charge
Tl 0.0003
U 0.0064
V 0.0166
# Zn 2.7 # from Plumlee et al. 1999

Selected_Output
-file NAG_Scale_10to1.txt
-state false
-distance false
-time false
-step false
-percent_error true
-totals Al As Ba Be Cd Ca Cl Cr Co Cu F Fe Pb Mg Mn Ni Hg Mo K Se Si Ag Na S(6) Tl U V Zn


EQUILIBRIUM_PHASES 0 # List based on "phreeqc model check 10jul08.xls"
# List modified to include Alunite
# List modified to remove Sr, Cu, Zn, Ni phases due to lack of data
    Al(OH)3(am) 0 0
    Al4(OH)10SO4 0 0
    Alunite 0 0
    Anglesite 0 0
#    Azurite   0 0
    Barite    0 0
    Birnessite 0 0
#    Brochantite 0 0
    Calcite   0 0
#    Celestite 0 0
    Cerrusite 0 0
#    Chalcanthite 0 0
    CoCO3     0 0
    CO2(g)  -2 10
#    Cu(OH)2   0 0
    Dolomite(disordered)  0 0
```

```
    Ferrihydrite 0 0
    Fluorite  0 0
#    Goslarite 0 0
    Gypsum    0 0
    H-Jarosite 0 0
    K-Jarosite 0 0
    Na-Jarosite 0 0
    Magnesite 0 0
#    Malachite 0 0
    Manganite 0 0
#    Ni(OH)2   0 0
    Otavite   0 0
    Rhodochrosite 0 0
    Siderite  0 0
    SiO2(am-ppt)  0 0
#    Smithsonite 0 0
    Witherite 0 0
#    Zn(OH)2(gamma) 0 0

REACTION 0
H2O -1.0
50 moles in 1 steps #evaporate 50 moles of H2O, i.e. 90%, leaving 5.55 moles

END
```

APPENDIX I
WATER BALANCE ANALYSIS

TECHNICAL MEMORANDUM

Date: February 25, 2011 **Project No.:** 093-92581
To: Michael Grass **Company:** Golder Associates Inc.
From: Christopher Jester
RE: **DETAILED CALCULATIONS FOR DEVELOPMENT ROCK STOCKPILE APP**

1.0 INTRODUCTION

To estimate the rate of discharge of non-stormwater from the placement of the Development Rock Stockpile, a water balance model was developed. The water balance strategy was designed to evaluate net monthly loss or accumulation of water during average mine and climate conditions. Any upgradient surface water runoff will be collected by the new perimeter channel, which will divert the runoff to Apex Tunnel or to Tailings Pond (TP) 6 as described in Section 3.4.2 of this report. The simulation of the stockpile water balance was prepared using an Excel™ spreadsheet program. Deterministic analysis was performed on a monthly basis for the typical year of the life of operations.

The stockpile is buttressed to the west and east by a natural ridge, to the south by TP 6, to the north by Apex Dam. The stormwater infiltration will report to TP 6 as seepage or discharged to the aquifer. All input data used in the water balance model for the Development Rock Stockpile were based on information provided by Resolution Copper Mining, Inc., other approved sources, or similar projects performed by Golder in the southern region of Arizona.

2.0 WATER BALANCE MODEL

Golder developed a water balance to estimate the inflows and outflows to the facility over time. An Average Year scenario was evaluated for this project analysis, which includes the average precipitation, the average evaporation, and normal mine operations. The development of the climatic data (precipitation and evaporation) for the project is gathered from the Superior Magma gauge, which is owned, operated, and provided by Resolution Copper Mining, Inc with data from 1920 to 2001.

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The deterministic water balance spreadsheet is structured to present annual data on a monthly basis for the variables used in the water balance from the following categories,

- Precipitation and evaporation data,
- Area and ore loading input data,
- Inflow volume calculation data,
- Outflow volume calculation data,
- Net water balance

A brief description of the line items for each category is presented in the following sections, corresponding to the format presented on the water balance spreadsheet provided in this submittal.

2.1 Variables Used in Water Balance

The variables used in the water balance model pertain to ore material parameters, design parameters (e.g. precipitation and evaporation), and physical geometry of the facility. These values are used in calculating the monthly water balance simulation and are listed on the first page of Attachment 1.

2.1.1 Variables by Month

Variables by month represent the variables in the model that change from month to month but are constant from year to year. These variables are shown in Table 1-1.

TABLE 1-1: PRECIPITATION AND EVAPORATION DATA

Month	Average Precipitation (in)	Average Pan Evaporation (in)
Jan	2.021	2.44
Feb	1.926	3.54
Mar	2.021	5.90
Apr	0.804	8.64
May	0.357	11.96
Jun	0.263	14.50
Jul	1.897	14.36
Aug	2.746	12.27
Sep	1.474	10.10
Oct	1.192	6.78
Nov	1.432	3.68
Dec	2.152	2.32
Totals	18.285	96.49
Monthly Avg.	1.524	8.04

2.1.2 Variables by Year

Variables by Year represent the variables in the model that are constant from month to month but are or could be variable from year to year. Those variables are presented in Table 1-2. The Upgradient Area and Stockpile Area were determined from the Ore Loading Schedule in conjunction with the Height vs. Capacity data and charts provided in Attachment 2 of this Appendix.

TABLE 1-2: VARIABLES BY YEAR

Year	Ore Loading (tons/yr)	Upgradient Area (sq. ft.)	Stockpile Area (sq. ft.)
2011	97,045	1,942,846	189,102
2012	109,390	1,853,404	278,544
2013	102,495	1,791,195	340,753
2014	101,808	1,739,247	392,701
2015	147,166	1,670,005	461,943
2016	419,080	1,429,688	702,260
2017	663,020	1,060,781	1,071,167
2018	1,365,652	697,650	1,434,298
2019	2,299,926	337,129	1,794,819
2020	2,316,159	85,155	2,046,792
2021	1,041,223	17,057	2,114,891
2022	287,036	0	2,131,948
Total	8,950,000		

2.1.3 Stockpile Evaporation Factor

Stockpile Evaporation Factor (percent) - is the percentage of the precipitation that falls on the area of the stockpile that does not infiltrate into the stockpile material. The precipitation that falls onto the stockpile that does not infiltrate is lost to evaporation or wetting of the near surface ore (typically less than 1 meter [m]) that drops below the field capacity moisture content due to the thermodynamic effects of solar radiation. A factor of 30 percent was applied based on experience gained by Golder on similar projects in the southwest.

2.1.4 Ore Moisture Loss to Ore Wetting

Ore Moisture Loss to Ore Wetting Percent (change in water content) - represents the difference between the natural moisture content of the stockpile material and the water content at the field capacity based on the dry density. This volume of water uptake is permanently retained by the stockpile and will not drain out, thereby representing a loss from the fluid system. The percent moisture loss to ore wetting that was applied was 7 percent (on a gravimetric basis).

2.2 Precipitation and Evaporation Input Data

Line items included in this category pertain to the climatic data developed for the project.

- Mean Monthly Precipitation (in) - precipitation data copied from the Variables by Month portion of the spreadsheet model (See Table 1-1).
- Site Pan Evaporation (in) - evaporation data copied from the Variables by Month portion of the spreadsheet model (See Table 1-1).

2.3 Area and Ore Loading Input Data

Line items included in this category pertain to the areas and tonnage of ore placed on the stockpile.

- Upgradient Area (square feet [sq. ft.]) - is the effective plan area upgradient of the stockpile. This area is used to determine the inflow due to precipitation. The data is copied from the Variable by Year portion of the spreadsheet model (See Table 1-2).
- Stockpile Area (square feet [sq. ft.]) - is the effective plan area of the stockpile. This area is used to determine the inflow due to precipitation. The data is copied from the Variable by Year portion of the spreadsheet model (See Table 1-2).
- Monthly Ore Tonnage Placed on Stockpile (Tons) - represents the new ore tonnage placed on the stockpile that is added to the facility on a monthly basis. The data is estimated from the Variable by Year portion of the spreadsheet model (See Table 1-2).

2.4 Inflow Volume Calculation Data

The line items in this category are calculated for the monthly water balance simulation as follows:

- Precipitation Volume on Upgradient Area (gallons [gal.]) - is the volume of precipitation inflow within the effective upgradient area. This value is calculated as the product of the Monthly Precipitation value and Upgradient Area.
- Precipitation Volume on Stockpile Area (gallons [gal.]) - is the volume of precipitation inflow within the effective stockpile area. This value is calculated as the product of the Monthly Precipitation value and Stockpile Area.

2.5 Outflow Volume Calculation Data

The line items presented in this category are calculated for the monthly simulation as follows:

- Precipitation Loss on Stockpile Area (gal.) - is the volume of precipitation that falls on the portion of the stockpile that is not under active irrigation that is lost due to thermal drying of the ore below a field capacity moisture content. The volume is calculated as the product of the Inactive Evaporation Factor, the Mean Monthly Precipitation and the Stockpile Area.
- Stockpile Runoff (gal.) - is the volume of precipitation that does not infiltrate the ore assuming pre-wetted conditions (Mean Monthly Precipitation is higher than 0.35 in) and flows over the stockpile. The volume is calculated as the product of the Stockpile Area and 25% of the Mean Monthly Precipitation.
- Consumptive Loss Due to Ore Wetting (gal.) - is the loss to wetting of newly placed ore calculated for the months when ore is being placed on the stockpile. It is calculated as the product of the Ore Moisture Loss to Ore Wetting and the Monthly Ore Tonnage Placed on Stockpile.
- Total Stockpile Outflows (gal.) – is the estimated total loss of water for the associated month. It is calculated as the sum of the Precipitation Loss on Inactive Pad Area, Stockpile Runoff and Consumptive Loss Due to Ore Wetting.
- Upgradient Area Runoff (gal.) - is the volume of precipitation that does not infiltrate the upgradient existing ground assuming pre-wetted conditions (Mean Monthly Precipitation is higher than 0.35 in) and flows over the upgradient area existing ground. The volume is calculated as the product of the Upgradient Area and 25% of the Mean Monthly Precipitation.

2.6 Net Water Balance

The line items included in this category are calculated for each month of the water balance as follows:

- Runoff Reporting to Tailings Pond 6 (gal.) - is the net volume of water that accumulates in the system during any particular month. The volume is calculated as the summation of the Upgradient Area Runoff and the Stockpile Runoff.
- Net Monthly Accumulation of Water (gal.) - is the net volume of water that accumulates in the system during any particular month in which the inflow from rainfall exceeds the outflow from the various components of evaporation, runoff, and ore uptake. The model is designed to report a value of zero when outflow exceeds inflow.
- Net Monthly Loss of Water (gal.) - is the net volume of water that is lost from the system during any particular month in which the outflow from the various components of evaporation, runoff, and ore uptake exceeds the inflow from precipitation. The model is designed to report a value of zero when inflow exceeds outflow.
- Discharge Volume (gal.) - represents the estimated volume of water that could discharge from the base of stockpile and flow towards TP 6 as seepage or discharged to the aquifer. It is equal to the Net monthly Accumulation of Water.
- Discharge Volume (gal./day) - is the value of the previous item converted from gallons per month to gallons per day.
- Discharge Volume (gal./min.) - is the value of the Discharge Volume in cubic meters per month converted to gallons per minute.

2.7 Results for Water Balance Analysis

The water balance model for the Development Rock Stockpile indicates that for average production and climate conditions, there will be a net loss of water for each month modeled during the first year of production. During the second production year, there will be approximately 35,750 gal of net monthly accumulation in August and 12,300 gal in December. During the third production year, there will be an average of approximately 19,900 gal of net monthly accumulation in the first three months, 21,500 gal in July, 100,500 gal in August, and 59,700 gal in December. During the fourth production year, there will be an average of approximately 54,600 gal of net monthly accumulation in the first three months, 52,400 gal in July, 144,100 gal in August, 15,600 gal in August, and 92,000 gal in December. During the fifth production year, there will be an average of approximately 22,700 gal of net monthly accumulation in the first three months, 20,800 gal in July, 128,400 gal in August, and 69,200 gal in December. During the sixth through final production years, there will be a net loss of water for each month modeled.

Runoff calculations for the design storm event were completed as part of this submittal (Appendix D). Attachment 1 contains the documentation for the data, calculation, and results for the Development Rock Stockpile Water Balance analysis.

ATTACHMENT 1
DEVELOPMENT ROCK STOCKPILE WATER BALANCE ANALYSIS

DATA FROM: Superior Magma Gauge Operated and Owned by RCML
VARIABLES USED IN WATER BALANCE:

Variables by Month		Avg Precip (in)	Avg Pan Evap (in)
1	Jan	2.021	2.440
2	Feb	1.926	3.540
3	Mar	2.021	5.900
4	Apr	0.804	8.640
5	May	0.357	11.960
6	Jun	0.263	14.500
7	Jul	1.897	14.360
8	Aug	2.746	12.270
9	Sep	1.474	10.100
10	Oct	1.192	6.780
11	Nov	1.432	3.680
12	Dec	2.152	2.320
Totals		18.285	96.490

Variables by Year		Ore Loading (tons/yr)
1	2011	97,045
2	2012	109,390
3	2013	102,495
4	2014	101,808
5	2015	147,166
6	2016	419,080
7	2017	663,020
8	2018	1,365,652
9	2019	2,299,926
10	2020	2,316,159
11	2021	1,041,223
12	2022	287,036
Total		8,950,000

Variables by Year		Upgradient Area (sq.ft.)	Stockpile Area (sq.ft.)	Stockpile Area Difference (sq.ft.)
1	2011	1,942,846	189,102	189,102
2	2012	1,853,404	278,544	89,443
3	2013	1,791,195	340,753	62,209
4	2014	1,739,247	392,701	51,947
5	2015	1,670,005	461,943	69,242
6	2016	1,429,688	702,260	240,317
7	2017	1,060,781	1,071,167	368,908
8	2018	697,650	1,434,298	363,131
9	2019	337,129	1,794,819	360,520
10	2020	85,155	2,046,792	251,974
11	2021	17,057	2,114,891	68,099
12	2022	0	2,131,948	17,057

Stockpile Evaporation Factor	30	Percent Loss
Ore Moisture Loss to Ore Wetting	7	percent by weight

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZONA
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
Production Year	1	1	1	1	1	1	1	1	1	1	1	1
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846	1,942,846
Stockpile Area (sq.ft.)	15,758	31,517	47,275	63,034	78,792	94,551	110,309	126,068	141,826	157,585	173,343	189,102
Monthly Tonnage Placed on Stockpile (Tons)	8,242	7,445	8,242	7,976	8,242	7,976	8,242	8,242	7,976	8,242	7,976	8,242
Cumulative Tons in Stockpile	8,242	15,687	23,929	31,905	40,147	48,124	56,366	64,608	72,584	80,827	88,803	97,045
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	2,447,683	2,332,626	2,447,683	973,744	432,372	318,526	2,297,504	3,325,749	1,785,198	1,443,661	1,734,331	2,606,341
Precipitation Volume on Stockpile Area (gal.)	19,853	37,840	59,560	31,592	17,535	15,501	130,446	215,802	130,318	117,096	154,739	253,681
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	5,956	11,352	17,868	9,478	5,260	4,650	39,134	64,741	39,095	35,129	46,422	76,104
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	4,963	9,460	14,890	7,898	4,384	0	32,611	53,950	32,580	29,274	38,685	63,420
Consumptive Loss due to Ore Wetting (gal.)	138,268	124,887	138,268	133,808	138,268	133,808	138,268	138,268	133,808	138,268	133,808	138,268
Total Stockpile Outflows	149,188	145,699	171,026	151,184	147,912	138,458	210,014	256,959	205,483	202,671	218,915	277,793
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	611,921	583,157	611,921	243,436	108,093	0	574,376	831,437	446,299	360,915	433,583	651,585
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	616,884	592,617	626,811	251,334	112,477	0	606,987	885,388	478,879	390,189	472,267	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(129,334)	(107,859)	(111,466)	(119,592)	(130,378)	(122,957)	(79,568)	(41,157)	(75,165)	(85,575)	(64,175)	(24,112)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
Production Year	2	2	2	2	2	2	2	2	2	2	2	2
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404	1,853,404
Stockpile Area (sq.ft.)	196,555	204,009	211,462	218,916	226,369	233,823	241,277	248,730	256,184	263,637	271,091	278,544
Monthly Tonnage Placed on Stockpile (Tons)	9,291	8,392	9,291	8,991	9,291	8,991	9,291	9,291	8,991	9,291	8,991	9,291
Cumulative Tons in Stockpile	106,336	114,727	124,018	133,009	142,299	151,290	160,581	169,872	178,863	188,153	197,144	206,435
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	2,335,000	2,225,240	2,335,000	928,916	412,467	303,862	2,191,734	3,172,642	1,703,013	1,377,199	1,654,488	2,486,353
Precipitation Volume on Stockpile Area (gal.)	247,629	244,938	266,410	109,720	50,377	38,335	285,321	425,774	235,396	195,900	241,996	373,669
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	74,289	73,481	79,923	32,916	15,113	11,500	85,596	127,732	70,619	58,770	72,599	112,101
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	61,907	61,234	66,602	27,430	12,594	0	71,330	106,444	58,849	48,975	60,499	93,417
Consumptive Loss due to Ore Wetting (gal.)	155,857	140,774	155,857	150,830	155,857	150,830	155,857	155,857	150,830	155,857	150,830	155,857
Total Stockpile Outflows	292,053	275,490	302,383	211,175	183,565	162,330	312,784	390,033	280,298	263,602	283,927	361,375
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	583,750	556,310	583,750	232,229	103,117	0	547,933	793,160	425,753	344,300	413,622	621,588
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	645,657	617,544	650,352	259,659	115,711	0	619,264	899,604	484,602	393,275	474,121	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	35,741	0	0	0	12,294
Net Monthly Loss of Water (gal.)	(44,424)	(30,552)	(35,973)	(101,456)	(133,187)	(123,995)	(27,463)	0	(44,901)	(67,702)	(41,931)	0
Discharge Volume (gal.)	0	0	0	0	0	0	0	35,741	0	0	0	12,294
Discharge Volume (gal./day)	0	0	0	0	0	0	0	1,153	0	0	0	397
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	1	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13
Production Year	3	3	3	3	3	3	3	3	3	3	3	3
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195	1,791,195
Stockpile Area (sq.ft.)	283,728	288,912	294,097	299,281	304,465	309,649	314,833	320,017	325,201	330,385	335,569	340,753
Monthly Tonnage Placed on Stockpile (Tons)	8,705	7,863	8,705	8,424	8,705	8,424	8,705	8,705	8,424	8,705	8,424	8,705
Cumulative Tons in Stockpile	215,140	223,003	231,708	240,132	248,837	257,261	265,966	274,671	283,096	291,801	300,225	308,930
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	2,256,626	2,150,550	2,256,626	897,737	398,622	293,663	2,118,169	3,066,153	1,645,852	1,330,974	1,598,955	2,402,899
Precipitation Volume on Stockpile Area (gal.)	357,454	346,875	370,516	149,998	67,757	50,766	372,304	547,803	298,813	245,498	299,554	457,123
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	107,236	104,063	111,155	44,999	20,327	15,230	111,691	164,341	89,644	73,649	89,866	137,137
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	89,363	86,719	92,629	37,499	16,939	0	93,076	136,951	74,703	61,374	74,889	114,281
Consumptive Loss due to Ore Wetting (gal.)	146,033	131,901	146,033	141,323	146,033	141,323	146,033	146,033	141,323	146,033	141,323	146,033
Total Stockpile Outflows	342,633	322,682	349,817	223,821	183,300	156,553	350,801	447,325	305,670	281,057	306,078	397,451
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	564,156	537,638	564,156	224,434	99,656	0	529,542	766,538	411,463	332,743	399,739	600,725
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	653,520	624,356	656,785	261,934	116,595	0	622,618	903,489	486,166	394,118	474,627	715,005
Net Monthly Accumulation of Water (gal.)	14,821	24,193	20,699	0	0	0	21,503	100,478	0	0	0	59,672
Net Monthly Loss of Water (gal.)	0	0	0	(73,824)	(115,543)	(105,786)	0	0	(6,857)	(35,559)	(6,523)	0
Discharge Volume (gal.)	14,821	24,193	20,699	0	0	0	21,503	100,478	0	0	0	59,672
Discharge Volume (gal./day)	478	864	668	0	0	0	694	3,241	0	0	0	1,925
Discharge Volume (gal/min.)	0	1	0	0	0	0	0	2	0	0	0	1

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Production Year	4	4	4	4	4	4	4	4	4	4	4	4
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247	1,739,247
Stockpile Area (sq.ft.)	345,082	349,411	353,740	358,069	362,398	366,727	371,056	375,385	379,714	384,043	388,372	392,701
Monthly Tonnage Placed on Stockpile (Tons)	8,647	7,810	8,647	8,368	8,647	8,368	8,647	8,647	8,368	8,647	8,368	8,647
Cumulative Tons in Stockpile	317,577	325,387	334,033	342,401	351,048	359,416	368,062	376,709	385,077	393,724	402,091	410,738
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	2,191,181	2,088,181	2,191,181	871,702	387,062	285,146	2,056,739	2,977,230	1,598,120	1,292,374	1,552,583	2,333,212
Precipitation Volume on Stockpile Area (gal.)	434,750	419,511	445,657	179,462	80,650	60,124	438,790	642,581	348,903	285,369	346,690	526,810
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	130,425	125,853	133,697	53,839	24,195	18,037	131,637	192,774	104,671	85,611	104,007	158,043
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	108,687	104,878	111,414	44,866	20,163	0	109,698	160,645	87,226	71,342	86,672	131,703
Consumptive Loss due to Ore Wetting (gal.)	145,055	131,017	145,055	140,375	145,055	140,375	145,055	145,055	140,375	145,055	140,375	145,055
Total Stockpile Outflows	384,167	361,748	390,166	239,080	189,412	158,413	386,389	498,474	332,272	302,007	331,055	434,800
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	547,795	522,045	547,795	217,925	96,765	0	514,185	744,307	399,530	323,093	388,146	583,303
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	656,483	626,923	659,209	262,791	116,928	0	623,882	904,953	486,756	394,436	474,818	715,005
Net Monthly Accumulation of Water (gal.)	50,583	57,763	55,491	0	0	0	52,401	144,107	16,631	0	15,635	92,010
Net Monthly Loss of Water (gal.)	0	0	0	(59,617)	(108,762)	(98,288)	0	0	0	(16,639)	0	0
Discharge Volume (gal.)	50,583	57,763	55,491	0	0	0	52,401	144,107	16,631	0	15,635	92,010
Discharge Volume (gal./day)	1,632	2,063	1,790	0	0	0	1,690	4,649	554	0	521	2,968
Discharge Volume (gal/min.)	1	1	1	0	0	0	1	3	0	0	0	2

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15
Production Year	5	5	5	5	5	5	5	5	5	5	5	5
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005	1,670,005
Stockpile Area (sq.ft.)	398,471	404,241	410,011	415,781	421,552	427,322	433,092	438,862	444,632	450,403	456,173	461,943
Monthly Tonnage Placed on Stockpile (Tons)	12,499	11,289	12,499	12,096	12,499	12,096	12,499	12,499	12,096	12,499	12,096	12,499
Cumulative Tons in Stockpile	423,237	434,526	447,026	459,121	471,620	483,716	496,215	508,714	520,810	533,309	545,405	557,904
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	2,103,946	2,005,047	2,103,946	836,998	371,652	273,794	1,974,857	2,858,701	1,534,496	1,240,922	1,490,772	2,240,322
Precipitation Volume on Stockpile Area (gal.)	502,011	485,341	516,550	208,387	93,814	70,059	512,151	751,241	408,554	334,678	407,214	619,699
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	150,603	145,602	154,965	62,516	28,144	21,018	153,645	225,372	122,566	100,404	122,164	185,910
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	125,503	121,335	129,138	52,097	23,454	0	128,038	187,810	102,138	83,670	101,804	154,925
Consumptive Loss due to Ore Wetting (gal.)	209,680	189,388	209,680	202,916	209,680	202,916	209,680	209,680	202,916	209,680	202,916	209,680
Total Stockpile Outflows	485,786	456,326	493,783	317,529	261,278	223,934	491,363	622,862	427,621	393,753	426,884	550,515
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	525,986	501,262	525,986	209,249	92,913	0	493,714	714,675	383,624	310,231	372,693	560,081
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	651,489	622,597	655,124	261,346	116,367	0	621,752	902,486	485,762	393,900	474,497	715,005
Net Monthly Accumulation of Water (gal.)	16,225	29,015	22,768	0	0	0	20,788	128,378	0	0	0	69,185
Net Monthly Loss of Water (gal.)	0	0	0	(109,142)	(167,463)	(153,875)	0	0	(19,067)	(59,075)	(19,670)	0
Discharge Volume (gal.)	16,225	29,015	22,768	0	0	0	20,788	128,378	0	0	0	69,185
Discharge Volume (gal./day)	523	1,036	734	0	0	0	671	4,141	0	0	0	2,232
Discharge Volume (gal/min.)	0	1	1	0	0	0	0	3	0	0	0	2

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Production Year	6	6	6	6	6	6	6	6	6	6	6	6
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688	1,429,688
Stockpile Area (sq.ft.)	481,969	501,996	522,022	542,049	562,075	582,101	602,128	622,154	642,180	662,207	682,233	702,260
Monthly Tonnage Placed on Stockpile (Tons)	35,593	32,149	35,593	34,445	35,593	34,445	35,593	35,593	34,445	35,593	34,445	35,593
Cumulative Tons in Stockpile	593,497	625,646	661,239	695,684	731,277	765,722	801,315	836,908	871,353	906,946	941,391	976,984
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	1,801,184	1,716,517	1,801,184	716,552	318,171	234,395	1,690,671	2,447,329	1,313,679	1,062,351	1,276,247	1,917,936
Precipitation Volume on Stockpile Area (gal.)	607,206	602,708	657,666	271,672	125,087	95,434	712,043	1,064,998	590,072	492,063	609,013	942,086
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	182,162	180,812	197,300	81,502	37,526	28,630	213,613	319,499	177,022	147,619	182,704	282,626
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	151,802	150,677	164,417	67,918	31,272	0	178,011	266,250	147,518	123,016	152,253	235,521
Consumptive Loss due to Ore Wetting (gal.)	597,099	539,315	597,099	577,838	597,099	577,838	597,099	597,099	577,838	597,099	577,838	597,099
Total Stockpile Outflows	931,062	870,805	958,816	727,257	665,897	606,468	988,723	1,182,848	902,377	867,733	912,795	1,115,246
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	450,296	429,129	450,296	179,138	79,543	0	422,668	611,832	328,420	265,588	319,062	479,484
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	602,098	579,806	614,713	247,056	110,814	0	600,679	878,082	475,938	388,603	471,315	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(323,856)	(268,097)	(301,149)	(455,585)	(540,810)	(511,034)	(276,680)	(117,850)	(312,305)	(375,671)	(303,782)	(173,161)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
Production Year	7	7	7	7	7	7	7	7	7	7	7	7
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781	1,060,781
Stockpile Area (sq.ft.)	733,002	763,744	794,486	825,229	855,971	886,713	917,456	948,198	978,940	1,009,683	1,040,425	1,071,167
Monthly Tonnage Placed on Stockpile (Tons)	56,311	50,862	56,311	54,495	56,311	54,495	56,311	56,311	54,495	56,311	54,495	56,311
Cumulative Tons in Stockpile	1,033,295	1,084,157	1,140,468	1,194,963	1,251,274	1,305,769	1,362,081	1,418,392	1,472,887	1,529,198	1,583,693	1,640,004
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	1,336,418	1,273,598	1,336,418	531,658	236,072	173,913	1,254,421	1,815,836	974,706	788,229	946,933	1,423,044
Precipitation Volume on Stockpile Area (gal.)	923,468	916,969	1,000,929	413,600	190,492	145,375	1,084,933	1,623,118	899,506	750,260	928,762	1,436,978
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	277,040	275,091	300,279	124,080	57,148	43,612	325,480	486,935	269,852	225,078	278,628	431,093
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	230,867	229,242	250,232	103,400	47,623	0	271,233	405,779	224,877	187,565	232,190	359,244
Consumptive Loss due to Ore Wetting (gal.)	944,661	853,242	944,661	914,188	944,661	914,188	944,661	944,661	914,188	944,661	914,188	944,661
Total Stockpile Outflows	1,452,569	1,357,575	1,495,172	1,141,668	1,049,432	957,801	1,541,374	1,837,376	1,408,917	1,357,304	1,425,007	1,734,999
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	334,105	318,399	334,105	132,914	59,018	0	313,605	453,959	243,676	197,057	236,733	355,761
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	564,972	547,642	584,337	236,315	106,641	0	584,839	859,738	468,553	384,622	468,924	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(529,101)	(440,606)	(494,243)	(728,068)	(858,940)	(812,426)	(456,441)	(214,258)	(509,410)	(607,044)	(496,246)	(298,021)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
Production Year	8	8	8	8	8	8	8	8	8	8	8	8
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	697,650	697,650	697,650	697,650	697,650	697,650	697,650	697,650	697,650	697,650	697,650	697,650
Stockpile Area (sq.ft.)	1,101,428	1,131,689	1,161,950	1,192,211	1,222,472	1,252,733	1,282,994	1,313,255	1,343,515	1,373,776	1,404,037	1,434,298
Monthly Tonnage Placed on Stockpile (Tons)	115,987	104,762	115,987	112,245	115,987	112,245	115,987	115,987	112,245	115,987	112,245	115,987
Cumulative Tons in Stockpile	1,755,991	1,860,753	1,976,740	2,088,985	2,204,972	2,317,218	2,433,205	2,549,191	2,661,437	2,777,424	2,889,669	3,005,656
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	878,930	837,615	878,930	349,658	155,259	114,378	825,002	1,194,231	641,040	518,399	622,775	935,902
Precipitation Volume on Stockpile Area (gal.)	1,387,628	1,358,732	1,463,876	597,530	272,056	205,383	1,517,198	2,248,019	1,234,499	1,020,805	1,253,349	1,924,120
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	416,288	407,620	439,163	179,259	81,617	61,615	455,159	674,406	370,350	306,241	376,005	577,236
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	346,907	339,683	365,969	149,382	68,014	0	379,300	562,005	308,625	255,201	313,337	481,030
Consumptive Loss due to Ore Wetting (gal.)	1,945,761	1,757,462	1,945,761	1,882,995	1,945,761	1,882,995	1,945,761	1,945,761	1,882,995	1,945,761	1,882,995	1,945,761
Total Stockpile Outflows	2,708,956	2,504,764	2,750,893	2,211,636	2,095,392	1,944,609	2,780,220	3,182,171	2,561,969	2,507,204	2,572,337	3,004,027
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	219,732	209,404	219,732	87,415	38,815	0	206,251	298,558	160,260	129,600	155,694	233,975
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	566,639	549,087	585,701	236,797	106,829	0	585,550	860,563	468,885	384,801	469,031	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(1,321,328)	(1,146,032)	(1,287,017)	(1,614,106)	(1,823,336)	(1,739,226)	(1,263,022)	(934,153)	(1,327,470)	(1,486,399)	(1,318,987)	(1,079,907)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
Production Year	9	9	9	9	9	9	9	9	9	9	9	9
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129
Stockpile Area (sq.ft.)	1,464,342	1,494,385	1,524,428	1,554,472	1,584,515	1,614,558	1,644,602	1,674,645	1,704,688	1,734,732	1,764,775	1,794,819
Monthly Tonnage Placed on Stockpile (Tons)	195,336	176,433	195,336	189,035	195,336	189,035	195,336	195,336	189,035	195,336	189,035	195,336
Cumulative Tons in Stockpile	3,200,992	3,377,425	3,572,761	3,761,796	3,957,132	4,146,167	4,341,503	4,536,840	4,725,875	4,921,211	5,110,246	5,305,582
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	424,730	404,765	424,730	168,967	75,027	55,272	398,671	577,095	309,774	250,509	300,947	452,261
Precipitation Volume on Stockpile Area (gal.)	1,844,842	1,794,193	1,920,542	779,093	352,627	264,704	1,944,816	2,866,644	1,566,365	1,289,018	1,575,371	2,407,761
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	553,453	538,258	576,163	233,728	105,788	79,411	583,445	859,993	469,910	386,705	472,611	722,328
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	461,211	448,548	480,135	194,773	88,157	0	486,204	716,661	391,591	322,255	393,843	601,940
Consumptive Loss due to Ore Wetting (gal.)	3,276,901	2,959,781	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901
Total Stockpile Outflows	4,291,564	3,946,588	4,333,199	3,599,696	3,470,846	3,250,606	4,346,550	4,853,555	4,032,695	3,985,861	4,037,649	4,601,169
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	106,183	101,191	106,183	42,242	18,757	0	99,668	144,274	77,443	62,627	75,237	113,065
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	567,393	549,740	586,318	237,015	106,913	0	585,872	860,935	469,035	384,882	469,080	715,005
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(2,446,722)	(2,152,394)	(2,412,657)	(2,820,603)	(3,118,219)	(2,985,902)	(2,401,734)	(1,986,911)	(2,466,330)	(2,696,843)	(2,462,277)	(2,193,409)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20
Production Year	10	10	10	10	10	10	10	10	10	10	10	10
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129
Stockpile Area (sq.ft.)	1,815,816	1,836,814	1,857,812	1,878,810	1,899,808	1,920,806	1,941,803	1,962,801	1,983,799	2,004,797	2,025,795	2,046,792
Monthly Tonnage Placed on Stockpile (Tons)	195,336	176,433	195,336	189,035	195,336	189,035	195,336	195,336	189,035	195,336	189,035	195,336
Cumulative Tons in Stockpile	5,500,918	5,677,351	5,872,687	6,061,722	6,257,058	6,446,093	6,641,429	6,836,766	7,025,801	7,221,137	7,410,172	7,605,508
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	424,730	404,765	424,730	168,967	75,027	55,272	398,671	577,095	309,774	250,509	300,947	452,261
Precipitation Volume on Stockpile Area (gal.)	2,287,646	2,205,322	2,340,553	941,650	422,794	314,912	2,296,271	3,359,908	1,822,828	1,489,694	1,808,377	2,745,785
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	686,294	661,597	702,166	282,495	126,838	94,474	688,881	1,007,972	546,848	446,908	542,513	823,736
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	571,911	551,330	585,138	235,412	105,698	0	574,068	839,977	455,707	372,424	452,094	686,446
Consumptive Loss due to Ore Wetting (gal.)	3,276,901	2,959,781	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901
Total Stockpile Outflows	4,535,106	4,172,709	4,564,205	3,689,102	3,509,437	3,265,668	4,539,850	5,124,850	4,173,750	4,096,233	4,165,802	4,787,083
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	106,183	101,191	106,183	42,242	18,757	0	99,668	144,274	77,443	62,627	75,237	113,065
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	678,094	652,522	691,321	277,654	124,455	0	673,735	984,251	533,150	435,051	527,331	799,512
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(2,247,460)	(1,967,387)	(2,223,652)	(2,747,452)	(3,086,644)	(2,950,756)	(2,243,579)	(1,764,943)	(2,350,922)	(2,606,539)	(2,357,425)	(2,041,298)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
Production Year	11	11	11	11	11	11	11	11	11	11	11	11
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129
Stockpile Area (sq.ft.)	2,052,467	2,058,142	2,063,817	2,069,492	2,075,167	2,080,842	2,086,517	2,092,192	2,097,867	2,103,542	2,109,216	2,114,891
Monthly Tonnage Placed on Stockpile (Tons)	195,336	176,433	195,336	189,035	195,336	189,035	195,336	195,336	189,035	195,336	189,035	195,336
Cumulative Tons in Stockpile	7,800,844	7,977,277	8,172,613	8,361,648	8,556,984	8,746,019	8,941,355	9,136,692	9,325,727	9,521,063	9,710,098	9,905,434
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	424,730	404,765	424,730	168,967	75,027	55,272	398,671	577,095	309,774	250,509	300,947	452,261
Precipitation Volume on Stockpile Area (gal.)	2,585,789	2,471,054	2,600,088	1,037,219	461,819	341,150	2,467,401	3,581,397	1,927,640	1,563,068	1,882,845	2,837,140
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	775,737	741,316	780,026	311,166	138,546	102,345	740,220	1,074,419	578,292	468,920	564,854	851,142
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	646,447	617,763	650,022	259,305	115,455	0	616,850	895,349	481,910	390,767	470,711	709,285
Consumptive Loss due to Ore Wetting (gal.)	3,276,901	2,959,781	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901
Total Stockpile Outflows	4,699,085	4,318,861	4,706,949	3,741,665	3,530,901	3,273,539	4,633,971	5,246,669	4,231,396	4,136,588	4,206,759	4,837,328
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	106,183	101,191	106,183	42,242	18,757	0	99,668	144,274	77,443	62,627	75,237	113,065
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	752,630	718,955	756,205	301,547	134,211	0	716,518	1,039,623	559,353	453,394	545,948	822,350
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(2,113,296)	(1,847,807)	(2,106,861)	(2,704,446)	(3,069,082)	(2,932,389)	(2,166,571)	(1,665,272)	(2,303,757)	(2,573,520)	(2,323,914)	(2,000,188)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

Water Balance
Average Year Scenario

PROJECT: DEVELOPMENT ROCK STOCKPILE, WEST PLANT SITE, SUPERIOR, ARIZ
SIMULATION SCENARIO: AVERAGE YEAR
AVERAGE RAINFALL AVERAGE EVAPORATION FROM SITE DATA

Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Month-Yr	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Production Year	12	12	12	12	12	12	12	12	12	12	12	12
PRECIPITATION AND EVAPORATION INPUT DATA												
Mean Monthly Precipitation (in.)	2.02	1.93	2.02	0.80	0.36	0.26	1.90	2.75	1.47	1.19	1.43	2.15
Site Pan Evaporation (in.)	2.44	3.54	5.90	8.64	11.96	14.50	14.36	12.27	10.10	6.78	3.68	2.32
AREA AND ORE LOADING INPUT DATA												
Upgradient Area (sq. ft.)	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129	337,129
Stockpile Area (sq.ft.)	2,116,313	2,117,734	2,119,156	2,120,577	2,121,998	2,123,420	2,124,841	2,126,262	2,127,684	2,129,105	2,130,527	2,131,948
Monthly Tonnage Placed on Stockpile (Tons)	195,336	176,433	195,336	189,035	195,336	189,035	195,336	195,336	189,035	195,336	189,035	195,336
Cumulative Tons in Stockpile	10,100,770	10,277,203	10,472,539	10,661,574	10,856,910	11,045,945	11,241,281	11,436,618	11,625,653	11,820,989	12,010,024	12,205,360
INFLOW VOLUME CALCULATION DATA												
Precipitation Volume on Upgradient Area (gal.)	424,730	404,765	424,730	168,967	75,027	55,272	398,671	577,095	309,774	250,509	300,947	452,261
Precipitation Volume on Stockpile Area (gal.)	2,666,224	2,542,601	2,669,806	1,062,822	472,241	348,130	2,512,721	3,639,719	1,955,037	1,582,063	1,901,868	2,860,022
OUTFLOW VOLUME CALCULATION DATA												
Precipitation Loss on Stockpile Area (gal.)	799,867	762,780	800,942	318,847	141,672	104,439	753,816	1,091,916	586,511	474,619	570,561	858,007
Stockpile Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	666,556	635,650	667,451	265,706	118,060	0	628,180	909,930	488,759	395,516	475,467	715,005
Consumptive Loss due to Ore Wetting (gal.)	3,276,901	2,959,781	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901	3,276,901	3,171,194	3,276,901	3,171,194	3,276,901
Total Stockpile Outflows	4,743,324	4,358,212	4,745,294	3,755,747	3,536,633	3,275,634	4,658,897	5,278,746	4,246,465	4,147,036	4,217,222	4,849,913
Upgradient Area Runoff (gal.) [25% of Mean Monthly Precipitation > 0.35 inches]	106,183	101,191	106,183	42,242	18,757	0	99,668	144,274	77,443	62,627	75,237	113,065
NET WATER BALANCE												
Runoff Reporting to Tailings Pond 6 (gal.)	772,739	736,842	773,634	307,947	136,817	0	727,848	1,054,204	566,203	458,143	550,704	828,071
Net Monthly Accumulation of Water (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Net Monthly Loss of Water (gal.)	(2,077,100)	(1,815,611)	(2,075,488)	(2,692,925)	(3,064,392)	(2,927,503)	(2,146,177)	(1,639,027)	(2,291,428)	(2,564,972)	(2,315,354)	(1,989,891)
Discharge Volume (gal.)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal./day)	0	0	0	0	0	0	0	0	0	0	0	0
Discharge Volume (gal/min.)	0	0	0	0	0	0	0	0	0	0	0	0

ATTACHMENT 2
HEIGHT VS CAPACITY ANALYSIS

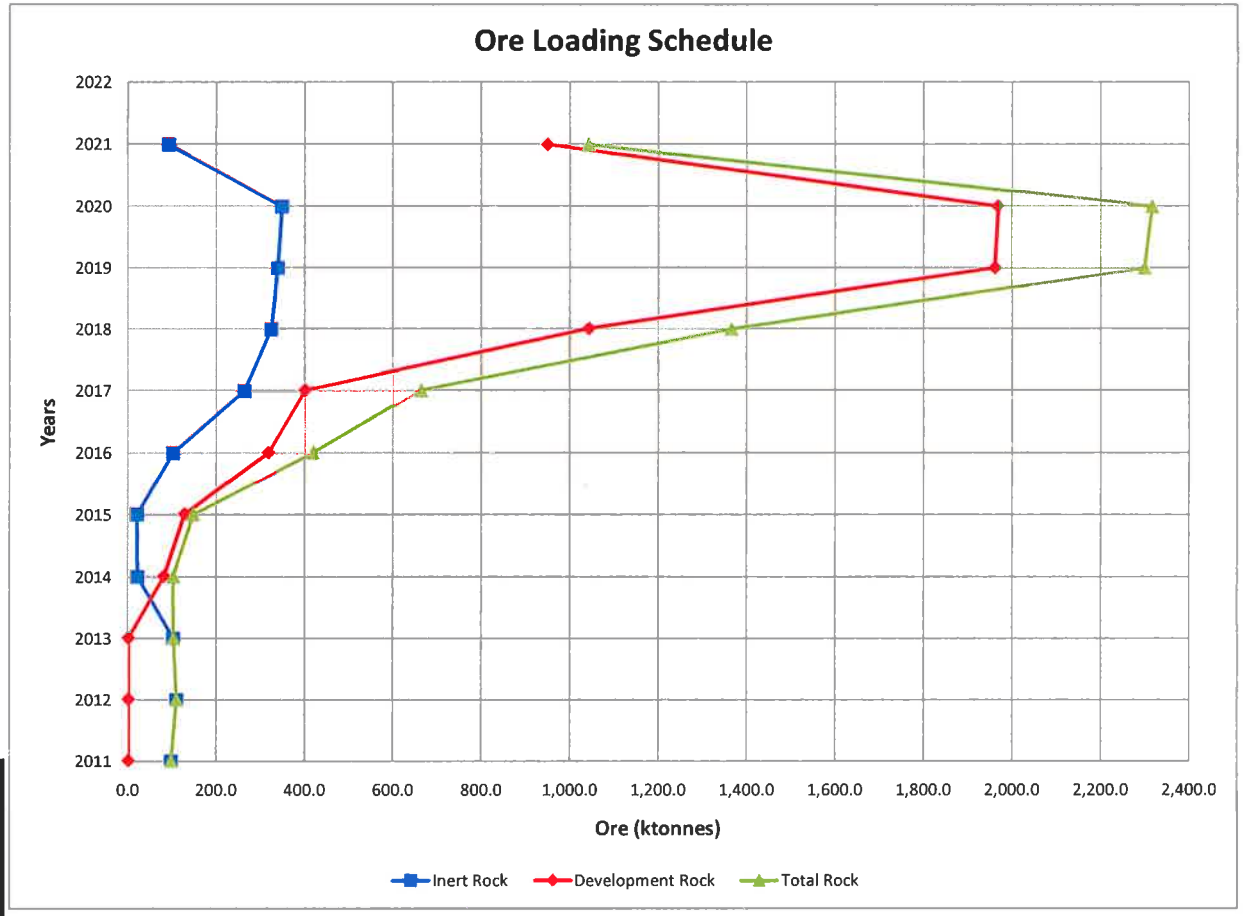
Height vs. Capacity Input
Ore Loading Rate Data Chart

"Vlookup" Data Tables for Height Capacity Curves:

Year	Development Production (ktonnes)	Inert Production (ktonnes)	Total Production (ktonnes)
2011	0.000	97.045	97.045
2012	0.000	109.390	109.390
2013	0.000	102.495	102.495
2014	80.870	20.938	101.808
2015	127.191	19.975	147.166
2016	317.387	101.693	419.080
2017	400.033	262.987	663.020
2018	1,042.222	323.430	1,365.652
2019	1,960.984	338.942	2,299.926
2020	1,967.961	348.198	2,316.159
2021	948.823	92.400	1,041.223
2022			

Development			
Production (tonnes)	Year	Cumulative Production (tonnes)	Yearly Production (tonnes)
0	**2011**	0	0
0	**2012**	0	0
0	**2013**	0	0
80,870	**2014**	80,870	80,870
208,061	**2015**	208,061	127,191
525,448	**2016**	525,448	317,387
925,481	**2017**	925,481	400,033
1,967,703	**2018**	1,967,703	1,042,222
3,928,687	**2019**	3,928,687	1,960,984
5,896,648	**2020**	5,896,648	1,967,961
6,845,471	**2021**	6,845,471	948,823

Combination of Development and Inert				
Production (tonnes)	Year	Cumulative Production (tonnes)	Yearly Production (tonnes)	Year
0	**0**	0	0	2010
97,045	**1**	97,045	97,045	2011
206,435	**2**	206,435	109,390	2012
308,930	**3**	308,930	102,495	2013
410,738	**4**	410,738	101,808	2014
557,904	**5**	557,904	147,166	2015
976,984	**6**	976,984	419,080	2016
1,640,004	**7**	1,640,004	663,020	2017
3,005,656	**8**	3,005,656	1,365,652	2018
5,305,582	**9**	5,305,582	2,299,926	2019
7,621,741	**10**	7,621,741	2,316,159	2020
8,662,964	**11**	8,662,964	1,041,223	2021
8,950,000	**12**	8,950,000	287,036	2022



For Graph:

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Inert	97.0	109.4	102.5	20.9	20.0	101.7	263.0	323.4	338.9	348.2	92.4
Development	0.0	0.0	0.0	80.9	127.2	317.4	400.0	1,042.2	1,961.0	1,968.0	948.8
Total	97.0	109.4	102.5	101.8	147.2	419.1	663.0	1,365.7	2,299.9	2,316.2	1,041.2

Height vs. Capacity Input
Elevation and Surface Area Data
Rate of Rise Caclulation

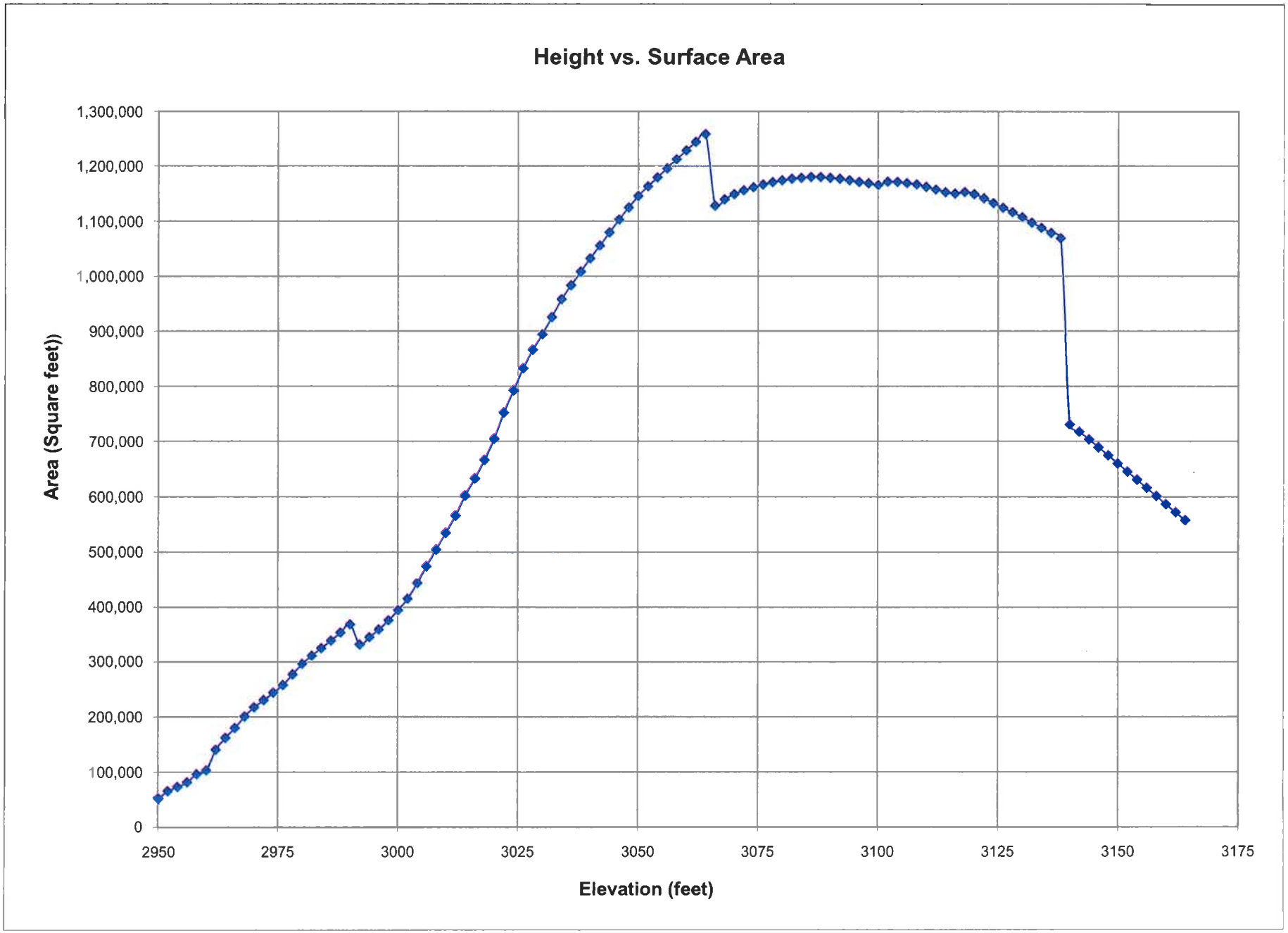
Assumptions:

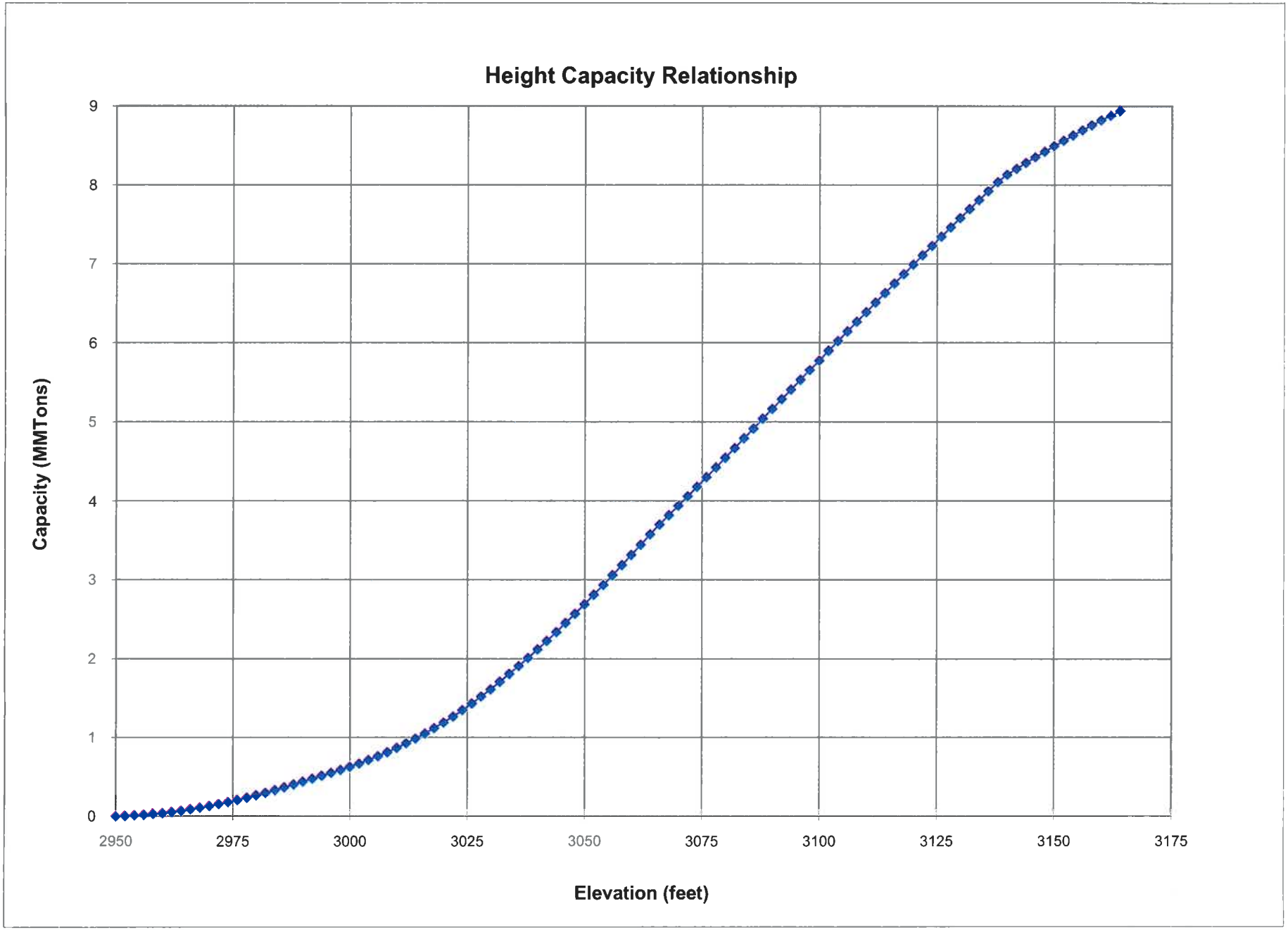
Annual Production (Metric Tons)=	Varies
Starting Operating Year =	2011

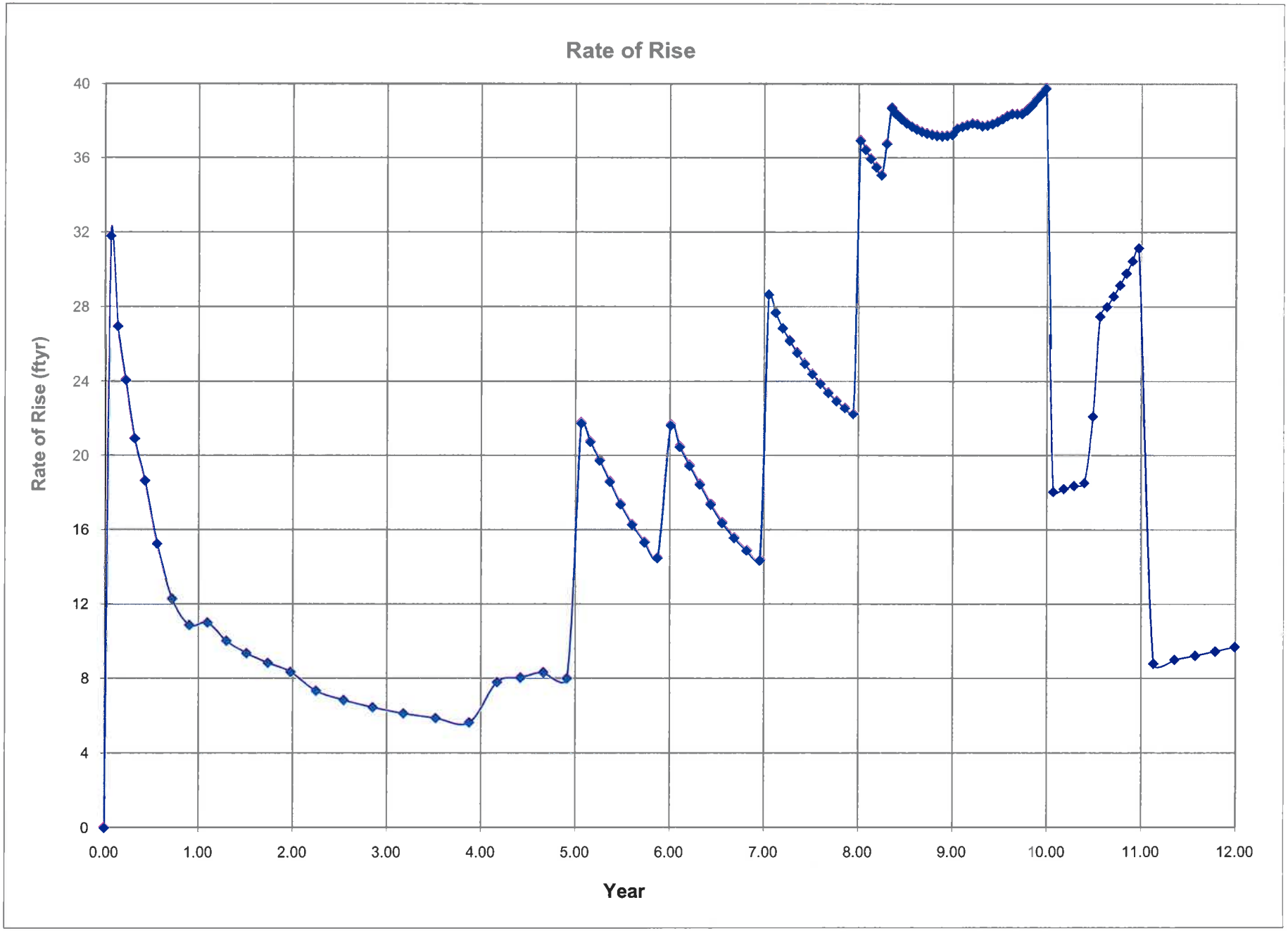
Conversions:

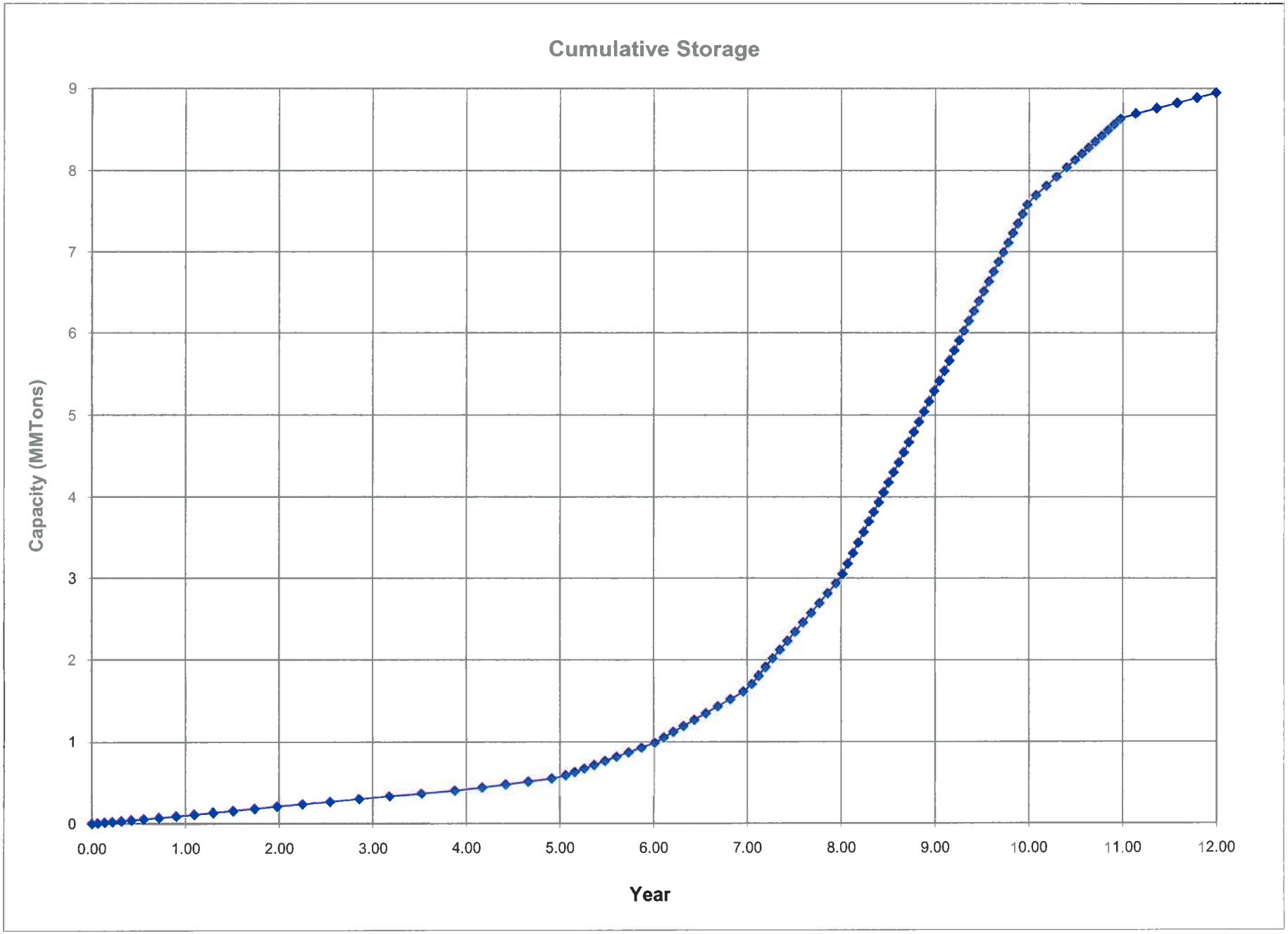
Density:	1 cubic meter =	1.8500	metric tons	Area:	1 square mile =	258.999	Hectares
Length:	1 meter =	3.28083	feet	Area:	1 Hectare =	10000	square meters

Top of Tailings (feet-amsl)	Top of Tailings (meters-amsl)	Top Surface Area (sq. feet)	Top Surface Area (sq. meters)	Top Surface Area (Hectares)	Lift Volume (cu m)	Lift Capacity (m tons)	Cumulative Capacity (m tons)	Cumulative Production (years)	Operating Year	Rate of Rise (m/yr)	Rate of Rise (ft/yr)
2950	899.16	51,783.66	4810.89	0.5	0	0	0	0.00	2011	0.00	0.00
2952	899.77	64,784.31	6018.70	0.6	3,301	6,107	6,107	0.06	2011	9.69	31.78
2954	900.38	72,694.72	6753.60	0.7	3,893	7,202	13,309	0.14	2011	8.21	26.95
2956	900.99	81,168.80	7540.87	0.8	4,357	8,060	21,369	0.22	2011	7.34	24.08
2958	901.60	95,928.20	8912.07	0.9	5,015	9,278	30,647	0.32	2011	6.38	20.92
2960	902.21	102,865.16	9556.54	1.0	5,629	10,414	41,061	0.42	2011	5.68	18.64
2962	902.82	140,206.45	13025.68	1.3	6,883	12,734	53,794	0.55	2011	4.65	15.24
2964	903.43	161,744.43	15026.64	1.5	8,550	15,818	69,613	0.72	2011	3.74	12.27
2966	904.04	179,783.84	16702.57	1.7	9,671	17,892	87,504	0.90	2011	3.31	10.85
2968	904.65	200,564.11	18633.13	1.9	10,770	19,925	107,429	1.09	2012	3.35	10.98
2970	905.26	217,320.21	20189.83	2.0	11,833	21,892	129,321	1.30	2012	3.05	9.99
2972	905.87	230,534.58	21417.49	2.1	12,682	23,462	152,782	1.51	2012	2.84	9.33
2974	906.48	243,841.35	22653.74	2.3	13,433	24,851	177,633	1.74	2012	2.68	8.80
2976	907.09	257,891.77	23959.07	2.4	14,208	26,284	203,917	1.98	2012	2.54	8.32
2978	907.70	277,054.62	25739.37	2.6	15,148	28,024	231,942	2.25	2013	2.23	7.31
2980	908.31	296,210.43	27519.02	2.8	16,233	30,031	261,973	2.54	2013	2.08	6.83
2982	908.92	311,231.32	28914.51	2.9	17,201	31,822	293,795	2.85	2013	1.96	6.44
2984	909.53	325,048.08	30198.14	3.0	18,018	33,333	327,127	3.18	2014	1.86	6.11
2986	910.14	338,773.41	31473.27	3.1	18,798	34,775	361,903	3.52	2014	1.78	5.86
2988	910.75	353,369.63	32829.31	3.3	19,599	36,259	398,162	3.88	2014	1.71	5.62
2990	911.35	368,546.02	34239.25	3.4	20,443	37,819	435,981	4.17	2015	2.37	7.78
2992	911.96	331,702.98	30816.40	3.1	19,829	36,684	472,664	4.42	2015	2.45	8.02
2994	912.57	345,117.30	32062.64	3.2	19,166	35,456	508,121	4.66	2015	2.53	8.30
2996	913.18	359,150.87	33366.41	3.3	19,943	36,894	545,015	4.91	2015	2.43	7.98
2998	913.79	375,866.93	34919.39	3.5	20,814	38,505	583,520	5.06	2016	6.63	21.77
3000	914.40	394,359.28	36637.40	3.7	21,811	40,350	623,869	5.16	2016	6.33	20.77
3002	915.01	415,379.71	38590.27	3.9	22,929	42,420	666,289	5.26	2016	6.02	19.76
3004	915.62	444,023.59	41251.39	4.1	24,336	45,021	711,310	5.37	2016	5.67	18.62
3006	916.23	475,642.50	44188.90	4.4	26,042	48,178	759,488	5.48	2016	5.30	17.40
3008	916.84	505,739.67	46985.04	4.7	27,790	51,411	810,900	5.60	2016	4.97	16.30
3010	917.45	535,820.06	49779.61	5.0	29,494	54,564	865,464	5.73	2016	4.68	15.36
3012	918.06	566,807.98	52658.50	5.3	31,223	57,763	923,227	5.87	2016	4.42	14.51
3014	918.67	602,373.14	55962.63	5.6	33,108	61,249	984,476	6.01	2017	6.60	21.65
3016	919.28	633,267.34	58832.82	5.9	34,990	64,731	1,049,207	6.11	2017	6.24	20.49
3018	919.89	666,576.51	61927.36	6.2	36,808	68,094	1,117,302	6.21	2017	5.94	19.47
3020	920.50	704,471.97	65447.98	6.5	38,824	71,825	1,189,126	6.32	2017	5.63	18.46
3022	921.11	751,478.22	69815.03	7.0	41,228	76,272	1,265,398	6.44	2017	5.30	17.39
3024	921.72	792,050.72	73584.36	7.4	43,708	80,860	1,346,259	6.56	2017	5.00	16.40
3026	922.33	832,207.00	77315.03	7.7	45,994	85,089	1,431,348	6.69	2017	4.75	15.58
3028	922.94	865,333.44	80392.59	8.0	48,069	88,928	1,520,277	6.82	2017	4.54	14.91
3030	923.55	893,965.97	83052.66	8.3	49,818	92,164	1,612,440	6.96	2017	4.39	14.39
3032	924.16	925,256.91	85959.70	8.6	51,515	95,303	1,707,743	7.05	2018	8.74	28.66
3034	924.77	957,727.10	88976.30	8.9	53,321	98,643	1,806,387	7.12	2018	8.44	27.69
3036	925.38	983,265.36	91348.89	9.1	54,963	101,682	1,908,069	7.20	2018	8.19	26.86
3038	925.99	1,008,148.79	93660.65	9.4	56,391	104,323	2,012,392	7.27	2018	7.98	26.18
3040	926.59	1,032,363.54	95910.29	9.6	57,781	106,896	2,119,288	7.35	2018	7.79	25.55
3042	927.20	1,055,961.15	98102.59	9.8	59,135	109,400	2,228,688	7.43	2018	7.61	24.97
3044	927.81	1,079,743.23	100312.03	10.0	60,477	111,882	2,340,570	7.51	2018	7.44	24.41
3046	928.42	1,102,998.61	102472.54	10.2	61,809	114,347	2,454,917	7.60	2018	7.28	23.89
3048	929.03	1,125,252.51	104540.01	10.5	63,098	116,731	2,571,648	7.68	2018	7.13	23.40
3050	929.64	1,145,763.39	106445.54	10.6	64,309	118,971	2,690,618	7.77	2018	7.00	22.96
3052	930.25	1,163,418.97	108085.81	10.8	65,389	120,970	2,811,589	7.86	2018	6.88	22.58
3054	930.86	1,179,682.58	109596.76	11.0	66,350	122,747	2,934,336	7.95	2018	6.78	22.25
3056	931.47	1,195,789.65	111093.16	11.1	67,266	124,443	3,058,779	8.02	2019	11.27	36.96
3058	932.08	1,212,519.11	112647.39	11.3	68,196	126,163	3,184,942	8.08	2019	11.11	36.46
3060	932.69	1,229,050.04	114183.17	11.4	69,138	127,906	3,312,848	8.13	2019	10.96	35.96
3062	933.30	1,244,245.18	115594.86	11.6	70,037	129,568	3,442,415	8.19	2019	10.82	35.50
3064	933.91	1,258,712.95	116938.96	11.7	70,877	131,122	3,573,537	8.25	2019	10.69	35.08
3066	934.52	1,128,365.45	104829.21	10.5	67,595	125,051	3,698,588	8.30	2019	11.21	36.78
3068	935.13	1,139,818.91	105893.28	10.6	64,228	118,823	3,817,411	8.35	2019	11.80	38.71
3070	935.74	1,149,118.38	106757.23	10.7	64,816	119,910	3,937,320	8.41	2019	11.69	38.36
3072	936.35	1,156,004.49	107396.98	10.7	65,274	120,758	4,058,078	8.46	2019	11.61	38.09
3074	936.96	1,161,725.68	107928.50	10.8	65,631	121,418	4,179,496	8.51	2019	11.55	37.88
3076	937.57	1,166,832.50	108402.94	10.8	65,938	121,985	4,301,481	8.56	2019	11.49	37.71
3078	938.18	1,171,239.54	108812.37	10.9	66,207	122,484	4,423,965	8.62	2019	11.45	37.55
3080	938.79	1,174,359.05	109102.18	10.9	66,421	122,878	4,546,843	8.67	2019	11.41	37.43
3082	939.40	1,177,177.50	109364.03	10.9	66,589	123,189	4,670,032	8.72	2019	11.38	37.34
3084	940.01	1,178,794.51	109514.25	11.0	66,714	123,421	4,793,454	8.78	2019	11.36	37.27
3086	940.62	1,180,417.16	109665.00	11.0	66,806	123,591	4,917,045	8.83	2019	11.34	37.22
3088	941.23	1,180,280.52	109652.31	11.0	66,848	123,669	5,040,714	8.88	2019	11.34	37.19
3090	941.83	1,179,000.45	109533.39	11.0	66,808	123,595	5,164,309	8.94	2019	11.34	37.22
3092	942.44	1,177,262.66	109371.94	10.9	66,723	123,437	5,287,745	8.99	2019	11.36	37.26
3094	943.05	1,174,582.14	109122.91	10.9	66,597	123,205	5,410,951	9.05	2020	11.46	37.60
3096	943.66	1,171,318.40	108819.70	10.9	66,429	122,894	5,533,844	9.10	2020	11.49	37.69
3098	944.27	1,169,008.20	108605.07	10.9	66,271	122,602	5,656,446	9.15	2020	11.52	37.78
3100	944.88	1,165,858.93	108312.49	10.8	66,117	122,316	5,778,762	9.20	2020	11.54	37.87
3102	945.49	1,171,855.85	108869.63	10.9	66,197	122,465	5,901,227	9.26	2020	11.53	37.83
3104	946.10	1,171,585.77	108844.54	10.9	66,359	122,765	6,023,992	9.31	2020	11.50	37.73
3106	946.71	1,169,447.90	108645.92	10.9	66,291	122,639	6,146,631	9.36	2020	11.51	37.77
3108	947.32	1,166,927.79	108411.79	10.8	66,159	122,395	6,269,026	9.42	2020	11.54	37.85
3110	947.93	1,162,648.32	108014.21	10.8	65,967	122,039	6,391,065	9.47	2020	11.57	37.96
3112	948.54	1,157,724.87	107556.81	10.8	65,706	121,557	6,512,621	9.52	2020	11.62	38.11
3114	949.15	1,152,805.06	107099.74	10.7	65,428	121,041	6,633,662	9.57	2020	11.66	38.27
3116	949.76	1,150,383.70	106874.79	10.7	65,220	120,656	6,754,318	9.63	2020	11.70	38.39
3118	950.37	1,153,216.98	107138.01	10.7	65,231	120,678	6,874,996	9.68	2020	11.70	38.39
3120	950.98	1,149,330.13	106776.91	10.7	65,201	120,623	6,995,619	9.73	2020	11.71	38.40
3122	951.59	1,141,697.96	106067.85	10.6	64,875	120,019	7,115,638	9.78	2020	11.76	38.60
3124	952.20	1,133,240.37	105282.11	10.5	64,420	119,176	7,234,815	9.83	2020	11.85	38.87
3126	952.81	1,124,611.80	104480.49	10.4	63,936	118,281	7,353,096	9.88	2020	11.94	39.16
3128	953.42	1,116,450.80	103722.30	10.4	63,460	117,402	7,470,498	9.93	2020	12.03	39.46
3130	954.03	1,107,508.66	102891.54	10.3	62,976	116,506	7,587,003	9.99	2020	12.12	39.76
3132	954.64	1,097,515.62	101963.15	10.2	62,440	115,514	7,702,517	10.08	2021	5.49	18.03
3134	955.25	1,088,184.44	101096.25	10.1	61,893	114,501	7,817,019	10.19	2021	5.54	18.19
3136	955.86	1,078,618.54	100207.55	10.0	61,358	113,512	7,930,530	10.30	2021	5.59	18.35
3138	956.47	1,069,227.84	99335.12	9.9	60,821	112,518	8,043,049	10.40	2021	5.64	18.51
3140	957.07	730,198.66	67838.08	6.8	50,955	94,266	8,137,315	10.50	2021	6.73	22.09
3142	957.68	717,280.30	66637.92	6.7	40,988	75,829	8,213,143	10.57	2021	8.37	27.46
3144	958.29	703,461.93	65354.15	6.5	40,231	74,428	8,287,571	10.64	2021	8.53	27.98
3146	958.90	689,270.02	64035.67	6.4	39,438	72,961	8,360,532	10.71	2021	8.70	28.54
3148	959.51	674,893.34	62700.02	6.3	38,629	71,464	8,431,996	10.78	2021	8.88	29.14
3150	960.12	660,396.51	61353.21	6.1	37,812	69,951	8,501,947	10.85	2021	9.07	29.77
3152	960.73	645,819.91	59999.00	6.0	36,988	68,428	8,570,375	10.91	2021	9.28	30.43
3154	961.34	631,268.55	58647.12	5.9	36,163	66,902	8,637,278	10.98	2021	9.49	31.13
3156	961.95	616,671.77	57291.03	5.7	35,338	65,375	8,702,653	11.14	2022	2.68	8.78
3158	962.56	602,009.91	55928.89	5.6	34,510	63,843	8,766,496	11.36	2022	2.74	8.99
3160	963.17	587,305.92	54562.83	5.5	33,678	62,304	8,828,800	11.58	2022	2.81	9.21
3162	963.78	572,792.89	53214.52	5.3	32,851	60,774	8,889,574	11.79	2022	2.88	9.45
3164	964.39	558,467.33	51883.63	5.2	32,034	59,263	8,948,837	12.00	2022	2.95	9.69


Height vs. Surface Area
Area (Square feet))
1,300,000
1,200,000
1,100,000
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
2950
2975
3000
3025
3050
3075
3100
3125
3150
3175
Elevation (feet)


Height Capacity Relationship
Capacity (MMTons)
0
1
2
3
4
5
6
7
8
9
2950
2975
3000
3025
3050
3075
3100
3125
3150
3175
Elevation (feet)


Rate of Rise
Rate of Rise (ftyr)
40
36
32
28
24
20
16
12
8
4
0
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
Year


Cumulative Storage
Capacity (MMTons)
0
1
2
3
4
5
6
7
8
9
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
11.00
12.00
Year

APPENDIX J
MONITORING WELL INVENTORY

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

October 07, 2003

Janet Napolitano
Governor

Herb Guenther
Director

BHP SUPERIOR OPERATIONS
102 MAGMA HEIGHTS
SUPERIOR, AZ 85273

Registration No. 55- 200644
File No. D(1-12) 35 BCC

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended drilling card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Jeannie Aguilar

Jeannie Aguilar
NOI Unit
Water Management Support Section

Enclosures

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004

GEOTECHNICAL WELL VARIANCE ISSUED

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-200644

AUTHORIZED DRILLER: GEOMECHANICS SOUTHWEST, INC. LICENSE NO: 498

NOTICE OF INTENTION TO DRILL A GEOTECHNICAL WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP SUPERIOR OPERATIONS 102 MAGMA HEIGHTS SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

SW ¼ of the SW ¼ of the NW ¼ Section 35 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 10

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 30TH DAY OF SEPTEMBER, 2004

Shannon L Rey

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

RECEIVED
OCT - 1 2003
GROUNDWATER MGT

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

$150 FEE

AMT PAID 150 | B 6 | SB
RECEIVED DATE 10-1-03 | WS 15
ISSUED DATE 10-7-03 | WQARF | DERQLA

FILE NUMBER D1-12 35 BCC
WELL REGISTRATION NUMBER 55-200044

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
- $150 check or money order for the filing fee. Only one Notice of Intent to Drill is required for all wells that are drilled by or for the same person to obtain geophysical, mineralogical or geotechnical data within a single section of land.
- Well construction diagram showing all proposed well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-596.

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE
- ☐ Mineral Exploration
- ☒ Geotechnical
- ☐ Heat Pump
- ☐ Cathodic Protection
- ☐ Grounding
- ☐ Other (*please specify*):

COUNTY WHERE WELL(S) ARE LOCATED: Pinal

Location of Well

WELL LOCATION ADDRESS (IF ANY): 102 Magma Heights, Superior, AZ 85273

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE	Number of Wells (holes) per 10-acre location
1 S	12 E	35	NW ¼	SW ¼	SW ¼	10
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	

Use additional boxes to the right to list 160,40,10 acre descriptions for multiple wells drilled to obtain geophysical or geotechnical data on different 10-acre parcels within a single section of land (160, 40, 10 acre descriptions are not required for mineralogical exploration wells).

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Superior Operations
MAILING ADDRESS: 102 Magma Heights
CITY / STATE / ZIP CODE: Superior, AZ 85273
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER: 520-689-2444
FAX:

Landowner (If different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL: Same
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER:
FAX:

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm

NAME: Geomechanics Southwest, Inc.
DWR LICENSE NUMBER: 498
ROC LICENSE CATEGORY: Class A-04
TELEPHONE NUMBER: 602-252-0559
FAX: 602-252-0721

Consultant (If applicable)

CONSULTING FIRM: Axelrod, Inc.
CONTACT PERSON NAME: Paul Axelrod
TELEPHONE NUMBER: 480-391-0754
FAX: 480-391-0752
E-MAIL ADDRESS:

SECTION 4.

VARIANCE GRANTED

Questions	Yes	No	If Yes:
1. Is the proposed well site within 100 feet of a septic tank system, sewer disposal area, landfill, hazardous materials or petroleum storage area or tank?		X	You must submit a letter requesting a variance from the 100-foot setback requirement (A.A.C. R12-15-818). However, if the proposed well is a geotechnical well that will be abandoned before the drill rig leaves the well site, a variance may be requested by simply checking the box below. ☒ *I request a variance from the 100-foot setback requirement for a geotechnical well.*
2. If applicable, are you requesting a variance to use thermoplastic casing in lieu of steel in the surface seal?		X	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
3. Is there another well name or identification number associated with this well?		X	PLEASE STATE

GSI Job #348-03P

RECEIVED - 1 2003 GROUNDWATER MGT

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

WELL REGISTRATION NUMBER 55 - 200644

Provide a well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6. Please submit additional sheets (page 2) and additional well construction diagrams if multiple wells are to be drilled and construction or abandonment details vary.

SECTION 5. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

DATE CONSTRUCTION TO BEGIN: October 2003

** Required Information **

Borehole: DEPTH FROM SURFACE FROM (feet)	Borehole: DEPTH FROM SURFACE TO (feet)	Borehole: BOREHOLE DIAMETER (inches)	Casing: DEPTH FROM SURFACE FROM (feet)	Casing: DEPTH FROM SURFACE TO (feet)	Casing: OUTER DIAMETER (inches)	MATERIAL TYPE (T): STEEL	MATERIAL TYPE (T): PVC	MATERIAL TYPE (T): ABS	MATERIAL TYPE (T): IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (T): BLANK OR NONE	PERFORATION TYPE (T): WIRE WRAP	PERFORATION TYPE (T): SHUTTER SCREEN	PERFORATION TYPE (T): MILLS KNIFE	PERFORATION TYPE (T): SLOTTED	PERFORATION TYPE (T): IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	45	8"	N/A													

Annular Material

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	ANNULAR MATERIAL TYPE (T): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	BENTONITE: CHIPS	BENTONITE: PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	FILTER PACK: GRAVEL	FILTER PACK: SIZE
N/A												

SECTION 6. PROPOSED WELL ABANDONMENT DESIGN (Refer to ADWR'S Well Abandonment Handbook for additional information.)

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Casing Treatment TYPE (T): SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING IS TO BE PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS TO BE ADDED	DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Sealing or Fill Material GROUT TYPE (T): NEAT CEMENT	CONCRETE	SAND-CEMENT GROUT	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	HIGH SOLIDS BENTONITE: GROUT	CHIPS	PELLETS	SAND	MIXING RATIO by (check one) ☐ Weight ☐ Volume	ESTIMATED VOLUME OF MATERIAL (cubic feet)
N/A							0	20'	X										
							20	45'	(backfill w/ cuttings)										

Proposed Abandonment Method (See Well Abandonment Handbook)

CHECK ONE
- ☐ Standard Method
- ☐ Alternative 1
- ☐ Alternative 2
- ☐ Alternative 3
- ☐ Alternative 4:
  - ☐ Variance Option *
- ☐ Alternative 5:
  - ☐ Variance Option 1*
  - ☐ Variance Option 2*
- ☒ Other (please specify): PER A.A.C. R12-15.816 (H.2 & I.1)

* requires a letter requesting a variance

Emplacement Method of Sealing or Fill Material

CHECK ONE
- ☒ Gravity (tremie)
- ☐ Pressure Grouting
- ☐ Tremie Pumped
- ☐ Other (please specify):

REMARKS

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

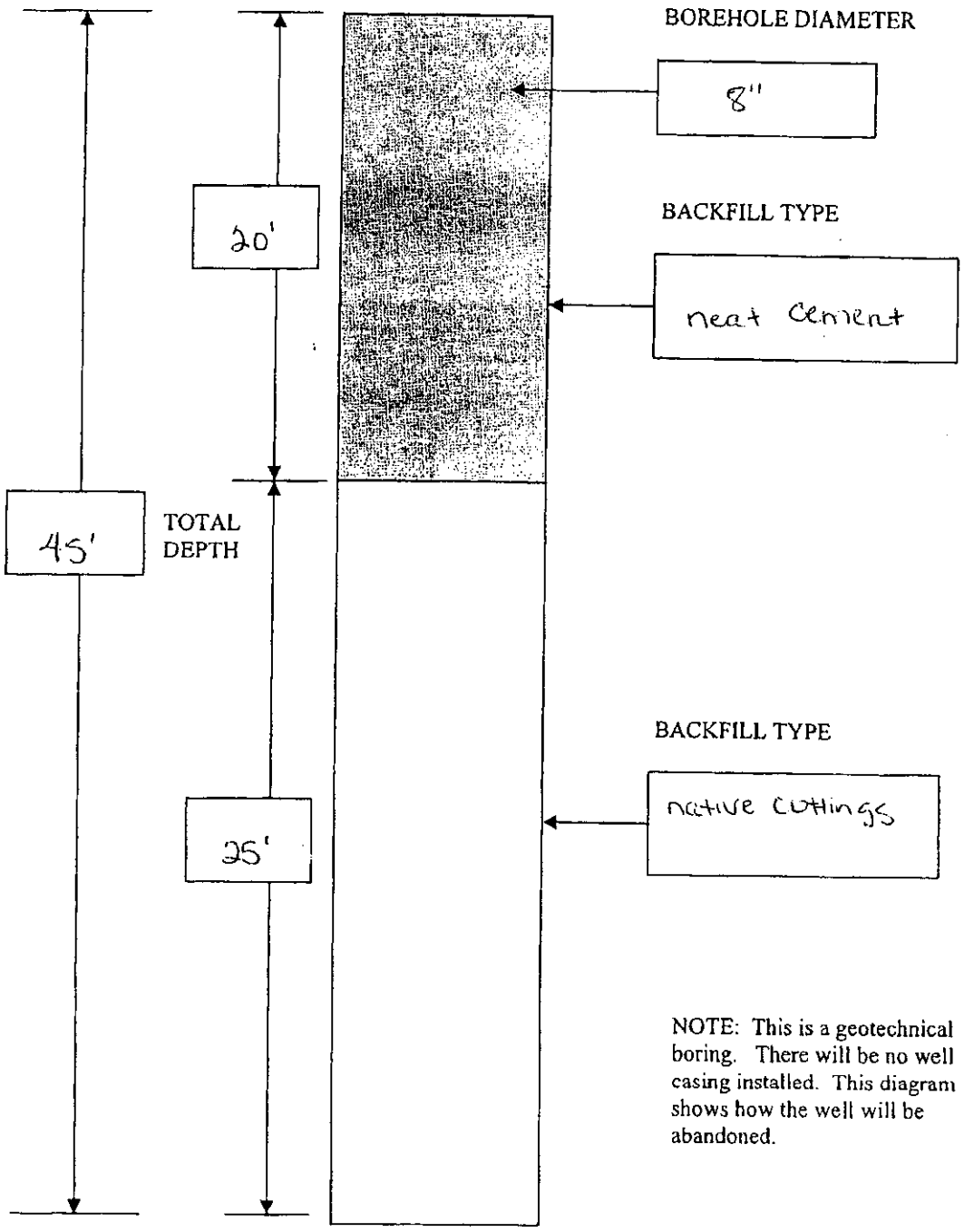
TYPE OR PRINT NAME AND TITLE: Greg Jones, GS I Operations Manager

SIGNATURE OF LANDOWNER, WELL OWNER OR EXPLORATION FIRM: [signature]

DATE: 9/30/03

200644

GEOTECHNICAL WELL CONSTRUCTION / ABANDONMENT DIAGRAM



NOTE: This is a geotechnical boring. There will be no well casing installed. This diagram shows how the well will be abandoned.

WELL OWNER: BHP Superior Operations

DRILLER: Geomechanics Southwest, Inc. (Lic. #498)

Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

RECEIVED
OCT - 1 2003
GROUNDWATER MGT

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

$150 FEE

AMA/INA		B	FB
RECEIVED	DATE	WS	
ISSUED	DATE	WQARF	CERCLA

FILE NUMBER
WELL REGISTRATION NUMBER
55 - 200094

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
- $150 check or money order for the filing fee. Only one Notice of Intent to Drill is required for all wells drilled by or for the same person to obtain geophysical, mineralogical or geotechnical data within a single section of land.
- Well construction diagram showing all proposed well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-596.

** PLEASE PRINT CLEARLY **

SECTION 1: REGISTRY INFORMATION

Well Type

CHECK ONE
- ☐ Mineral Exploration
- ☒ Geotechnical
- ☐ Heat Pump
- ☐ Cathodic Protection
- ☐ Grounding
- ☐ Other (*please specify*):

COUNTY WHERE WELL(S) ARE LOCATED: Pinal

Location of Well

WELL LOCATION ADDRESS (IF ANY)
102 Magma Heights, Superior, AZ 85273

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE	Number of Wells (holes) per 10-acre location
1 S	12 E	35	NW ¼	SW ¼	SW ¼	10
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	
			¼	¼	¼	

Use additional boxes to the right to list 160,40,10 acre descriptions for multiple wells drilled to obtain geophysical or geotechnical data on different 10-acre parcels within a single section of land (160, 40, 10 acre descriptions are not required for mineralogical exploration wells).

SECTION 2: OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
BHP Superior Operations

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL

GEOMECHANICS SOUTHWEST, INC.
1212 9TH ST. (602) 252-0559
PHOENIX, AZ 85034

91-170/1221 4561

DATE 10/1/03

PAY TO THE ORDER OF ADWR $ 300.00

Three Hundred dollars + 00/100 DOLLARS

Bank of America

Security Features Details on Back

TOUCH OR PRESS HERE DISAPPEARS WITH HEAT

geotech permits - 348-03P
FOR

[redacted]
AUTHORIZED SIGNATURE

[redacted]

THE FACE OF THIS DOCUMENT CONTAINS A MICRO-PRINT SIGNATURE LINE AND HEAT-SENSITIVE INK. ABSENCE OF THESE FEATURES WILL INDICATE A COPY.

SECTION 4: [illegible]

Questions	Yes	No	If Yes
1. Is the proposed well site within 100 feet of a septic tank system, sewer disposal area, landfill, hazardous materials or petroleum storage area or tank?		X	You must submit a letter requesting a variance from the 100-foot setback requirement (A.A.C. R12-15-818). However, if the proposed well is a geotechnical well that will be abandoned before the drill rig leaves the well site, a variance may be requested by simply checking the box below. ☒ *I request a variance from the 100-foot setback requirement for a geotechnical well.*
2. If applicable, are you requesting a variance to use thermoplastic casing in lieu of steel in the surface seal?		X	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
3. Is there another well name or identification number associated with this well?		X	PLEASE STATE

GSI Job #348-03P

200644

FAX

GEOMECHANICS SOUTHWEST, INC.
1212 South 9th Street
Phoenix, Arizona 85034

Date 10-7-03

Number of pages including cover sheet 2

To:
Jeannie
ADWR

Phone
Fax Phone 417-2422
C.C.

From:
Sondra Monroe
Geomechanics SW, Inc.
1212 S. 9th St.
Phoenix, AZ 85034

Phone 602-252-0559
Fax Phone 602-252-0721

RE: BHP Superior - Well Diagram

REMARKS:

☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment

Jeannie,

Here is the well diagram you requested. Thanks for calling and letting me fax it to you!

Sondra

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-519005

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	O ¼	O ¼	O ¼

LATITUDE Degrees	Minutes	Seconds N	LONGITUDE Degrees	Minutes	Seconds W
°	'	"	°	'	"

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

- ☐ Change of Well Drilling Contractor *(Fill out Section 2)*
- ☒ Change of Well Ownership *(Fill out Section 3)*
- ☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

$10 FEE

Current Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER:

TELEPHONE NUMBER: FAX:

New Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER: ROC LICENSE CATEGORY:

TELEPHONE NUMBER: FAX:

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

Previous Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper, Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

New Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining LLC

MAILING ADDRESS: 2525 East Arizona Biltmore Circle Suite c-135

CITY / STATE / ZIP CODE: Phoenix, AZ 85016

CONTACT PERSON NAME AND TITLE: F. D. Hegner

TELEPHONE NUMBER: 602-956-0223 FAX: 602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: F. D. Hegner V.P, G M

SIGNATURE OF WELL OWNER: F. D. Hegner DATE: 2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkey, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By _____
Vice President

ATTEST:

_____
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-1[illegible]

FILE NUMBER

WELL REGISTRATION NUMBER
55-(See attached list)

PLEASE PRINT CLEARLY

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET

PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

NO FEE

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
Name
Box 37; Superior, AZ 85273
Address

2. Lessee or Operator
Name
Address

3. Driller Joy Technologies Inc.
Name
750 E. Evans Blvd.; Tucson, AZ 85713
Address

4. Location of 1S 12E 35
TOWNSHIP RANGE SECTION
DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole I, a 50° angle hole, was drilled NC to 10 feet. From there the hole was drilled NX to a total length of 395 feet. Upon completion, the hole was filled with heavy mud and the top 20 feet was cemented.

OK mw 10-13-87

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 9/9/87 to 9/21/87

LOG OF WELL

[X] Unconsolidated Formation 0' - 10'

[X] Consolidated Formation 10' - 395'

Depth to water in feet below land surface: Indeterminant - if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J.H. Koontz / MR J. H. Koontz 10/9/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received By

Entered ENTERED OCT 14 1987 By

File No. D(1-12)35

DWR-55-42-10/83

EXPLORATION WELL(S)

FILING FEE $10.00

DEPARTMENT OF WATER RESOURCES (DWR)
NOTICE OF INTENTION TO DRILL
EXPLORATION WELL(S)

EXPLORATION WELL(S)

Section 45-596, Arizona Revised Statutes and Rule R12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, lessee or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

1. Township T1 N(S)
   Range 12 (E)W
   Section 35

In the case of a single well, list 10-acre subdivision

____ ¼, ____ ¼, ____ ¼

2. County Pinal

3. Applicant:
   Magma Copper Company
   Name
   Box 37
   Address
   Superior, AZ 85273
   City State Zip

4. Frank M. Florez
   NAME OF CONTACT PERSON
   Phone 689-2444

5. Owner of well:
   Magma Copper Company
   Name
   Box 37
   Address
   Superior, AZ 85273
   City State Zip

6. Purpose of well(s) drilled pursuant to this Notice:
   Mineral Exploration x
   Geotechnical ____
   Cathodic Protection ____
   Grounding ____

7. Number of wells 3
   (See Condition 3 on reverse)

8. Owner of land:
   Magma Copper Company
   Name
   Box 37
   Address
   Superior, AZ 85273
   City State Zip

9. DESCRIPTION OF WELL:
   Diameter 3 inches
   Depth 250'-300' feet
   Type of casing none
   (If none, so state)

10. Construction will start:
    9 08 1987
    Month Day Year

DO NOT WRITE IN THIS SPACE
OFFICE RECORD
File No. D(1-12)35
Filed 9-2-87 By ek
Input ENTERED SEP 09 1987 By
Duplicate Mailed 9-8-87 By ek
Registration 55-519005
AMA/INA PHL
W/S 118 S/B 06

11. Drilling firm:
    Joy Manufacturing Company
    Name Contract Drill Div.
    ~~707 Boyd Boulevard~~
    ~~P. O. Drawer 489~~
    Address 750 E. EVANS BLVD.
    Tucson AZ. 85713
    ~~La Porte, Indiana 46350~~
    City State Zip

    No. 75 A-4
    DWR License Number

12. Period well will remain in use 6 months.

13. Proposed method of abandonment of well(s) after project is completed:

    Cement Group plug as per DWR Rule R12-15-816 Paragraph B-1 or B-2

SEP 1987
HYDROLOGY
APPROVED
RKF

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials? Yes ___ No x

If yes, a request for a variance must accompany this application pursuant to R12-15-820.

GENERAL INSTRUCTIONS

1. Fill out this form in duplicate and mail to Department of Water Resources, Suite 100, 99 East Virginia, Phoenix, Arizona 85004.
2. Proper filing fee of $10.00 must accompany Notice.

I state that this Notice is filed in compliance with Rule R12-15-809 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

DATE September 1, 1987

Frank M Florez Manager,
Signature of Applicant Special Projects

DWR 55-40-8/86 (Revised)

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with DWR Rules R12-15-811 and R12-15-816.

2. Drilling of the well(s) shall be completed within one (1) year after the date of Notice.

3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these wells, then the well(s) must be properly abandoned in accordance with Condition 1 above.

4. More than one well may be drilled under a single notice for mineral exploration, geotechnical, cathodic protection and grounding purposes, so long as they are located within a single section.

5. A Project Completion Report, DWR-55-42-10/83, for each hole is required within 30 days of completion of the project.

6. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.

7. Special construction standards required pursuant to R12-15-821: _____

_____

_____

RECEIVED
SEP 7 1987
DEPT. OF WATER RESOURCES

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
Name

Box 37; Superior, AZ 85273
Address

2. Lessee or Operator
Name

Address

3. Driller Joy Technologies Inc.
Name

750 E. Evans Blvd.; Tucson, AZ 85713
Address

RECEIVED NOV 10 1987 DEPT. OF WATER RESOURCES

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 7 was a 30° angle hole drilled NC to 6' and NX to 236.5'. Upon completion the hole was filled with heavy mud and the top 20 feet was cemented.

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 10/15/87 through 10/23/87

LOG OF WELL

[X] Unconsolidated Formation 0 - 6'

[X] Consolidated Formation 6' - 236.5'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received _____ By ____

Entered _____ By ____

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
Name

Box 37; Superior, AZ 85273
Address

2. Lessee or Operator
Name

Address

3. Driller Joy Technologies Inc.
Name

750 E. Evans Blvd.; Tucson, AZ 85713
Address

RECEIVED NOV 10 1987 DEPT. OF WATER RESOURCES

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 6 was a 60° angle hole drilled NC to 6' and NX to 287'. Upon completion the hole was filled with heavy mud and the top 20 feet was cemented.

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 10/10/87 through 10/15/87

LOG OF WELL

[X] Unconsolidated Formation 0 - 6'

[X] Consolidated Formation 6'- 287'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received By

Entered By

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

RECEIVED DEC 28 1987 DEPT. OF WATER RESOURCES

1. Owner Magma Copper Company
   Name
   Box 37; Superior, AZ 85273
   Address

2. Lessee or Operator
   Name
   Address

3. Driller Joy Technologies Inc.
   Name
   750 E. Evans Blvd.; Tucson, AZ 85713
   Address

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 14 was a 60° angle hole drilled NC to 18' and NX to 280'. Upon completion the hole was filled with heavy mud and the top 20' was cemented. OK - MW 12-30-87

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 11/23/87 through 12/1/87

LOG OF WELL

[X] Unconsolidated Formation 0' - 18'

[X] Consolidated Formation 18' - 280'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 12/24/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received By

Entered ENTERED DEC 31 1987 By

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
   Name
   Box 37; Superior, AZ 85273
   Address

2. Lessee or Operator
   Name
   Address

3. Driller Joy Technologies Inc.
   Name
   750 E. Evans Blvd.; Tucson, AZ 85713
   Address

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 5 was a 60° angel hole drilled NC to 6' and NX to 268'. Upon completion the hole was filled with heavy mud and the top 20 feet was cemented.

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 10/6/87 through 10/10/87

LOG OF WELL

[X] Unconsolidated Formation 0 - 6'

[X] Consolidated Formation 0 - 268'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received By

Entered By

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
   Name
   Box 37; Superior, AZ 85273
   Address

2. Lessee or Operator
   Name
   Address

3. Driller Joy Technologies Inc.
   Name
   750 E. Evans Blvd.; Tucson, AZ 85713
   Address

4. Location of Township: 1S Range: 12E Section: 35

RECEIVED NOV 10 1987 DEPT. OF WATER RESOURCES

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 4 was a 60° angle hole which was drilled NC to 6' and NX to 253'. Upon completion the hole was filled with heavy mud and the top 20' was cemented.

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 10/1/87 through 10/6/87

LOG OF WELL

[x] Unconsolidated Formation 0-6'

[x] Consolidated Formation 6'- 253'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005
Received By
Entered By
File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

1. Owner Magma Copper Company
Name
Box 37; Superior, AZ 85273
Address

RECEIVED NOV 10 1987 DEPT. OF WATER RESOURCES

2. Lessee or Operator
Name
Address

3. Driller Joy Technologies Inc.
Name
750 E. Evans Blvd.; Tucson, AZ 85713
Address

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole III was a 60° angle hole and was drilled NC to 6' and NX to 258'. Upon completion the hole was filled with heavy mud and the top 20 feet was cemented.

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 9/28/87 through 10/1/87

LOG OF WELL

[X] Unconsolidated Formation 0 - 6'

[X] Consolidated Formation 0 - 258'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received _____ By ____

Entered _____ By ____

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

RECEIVED NOV 10 1987 DEPT. OF WATER RESOURCES

1. Owner Magma Copper Company
   Name
   Box 37; Superior, AZ 85273
   Address

2. Lessee or Operator
   Name
   Address

3. Driller Joy Technologies Inc.
   Name
   750 E. Evans Blvd.; Tucson, AZ 85713
   Address

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole II is a 60° angle hole drilled NC to 5' and NX to 339'. Upon completion the hole was filled with heavy mud and the top 20 feet was cemented. ok. mr 11-16-87

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 9/21/87 through 9/28/87

LOG OF WELL

[X] Unconsolidated Formation 0 - 6'

[X] Consolidated Formation 0 - 339'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 11/5/87

Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received By

Entered By ENTERED NOV 16 1987

File No. D(1-12)35

DWR-55-42-10/83

STATE OF ARIZONA

DEPARTMENT OF
WATER RESOURCES

PROJECT COMPLETION REPORT FOR EXPLORATION DRILLING

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well drilling project.

RECEIVED DEC 7 1987 DEPT. OF WATER RESOURCES

1. Owner Magma Copper Company
Name

Box 37; Superior, AZ 85273
Address

2. Lessee or Operator
Name

Address

3. Driller Joy Technologies Inc.
Name

750 E. Evans Blvd.; Tucson, AZ 85713
Address

4. Location of Township: 1S Range: 12E Section: 35

DESCRIPTION OF WELL

5. Type of casing (if installed)

6. Abandonment method and materials used if abandoned: Hole 13 was a 60° angle hole drilled NC to 10' and NX to 114'. Upon completion the hole was filled with heavy mud and the top 20' was cemented.

OK - m, 12-7-87

7. Construction details if completed for monitoring purposes, re-entry or conversion to water wells:

8. Date or period drilled 11/20/87 through 11/22/87

LOG OF WELL

[X] Unconsolidated Formation 0' - 10'

[X] Consolidated Formation 10' - 114'

Depth to water in feet below land surface: Indeterminant if any
(if encountered or detected)

I state that this report is filed in compliance with ARS §45-600 and is complete and correct to the best of my knowledge and belief.

J. H. Koontz 12/3/87
Driller's Signature Date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-519005

Received _____ By ____

Entered _____ By ____

File No. D(1-12)35

DWR-55-42-10/83

ORIGINAL

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee.
NOTE: A.R.S. § 45-593.C requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 519005 **FILE NO:** D(1-12)35

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

_____

Date _____ **Signature of Current Well Owner** _____

2. STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached

File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-98
Title: Land Manager

ENTERED MAY - 7 1999 MAG

DWR 55-71 (Rev 12/95)

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. **REQUEST TO CHANGE WELL DRILLER** **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. **REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)**

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO GRID: I 10

OPERATIONS DIVISION

REPORT DATE: 1/31/96 **** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

FULL-NAME		QUAD	TOWN	RNGE	SECT	QTR 1 2 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LOGT	CR	OWN
MAGMA COPPER CO BOX 37 SUPERIOR	AZ	D	1.0	12.0	25		55-519696						12/11/1987	075	N	15	X	N	
MAGMA COPPER CO BOX M SAN MANUEL	AZ	D	8.0	18.0	10	D A A	55-518855	0010					9/04/1987	075	N	11	X	N	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	1.0	15.0	24		55-518026						6/06/1987	075	N	07	X	N	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	1.0	15.0	07	C A B	55-519761	0610	0605	10	0230	00015	12/16/1987	360	M	07	X	X	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	1.0	14.0	12	A A B	55-519762	0460	0460	10	0105	00015	12/22/1987	360	M	07	X	X	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	36		55-519007						10/24/1987	075	N	15	X	N	
MAGMA COPPER CO BOX 37 SUPERIOR	AZ	D	1.0	12.0	35		55-519005						9/21/1987	075	N	15	X	N	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	1.0	15.0	21	A C D	55-526109	0600	0585	12	0098	00050	1/06/1990	360	I	07	X	X	
MAGMA COPPER CO BOX 37 SUPERIOR	AZ	D	1.0	13.0	32	B B D	55-525312								L	15	N	N	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	2.0	15.0	28	B A C	55-525733	0700		07			9/01/1989	109	I	07	X	C	
MAGMA COPPER CO BOX 100 MIAMI	AZ	A	1.0	14.0	20	D B B	55-525734	0670		07	0040		8/30/1989	109	I	07	X	C	

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ELFRIDA
MAHER
PO BOX 1
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131 W CAN
APACHE JU

-132 X 64 10-6

ARIZONA DEPARTMENT OF WATER RESOURCES
99 E. Virginia Avenue, Phoenix, Arizona 85004

9/8/87

MAGMA COPPER CO
BOX 37
SUPERIOR AZ 85273

Registration No. 55-519005 & 55-519007
File No. D(1-12)35
D(1-12)36

Evan Mecham, Governor
Alan P. Kleinman, Director

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill an exploration well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed separately a Well Drilling Card which he is required to have in his possession before commencing to drill the well.

[ ] Since this well is being drilled as a monitor well, or for cathodic protection, grounding, geotechnical or piezometer purposes, our standard driller report form is also being furnished to the driller which he is required to complete and return to the Department within 30 days after the completion of drilling. A Completion Report form is being furnished for monitor wells where pump equipment is authorized to be installed as part of this packet so that you may submit the report within 30 days after the installation of pumping equipment on a monitor well as required by A.R.S. §45-600.

[X] This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion Report is being furnished your designated driller for each hole to be drilled. Your driller is required to submit this Project Completion Report within 30 days after completion of drilling. You should insist that this is done.

For monitor, geotechnical, cathodic protection, grounding and piezometer wells, you should obtain the written permission of the Department of Water Resources before proceeding with the drilling in the event that you determine it necessary to change the location of the proposed well. A properly signed amended Drilling Card must be in the possession of the driller before drilling commences at a different location than originally authorized.

For your <u>future</u> use, a Change of Well Information form is enclosed should it become needed. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, including abandonment, in order to keep the well registration file current and accurate.

Sincerely,

R. A. Gessner
Chief, Operations Division

RAG:ek
Enclosures
DWR-55-8-8/84

TWITTY, SIEVWRIGHT & MILLS
2702 N THIRD STREET
SUITE 4007

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
WATER RIGHTS ADMINISTRATION
99 EAST VIRGINIA
PHOENIX, ARIZONA 85004

RECEIPT

KIND ENTRY	FILE REFERENCE NO.
55	519005
55	XXXXXXX519007

MAGNA COPPER CO

ACCOUNT NO. FUND SOURCE	AGENCY	CHAPTER	DIV.	INT. ACCT.	ITEM DESCRIPTION	RATE	$ AMOUNT
					FILING FEE FOR NOTICES OF INTENTION TO	10.00	20.00
					DRILL WELLS		
					FILE#D(1-12)35 REG#55-519005		
					~~#D(1-12)36 Reg#55-519007~~		

SEP 1987
PAID

TOTAL $ 20.00

9/8/87/ek
CK#31124

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
99 EAST VIRGINIA AVENUE
PHOENIX, ARIZONA 85004

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

RECEIVED DEC 23 1988 DEPT. OF WATER RESOURCES

1. Owner SW GAS
   Name
   Tucson Az
   Mailing Address
2. Driller Huron Drilling - PO 1422
   Name
   Huron SD 57350
   Mailing Address
3. Location of well: Superior - Prophyry & Kellner Strt
4. Permit No. NA
   (if issued)

DESCRIPTION OF WELL

5. Total depth of hole 120' ft.
6. Type of casing NA
7. Diameter and length of casing NA in. from ____ to ____, ____ in from ____ to ____.
8. Method of sealing at reduction points 25' GROUTED on TOP
9. Perforated from NA to ____, from ____ to ____, from ____ to ____.
10. Size of cuts NA Number of cuts per foot ____
11. If screen was installed: Length NA ft. Diam ____ in. Type ____
12. Method of construction ____
    (drilled), dug, driven, bored, jetted, etc.
13. Date started 12 (Month) 2 (Day) 88 (Year)
14. Date completed 12 (Month) 2 (Day) 88 (Year)
15. Depth to water NA ft. (If flowing well, so state.)
16. Describe point from which depth measurements were made, and give sea-level elevation if available NA
17. If flowing well, state method of flow regulation: NA
18. Remarks: CATHODIC PROTECTION

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

REG. NO. 55-522271

File No. D(1-12)34aac

Entered ENTERED DEC 28 1988 By ____

DWR-55-6-Rev. 8/85

LOG OF WELL

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material

I hereby certify that this well was drilled by me (or under my supervision), and that each and all of the statements herein contained are true to the best of my knowledge and belief.

Driller Huron Drilling Fred Osborn
Name

PO 1422
Address

Huron SD 57350
City State Zip

Date 12/12/88

EXPLORATION WELL(S)

FILING FEE $10.00

DEPARTMENT OF WATER RESOURCES (DWR)
NOTICE OF INTENTION TO DRILL
EXPLORATION WELL(S)

EXPLORATION WELL(S)

RECEIVED SEP 6 1988 DEPT. OF WATER RESOURCES

Section 45-596, Arizona Revised Statutes and Rule R12-15-817 provide: Prior to drilling one or more exploration wells, the well owner, lessee or exploration firm shall file a Notice of Intention to Drill on a form provided by the Department.

WELL/LAND LOCATION

1. Township 1S N/S
   Range 12E E/W
   Section 34

In the case of a single well, list 10-acre subdivision

SW ¼, NE ¼, NE ¼

2. County Pinal

3. Applicant:

Southwest Gas Corporation
Name

3401 East Gas Road
Address

Tucson Arizona 85714
City State Zip

4. Donald R. Cuffe
NAME OF CONTACT PERSON

Phone 794-6025

5. Owner of well:

Southwest Gas Corporation
Name

3401 East Gas Road
Address

Tucson Arizona 85714
City State Zip

6. Purpose of well(s) drilled pursuant to this Notice:

Mineral Exploration ____
Geotechnical ____
Cathodic Protection X
Grounding ____

7. Number of wells 1
(See Condition 3 on reverse)

8. Owner of land:

City of Superior Right-of-Way
Name

Prophyry & Kellner Street
Address

Superior Arizona
City State Zip

9. DESCRIPTION OF WELL:

Diameter 10" inches

Depth 220' feet

Type of casing None
(If none, so state)

10. Construction will start:

September 15 1988
Month Day Year

11. Drilling firm:

Huron Drilling, Inc.
Name

Post Office Box 1422
Address

Huron, South Dakota 57350
City State Zip

499-A-4
DWR License Number

12. Period well will remain in use 240 months.

13. Proposed method of abandonment of well(s) after project is completed:

In accordance with R12-15-816

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D(1-12)34aae
Filed 9-6-88 By ek
Input ENTERED SEP 09 1988
Duplicate Mailed 9-9-88 By ek
Registration 55-502271
AMA/INA PHY a m a
W/S U8 S/B 06

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility or storage area of hazardous materials? Yes ____ No X

If yes, a request for a variance must accompany this application pursuant to R12-15-820.

SEP 1988 HYDROLOGY APPROVED

GENERAL INSTRUCTIONS

1. Fill out this form in duplicate and mail to Department of Water Resources, 99 East Virginia, Phoenix, Arizona 85004.
2. Proper filing fee of $10.00 must accompany Notice.

I state that this Notice is filed in compliance with Rule R12-15-809 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

DATE 8/18/88

Signature of Applicant

DWR 55-40-8/86 (Revised)

CONDITIONS

1. Construction and abandonment standards for all wells shall be in accordance with DWR Rules R12-15-811 and R12-15-816.

2. Drilling of the well(s) shall be completed within one (1) year after the date of Notice.

3. Mineral exploration, geotechnical, cathodic protection or grounding holes of 100 feet of depth or less do not apply to these provisions and do not require filing. However, if water is encountered during the drilling of these wells, then the well(s) must be properly abandoned in accordance with Condition 1 above.

4. More than one well may be drilled under a single notice for mineral exploration, geotechnical, cathodic protection and grounding purposes, so long as they are located within a single section.

5. A Project Completion Report, DWR-55-42-10/83, for each hole is required within 30 days of completion of the project.

6. Pump equipment may not be installed on wells drilled for mineral exploration, geotechnical, cathodic protection or grounding purposes.

7. Special construction standards required pursuant to R12-15-821: _____

_____

_____

EXPLORATION WELL

EXPLORATION WELL

DEPARTMENT OF WATER RESOURCES
99 East Virginia
Phoenix, Arizona 85004

THIS DRILLING CARD SHALL BE IN THE POSSESSION OF THE DRILLER
BEFORE DRILLING OPERATIONS COMMENCE

AUTHORIZED DRILLER HURON DRILLING, INC. LICENSE NO. 499
(Unless superceded by a notification of change of well driller)

Notice(s) of Intention to Drill/~~Deepen~~ Exploration Well(s) for CATHODIC PROTECTION purposes has been filed with the Department by:

Name	Address	City	State	Zip
SOUTHWEST GAS CORP	3401 E. GAS RD	TUCSON	AZ	85714

Well(s) to be located in:

Township	Range	Section	¼	¼	¼
1S	12E	34	SW	NE	NE

Number of wells in project: 1 Registration No. 55- 522271

This authorization to drill/~~deepen~~ the above well(s) expires at midnight on 9/8/89.

PURSUANT TO ARS 45-600, THE DRILLER SHALL FILE ON THE PRESCRIBED DEPARTMENT FORM, A LOG OF THE WELL(S) WITHIN 30 DAYS OF COMPLETION OF DRILLING.

for [signature]
Deputy Director

DWR-55-45-11/83

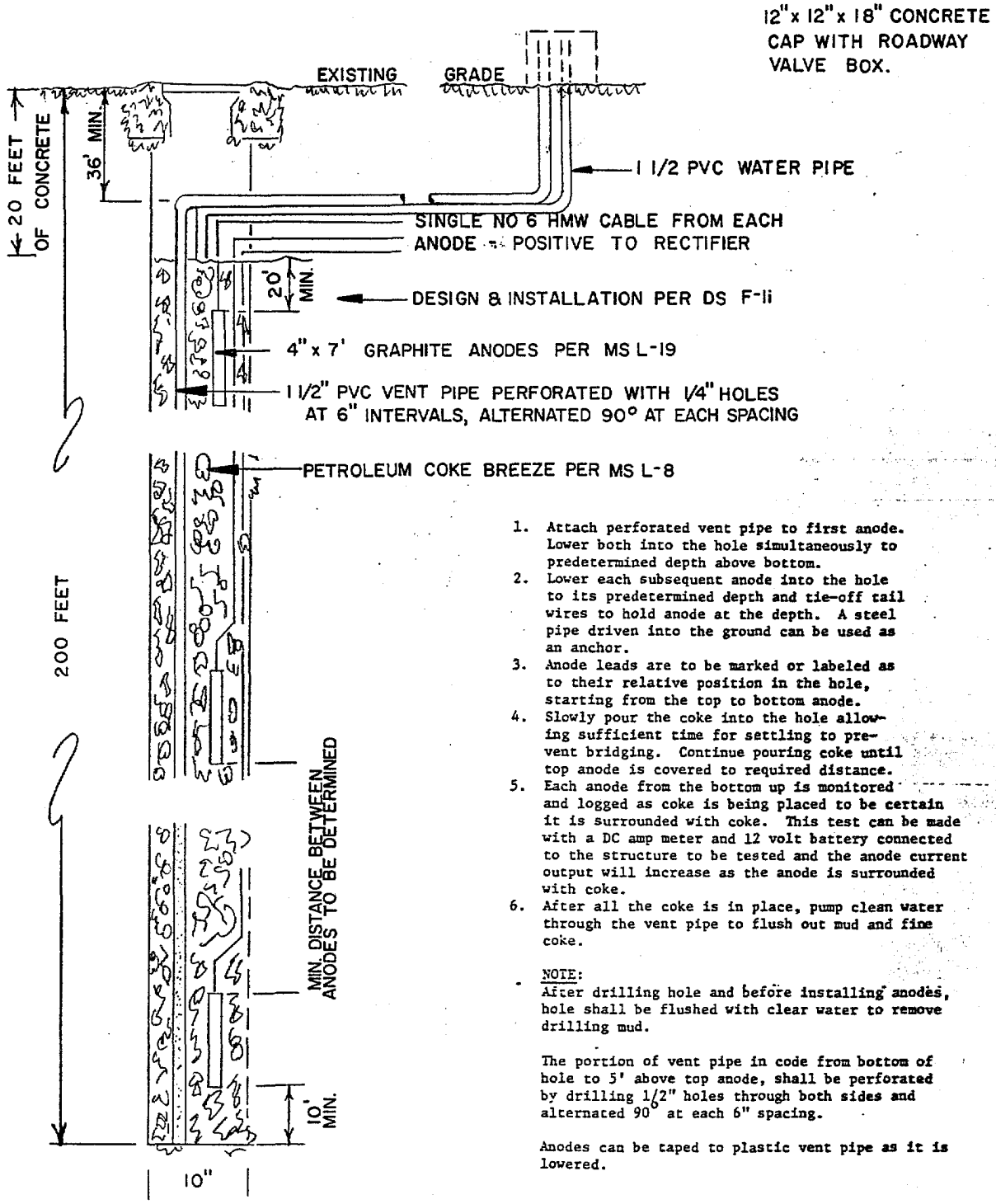
Superior

SOUTHWEST GAS CORPORATION
DESIGN STANDARD

ISSUED BY: ENGINEERING/CORROSION/APACHE	PREPARED BY: Donald Cuffe
DATE ISSUED: May 27, 1986	APPROVED BY: M. Gast/P. Chimos
SUBJECT: CORROSION CONTROL Typical Impressed Current Ground Bed Installation - Deep Well Anode Installation	ORIGINAL ☐ REVISIONS ☐ SUPERSEDES:

CONFORMS TO ARIZONA STATE STATUTE AND RULE R12-15-817 R12-15-816

FOR RECTIFIER INSULATION & VENTING CONFIGURATION, SEE DS D-6d1 OR D-6d2



1. Attach perforated vent pipe to first anode. Lower both into the hole simultaneously to predetermined depth above bottom.
2. Lower each subsequent anode into the hole to its predetermined depth and tie-off tail wires to hold anode at the depth. A steel pipe driven into the ground can be used as an anchor.
3. Anode leads are to be marked or labeled as to their relative position in the hole, starting from the top to bottom anode.
4. Slowly pour the coke into the hole allowing sufficient time for settling to prevent bridging. Continue pouring coke until top anode is covered to required distance.
5. Each anode from the bottom up is monitored and logged as coke is being placed to be certain it is surrounded with coke. This test can be made with a DC amp meter and 12 volt battery connected to the structure to be tested and the anode current output will increase as the anode is surrounded with coke.
6. After all the coke is in place, pump clean water through the vent pipe to flush out mud and fine coke.

NOTE:
After drilling hole and before installing anodes, hole shall be flushed with clear water to remove drilling mud.

The portion of vent pipe in code from bottom of hole to 5' above top anode, shall be perforated by drilling 1/2" holes through both sides and alternated 90° at each 6" spacing.

Anodes can be taped to plastic vent pipe as it is lowered.

HURON DRILLING INC. DRILLERS LOG

PAGE NO.

JOB NAME	LOCATION	DATE	RIG NO.	FOREMAN
SWGAS	City Superior	12/2/88	30	Karl Osberg

Jt No.	DEPTH	TIME	REMARKS
1	20		0-4 CLAY
2	40		4-120 ROCK
3	60		
4	80		
5	100		
6	120	TD	

Reminder Printing & Office Supply Inc. 6697 Huron, SD

GOUDY ENGINEERING, INC.
P.O. Box 18258
Tucson, Az. 85731

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
WATER RIGHTS ADMINISTRATION
99 EAST VIRGINIA
PHOENIX, ARIZONA 85004

RECEIPT

KIND ENTRY	FILE REFERENCE NO.
55	522248
	THRU
55	522294

FOR: SOUTHWEST GAS

ACCOUNT NO. FUND SOURCE	AGENCY	CHAPTER	DIV	INT. ACCT.	ITEM DESCRIPTION	RATE	$ AMOUNT
					FILING FEE FOR NOTICE OF INTENT TO	10.00	470.00
					DRILL EXPLORATION WELLS		
					CHECK NO. 2496 9-6-88 sv		

PAID SEP 8 1988 PAID

TOTAL $ 470.00

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-550403

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	C ¼	A ¼	B ¼

LATITUDE Degrees °	Minutes '	Seconds "N	LONGITUDE Degrees °	Minutes '	Seconds "W

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

- ☐ Change of Well Drilling Contractor *(Fill out Section 2)*
- ☒ Change of Well Ownership *(Fill out Section 3)*
- ☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

$10 FEE

Current Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER:

TELEPHONE NUMBER: FAX:

New Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER: ROC LICENSE CATEGORY:

COMPLETED MAR 03 2005

TELEPHONE NUMBER: FAX:

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

Previous Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper, Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

New Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining LLC

MAILING ADDRESS: 2525 East Arizona Biltmore Circle Suite c-135

CITY / STATE / ZIP CODE: Phoenix, AZ 85016

CONTACT PERSON NAME AND TITLE: F. D. Hegner

TELEPHONE NUMBER: 602-956-0223 FAX: 602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: F. D. Hegner V.P, G M

SIGNATURE OF WELL OWNER: F.D. Hegner DATE: 2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkay, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By M H Campbell
Vice President

ATTEST:

Andrew L. Bradkay
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

PLEASE PRINT CLEARLY

WELL REGISTRATION NUMBER
55-(See attached list)

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF
ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

MONITOR/PIEZOMETER WELL

FILING FEE $10.00

MCC5D

ARIZONA DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004 (602) 417-2470

MONITOR/PIEZOMETER WE.

FILING FEE $10.

DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

Section § 45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. **WELL LOCATION:**

   1 N/S | 12 E/W | 35
   Township | Range | Section

   NW 1/4 | NE 1/4 | SW 1/4
   10 ACRE | 40 ACRE | 160 ACRE

2. Position location of the well on the land:

   Latitude 33 0 17 58 "

   Longitude 110 0 06 17 "

3. County: PINAL

4. **Owner of the land of wellsite:**

   MAGMA COPPER
   Name
   P.O. BOX 37
   Address
   SUPERIOR AZ 85273
   City State Zip

5. **Lessee of the land of wellsite:**

   Name
   Address
   City State Zip

6. **Owner of well:**

   MAGMA COPPER COMPANY
   Name
   P.O. BOX 37
   Address
   SUPERIOR AZ 85273
   City State Zip

7. Consulting Firm: BROWN AND CALDWELL

   Contact Person: BRIAN ANDERSON

   Phone: (602) 222-4492

8. Purpose of well drilled pursuant to this notice

   Monitor X

   Piezometer

9. If for deepening or modifying, Well Registration Number

   55-

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D (1-12) 35C AB

Filed 6-16-95 By ok

Input By

DUPLICATE

Mailed 7-8-95 By ok

Registration 55- 550403

AMA/INA PM

W/S 28 S/B 06

10. Construction will start:

    6 5 95
    Month Day Year

11. Period well will remain in use 10 Months/Years

12. For monitoring wells, is pump equipment to be installed?

    Yes ✓ No

    (a) If yes, design pump capacity 5-7 GPM

    (b) What use will be made of the water ANALYTICAL TESTING

13. **Drilling firm:**

    WDC/Water Development Corp. of California (FN)
    Name
    1202 KENTUCKY AVENUE
    Address
    WOODLAND CALIF. 95776
    City State Zip

    DWR License No. 161

    A4
    ROC License classification

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility, storage area of hazardous material or petroleum storage areas and tanks?

    Yes No X

16. Proposed method of abandonment of well after project is completed: PER AAC R12-15-816 JUN 16 1995

17. Is this well to monitor existing contamination? NO Potential contamination . Please explain:

GENERAL INSTRUCTIONS

1. Fill out this form in **DUPLICATE** and send **WITH $10.00 FEE** to 500 NORTH THIRD STREET, PHOENIX, AZ 85004
2. For specific instructions, limitations and conditions, see the reverse side of this form.
3. **Must be signed by land owner or lessee.**
4. Section §45-596(D), provides that the Director shall determine that all information required on form has been submitted. If not, the person filing will be notified and the drilling, deepening, or modification of the well may not proceed.

I state that Notice is filed in compliance with Section § 45-596 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Jeff J. Parker
Typed or Printed Name

Signature [X] Land Owner [ ] Lessee of wellsite

4/7/95
Date

DWR 55-44 9/92 (Rev.)

18. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? Ms. Shirin Tolle

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact? _____

19. WELL CONSTRUCTION PLAN

a) Drilling method (mud rotary, hollow-stem auger, etc.) Direct Air Rotary Drilling

b) Borehole diameters: 9 5/8 inches from 0 feet to 500 feet.

_____ inches from _____ feet to _____ feet.

c) Casing materials (PVC, steel, hollow-stem auger, etc.)

material LOW CARBON STEEL diameter 5 9/16 inches from 1/2 feet als to 460 feet bls

material STAINLESS STEEL diameter 5 9/16 inches from 460 feet to 490 feet

d) Method of sealing at reductions NA

e) Annular seal materials (cement, grout, etc.); method of placement (tremied, circulated)

material CEMENT GROUT method TREMIE from 0 feet to 450 feet

material BENTONITE method TREMIE from 450 feet to 455 feet

f) Filter packs (state material):

material SILICA SAND 10-20 MESH from 455 feet to 500 feet

material _____ from _____ feet to _____ feet

g) Perforations or screen specifications:

type 5 9/16 SLOTTED STAINLESS STEEL from 460 feet to 490 feet

type _____ from _____ feet to _____ feet

h) Method of well development (bail, air lift, surge) bail, surge, pump

i) Will surface or conductor casing extend above grade: Yes X No _____

20. Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.

CONDITIONS

I. Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.

II. Drilling of the well shall be completed within one (1) year after the date of Notice.

III. A Well Driller Report, is required within 30 days of completion of drilling. A Completion Report, is required to be filed with the Department within 30 days after installation of pump equipment for monitor wells.

IV. Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.

V. A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."

VI. Special construction standards required pursuant to A.A.C. Rule R12-15-821: _____

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee.
NOTE: A.R.S. § 45-593.C requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 550403 **FILE NO:** D(1-12)35 CAB

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

Date _____ **Signature of Current Well Owner** _____

2. STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-96
Title: Land Manager

ENTERED MAY 10 1996 MAG

DWR 55-71 (Rev 12/95)

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. **REQUEST TO CHANGE WELL DRILLER** **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. **REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)**

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO

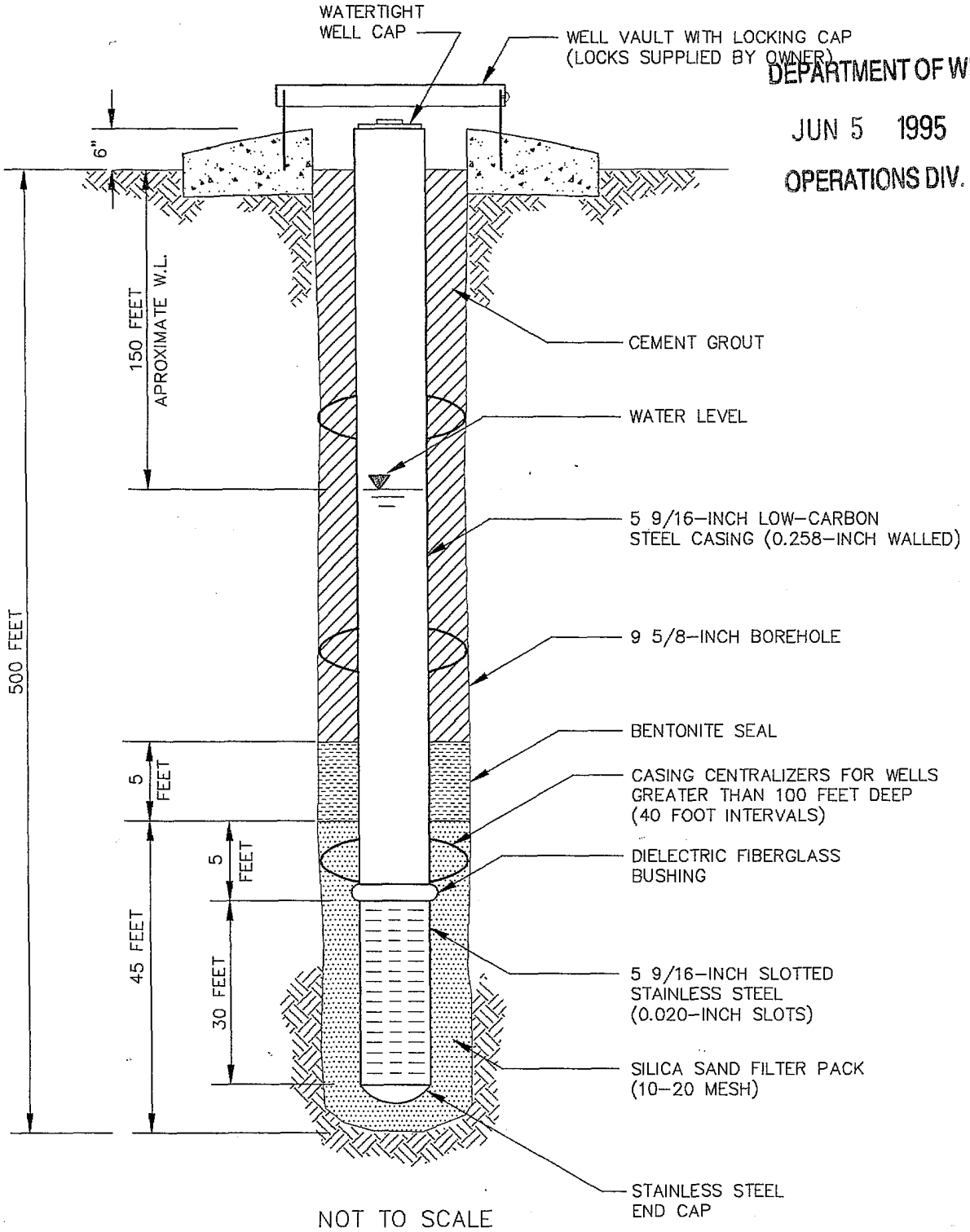
GRID: E 08

REPORT NO: WL9020

ARIZONA DEPARTMENT OF WATER RESOURCES WELL REPORT
OPERATIONS DIVISION
**** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

REPORT DATE: 1/31/96

FULL-NAME		QUAD	TOWN	RNGE	SECT	QTR 1	QTR 2	QTR 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LOGT	CR	OWN
MAGMA COPPER CO PO BOX 100 MIAMI	AZ 85539	A	1.0	15.0	29	B	B	C	55-552282							028	M	07	I	N	
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	2.0	15.0	29	A	A	B	55-501092	0763			0040	00320	4/24/1980	053	F	07	X	N	X
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	2.0	13.0	33	D	D	A	55-502723	0700	0700	12	0044		4/00/1982	053	F	07	X	C	X
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	2.0	15.0	29	A	D	B	55-501093	0770	0000	00	0022	00225	8/07/1779	053	F	07	X	X	X
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	2.0	15.0	29	D	A	C	55-501094	1025	1025	06	0031	00125	8/11/1977	053	F	07	X	X	X
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	1.0	15.0	10	C	B	B	55-501095	1005	1005	06	0242	00000	0/00/1981	053	F	07	X	X	X
MAGMA COPPER CO BOX 100 MIAMI	AZ 85539	A	2.0	15.0	28	C	D	D	55-501096	0840	0000	00	0000	00000	0/00/1981	053	F	07	X	X	X
MAGMA COPPER CO PO BOX 100 MIAMI	AZ 85539	A	1.0	13.0	25	D	D	C	55-553712							360	M	07	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ 85273	D	1.0	12.0	35	C	A	B	55-550403							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ 85273	D	1.0	12.0	34	D	B	C	55-550404							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ 85273	D	1.0	12.0	34	D	B	C	55-550405							161	M	15	I	N	



DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.

JUN 16 1995

NOTE:

1. CASING DIMENSIONS ARE OUTSIDE DIAMETER

MCC-5D

BROWN AND CALDWELL

MONITOR WELL DESIGN TYPE B

F2126020 05-23-95 GaryG

Environmental Drilling, Construction, Development and Well Abandonment Services.

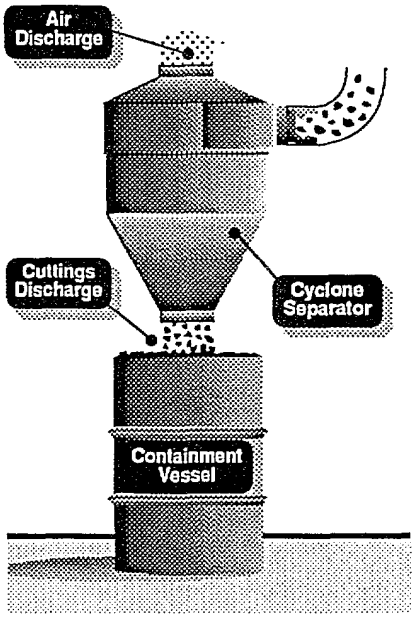
AIR ROTARY CASING HAMMER

On The Cutting Edge of a Cleaner Environment.

Air Rotary Casing Hammer • Dual Tube Reverse Rotary • Dual Tube Percussion • Direct Air Rotary • Direct Mud Rotary • Reverse Circulation

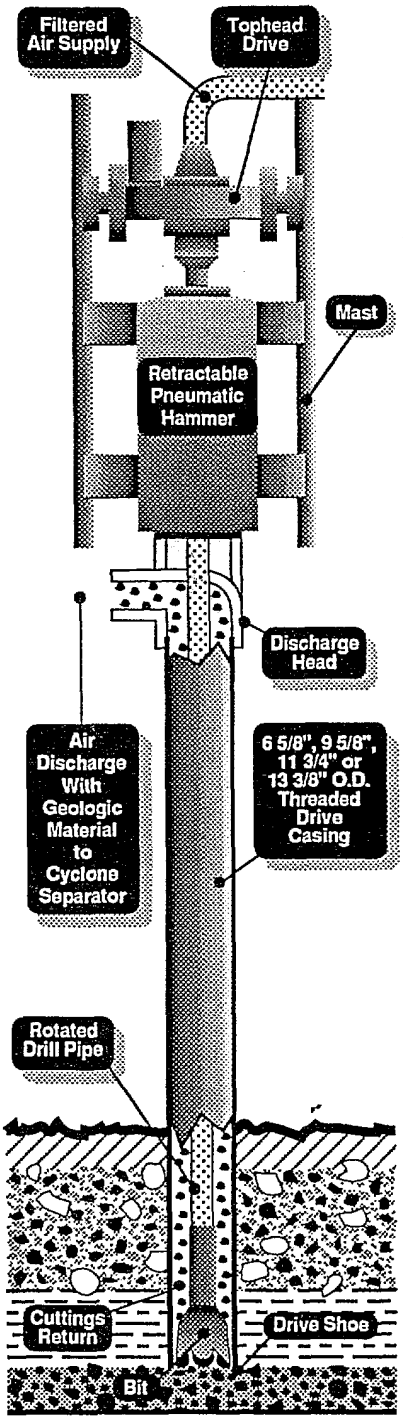
The Air Rotary Casing Hammer method of drilling is described as a nonrotating threaded casing driven simultaneously with the rotated drilling of a smaller diameter borehole while filtered air is forced downward through the center drill rod to the bit. The air returns upward through the annulus between the drive casing and the smaller rotating drill rod bringing with it a continuous discharge of drill cuttings. A water mist injection is occasionally used to assist the drilling and sample recovery rate. The material is discharged into a cyclone arrangement which separates the air from the formation cuttings to facilitate sampling and drill cuttings containment.

The drive casing is a heavy wall flush threaded pipe. Five diameters are available. The 6 5/8" O.D. system allows for installation of a 2" well to 800'. The 9 5/8" O.D. system allows for installation of up to a 5"



well to 600'. The 11 3/4" O.D. system allows for installation of a 6" well to 400', the 13 3/8" O.D. system allows for installation of up to an 8" well to 300' and the 16" system allows for installation of up to a 12" well to 250'. All of these systems can be telescoped to achieve greater depths. The casing is driven by a pneumatic drill through drive hammer which is rated up to 9700 foot pounds of energy.

Upon completion of drilling, the drill rod and bit are extracted from the center of the drive casing and permanent well completion materials are installed. Casing withdrawal is accomplished by a hydraulic casing extractor. This puller system consists of a structure housing two hydraulic cylinders and a tapered slip arrangement which grips the outside of the drive casing. Sand, bentonite pellets, and cement are installed in the annulus as the drive casing is pulled.



Water Development CORPORATION

(800) 873-3073

(916) 662-2829 • (916) 662-1592 *FAX*
1202 Kentucky Avenue • Woodland, CA 95776

METHOD BENEFITS

- **Does not plug or permanently seal off individual formation aquifers.**
- **Results in continuous, well defined stratigraphy samples.**
- **Can be used in conjunction with a bailer, submersible pump or other type sampler to assess ground water quality.**
- **Eliminates the need to set cemented-in conductor casing in upper aquifers in order to drill into lower aquifers.**
- **Facilitates a very clean drill site as there is no mud or externally induced viscosfiers. Drill cuttings can be discharged directly into a containment vessel.**
- **Provides the ability to take undisturbed soil samples at 5', 10', and 20' intervals.**
- **Can be used to drill through any geologic formation including boulders, cobbles, glacial till, loose or flowing sands, clay, dry sand, gravel, silt or overburden in all weather conditions.**
- **The flush-threaded drive casing seals all formations in the borehole as drilling progresses, thus eliminating the possibility of cross-contamination of the aquifers.**
- **Well installation is easily accomplished through the drive casing upon completion of the drilling. There is less of a bridging problem when installing backfill materials than in the direct rotary or rotary wash methods. The clean, mudless inside wall of the drive casing provides an excellent conduit for well casing, sand, bentonite and cement to give greater assurance the well is being constructed as required and without voids.**
- **Has an economical cost when considering the quality of the data derived, the assurance of an appropriate well completion, the assurance of no cross-contamination of aquifers, and the tremendous disposal costs of mud rotary methods.**
- **Utilizes a water tight discharge system so that during the drilling phase no potentially contaminated fluids are spilled on the ground or the operating personnel.**
- **The development of the completed well is very fast and effective since no drilling muds need to be pumped or bailed from the well. This results in significant cost savings.**
- **Has been approved and utilized on projects for the Environmental Protection Agency, California Department of Health Services, Regional Water Quality Control Boards, Department of Energy, Department of Defense and private clients throughout the Western States.**
- **Sample specifications and references are available upon request.**

Hollow Stem Auger • ODEX Drilling • NX Wireline Coring • 94 mm Wireline Coring • Pump Installation • Well Development • Well Abandonment • Direct Air Rotary • Direct Mud Rotary

Hollow Stem Auger • ODEX Drilling • NX Wireline Coring • 94 mm Wireline Coring • Pump Installation • Well Development • Well Abandonment • Direct Air Rotary • Direct Mud Rotary

Air Rotary Casing Hammer • Dual Tube Reverse Rotary • Dual Tube Percussion • Direct Air Rotary • Direct Mud Rotary • Reverse Circulation

ARIZONA DEPARTMENT OF WATER RESOURCES

500 N 3RD ST., PHOENIX, AZ. 85004
Telephone (602) 417-2470
Fax (602) 417-2401

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

July 6, 1995

MAGMA COPPER CO.
P OBOX 37
SUPERIOR, AZ. 85273

RE: Registration No. 55-550403 THRU 55-550414

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Ellen Kane

Ellen Kane
Groundwater Permit Specialist

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425

June 28, 1995

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Water Development Corporation
1202 Kentucky Avenue
Woodland, California 95776
ATTN: Jim Whitley

Re: Variance for Construction of Eight Monitor Wells Registration Numbers 55-550405 through 55-550408 and 55-550410 and 55-550412 through 55-550414

Dear Mr. Whitley:

The Arizona Department of Water Resources received your request dated June 2, 1995 for a variance for construction of eight monitor wells to be located in Pinal County. The purpose of these wells will be to evaluate potential groundwater contamination.

The Arizona Department of Water Resources approves this request for the following variance:

- Thermoplastic casings (risers) with a watertight cap may be used in lieu of steel casings (R12-15-811.B.1).

The following *special requirements* are conditions for this variance (R12-15-821.):

- The wells shall be completed flush-to-ground with vandalproof, traffic-rated vaults per ASTM Standard Guide D5092, Section 8.9.2.3.
- The PVC inner casings (risers) shall comply with ASTM Standard Guide D5092, Section 6.5.
- The wells shall be constructed per the "Variance Granted" Notice of Intention to Drill.
- The wells shall be abandoned (decommissioned) per ASTM Standard Guide D5299, Section 7.3.8.

If you have any questions, please contact Abe Malek of my staff at (602) 417-2400 ext.# 7335.

Sincerely,

Greg Wallace
Chief Hydrologist

GW/AM/ef
501768

DEPARTMENT OF WR

JUN 5 1995

OPERATIONS DIV.

Water
Development
CORPORATION

Environmental Drilling, Construction, Development and Well Abandonment Services.

June 2, 1995

Arizona Department of Water Resources
500 North Third Street
Phoenix, AZ 85004

Attn: Operations Division

RE: Request For Variance

To Whom It May Concern:

Water Development respectfully requests a variance from the requirement for installation of a permanent steel casing as stated in Section R12-15-811(B)(1) of the Arizona Revised Statutes, Title 45, Article 10, in regard to the well referenced in the attached Notice of Intention to Drill.

Please note the following:

1. The annular space will be sealed with cement grout to a depth in excess of the 20 foot minimum required in R12-15-811(B)(1).

2. The upper section of the borehole will be protected from caving during drilling by the installation of an 11 3/4" O.D. driven casing from surface to the contact with competent rock.

3. The driven casing will be extracted during cementing in order to allow the grout to bond directly to the surrounding formation. Should any potential for caving exist, the grout will not be allowed to drop below the shoe of the casing while it is being extracted.

4. The annular space for the grout seal will exceed 1.5 inches.

The procedures noted above will ensure that this variance will not adversely affect other water users or the local aquifers.

Should you have any questions or require further information please contact me.

Respectfully:

Jim Whitley

JUN 16 1995

Jim Whitley
Operations Manager

1202 Kentucky Avenue • Woodland, CA 95776 • (800) 873-3073 • (916) 662-2829 • (916) 662-1592 *FAX*

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004-3903

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-550403

AUTHORIZED DRILLER: WDC/WTR. DEV. CORP. OF CA. LICENSE NO: 161

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

MAGMA COPPER CO.

The well(s) is/are to be located in:

NW 1/4 of the NE 1/4 of the SW 1/4 Section 35 Township 1S Range 12E

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON 6/15/96

CHIEF, OPERATIONS DIVISION

THE DRILLER SHALL FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING.

RECEIPT № 20871

THE WATER DEVELOPMENT CORP.
P O BOX [illegible]
WOODLAND, CA. 95776

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH 3RD STREET
PHOENIX, ARIZONA 85004
(602) 417-2470

ENTRY CODE 55

FILE NO. VARIOUS 550403 **THRU** 550434

ITEM DESCRIPTION	RATE	AMOUNT
FILING FEE FOR NOI TO DRILL WELLS	$30.00	$120.00
7/7/95/ek CK#34[illegible]3		$120.00

PAID JUL 7 1995 PAID

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL $ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 – Rev. 4/91

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-550407

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	C ¼	A ¼	B ¼

LATITUDE Degrees °	Minutes '	Seconds "N	LONGITUDE Degrees °	Minutes '	Seconds "W

COUNTY ASSESSOR'S PARCEL ID NUMBER

BOOK	MAP	PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

- ☐ Change of Well Drilling Contractor *(Fill out Section 2)*
- ☒ Change of Well Ownership *(Fill out Section 3)*
- ☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

$10 FEE

Current Well Drilling Contractor		New Well Drilling Contractor	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	
DWR LICENSE NUMBER		DWR LICENSE NUMBER	ROC LICENSE CATEGORY
TELEPHONE NUMBER	FAX	TELEPHONE NUMBER	FAX

COMPLETED MAR 03 2005

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

Previous Well Owner		New Well Owner	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	
BHP Copper, Inc. (See Note 1)		Resolution Copper Mining LLC	
MAILING ADDRESS		MAILING ADDRESS	
200 South Veterans Memorial Blvd		2525 East Arizona Biltmore Circle Suite c-135	
CITY / STATE / ZIP CODE		CITY / STATE / ZIP CODE	
San Manuel, AZ 85631		Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE		CONTACT PERSON NAME AND TITLE	
Carla Consoli, Counsel		F. D. Hegner	
TELEPHONE NUMBER	FAX	TELEPHONE NUMBER	FAX
602-364-7000	602-364-7070	602-956-0223	602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner V.P, G M	F. D. Hegner	2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkay, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By M H Campbell
Vice President

ATTEST:

Andrew L. Bradkay
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

PLEASE PRINT CLEARLY

WELL REGISTRATION NUMBER
55-(See attached list)

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF
ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

MONITOR/PIEZOMETER WELL

FILING FEE $10.00

MCC5B

ARIZONA DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004 (602) 417-2470

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

MONITOR/PIEZOMETER WE.
FILING FEE $10.

DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.

Section § 45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. **WELL LOCATION:**

1 N/S	12 E/W	35
Township	Range	Section

NW 1/4 (10 ACRE) NE 1/4 (40 ACRE) SW 1/4 (160 ACRE)

2. Position location of the well on the land:

Latitude 33 0 17 58 "

Longitude 110 0 06 17 "

3. County: PINAL

4. **Owner of the land of wellsite:**

MAGMA COPPER COMPANY
Name

P.O. BOX 37
Address

SUPERIOR AZ 85273
City State Zip

5. **Lessee of the land of wellsite:**

Name

Address

City State Zip

6. **Owner of well:**

MAGMA COPPER COMPANY
Name

P.O. BOX 37
Address

SUPERIOR AZ 85273
City State Zip

7. Consulting Firm: BROWN + CALDWELL

Contact Person: BRIAN ANDERSON

Phone: (602) 222-4492

8. Purpose of well drilled pursuant to this notice

Monitor X

Piezometer

9. If for deepening or modifying, Well Registration Number

55-

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D(1-12)35CAB

Filed 6-16-95 By

Input ENTERED JUL 10 1995

DUPLICATE

Mailed 7-8-95 By

Registration 55-550407

AMA/INA Phy

W/S 20 S/B 16

10. Construction will start:

6 (Month) 5 (Day) 95 (Year)

11. Period well will remain in use 10 Months/Years

12. For monitoring wells, is pump equipment to be installed?

Yes ✓ No

(a) If yes, design pump capacity 5-7 GPM

(b) What use will be made of the water ANALYTICAL TESTING

13. **Drilling firm:**

WDC/Water Development Corp. of California (FN)
Name

1202 KENTUCKY AVENUE
Address

WOODLAND CALIF 95776
City State Zip

DWR License No. 161

A4
ROC License classification

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility, storage area of hazardous material or petroleum storage areas and tanks?

Yes No X

SPECIAL REQUIREMENT

VARIANCE GRANTED
JUN 16 1995

16. Proposed method of abandonment of well after project is completed: PER AAC R12-15-816

17. Is this well to monitor existing contamination? NO Potential contamination _____. Please explain: _____

GENERAL INSTRUCTIONS

1. Fill out this form in **DUPLICATE** and send **WITH $10.00 FEE** to 500 NORTH THIRD STREET, PHOENIX, AZ 85004
2. For specific instructions, limitations and conditions, see the reverse side of this form.
3. **Must be signed by land owner or lessee.**
4. Section §45-596(D), provides that the Director shall determine that all information required on form has been submitted. If not, the person filing will be notified and the drilling, deepening, or modification of the well may not proceed.

I state that Notice is filed in compliance with Section § 45-596 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

JEFF J. PARKER
Typed or Printed Name

Signature [X] Land Owner [ ] Lessee of wellsite

4/7/95
Date

DWR 55-44 9/92 (Rev.)

18. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? Ms. Shirin Tolle

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact? _____

19. WELL CONSTRUCTION PLAN

a) Drilling method (mud rotary, hollow-stem auger, etc.) Direct Air Rotary Drilling

b) Borehole diameters: 9 5/8 inches from 0 feet to 185 feet.

_____ inches from _____ feet to _____ feet.

c) Casing materials (PVC, steel, hollow-stem auger, etc.)

material PVC diameter 5 9/16 inches from 1/2 feet to 175 feet

material _____ diameter _____ inches from _____ feet to _____ feet

d) Method of sealing at reductions _____

e) Annular seal materials (cement, grout, etc.); method of placement (tremied, circulated)

material CEMENT GROUT method TREMIE from 0 feet to 135 feet

material BENTONITE method TREMIE from 135 feet to 140 feet

f) Filter packs (state material):

material SILICA SAND 10-20 MESH from 140 feet to 185 feet

material _____ from _____ feet to _____ feet

g) Perforations or screen specifications:

type 5 9/16" slotted PVC, sch. 80, 0.020 from 145 feet to 175 feet

type _____ from _____ feet to _____ feet

h) Method of well development (bail, air lift, surge) bail, surge, pump

i) Will surface or conductor casing extend above grade: Yes ____ No X

20. Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.

CONDITIONS

I. Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.

II. Drilling of the well shall be completed within one (1) year after the date of Notice.

III. A Well Driller Report, is required within 30 days of completion of drilling. A Completion Report, is required to be filed with the Department within 30 days after installation of pump equipment for monitor wells.

IV. Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.

V. A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."

VI. Special construction standards required pursuant to A.A.C. Rule R12-15-821: _____

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee. NOTE: **A.R.S. § 45-593.C** requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. **CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)**

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 550407 **FILE NO:** D(1-12)35 CAB

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

Date _____ **Signature of Current Well Owner** _____

2. **STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)**

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-96
Title: Land Manager

ENTERED MAY 10 1996
MAC

DWR 55-71 (Rev 12/95)

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. **REQUEST TO CHANGE WELL DRILLER** **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. **REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)**

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO

GRID: F 08

REPORT NO: WL9020

ARIZONA DEPARTMENT OF WATER RESOURCES WELL REPORT
OPERATIONS DIVISION
**** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

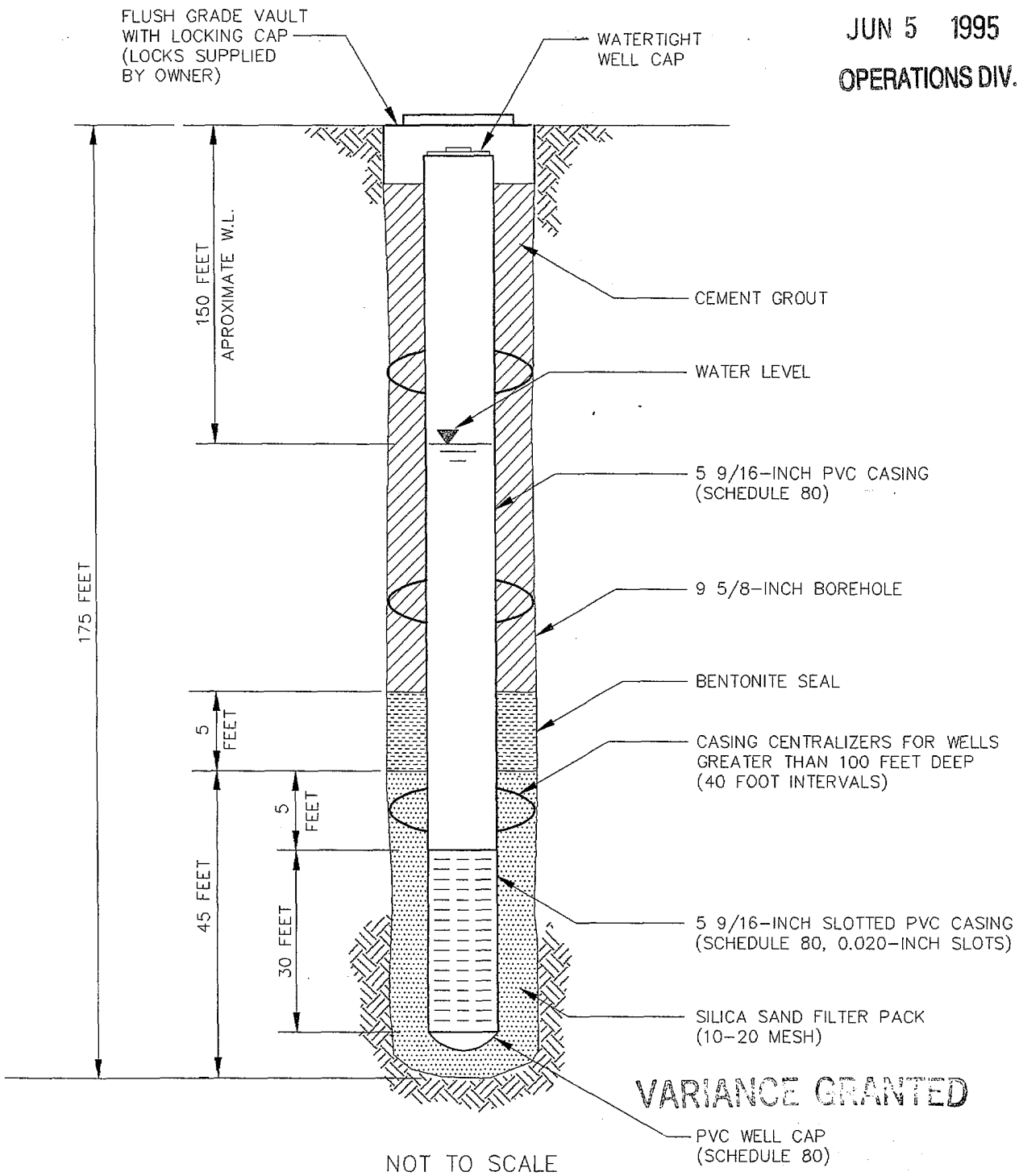
REPORT DATE: 1/31/96

FULL-NAME		QUAD	TOWN	RNGE	SECT	QTR 1 2 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LOG	CRT	OWN
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	34	D B C	55-550406							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	35	C A B	55-550407							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	2.0	12.0	04	A C A	55-550408							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON	AZ	D	9.0	17.0	15	B B D	55-550602							182	M	11	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	35	C D B	55-550409							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	34	D D A	55-550410							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	34	D D A	55-550411							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	34	A D B	55-550412							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	35	C D B	55-550413							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D	1.0	12.0	35	C D B	55-550414							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON	AZ	D	2.0	13.0	06		55-551163							028	N	U8	I	N	

8-132 X 64 10-6

8-132 X 64 10-6

DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.



VARIANCE GRANTED

NOT TO SCALE

SPECIAL REQUIREMENT
JUN 16 1995

NOTES:

1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER

MCC-5B

BROWN AND CALDWELL

MONITOR WELL DESIGN TYPE A

F2126016 05-23-95 GaryG

DEPARTMENT OF WR

JUN 5 1995

OPERATIONS DIV.

Water
Development
CORPORATION

Environmental Drilling, Construction, Development and Well Abandonment Services.

June 2, 1995

Arizona Department of Water Resources
500 North Third Street
Phoenix, AZ 85004

Attn: Operations Division

RE: Request For Variance

To Whom It May Concern:

Water Development respectfully requests a variance from the requirement for installation of a permanent steel casing as stated in Section R12-15-811(B)(1) of the Arizona Revised Statutes, Title 45, Article 10, in regard to the well referenced in the attached Notice of Intention to Drill.

Please note the following:

1. The annular space will be sealed with cement grout to a depth in excess of the 20 foot minimum required in R12-15-811(B)(1).

2. The upper section of the borehole will be protected from caving during drilling by the installation of an 11 3/4" O.D. driven casing from surface to the contact with competent rock.

3. The driven casing will be extracted during cementing in order to allow the grout to bond directly to the surrounding formation. Should any potential for caving exist, the grout will not be allowed to drop below the shoe of the casing while it is being extracted.

4. The annular space for the grout seal will exceed 1.5 inches.

The procedures noted above will ensure that this variance will not adversely affect other water users or the local aquifers.

Should you have any questions or require further information please contact me.

JUN 16 1995

Respectfully:

Jim Whitley

Jim Whitley
Operations Manager

1202 Kentucky Avenue • Woodland, CA 95776 • (800) 873-3073 • (916) 662-2829 • (916) 662-1592 *FAX*

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

June 28, 1995

Water Development Corporation
1202 Kentucky Avenue
Woodland, California 95776
ATTN: Jim Whitley

Re: Variance for Construction of Eight Monitor Wells Registration Numbers 55-550405 through 55-550408 and 55-550410 and 55-550412 through 55-550414

Dear Mr. Whitley:

The Arizona Department of Water Resources received your request dated June 2, 1995 for a variance for construction of eight monitor wells to be located in Pinal County. The purpose of these wells will be to evaluate potential groundwater contamination.

The Arizona Department of Water Resources approves this request for the following variance:

- Thermoplastic casings (risers) with a watertight cap may be used in lieu of steel casings (R12-15-811.B.1).

The following *special requirements* are conditions for this variance (R12-15-821.):

- The wells shall be completed flush-to-ground with vandalproof, traffic-rated vaults per ASTM Standard Guide D5092, Section 8.9.2.3.
- The PVC inner casings (risers) shall comply with ASTM Standard Guide D5092, Section 6.5.
- The wells shall be constructed per the "Variance Granted" Notice of Intention to Drill.
- The wells shall be abandoned (decommissioned) per ASTM Standard Guide D5299, Section 7.3.8.

If you have any questions, please contact Abe Malek of my staff at (602) 417-2400 ext.# 7335.

Sincerely,

Greg Wallace
Chief Hydrologist

GW/AM/ef
501768

ARIZONA DEPARTMENT OF WATER RESOURCES

500 N 3RD ST., PHOENIX, AZ. 85004
Telephone (602) 417-2470
Fax (602) 417-2401

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

July 6, 1995

MAGMA COPPER CO.
P OBOX 37
SUPERIOR, AZ. 85273

RE: Registration No. 55-550403 THRU 55-550414

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Ellen Kane

Ellen Kane
Groundwater Permit Specialist

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004-3903

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-550407

AUTHORIZED DRILLER: WDC/WTR. DEV. CORP. OF CA. LICENSE NO: 161

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

MAGMA COPPER CO.

The well(s) is/are to be located in:

NW 1/4 of the NE 1/4 of the SW 1/4 Section 35 Township 1S Range 12E

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON 6/15/96

VARIANCE ISSUED

CHIEF, OPERATIONS DIVISION

THE DRILLER SHALL FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING.

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

RECEIPT № 20871

THE WATER DEVELOPMENT CORP.
P O BOX 888
WOODLAND, CA. 95776

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH 3RD STREET
PHOENIX, ARIZONA 85004
(602) 417-2470

ENTRY CODE 55

FILE NO. VARIOUS 550403 **THRU** 550414

ITEM DESCRIPTION	RATE	AMOUNT
FILING FEE FOR NOI TO DRILL WELLS	$10.00	$120.00
7/7/95/ek CK#34683		$120.00

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL $ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 – Rev. 4/91

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-550412

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	34	A ¼	D ¼	B ¼

LATITUDE Degrees	Minutes	Seconds N	LONGITUDE Degrees	Minutes	Seconds W
°	'	"	°	'	"

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

- ☐ Change of Well Drilling Contractor *(Fill out Section 2)*
- ☒ Change of Well Ownership *(Fill out Section 3)*
- ☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

$10 FEE

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

Current Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER:

TELEPHONE NUMBER: FAX:

New Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER: ROC LICENSE CATEGORY:

TELEPHONE NUMBER: FAX:

COMPLETED MAR 03 2005

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

$10 FEE

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

Previous Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper, Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

New Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining LLC

MAILING ADDRESS: 2525 East Arizona Biltmore Circle Suite c-135

CITY / STATE / ZIP CODE: Phoenix, AZ 85016

CONTACT PERSON NAME AND TITLE: F. D. Hegner

TELEPHONE NUMBER: 602-956-0223 FAX: 602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: F. D. Hegner V.P, G M

SIGNATURE OF WELL OWNER: F. D. Hegner DATE: 2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkay, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By M H Campbell
Vice President

ATTEST:

Andrew L. Bradkay
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

PLEASE PRINT CLEARLY

WELL REGISTRATION NUMBER
55-(See attached list)

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF
ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

MONITOR/PIEZOMETER WELL

FILING FEE $10.00

ARIZONA DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004 .. (602) 417-2470

MONITOR/PIEZOMETER WE

FILING FEE $10

DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.

MCC 1B

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

Section § 45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. **WELL LOCATION:**

   1 N/S | 12 E/W | 34
   Township | Range | Section

   NW 1/4 (10 ACRE) SE 1/4 (40 ACRE) NE 1/4 (160 ACRE)

2. Position location of the well on the land:

   Latitude 33 0 18 ' 11 "

   Longitude 110 0 06 ' 50 "

3. County: PINAL

4. **Owner of the land of wellsite:**

   MAGMA COPPER COMPANY
   Name
   POST OFFICE BOX 37
   Address
   SUPERIOR, ARIZONA 85273
   City State Zip

5. **Lessee of the land of wellsite:**

   Name
   Address
   City State Zip

6. **Owner of well:**

   MAGMA COPPER COMPANY
   Name
   POST OFFICE BOX 37
   Address
   SUPERIOR, ARIZONA 85273
   City State Zip

7. Consulting Firm: BROWN AND CALDWELL

   Contact Person: BRIAN ANDERSON

   Phone: (602) 222-4492

8. Purpose of well drilled pursuant to this notice

   Monitor X

   Piezometer

9. If for deepening or modifying, Well Registration Number

   55-

10. Construction will start: 6 5 95
    Month Day Year

11. Period well will remain in use 10 Months/Years

12. For monitoring wells, is pump equipment to be installed?

    Yes ✓ No

    (a) If yes, design pump capacity 5-7 GPM

    (b) What use will be made of the water ANALYTICAL TESTING

13. **Drilling firm:**

    WDC/Water Development Corp. of California (FN)
    1202 KENTUCKY AVENUE
    Address
    WOODLAND, CALIF. 95776
    City State Zip

    DWR License No. 161

    A4
    ROC License classification

14. Is the proposed wellsite within 100 feet of a septic tank system, sewage disposal area, landfill, hazardous waste facility, storage area of hazardous material or petroleum storage areas and tanks?

    Yes X

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

File No. D(1-12)34ADB

Filed 6-16-95 By ek

Input ENTERED JUL 10 1995

DUPLICATE

Mailed 7-8-95 By ek

Registration 55- 550412

AMA/INA PH

W/S 28 S/B 16

VARIANCE GRANTED
SPECIAL REQUIREMENT
JUN 16 1995

16. Proposed method of abandonment of well after project is completed: PER AAC R12-15-816

17. Is this well to monitor existing contamination? NO Potential contamination _____. Please explain: _____

GENERAL INSTRUCTIONS

1. Fill out this form in **DUPLICATE** and send **WITH $10.00 FEE** to 500 NORTH THIRD STREET, PHOENIX, AZ 85004
2. For specific instructions, limitations and conditions, see the reverse side of this form.
3. **Must be signed by land owner or lessee.**
4. Section §45-596(D), provides that the Director shall determine that all information required on form has been submitted. If not, the person filing will be notified and the drilling, deepening, or modification of the well may not proceed.

I state that Notice is filed in compliance with Section § 45-596 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

JEFF J. PARKER
Typed or Printed Name

Signature [X] Land Owner [ ] Lessee of wellsite

4/7/95
Date

DWR 55-44 9/92 (Rev.)

18. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? Ms. Shirin Tolle

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact? _____

19. WELL CONSTRUCTION PLAN

a) Drilling method (mud rotary, hollow-stem auger, etc.) Direct Air Rotary Drilling

b) Borehole diameters: 9 5/8 inches from 0 feet to 180 feet. 6/s.

_____ inches from _____ feet to _____ feet.

c) Casing materials (PVC, steel, hollow-stem auger, etc.)

material PVC diameter 5 9/16 inches from 1/2 feet to 170 feet

material _____ diameter _____ inches from _____ feet to _____ feet

d) Method of sealing at reductions _____

e) Annular seal materials (cement, grout, etc.); method of placement (tremied, circulated)

material Bentonite method Tremie from 130 feet to 135 feet

material Cement grout method Tremie from 0 feet to 130 feet

f) Filter packs (state material):

material Silica Sand 10-20 mesh from 135 feet to 180 feet

material _____ from _____ feet to _____ feet

g) Perforations or screen specifications:

type 5 9/16" slotted PVC, sch. 80, 0.020 from 140 feet to 170 feet

type _____ from _____ feet to _____ feet

h) Method of well development (bail, air lift, surge) bailing, surging, pumping

i) Will surface or conductor casing extend above grade: Yes X No _____

20. Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.

CONDITIONS

I. Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.

II. Drilling of the well shall be completed within one (1) year after the date of Notice.

III. A Well Driller Report, is required within 30 days of completion of drilling. A Completion Report, is required to be filed with the Department within 30 days after installation of pump equipment for monitor wells.

IV. Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.

V. A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."

VI. Special construction standards required pursuant to A.A.C. Rule R12-15-821: _____

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee. NOTE: **A.R.S. § 45-593.C** requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 550412 **FILE NO:** D(1-12)34ADB

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

_____

Date _____ **Signature of Current Well Owner** _____

2. STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-96
Title: Land Manager

ENTERED MAY 10 1996
MAG

DWR 55-71 (Rev 12/95)

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. REQUEST TO CHANGE WELL DRILLER **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO

GRID: F 08

REPORT NO: WL9020

ARIZONA DEPARTMENT OF WATER RESOURCES WELL REPORT
OPERATIONS DIVISION
**** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

REPORT DATE: 1/31/96

FULL-NAME	QUAD	TOWN	RNGE	SECT	QTR 1	QTR 2	QTR 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LORG	CRT	OWN
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	B	C	55-550406							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	A	B	55-550407							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	2.0	12.0	04	A	C	A	55-550408							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON AZ 85704	D	9.0	17.0	15	B	B	D	55-550602							182	M	11	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550409							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	D	A	55-550410							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	D	A	55-550411							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	A	D	B	55-550412							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550413							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550414							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON AZ 85704	D	2.0	13.0	06				55-551163							028	N	U8	I	N	

B-132 X 64 10-6

B-132 X 64 10-6

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee.
NOTE: A.R.S. § 45-593.C requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. **CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)**

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 550406 **FILE NO:** D(1-12)34 DBC

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

Date _____ **Signature of Current Well Owner** _____

2. **STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)**

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-96
Title: Land Manager

DWR 55-71 (Rev 12/95)

ENTERED MAY 10 1996 MAG

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. REQUEST TO CHANGE WELL DRILLER **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO

GRID: F 08

REPORT NO: WL9020

REPORT DATE: 1/31/96

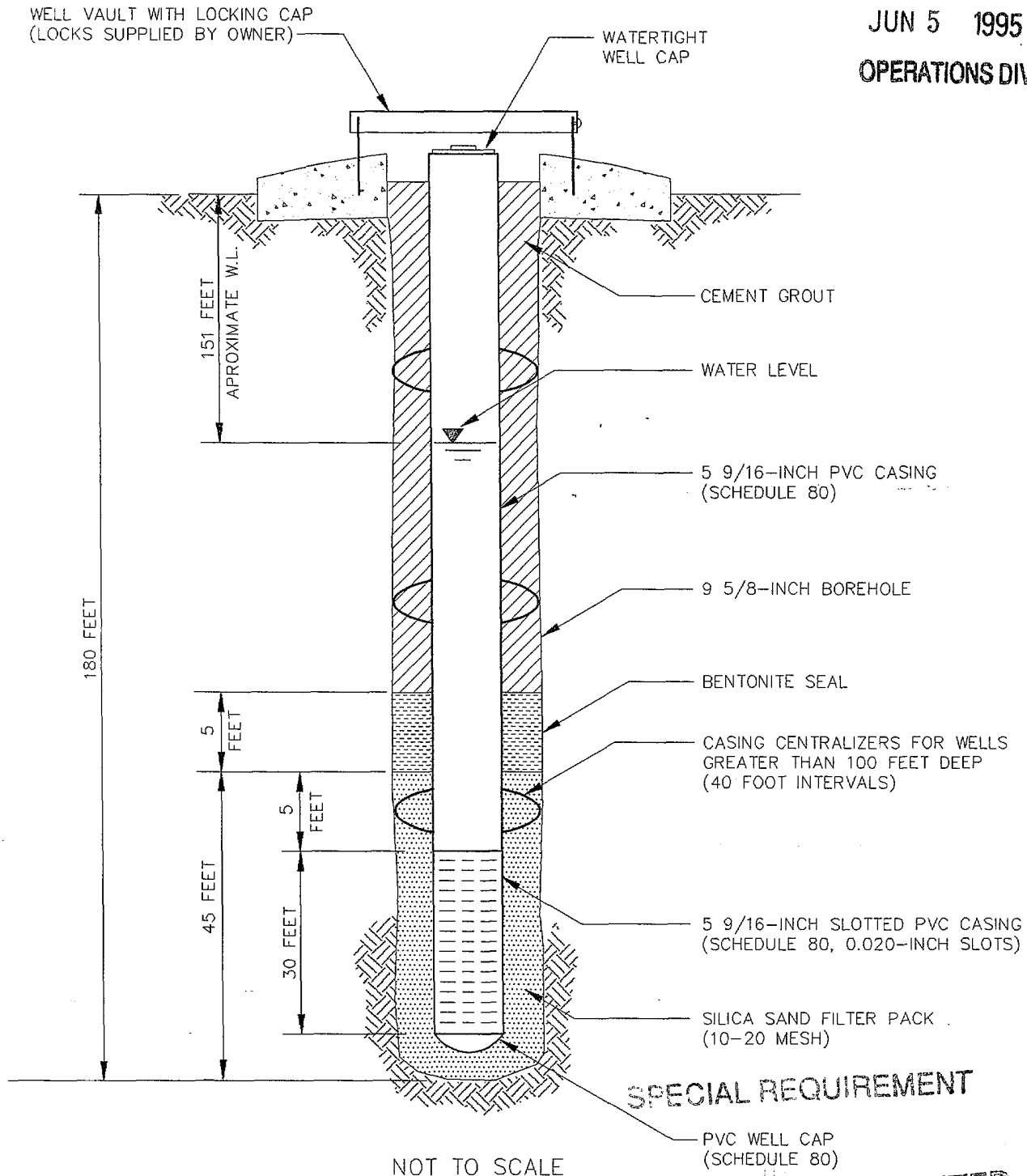
ARIZONA DEPARTMENT OF WATER RESOURCES WELL REPORT
OPERATIONS DIVISION
**** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

FULL-NAME	QUAD	TOWN	RNGE	SECT	QTR 1	QTR 2	QTR 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LORG	CRT	OWN
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	B	C	55-550406							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	A	B	55-550407							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	2.0	12.0	04	A	C	A	55-550408							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON AZ 85704	D	9.0	17.0	15	B	B	D	55-550602							182	M	11	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550409							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	D	A	55-550410							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	D	D	A	55-550411							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	34	A	D	B	55-550412							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550413							161	M	15	I	N	
MAGMA COPPER CO PO BOX 37 SUPERIOR AZ 85273	D	1.0	12.0	35	C	D	B	55-550414							161	M	15	I	N	
MAGMA COPPER CO 7400 N ORACLE RD 200 TUCSON AZ 85704	D	2.0	13.0	06				55-551163							028	N	U8	I	N	

8-132 X 64 10-6

8-132 X 64 10-6

DEPARTMENT OF WR
JUN 5 1995
OPERATIONS DIV.



NOT TO SCALE

SPECIAL REQUIREMENT
VARIANCE GRANTED
JUN 16 1995

NOTES:
1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER

F2126010 05-23-95 GaryG

BROWN AND CALDWELL

MCC-1B

MONITOR WELL DESIGN TYPE A

DEPARTMENT OF WR

JUN 5 1995

OPERATIONS DIV.

Water
Development
CORPORATION

Environmental Drilling, Construction, Development and Well Abandonment Services.

June 2, 1995

Arizona Department of Water Resources
500 North Third Street
Phoenix, AZ 85004

Attn: Operations Division

RE: Request For Variance

To Whom It May Concern:

Water Development respectfully requests a variance from the requirement for installation of a permanent steel casing as stated in Section R12-15-811(B)(1) of the Arizona Revised Statutes, Title 45, Article 10, in regard to the well referenced in the attached Notice of Intention to Drill.

Please note the following:

1. The annular space will be sealed with cement grout to a depth in excess of the 20 foot minimum required in R12-15-811(B)(1).

2. The upper section of the borehole will be protected from caving during drilling by the installation of an 11 3/4" O.D. driven casing from surface to the contact with competent rock.

3. The driven casing will be extracted during cementing in order to allow the grout to bond directly to the surrounding formation. Should any potential for caving exist, the grout will not be allowed to drop below the shoe of the casing while it is being extracted.

4. The annular space for the grout seal will exceed 1.5 inches.

The procedures noted above will ensure that this variance will not adversely affect other water users or the local aquifers.

Should you have any questions or require further information please contact me.

JUN 16 1995

Respectfully:

Jim Whitley

Jim Whitley
Operations Manager

1202 Kentucky Avenue • Woodland, CA 95776 • (800) 873-3073 • (916) 662-2829 • (916) 662-1592 *FAX*

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425

June 28, 1995

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Water Development Corporation
1202 Kentucky Avenue
Woodland, California 95776
ATTN: Jim Whitley

Re: Variance for Construction of Eight Monitor Wells Registration Numbers 55-550405 through 55-550408 and 55-550410 and 55-550412 through 55-550414

Dear Mr. Whitley:

The Arizona Department of Water Resources received your request dated June 2, 1995 for a variance for construction of eight monitor wells to be located in Pinal County. The purpose of these wells will be to evaluate potential groundwater contamination.

The Arizona Department of Water Resources approves this request for the following variance:

- Thermoplastic casings (risers) with a watertight cap may be used in lieu of steel casings (R12-15-811.B.1).

The following *special requirements* are conditions for this variance (R12-15-821.):

- The wells shall be completed flush-to-ground with vandalproof, traffic-rated vaults per ASTM Standard Guide D5092, Section 8.9.2.3.
- The PVC inner casings (risers) shall comply with ASTM Standard Guide D5092, Section 6.5.
- The wells shall be constructed per the "Variance Granted" Notice of Intention to Drill.
- The wells shall be abandoned (decommissioned) per ASTM Standard Guide D5299, Section 7.3.8.

If you have any questions, please contact Abe Malek of my staff at (602) 417-2400 ext.# 7335.

Sincerely,

Greg Wallace
Chief Hydrologist

GW/AM/ef
501768

ARIZONA DEPARTMENT OF WATER RESOURCES
500 N 3RD ST., PHOENIX, AZ. 85004
Telephone (602) 417-2470
Fax (602) 417-2401

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

July 6, 1995

MAGMA COPPER CO.
P OBOX 37
SUPERIOR, AZ. 85273

RE: Registration No. 55-550403 THRU 55-550414

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Ellen Kane

Ellen Kane
Groundwater Permit Specialist

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004-3903

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-550412

AUTHORIZED DRILLER: WDC/WTR. DEV. CORP. OF CA. LICENSE NO: 161

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

MAGMA COPPER CO.

The well(s) is/are to be located in:

NW 1/4 of the SE 1/4 of the NE 1/4 Section 34 Township 1S Range 12E

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON 6/15/96

VARIANCE ISSUED

CHIEF, OPERATIONS DIVISION

THE DRILLER SHALL FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING.

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

RECEIPT № 20871

THE WATER DEVELOPMENT CORP.
P O BOX 888
WOODLAND, CA. 95776

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
500 NORTH 3RD STREET
PHOENIX, ARIZONA 85004
(602) 417-2470

ENTRY CODE 55

FILE NO. VARIOUS 550403 THRU 550414

ITEM DESCRIPTION	RATE	AMOUNT
FILING FEE FOR NOI TO DRILL WELLS	$10.00	$120.00
7/7/95/ek CK#34683		$120.00

PAID JUL 7 1995

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL $ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 – Rev. 4/91

RECEIVED
SEP - 6 1996
RECORDS MGT

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGMENT SUPPORT SECTION

500 North Third Street - Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

* **WELL DRILLER REPORT**

This report should be prepared by the Driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner's Name: BHP Copper
   Address: #17 Smelter Rd (Street) Superior (City) AZ (State) (Zip) (Telephone Number)
2. Drilling Firm: Water Development Corp
   Address: 1702 Kentucky Ave (Street) Woodland (City) CA (State) 95776 (Zip) 916-662-2829 (Telephone Number)
3. Location: SW ¼ (10 Acre) SE ¼ (40 Acre) SW ¼ (160 Acre) of Section 26 Township 1 South Range 12 East
4. Well Registration No. 55-558204 (Required)
5. Permit No. _____ (If issued)

DESCRIPTION OF WELL

6. Total Depth of Hole 430 ft ft.
7. Type of Casing _____
8. Diameter and length of casing _____ inches from _____ to _____, _____ inches from _____ to _____
9. Method of sealing at reduction points _____
10. Perforated from _____ to _____ from _____ to _____ from _____ to _____
11. Size of cuts _____ Number of cuts per foot _____
12. If screen was installed: Length _____ feet. Diameter _____ inches. Type _____
13. Method of construction _____ (drilled, dug, driven, bored, jetted, etc.)
14. Date started 8 (Month) 22 (Day) 96 (Year)
15. Date completed 8 (Month) 26 (Day) 96 (Year)
16. Depth to water Not found ft. (If flowing well, so state).
17. Describe point from which depth measurements were made, and give sea-level elevation if available _____
18. If flowing well, state method of flow regulation:
19. Remarks: Core Drill 0-198
    Open Hole 10 5/8 0-410
    Water not encountered, client
    Rec C advise to leave hole open, secure top of
    Well, so we to check for possible Water later date

DO NOT WRITE IN THIS SPACE
OFFICE RECORD
Registration No. 558204
File No. D(1-12)26 CDC
Received _____ By _____
Entered ENTERED SEP 17 1996

DWR-55-55 (Rev 2/96)

DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

MAIL TO: P.O. BOX 458, PHOENIX, ARIZONA 85001-0458
500 NORTH 3RD STREET, PHOENIX, ARIZONA 85004-3903
PHONE (602) 417-2470 FAX (602) 417-2422

MCL-7

RECEIVED JUN 6 1996 GROUNDWATER MGT

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

PLEASE READ GENERAL INSTRUCTIONS AND CONDITIONS ON REVERSE SIDE OF THIS FORM BEFORE COMPLETING.

Section §45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. Well/land Location:

1 N/S 12 E/W 26
Township Range Section

SW ¼ SE ¼ SW ¼
10 Acre 40 Acre 160 Acre

2. Position location of the well on the land:

Latitude 33 o 18 ' 28 "

Longitude 111 o 06 ' 20 "

3. County: PINAL

4. Owner of the well:

BHP COPPER
Name
POST OFFICE BOX 37
Mailing Address
SUPERIOR, AZ 85273
City State Zip

Telephone No. (602) 229-4202

5. Lessee of the land of wellsite:

N/A
Name

Mailing Address

City State Zip

Telephone No.

VARIANCE GRANTED

6. Owner of the Land of Wellsite:

BHP COPPER
Name
POST OFFICE BOX 37
Mailing Address
SUPERIOR, AZ 85273
City State Zip

Telephone No. (602) 229-4202

7. Consulting firm:

BROWN AND CALDWELL
Name
B. ANDERSON
Contact Person

Telephone No. (602) 222-4444

8. Purpose of well drilled pursuant to this notice:

Monitor ✓
Piezometer

9. If for deepening or modifying, list well registration number:

55-

FOR DEPARTMENT USE ONLY
File No. D(1-12)26 cdc
Filed 6-6-96 By 413
Input By
ENTERED JUL - 2 1996
DUPLICATE
Mailed 6-27-96 By 413
Registration 55- 558204
AMA/INA PNA
W/S 48 S/B 06

SPECIAL REQUIREMENT

10. Will this proposed well be associated with a permit: Yes____ No ✓
If yes, Permit No.

11. Construction will start:

6 14 96
Month Day Year

12. Period well will remain in use:

10 Months/Years

13. For monitoring wells, is pump equipment to be installed?

Yes ✓ No

(a) If yes, design pump capacity:

5 GPM

(b) What use will be made of the water: ANALYTICAL TESTING

14. Drilling Firm:

W.D.C. / WATER DEVELOPMENT CORP
Name
1202 KENTUCKY AVE.
Mailing Address
WOODLAND, CALIF. 95776
City State Zip
(919) 662-2829
Telephone No.
161
DWR License Number
A4
ROC License Category

15. Proposed method of abandonment of well after project is completed: PER AAC R12-15-816, **pursuant to R12-15-816.**

16. Is this well to monitor existing contamination? No **Potential contamination** No. **Please explain:** monitor groundwater flow; may be used for water quality sampling. (per B. Anderson 6/24/96 SM)

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Jeff J. Parker Sr. Enviro Engineer — Jeff J. Parker — 5-30-96
Typed or Printed Name and Title — Signature [ ] Land Owner [ ] Lessee of Wellsite, Title — Date

DWR-55-44a (Rev 3/96)

17. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? MR. GARY BURCHARD

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact? _____

18. **WELL CONSTRUCTION PLAN:**

a) Drilling method (mud rotary, hollow-stem auger, etc.) DIRECT AIR DRILLING

b) Borehole diameters: 10 5/8" inches from 0 feet to 365 feet.
_____ inches from _____ feet to _____ feet.

c) Casing materials (PVC), steel, hollow-stem auger, etc.)
material PVC diameter 5 9/16 inches from 0 feet to 360 feet.
material _____ diameter _____ inches from _____ feet to _____ feet.

d) Method of sealing at reductions N/A

e) Annular seal materials (cement, grout, etc.,); method of placement (tremied, circulated):
material CEMENT GROUT method TREMIE from 0 feet to 310 feet.
material BENTONITE method TREMIE from 310 feet to 315 feet.

f) Filter packs (state material):
material SILICA SAND 10-20 MESH from 315 feet to 365 feet.
material _____ from _____ feet to _____ feet.

g) Perforations or screen specifications:
Type PVC 5 9/16", .020" SLOTTED from 320 feet to 360 feet
Type _____ from _____ feet to _____ feet

h) Method of well development (bail, air lift, surge) BAIL/SWAB AND PUMP

i) Will surface or conductor casing extend above grade?: Yes____ No ✓

19. **Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.**

GENERAL INSTRUCTIONS

1. **Please submit two original notices, with original signatures, and a check or money order (no cash) in the amount of $10.00, to P.O. Box 458, Phoenix, Arizona 85001-0458 or hand deliver to 500 North 3rd Street, Phoenix, Arizona 85004-3903.**

CONDITIONS

1. **If an individual other than the land owner or lessee, signs this notice, an original letter of authorization from the land owner/lessee, stating that the individual has permission to sign this specific Notice on their behalf, shall accompany the Notice of Intention to Drill a Monitor/Piezometer Well form.**

2. **Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.**

3. **Drilling of the well shall be completed within one year after the date of Notice.**

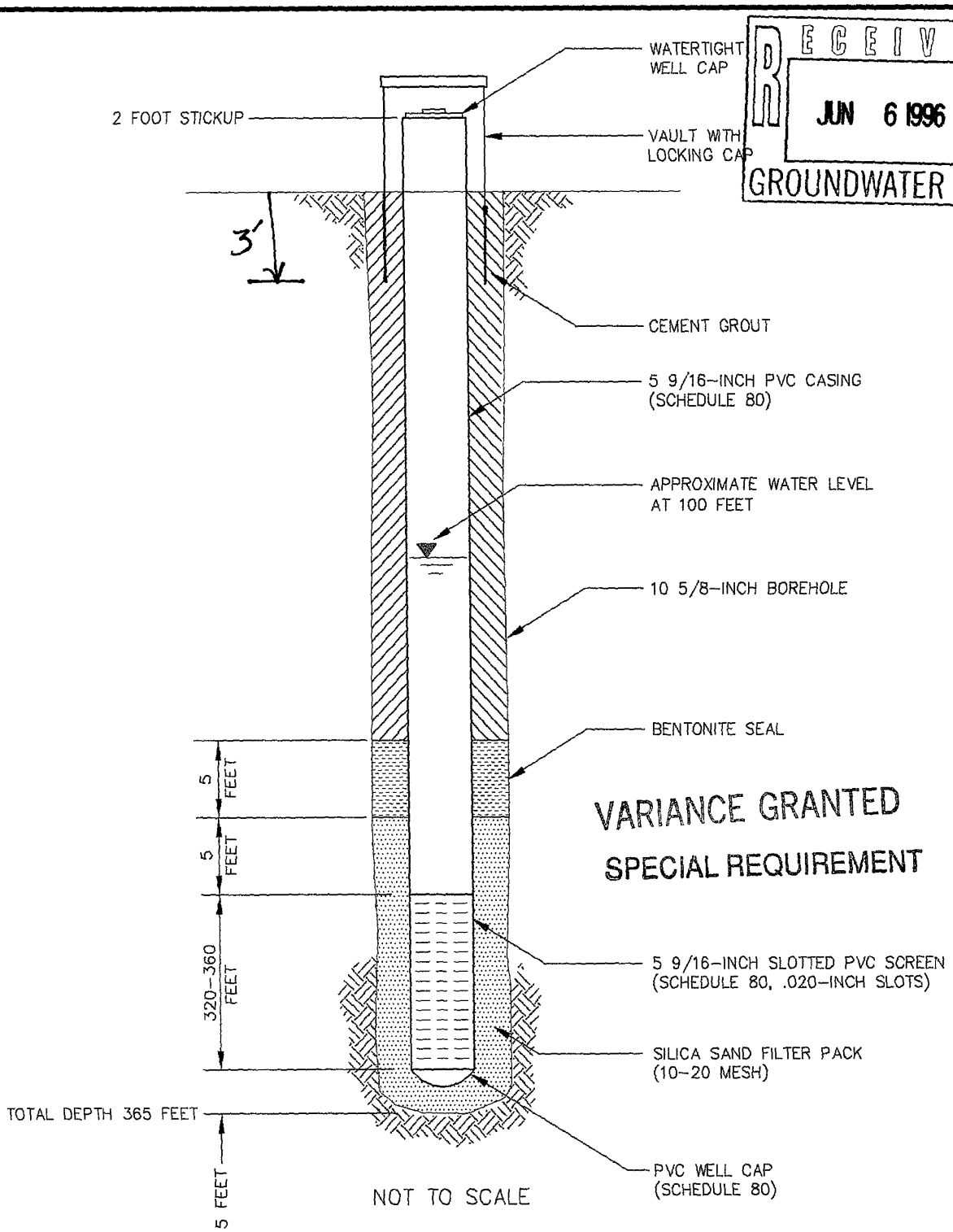
4. **A Well Driller Report is required within thirty days of completion of drilling. A Completion Report, is required to be filed with the Department within thirty days after installation of pump equipment for monitor wells.**

5. **Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.**

6. **A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."**

7. **Special construction standards required pursuant to A.A.C. Rule R12-15-821:** _____

RECEIVED
JUN 6 1996
GROUNDWATER MGT



VARIANCE GRANTED

SPECIAL REQUIREMENT

NOTES:

1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER
3. SLOTTED INTERVAL BASED ON SITE SPECIFIC GEOLOGICAL CONDITIONS AND TEST OBJECTIVES.

MONITOR WELL DESIGN
MCC-7

BROWN AND CALDWELL
PHOENIX, ARIZONA

BHP
BHP Copper *Superior Operations*

L:\BHP\2126\WELL-3 (1=1) 05-29-96 JasonC

From [illegible]

To : Ground Water Management " Sir / Madam "

Enclosed are 8 WOIs for BHP / Superior Mining Project

6 are Monitoring Wells & 2 are abandonments

I have also enclosed Original Well Completion Diagrams &

a $60 Personal check for the well Permits

Please send Permits & Cards to the address mentioned on my business card

Regards

Eric L Main

Water
Development
CORPORATION

Environmental Drilling, Construction, Development and Well Abandonment Services.

June 13, 1996

Ms. Sharon Masek
Hydrology Division
Department of Water Resources
500 N Third Street
Phoenix, Arizona 85004-3903

Re: Request for Variance/Superior, AZ (BHP Copper Co.)

Dear Ms. Masek:

This letter is a formal request for variance at the project site located in Superior, Arizona (BHP Copper Co.).

Specifically, this variance pertains to the installation of six (6) monitoring wells. First, we anticipate installing Schedule 80 PVC screens and Schedule 80 PVC casing in all six (6) wells. Second, above ground completion will consist of 8" steel casing embedded three (3) feet into the ground and sticking up two and one-half (2½) feet from the ground surface. Four (4) inch crash post will be embedded two (2) feet into the ground and four (4) feet above, to approximately five (5) feet apart to protect the well head.

I hope that this information will satisfy the State requirements for compliance. Please contact me if you need additional information or if I may be of service in some other way. Thank you for your assistance with this matter.

Very truly yours:
Water Development Corporation

Gigi L. Marie

Gigi Louise Marie
Operations Manager

L.G.

GLM/lg

RECEIVED
JUN 20 1996
HYDROLOGY DIV.

(916) 662-2829
(916) 662-1592 *(FAX)*

1202 Kentucky Avenue • Woodland, CA 95776

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

June 27, 1996

BHP COPPER
P.O. BOX 37
SUPERIOR, AZ 85273

RE: Registration No. 55-558204
File No. D(1-12)26 CDC

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Toni M. Bergeman

Toni M. Bergeman
Water Resource Technician
Groundwater Management Support Section

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004-3903

VARIANCE GRANTED

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-558204

AUTHORIZED DRILLER: W.D.C./WATER DEVELOPMENT LICENSE NO: 161

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER

The well(s) is/are to be located in the:

SW 1/4 of the SE 1/4 of the SW 1/4 Section 26 Township 1 SOUTH Range 12 EAST

No. of Wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 5TH DAY OF JUNE, 1997.

CHIEF, GROUNDWATER MANAGEMENT SUPPORT

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-594157

AUTHORIZED DRILLER: PROSONIC CORPORATION LICENSE NO: 685

NOTICE OF INTENTION TO DRILL A MONITOR WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER INC P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

SW ¼ of the SE ¼ of the NE ¼ Section 34 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 14TH DAY OF AUGUST, 2003

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA	B	SB
Phx	06	
RECEIVED DATE	WS	
8-15-02	15	
ISSUED DATE	WQARF	CERCLA
8-22-02	—	

FILE NUMBER: D(1-12)34ADC
WELL REGISTRATION NUMBER: 55-594157

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type (CHECK ONE)
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action (CHECK ONE)
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well
WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 | MAP 08 | PARCEL 006
COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2. OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160 FAX: (520) 689-5158

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER: FAX:

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm
NAME: Prosonic Corp.
DWR LICENSE NUMBER: 685 ROC LICENSE CATEGORY: A-04
TELEPHONE NUMBER: 480-635-9665 FAX: 480-635-9690

Consultant (if applicable)
CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818 FAX: (520) 888-8818
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4.

Questions	Yes	No	Explanation:
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
3. Are you requesting a variance to use thermoplastic casing in lieu of steel casing in the surface seal?		X	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
4. Is there another well name or identification number associated with this well?		X	IF YES, PLEASE STATE
5. Have construction plans been coordinated with the Arizona Department of Environmental Quality?		X	IF YES, PLEASE STATE AGENCY CONTACT & PHONE NUMBER
6. For monitor wells, is dedicated pump equipment to be installed?		X	IF YES, PLEASE STATE DESIGN PUMP CAPACITY Gallons per Minute
7. Will the well registration number be stamped on the vault cover or on the upper part of the casing?		X	IF NO, WHERE WILL THE REGISTRATION NUMBER BE PLACED? Etched in cement pad w/ nail prior to cement drying.

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

WELL REGISTRATION NUMBER 55-594150

SECTION 5. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ONE

- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☒ Other (*please specify*): Sonic

Method of Well Development

CHECK ONE

- ☐ Airlift
- ☒ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Grout Emplacement Method

CHECK ONE

- ☐ Gravity
- ☐ Pressure Grout
- ☒ Tremie
- ☐ Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE

- ☒ None
- ☐ Welded
- ☐ Swedged
- ☐ Packed
- ☐ Other (*please specify*):

Surface or Conductor Casing

CHECK ONE

- ☐ Flush Mount in a vault
- ☒ Extend 1' above grade

SECTION 6. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

DATE CONSTRUCTION TO BEGIN

Attach a well construction diagram labeling all specifications below.

Borehole			Casing												
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (X)				PERFORATION TYPE (X)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	110	8	90	110	4									X		0.020
			20	90	4		X									
			0	20	4	X										

Annular Material												
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (X)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
85	110									X		10-20
80	85						X					
20	80					X						
0	20			X								

RECEIVED AUG 15 2002 GROUNDWATER MGT

IF THIS WELL HAS NESTED CASINGS, SPECIFY NUMBER OF CASING STRINGS	EXPECTED DEPTH TO WATER 100 Feet Below Ground Surface

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

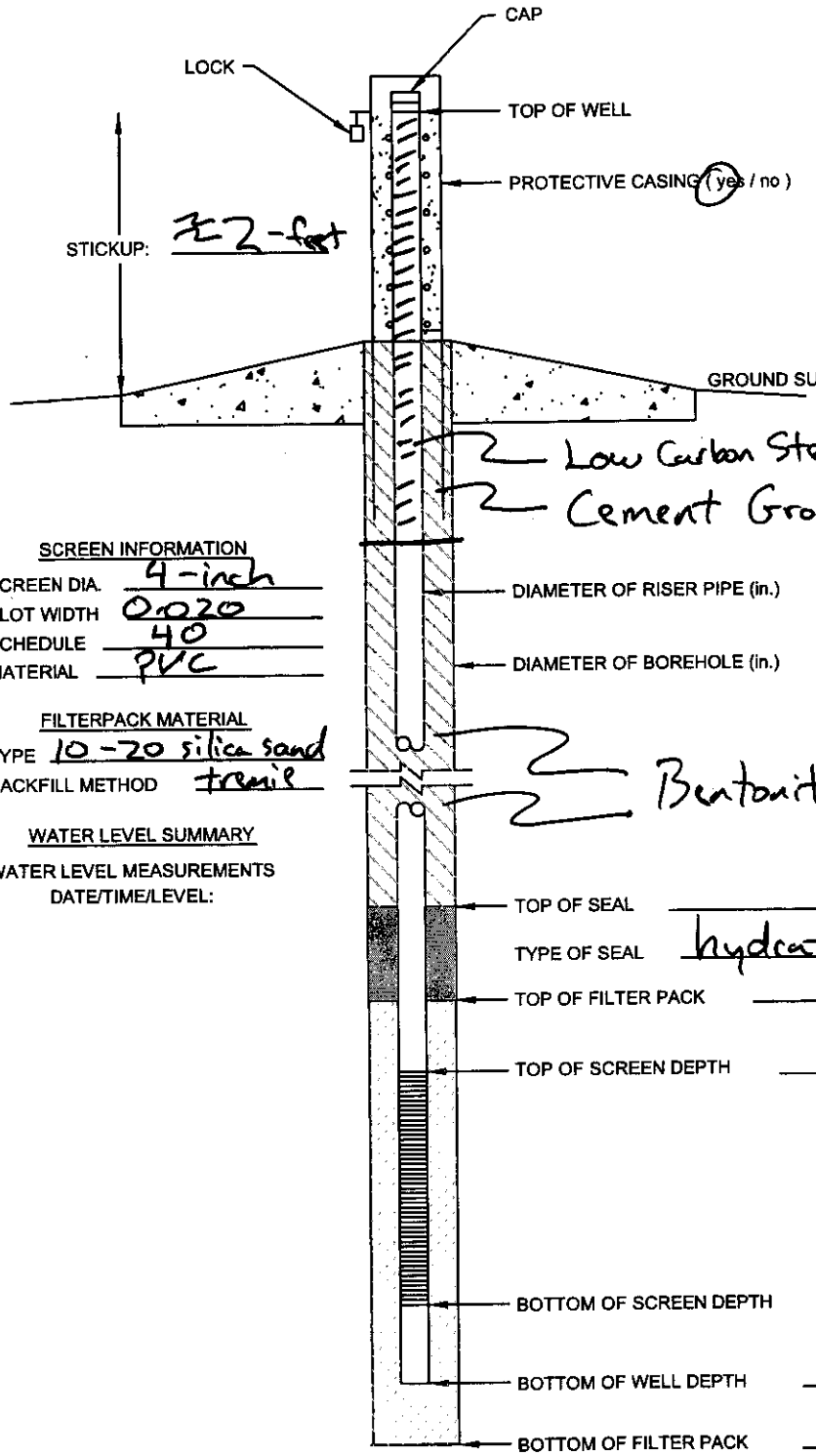
TYPE OR PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER OR LANDOWNER	DATE
William Gray - Env. Project Mgr	William Gray	8-14-02

GROUNDWATER MONITORING WELL

Golder Associates

SITE NAME: Superior	LOCATION: Tailing #6	
CLIENT:	SURFACE ELEVATION:	
GEOLOGIST:	NORTHING:	EASTING:
DRILLER:	STATIC WATER LEVEL:	COMPLETION DATE:
DRILLING COMPANY:	DRILLING METHODS:	

DEPTHS MEASURED FROM GROUND SURFACE



Locking Steel Monument

SCREEN INFORMATION

SCREEN DIA. 4-inch
SLOT WIDTH 0.020
SCHEDULE 40
MATERIAL PVC

FILTERPACK MATERIAL

TYPE 10-20 silica sand
BACKFILL METHOD tremie

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS DATE/TIME/LEVEL:

DIAMETER OF RISER PIPE (in.) 4

DIAMETER OF BOREHOLE (in.) 8

TOP OF SEAL 80 FT. BGS.

TYPE OF SEAL hydrated bentonite chips

TOP OF FILTER PACK 85 FT. BGS.

TOP OF SCREEN DEPTH 90 FT. BGS.

BOTTOM OF SCREEN DEPTH 110 FT. BGS.

BOTTOM OF WELL DEPTH 110 FT. BGS.

BOTTOM OF FILTER PACK 110 FT. BGS.

RECEIVED
AUG 15 2002
GROUNDWATER MGT

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

August 22, 2002

JANE DEE HULL
Governor

JOSEPH C. SMITH
Director

BHP COPPER INC
P O BOX 37
SUPERIOR, AZ 85273

Registration No. 55-594157
File No. D(1-12) 34 ADC

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended drilling card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Monica Ortiz

Monica Ortiz
Water Resource Technician
Groundwater Management Support Section

Enclosures

VARIANCE CHECKLIST – HYDROLOGY

DATE RECEIVED 8-15-02
DATE TO HYDRO 8-19-02
DATE TO GMSS 8-20-02

POTENTIAL REG. # 55-_____

55- 594157 THRU 55- 594160

FRONT OF NOI COMPLETE/CORRECT: YES X NO _____

VARIANCE LETTER RECEIVED YES _____ NO X
WELL DIAGRAM RECEIVED YES X NO _____
SITE PLAN RECEIVED YES _____ NO X

TYPE AND NUMBER OF WELLS:

4 MONITOR
_____ PIEZOMETER
_____ GEOTECHNICAL
_____ MINERAL EXPLORATION
_____ WATER PRODUCTION

_____ CATHODIC PROTECTION
_____ GROUNDING
_____ HEAT PUMP
_____ OTHER_____
DESCRIBE TYPE OF WELL

GROUNDWATER REVIEW:

WOULD ROUTE:	IF YES, AT WHAT STEP	DECISION TIME
YES X	#2	1 min
NO _____		

RETURN TO: Monica

VARIANCE:

_____ REQUIRED
✓ NOT REQUIRED

_____ GRANTED
_____ NOT GRANTED
_____ LETTER ISSUED

COMMENTS: OK-Gah

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA		B	SB
RECEIVED	DATE	WS	
ISSUED	DATE	WQARF	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER 55 -

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1: REGISTRY INFORMATION

Well Type

CHECK ONE

- [X] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action

CHECK ONE

- [X] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:

WELL REGISTRATION NUMBER: 55 -

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 | MAP 08 | PARCEL 006

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2: OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.

MAILING ADDRESS: PO Box 37

CITY / STATE / ZIP CODE: Superior AZ 85273-0037

CONTACT PERSON NAME AND TITLE: William Gray

TELEPHONE NUMBER: (520) 689-5160 | FAX: (520) 689-5158

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:

MAILING ADDRESS:

CITY / STATE / ZIP CODE:

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER: | FAX:

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 3: DRILLING AUTHORIZATION

Drilling Firm

NAME: Boart Longyear

DWR LICENSE NUMBER: 87 | ROC LICENSE CATEGORY: A-04

TELEPHONE NUMBER: 1-800-808-2420 | FAX: 602-486-1885

Consultant (if applicable)

CONSULTING FIRM: Golder Associates

CONTACT PERSON NAME: John Malusa

TELEPHONE NUMBER: (520) 888-8818 | FAX: (520) 888-8818

E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4: [illegible]

Questions	Yes	No	Explanation
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).

91-552/1221 6056 806

GOLDER ASSOCIATES, INC.
4730 N. ORACLE RD., STE. 210 520-888-8818
TUCSON, AZ 85705

DATE Aug. 14, 2002

PAY TO THE ORDER OF Arizona Dept of Water Resources $ 80.00

Eighty and no/100 DOLLARS

WELLS FARGO
Wells Fargo Bank
7080 North Oracle Road
Tucson, AZ 85704

Security features included. Details on back.

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-594162

AUTHORIZED DRILLER: PROSONIC CORPORATION LICENSE NO: 685

NOTICE OF INTENTION TO DRILL A MINERAL EXPLORATION WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER INC P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

¼ of the ¼ of the ¼ Section 35 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 9

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 14TH DAY OF AUGUST, 2003

AWS

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram showing all proposed well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

AMA / INA	B	SB
Phx	06	
RECEIVED DATE 8-15-02	WS 15	
ISSUED DATE 8-22-02	WQARF CERCLA	

FILE NUMBER: D(1-12)35
WELL REGISTRATION NUMBER: 55-594162

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE

- [x] *Mineral Exploration
- [ ] *Geotechnical
- [ ] *Heat Pump
- [ ] Cathodic Protection
- [ ] Grounding
- [ ] Other (*please specify*):

*NUMBER OF WELLS (HOLES): 9

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	35	¼	¼	¼

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160
FAX: (520) 689-5158

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER:
FAX:

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm

NAME: Prosonic Corp.
DWR LICENSE NUMBER: 685
ROC LICENSE CATEGORY: A-04
TELEPHONE NUMBER: 480-635-9665
FAX: 480-635-9690

Consultant (if applicable)

CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818
FAX: (520) 888-8817
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4.

Questions	Yes	No	If Yes:
1. Is the proposed well site within 100 feet of a septic tank system, sewer disposal area, landfill, hazardous materials or petroleum storage area or tank?		X	You must submit a letter requesting a variance from the 100-foot setback requirement (A.A.C. R12-15-818). However, if the proposed well is a geotechnical well that will be abandoned before the drill rig leaves the well site, a variance may be requested by simply checking the box below. ☐ *I request a variance from the 100-foot setback requirement for a geotechnical well.*
2. If applicable, are you requesting a variance to use thermoplastic casing in lieu of steel in the surface seal?			The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
3. Is there another well name or identification number associated with this well?		X	PLEASE STATE

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

Provide a well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

WELL REGISTRATION NUMBER 55-594162

SECTION 5. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

DATE CONSTRUCTION TO BEGIN

*** Required Information ***

Borehole: DEPTH FROM SURFACE FROM (feet)	Borehole: DEPTH FROM SURFACE TO (feet)	Borehole: BOREHOLE DIAMETER (inches)	Casing: DEPTH FROM SURFACE FROM (feet)	Casing: DEPTH FROM SURFACE TO (feet)	Casing: OUTER DIAMETER (inches)	MATERIAL TYPE (X): STEEL	MATERIAL TYPE (X): PVC	MATERIAL TYPE (X): ABS	MATERIAL TYPE (X): IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (X): BLANK OR NONE	PERFORATION TYPE (X): WIRE WRAP	PERFORATION TYPE (X): SHUTTER SCREEN	PERFORATION TYPE (X): MILLS KNIFE	PERFORATION TYPE (X): SLOTTED	PERFORATION TYPE (X): IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	165	8														

Annular Material

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	ANNULAR MATERIAL TYPE (X): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	BENTONITE: CHIPS	BENTONITE: PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	FILTER PACK: GRAVEL	SIZE

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 6. PROPOSED WELL ABANDONMENT DESIGN (Refer to ADWR'S Well Abandonment Handbook for additional information.)

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Casing Treatment TYPE (X): SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING IS TO BE PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS TO BE ADDED	DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Sealing or Fill Material GROUT TYPE (X): NEAT CEMENT	CONCRETE	SAND-CEMENT GROUT	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	HIGH SOLIDS BENTONITE: GROUT	CHIPS	PELLETS	SAND	MIXING RATIO by (check one) ☐ Weight ☐ Volume	ESTIMATED VOLUME OF MATERIAL (cubic feet)
							0	20				X							21
							20	165									X		152

Proposed Abandonment Method (See Well Abandonment Handbook)

CHECK ONE

- ☐ Standard Method
- ☐ Alternative 1
- ☒ Alternative 2
- ☐ Alternative 3
- ☐ Alternative 4:
  - ☐ Variance Option *
- ☐ Alternative 5:
  - ☐ Variance Option 1*
  - ☐ Variance Option 2*
- ☐ Other *(please specify)*:

* requires a letter requesting a variance

Emplacement Method of Sealing or Fill Material

CHECK ONE

- ☒ Gravity
- ☐ Pressure Grouting
- ☐ Tremie Pumped
- ☐ Other *(please specify)*:

REMARKS

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF LANDOWNER, WELL OWNER OR EXPLORATION FIRM	DATE
William Gray - Env. Project Mgr	William Gray	8-14-02

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

August 22, 2002

JANE DEE HULL
Governor

JOSEPH C. SMITH
Director

BHP COPPER INC
P O BOX 37
SUPERIOR, AZ 85273

Registration No. 55-594162
File No. D(1-12) 35

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a well drilling card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion Report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended drilling card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Monica Ortiz
Water Resource Technician
Groundwater Management Support Section

Enclosures

VARIANCE CHECKLIST – HYDROLOGY

DATE RECEIVED 8-15-02
DATE TO HYDRO 8-19-02
DATE TO GMSS 8-20-02

POTENTIAL REG. # 55-_____

55-594161 THRU 55-594164

FRONT OF NOI COMPLETE/CORRECT: YES X NO _____

VARIANCE LETTER RECEIVED YES _____ NO X
WELL DIAGRAM RECEIVED YES _____ NO X
SITE PLAN RECEIVED YES _____ NO X

TYPE AND NUMBER OF WELLS:

_____	MONITOR	_____	CATHODIC PROTECTION
_____	PIEZOMETER	_____	GROUNDING
_____	GEOTECHNICAL	_____	HEAT PUMP
4	MINERAL EXPLORATION	_____	OTHER_____
_____	WATER PRODUCTION		DESCRIBE TYPE OF WELL

GROUNDWATER REVIEW:

WOULD ROUTE:	IF YES, AT WHAT STEP	DECISION TIME
YES_____	N/A	_____
NO _____		

RETURN TO: Monica

VARIANCE:

_____	REQUIRED	_____	GRANTED
✓	NOT REQUIRED	_____	NOT GRANTED
		_____	LETTER ISSUED

COMMENTS: OK - lmh

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

$10 FEE

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

AMA / INA	B	SB
RECEIVED DATE	WS	
ISSUED DATE	WQARF	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER 55 -

SECTION 1 - REGISTRY INFORMATION

Well Type

CHECK ONE
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action

CHECK ONE
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:

WELL REGISTRATION NUMBER 55 -

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER

BOOK 106 | MAP 08 | PARCEL 006

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2 - OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.

MAILING ADDRESS: PO Box 37

CITY / STATE / ZIP CODE: Superior AZ 85273-0037

CONTACT PERSON NAME AND TITLE: William Gray

TELEPHONE NUMBER: (520) 689-5160 | FAX: (520) 689-5158

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:

MAILING ADDRESS:

CITY / STATE / ZIP CODE:

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER: | FAX:

SECTION 3 - DRILLING AUTHORIZATION

Drilling Firm

NAME: Boart Longyear

DWR LICENSE NUMBER: 87 | ROC LICENSE CATEGORY: A-04

TELEPHONE NUMBER: 1-800-808-2420 | FAX: 602-486-1885

Consultant (if applicable)

CONSULTING FIRM: Golder Associates

CONTACT PERSON NAME: John Malusa

TELEPHONE NUMBER: (520) 888-8818 | FAX: (520) 888-8818

E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4

Questions	Yes	No	Explanation
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).

GOLDER ASSOCIATES, INC.
4730 N. ORACLE RD., STE. 210 520-888-8818
TUCSON, AZ 85705

91-552/1221 6056

806

PAY TO THE ORDER OF Arizona Dept of Water Resources

DATE Aug. 14, 2002

$ 80.00/xx

Eighty and no/100 DOLLARS

WELLS FARGO
Wells Fargo Bank
7080 North Oracle Road
Tucson, AZ 85704

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-594164

AUTHORIZED DRILLER: BOART LONGYEAR COMPANY LICENSE NO: 83

NOTICE OF INTENTION TO DRILL A MINERAL EXPLORATION WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER INC P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

¼ of the ¼ of the ¼ Section 35 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 9

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 14TH DAY OF AUGUST, 2003

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

AMA/INA	B	SB
Pnx	06	
RECEIVED DATE 8-15-02	WS 15	
ISSUED DATE 8-22-02	WQARF CERCLA —	

FILE NUMBER: D(1-12)35
WELL REGISTRATION NUMBER: 55-594164

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram showing all proposed well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE

- [x] *Mineral Exploration
- [ ] *Geotechnical
- [ ] *Heat Pump
- [ ] Cathodic Protection
- [ ] Grounding
- [ ] Other (*please specify*):

*NUMBER OF WELLS (HOLES): 9

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	35	¼	¼	¼

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160
FAX: (520) 689-5158

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER:
FAX:

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm

NAME: Boart Longyear
DWR LICENSE NUMBER: ~~87~~ 83
ROC LICENSE CATEGORY: A-04
TELEPHONE NUMBER: 800-808-2420
FAX: 602-486-1885

Consultant (if applicable)

CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818
FAX: (520) 888-8817
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4.

Questions	Yes	No	If Yes:
1. Is the proposed well site within 100 feet of a septic tank system, sewer disposal area, landfill, hazardous materials or petroleum storage area or tank?		X	You must submit a letter requesting a variance from the 100-foot setback requirement (A.A.C. R12-15-818). However, if the proposed well is a geotechnical well that will be abandoned before the drill rig leaves the well site, a variance may be requested by simply checking the box below. ☐ *I request a variance from the 100-foot setback requirement for a geotechnical well.*
2. If applicable, are you requesting a variance to use thermoplastic casing in lieu of steel in the surface seal?			The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
3. Is there another well name or identification number associated with this well?		X	PLEASE STATE

Notice of Intent to Drill and Abandon an *Exploration / Specialty* Well

WELL ID NUMBER (ADWR USE ONLY) 55-594204

Provide a well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

SECTION 5. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

DATE CONSTRUCTION TO BEGIN

*** Required Information ***

Borehole: DEPTH FROM SURFACE FROM (feet)	Borehole: DEPTH FROM SURFACE TO (feet)	Borehole: BOREHOLE DIAMETER (inches)	Casing: DEPTH FROM SURFACE FROM (feet)	Casing: DEPTH FROM SURFACE TO (feet)	Casing: OUTER DIAMETER (inches)	Casing: MATERIAL TYPE (X) STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (X) BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	165	8														

Annular Material

DEPTH FROM SURFACE FROM (feet)	TO (feet)	ANNULAR MATERIAL TYPE (X) NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL DESCRIBE	FILTER PACK SAND	GRAVEL	SIZE

RECEIVED AUG 15 2002 GROUNDWATER MGT

SECTION 6. PROPOSED WELL ABANDONMENT DESIGN (Refer to ADWR's Well Abandonment Handbook for additional information)

DEPTH FROM SURFACE FROM (feet)	TO (feet)	Casing Treatment (if applicable) TYPE (X): SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING IS TO BE PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS TO BE ADDED	DEPTH FROM SURFACE FROM (feet)	TO (feet)	Sealing or Fill Material GROUT TYPE (X): NEAT CEMENT	CONCRETE	SAND-CEMENT GROUT	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	HIGH SOLIDS BENTONITE GROUT	CHIPS	PELLETS	SAND	MIXING RATIO by (check one) ☐ Weight ☐ Volume	ESTIMATED VOLUME OF MATERIAL (cubic feet)
							0	20				X							21
							20	165									X		152

Proposed Abandonment Method (See Well Abandonment Handbook)

CHECK ONE

- ☐ Standard Method
- ☐ Alternative 1
- ☒ Alternative 2
- ☐ Alternative 3
- ☐ Alternative 4:
  - ☐ Variance Option *
- ☐ Alternative 5:
  - ☐ Variance Option 1*
  - ☐ Variance Option 2*
- ☐ Other *(please specify)*:

* requires a letter requesting a variance

Emplacement Method of Sealing or Fill Material

CHECK ONE

- ☒ Gravity
- ☐ Pressure Grouting
- ☐ Tremie Pumped
- ☐ Other *(please specify)*:

REMARKS

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF LANDOWNER, WELL OWNER OR EXPLORATION FIRM	DATE
William Gray - Env. Project Mgr	William Gray	8-14-02

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

August 22, 2002

JANE DEE HULL
Governor

JOSEPH C. SMITH
Director

BHP COPPER INC
P O BOX 37
SUPERIOR, AZ 85273

Registration No. 55- 594164
File No. D(1-12) 35

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well which was recently filed with this Department. This is returned to you as evidence of compliance with A.R.S. §45-596. Your designated driller has been mailed, separately, a well drilling card which he is required to have in his possession before commencing to drill the well.

This well is authorized to be drilled for mineral exploration purposes. Because of this, no pump equipment may be installed. A Project Completion Report is being furnished you for each hole to be drilled. You are required to submit this within 30 days after completion of drilling. Frequently, exploration wells are abandoned shortly after drilling. Per R12-15-816.F a Well Abandonment Completion Report must be submitted by the driller. The Department of Water Resources requires you to obtain written permission before proceeding with the drilling, in the event, that you determine it necessary to change the location of the proposed well. A properly signed amended drilling card must be in the possession of the driller before drilling commences at a different location.

For your future use, a Change of Well information form is enclosed for your convenience. Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Monica Ortiz

Monica Ortiz
Water Resource Technician
Groundwater Management Support Section

Enclosures

VARIANCE CHECKLIST – HYDROLOGY

DATE RECEIVED 8-15-02
DATE TO HYDRO 8-19-02
DATE TO GMSS 8-20-02

POTENTIAL REG. # 55-_____

55-594161 THRU 55-594164

FRONT OF NOI COMPLETE/CORRECT: YES X NO _____

VARIANCE LETTER RECEIVED	YES _____	NO X
WELL DIAGRAM RECEIVED	YES _____	NO X
SITE PLAN RECEIVED	YES _____	NO X

TYPE AND NUMBER OF WELLS:

_____	MONITOR	_____	CATHODIC PROTECTION
_____	PIEZOMETER	_____	GROUNDING
_____	GEOTECHNICAL	_____	HEAT PUMP
4	MINERAL EXPLORATION	_____	OTHER_____
_____	WATER PRODUCTION		DESCRIBE TYPE OF WELL

GROUNDWATER REVIEW:

WOULD ROUTE:	IF YES, AT WHAT STEP	DECISION TIME
YES _____	N/A	_____
NO _____		

RETURN TO: Monica

VARIANCE:

_____	REQUIRED	_____	GRANTED
✓	NOT REQUIRED	_____	NOT GRANTED
		_____	LETTER ISSUED

COMMENTS: OK - lmh

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

$10 FEE

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA	B	SB
RECEIVED DATE	WS	
ISSUED DATE	WQARF	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER 55-

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1: REGISTRY INFORMATION

Well Type (CHECK ONE)
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action (CHECK ONE)
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 MAP 08 PARCEL 006

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2: OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160 FAX: (520) 689-5158

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER: FAX:

SECTION 3: DRILLING AUTHORIZATION

Drilling Firm

NAME: Boart Longyear
DWR LICENSE NUMBER: 87
ROC LICENSE CATEGORY: A-04
TELEPHONE NUMBER: 1-800-808-2420 FAX: 602-486-1885

Consultant (if applicable)

CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818 FAX: (520) 888-8818
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4: [illegible]

Questions	Yes	No	Explanation
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).

GOLDER ASSOCIATES, INC.
4730 N. ORACLE RD., STE. 210 520-888-8818
TUCSON, AZ 85705

91-552/1221 6056

806

PAY TO THE ORDER OF Arizona Dept of Water Resources DATE Aug. 14, 2002

Eighty and no/100 $ 80.00 DOLLARS

Security features included. Details on back.

WELLS FARGO
Wells Fargo Bank
7080 North Oracle Road
Tucson, AZ 85704

DEPARTMENT OF WATER RESOURCES
99 EAST VIRGINIA AVENUE
PHOENIX, ARIZONA 85004

RECEIVED JUN 1982 DEPT. OF WATER RESOURCES

REGISTRATION OF EXISTING WELLS

READ INSTRUCTIONS ON BACK OF THIS FORM BEFORE COMPLETING
PRINT OR TYPE — FILE IN DUPLICATE

48

FOR OFFICE USE ONLY
REGISTRATION NO. 55- 621501
FILE NO. D(1-12)35
FILED JUN 14 1982 (DATE) AT 4pm (TIME)
INA
AMA Phoenix

REGISTRATION FEE (CHECK ONE)
EXEMPT WELL (NO CHARGE) ☐
NON-EXEMPT WELL — $10.00 ☒

1. Name of Registrant: BRUCE G. VAUGHAN
PO Box 452 (Address) SUPERIOR (City) ARIZONA (State) 85273 (Zip)

2. File and/or Control Number under previous groundwater law: _____ (File Number) 35- _____ (Control Number) NOT AVAILABLE

3. a. The well is located within the ____ ¼ ____ ¼ ____ ¼, Section 35, of Township 2S N/S, Range 12E E/W, G & SRB & M, in the County of PINAL.
b. ~~If in a subdivision: Name of subdivision~~ COUNTY 11 BOOK 106 MAP ~~Lot No.~~ ~~Address~~ 12 PARCEL 15107.

4. The principal use(s) of water (Examples: irrigation stockwater domestic municipal industrial)
WE RAISE BIRDS COMMERCIALLY.

5. If for irrigation use, number of acres irrigated from well 1.

6. Owner of land on which well is located. If same as Item 1, check this box ☑
(Address) (City) (State) (Zip)

7. Well data (If data not available, write N/A)
a. Depth of Well 100' feet
b. Diameter of casing 10" inches
c. Depth of casing 100' ± feet
d. Type of casing STEEL.
e. Maximum pump capacity 45 gallons per minute.
f. Depth to water 25' feet below land surface.
g. Date well completed PRIOR TO 1935 (Month) (Day) (Year)

8. The place(s) of use of water. If same as Item 3, check this box ☑
____ ¼ ____ ¼ ____ ¼, Section ____ Township ____ Range ____
____ ¼ ____ ¼ ____ ¼, Section ____ Township ____ Range ____
Attach additional sheet if necessary.

9. DATE Jun 14, 1982 SIGNATURE OF REGISTRANT [signature]

MICROFILMED

INSTRUCTIONS FOR COMPLETING REGISTRATION FORM

General Instructions

1. A person who owns an "Existing Well" shall register the well, pursuant to A.R.S. 45-593, by filing this form **in duplicate** with the Department of Water Resources not later than midnight June 14, 1982. The form must be completed and signed. Failure to do so will constitute a violation of A.R.S. 45-593, and may subject the well owner to injunction and/or civil penalties, pursuant to A.R.S. Title 45, Article 12.

2. An "Existing Well" means, (1) a well which was drilled on or before June 12, 1980 and which is not abandoned or sealed, or (2) a well which was not completed on or before June 12, 1980, but for which a Notice of Intention to Drill was on file with the Arizona Water Commission on or before June 12, 1980.

3. No registration fee is required for Exempt Wells. A $10.00 registration fee must accompany registration forms for all Non-Exempt Wells.

4. An "Exempt Well" means a well having a pump with a maximum capacity of not more than 35 gallons per minute which is used to withdraw groundwater. An Exempt Well may include the non-commercial irrigation of not more than 1 acre of land.

5. A "Non-Exempt Well" means a well that is not an "Exempt Well".

INSTRUCTIONS FOR REGISTRATION QUESTIONS

1. The Registrant must be the owner of the well and may be an individual, public or private corporation, company, partnership, firm, association, society, estate, trust, any other private organization or enterprise, the United States, any state, territory or country or a governmental entity, political subdivision or municipal corporation organized under or subject to the constitution and laws of this State.

2. If you own an existing irrigation well drilled at any time, or any other type of well drilled on or after June 20, 1968, you should have an assigned control and/or file number. Write these numbers in item 2. If you do not know the number, please explain the reason on the form or on an attached sheet.

3. a. Fill in the Section, Township and Range in all cases if it is available.
   b. If the well is in a subdivision and you have this information, give the subdivision name, Lot Number, and Address.

4. Show all purposes for which the water is used.

5. If the well is used for irrigation, give the number of acres irrigated in 1980 from the well.

6. If the owner of the land is an individual, give the last name, first name, middle initial. If the owner of the land is a corporation, partnership, firm, etc., fill in the appropriate title.

7. Complete the section on Well Data with the most accurate information available to you. If the data is not available, write N/A in the blanks.

8. Give the legal description of the place of use of the water. If place of use is in a subdivision and legal description is not available, give the subdivision name, Lot Number and/or address on the blank line.

9. The person in whose name a well is registered shall notify the Department of any change in ownership and shall keep all information on the registration record current and accurate. A form entitled "Change of Well Information/Ownership" is available for this purpose. A blank form will be furnished with the returned duplicate copy of the registration form.

B G VAUGHAN
P O BOX 452
SUPERIOR AZ 85273

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
WATER RIGHTS ADMINISTRATION
99 EAST VIRGINIA
PHOENIX, ARIZONA 85004

MICROFILMED

RECEIPT

KIND ENTRY	FILE REFERENCE NO.
55	621501
	THRU
55	

ACCOUNT NO. FUND SOURCE	AGENCY	CHAPTER	DIV.	INT. ACCT.	ITEM DESCRIPTION	RATE	$ AMOUNT
					Filing Fee for Registration of	10.00	10.00
					Existing Wells		
					File No. D(1-12)35		

WAITER PAYMENT
GUESTS 1
CHK NO 204
55-1 10.00
TAX 0.00
TOTL 10.00
GEN.CHEK 10.00

2638 A 15:29

9/23/82 jc Check # 204 TOTAL $ 10.00

RECORD OF MONITORING WELL INSTALLATION

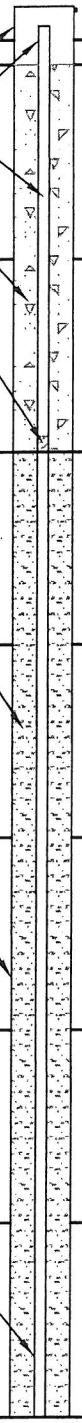
GAI-02-01

PROJECT NUMBER: 023-2552
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
COORDINATES **N:** **E:** **EL:** 3007

SHEET: 1 OF 7
PROJECT: SUPERIOR MONITOR WELLS
BORING DATE: 04/23/02

STRATIGRAPHY: DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	PASTE pH	PASTE COND. (µS/cm)	MONITORING WELL COMPLETION: DESCRIPTION	DRILLING NOTES	DEPTH (feet)
0	Well-graded sand with gravel, light brown/tan with variably colored clast; sand and gravel, poorly-graded, angular to sub-rounded, clast composed of schist granite, metavolcanics and limestone: dry. (40/60/TR)		SW	S	7.95	124	8" LOCKING MONUMENT; 2' STICK UP; 4" SCH. 40 LOW CARBON STEEL (2' AGS–19.2' BGS); CEMENT (0'–20')	DRILLING TECHNIQUE USES HAMMER BIT WITH APPROXIMATLY 1" INTERCHANGE WHICH RESULTS IN CRUSHING COURSE GRAVEL UP TO BOULDER SIZE MATERIAL INTO FINE ANGULAR GRAVEL.	0
10	Well-graded sand with gravel, light brown/tan with variably colored clast; sand and gravel, poorly-graded, angular to sub-rounded, clast composed of schist granite, metavolcanics and limestone: dry. (40/60/TR)		SW	S	8.27	120	SCH. 40–80 STEEL ADAPTOR (19.2'–20')		10
20	Well-graded sand with gravel, light gray/brown; no plasticity, well-graded in all size fractions; sand, dry. (30/65/5)		SW	S	9.33	98			20
30	Well-graded sand with gravel, light grey/brown; no plasticity, well-graded in all size fractions; sand, well-graded; dry. (30/65/5)		SW	S	9.26	181	BENTONITE SLURRY (20'–145')		30
40	Silty sand with gravel; light brown, no plasticity; well-graded sand and gravel fraction; predominantly angular to sub-angular; dry. (30/55/15)		SM	S	9.44	195	8" BORHOLE (0'–440')		40
50	Silty sand with gravel; light gray/brown, predominantly fine sand and silt; dry. (15/65/20)		SM	S	9.32	195			50
60	Silty sand with gravel; light gray/brown, predominantly fine sand and silt; dry. (15/65/20)		SM	S	9.58	130	4" SCH. 80 PVC CASING (20'–165.8')		60
70									70

WELL SKETCH



GILA CONGLOMERATE

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
DRILLER: MARK HALAGER

LOGGED: JJM
CHECKED:
DATE:

Golder Associates

K:\2002 Projects\023-2552\0232552A001.dwg

RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552
SHEET: 2 OF 7
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
PROJECT: SUPERIOR MONITOR WELLS
COORDINATES **N:** **E:** **EL:** 3007
BORING DATE: 04/23/02

STRATIGRAPHY					PASTE		MONITORING WELL COMPLETION			
DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	pH	COND. (µS/cm)	DESCRIPTION	WELL SKETCH	DRILLING NOTES	DEPTH (feet)
70–80	Silty sand with gravel; light gray; no plasticity; sand poorly-graded; predominantly fine; gravel angular, mainly dark aphanitic volcanics: dry. (30/45/25)		SM	S	9.51	125				70
80–90	Silty sand with gravel; light gray; no plasticity; sand poorly-graded; predominantly fine; gravel angular, mainly dark aphanitic volcanics: dry. (30/45/25)		SM	S	9.31	126	BENTONITE SLURRY (20'–145')			80
90–100	Silty sand with gravel; light gray; no plasticity; sand, poorly-graded, predominantly fine; gravel fine, angular: dry. (40/40/20)		SM	S	9.28	141				90
100–110	Silty sand with gravel; light gray; no plasticity; sand, poorly-graded, predominantly fine; gravel, fine, angular, dry. (40/50/10)		SM	S	9.20	140	8" BORHOLE (0'–440')	GILA CONGLOMERATE		100
110–120	Silty sand with gravel; light gray; no plasticity; sand, poorly-graded, predominantly fine; gravel, fine, angular, dry. (40/50/10)		SM	S	9.25	125				110
120–130	Silty sand; light gray/brown with varied colored clast; sand, well-graded; gravel, fine, angular no plasticity; dry. (30/55/15)		SM	S	9.31	155	4" SCH. 80 PVC CASING (20'–165.8')		Temporarily shut down, no contract signed.	120
130–140	Silty sand; light gray/brown with varied colored clast; sand, well-graded; gravel, fine, angular no plasticity; dry. (30/55/15)		SM	S	9.32	140				130
140										140

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
LOGGED: JJM
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
CHECKED:
DRILLER: MARK HALAGER
DATE:

Golder Associates

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RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552 **SHEET:** 3 OF 7

BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM **PROJECT:** SUPERIOR MONITOR WELLS

COORDINATES **N:** **E:** **EL:** 3007 **BORING DATE:** 04/23/02

STRATIGRAPHY: DEPTH (feet)	STRATIGRAPHY: DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	PASTE pH	PASTE COND. (µS/cm)	MONITORING WELL COMPLETION: DESCRIPTION	DRILLING NOTES
140–150	Silty sand; light gray/brown with varied colored clast; sand, well-graded; gravel, fine, angular no plasticity; dry. (30/55/15)		SM	S	9.24	82.4	BENTONITE SLURRY (20'–145'); HYDRATED BENTONITE CHIPS (145'–147')	● 145' Slight dampness and dust reduction. ● 147' Fracture or void in formation.
150–160	Silty sand; light gray/brown with varied colored clast; sand, well-graded; gravel, fine, angular no plasticity; dry. (30/55/15)		SM	S	9.31	85	HYDRATED BENTONITE PELLETS (147'–150'); #50–70 SILICA CHOKE SAND (150'–152')	
160–170	Silty sand; light gray/brown with varied colored clast; sand, well-graded; gravel, fine, angular no plasticity; dry. (30/55/15)		SM	S	9.27	103	4" SCH. 80 PVC CASING (20'–165.8')	● approx. 165' Slight moisture occuring in cuttings blowing out of surface casing.
170–180	Well-graded sand with gravel and silt; light brown/gray, non-plastic; sand, angular to sub-rounded; gravel, fine, angular, dry. (30/60/10)		SW–SM	S	9.58	58	4" SCH. 80 PVC 0.020 SLOT (165.8'–195.2'); #10–20 SILICA SAND (152'–206')	▽ Static water level approx. 176' BGS (measured 05/07/02) Slightly decrease in fines, possibly due to fines adhering to inside of drill pipe.
180–190	Slightly increase in gravel. Well-graded sand with gravel and silt; light brown/gray, non-plastic; sand, angular to sub-rounded; gravel, fine, angular, dry. (40/60/10)		SW–SM	S	9.50	71	8" BORHOLE (0'–440')	
190–200	Well-graded sand with gravel; light gray/brown; sand well-graded; gravel fine, angular; fine fraction reduced; dry. (40/55/5)		SW	S	9.52	60	4" SCH. 80 PVC SUMP (195.2'–200.3'); 4" SCH. 80 PVC END CAP (200.3'–200.5')	
200–210	Well-graded sand with gravel and silt; light brown/gray; non-plastic; gravel fine, angular; dry. (30/50/10)		SW–SM	S	9.50	65	HYDRATED BENTONITE CHIPS (206'–208'); HYDRATED BENTONITE PELLETS (208'–211')	

WELL SKETCH

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION **LOGGED:** JJM

DRILLING CONTRACTOR: LAYNE CHRISTENSEN **CHECKED:**

DRILLER: MARK HALAGER **DATE:**

Golder Associates

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RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552
SHEET: 4 OF 7
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
PROJECT: SUPERIOR MONITOR WELLS
COORDINATES **N:** **E:** **EL:** 3007
BORING DATE: 04/23/02

STRATIGRAPHY					PASTE		MONITORING WELL COMPLETION			
DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	pH	COND. (µS/cm)	DESCRIPTION	WELL SKETCH	DRILLING NOTES	DEPTH (feet)
210	Well-graded sand with gravel and silt; light brown/gray; non-plastic; gravel fine, angular; dry, cuttings from cyclone are slightly moist. (40/45/10)		SW-SM	S	9.48	90.3	HYDRATED BENTONITE PELLETS (208'-211')		● 213' First moisture in cuttings at both cyclone and surface casing. Circulation momentarily, clogged, driller ups pressure to flush lines.	210
220	Silty sand with gravel; sand, poorly graded, predominantly fine; gravel, fine, angular; moist. (35/50/15)		SM	S	9.22	111				220
230	Silty sand with gravel; sand, poorly graded, predominantly fine; gravel, fine, angular; moist. (35/50/15)		SM	S	8.82	119	BENTONITE SLURRY (211'-440')			230
240	Poorly graded sand with silt; sand, predominantly fine to very fine; gravel, fine, angular; moist. (10/80/10)		SP-SM	S	9.31	152		GILA CONGLOMERATE	● 240'-250' extra moist; water producing zone.	240
250	Poorly graded sand with silt; sand, predominantly fine to very fine; gravel, fine, angular; moist. (10/80/10)		SP-SM	S	9.22	135	8" BORHOLE (0'-440')			250
260	Silty sand; light brown/gray, sand, poorly graded, fine; gravel, fine, angular; fine fraction is silt; moist. (10/60/30)		SM	S	9.51	95.4				260
270	Silty sand; light brown/gray, sand, poorly graded, fine; gravel, fine, angular; fine fraction is silt; slight decrease in silt; moist. (10/70/20)		SM	S	9.45	140				270
280										280

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
LOGGED: JJM
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
CHECKED:
DRILLER: MARK HALAGER
DATE:

Golder Associates

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RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
COORDINATES **N:** **E:** **EL:** 3007

SHEET: 5 OF 7
PROJECT: SUPERIOR MONITOR WELLS
BORING DATE: 04/23/02

STRATIGRAPHY					PASTE		MONITORING WELL COMPLETION			
DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	pH	COND. (µS/cm)	DESCRIPTION	WELL SKETCH	DRILLING NOTES	DEPTH (feet)
280	Well-graded sand with gravel and silt; light brown/gray; sand, well-graded, sub-angular, sub-rounded; gravel, fine, angular; moist. (30/65/5)		SW	S	9.63	189			THERE HAS BEEN NO WATER PRODUCTION, HOWEVER, MORE TIME IS NEEDED TO BLOW OUT STICKY MOIST MATERIAL WITH EVERY DRILL PIPE CONNECTION.	280
290	Silty sand; light brown; sand poorly-graded, predominantly fine; gravel, fine, angular; fines composed of silt, non-plastic; moist. (5/75/20)		SM	S	9.35	170				290
300	Silty sand; light brown; sand poorly graded, predominantly fine; gravel, fine, angular; fines composed of silt, non-plastic; moist. (5/75/20)		SM	S	9.45	160	BENTONITE SLURRY (211'-440')	GILA CONGLOMERATE		300
310	Silty sand; light brown; sand poorly graded, predominantly fine; gravel, fine, angular; fines composed of silt, non-plastic; moist. (5/75/20)		SM	S	9.51	180				310
320	Silty sand; light brown; sand poorly graded, predominantly fine; gravel, fine, angular; fines composed of silt, non-plastic; moist. (5/75/20)		SM	S	9.62	196	8" BORHOLE (0'-440')		Trace of low plasticity clay.	320
330	Poorly graded sand; light brown; sand, fine to very fine; trace gravel, angular; fines composed of silt, non-plastic; moist. (TR/95/5)		SP	S	9.55	225				330
340	Silty sand; light brown; sand, well-graded; fines predominantly silt, non-plastic; moist. (TR/80/20)		SM	S	9.53	224				340
350										350

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
DRILLER: MARK HALAGER

LOGGED: JJM
CHECKED:
DATE:

Golder Associates

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RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552
SHEET: 6 OF 7
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
PROJECT: SUPERIOR MONITOR WELLS
COORDINATES **N:** **E:** **EL:** 3007
BORING DATE: 04/23/02

STRATIGRAPHY					PASTE		MONITORING WELL COMPLETION			
DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	pH	COND. (µS/cm)	DESCRIPTION	WELL SKETCH	DRILLING NOTES	DEPTH (feet)
350	Silty sand; brown; sand, poorly-graded, predominantly fine; fine fraction, predominantly silt with trace of low plasticity clay; moist. (0/75/25)		SM	S	9.50	84.6		GILA CONGLOMERATE	THERE HAS BEEN NO WATER PRODUCTION, HOWEVER, MORE TIME IS NEEDED TO BLOW OUT STICKY MOIST MATERIAL WITH EVERY DRILL PIPE CONNECTION.	350
360	Silty sand; brown; sand, poorly graded, predominantly fine; fine fraction, predominantly silt with trace of low plasticity clay; moist. (TR/60/40)		SM	S	9.55	187				360
370	Sandy silt; strong brown; sand, well-graded; fine fraction predominantly silt with approx. 30% low plasticity clay; moist. (TR/40/60)		ML	S	9.53	320	BENTONITE SLURRY (211'-440')			370
380	Sandy silt; strong brown; sand, well-graded; fine fraction predominantly silt with approx. 30% low plasticity clay; moist. (TR/40/60)		ML	S	9.52	341		GILA CONGLOMERATE (INTERBEDDED SILTSTONE/MUDSTONE)		380
390	Sandy silt; strong brown; sand, well-graded; fine fraction predominantly silt with approx. 30% low plasticity clay; moist. (TR/40/60)		ML	S	9.51	325	8" BORHOLE (0'-440')		First seen, trace of low plasticity clay.	390
400	Silt with sand; brown; sand, well-graded; fine fraction predominantly silt with approx. 40% low plasticity clay; moist. (0/15/85)		ML	S	9.46	311				400
410	Silt with sand; brown; sand, well-graded; fine fraction predominantly silt with approx. 40% low plasticity clay; moist. (0/15/85)		ML	S	9.52	260				410
420										420

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
LOGGED: JJM
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
CHECKED:
DRILLER: MARK HALAGER
DATE:

Golder Associates

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RECORD OF MONITORING WELL INSTALLATION

GAI-02-01

PROJECT NUMBER: 023-2552
BOREHOLE LOCATION: APPROX. 200' SE OF TAILINGS POND 6 DAM
COORDINATES **N:** **E:** **EL:** 3007

SHEET: 7 OF 7
PROJECT: SUPERIOR MONITOR WELLS
BORING DATE: 04/23/02

STRATIGRAPHY					PASTE		MONITORING WELL COMPLETION				
DEPTH (feet)	DESCRIPTION (Gravel/Sand/Fine)	GRAPHIC LOG	ASTM CLASS.	HCl REACTIVITY	pH	COND. (µS/cm)	DESCRIPTION	WELL SKETCH		DRILLING NOTES	DEPTH (feet)
420	Silt with sand; brown; sand, well-graded; fine fraction predominantly silt with approx. 40% low plasticity clay; moist. (0/10/90)		ML	S			BENTONITE SLURRY (211'–440')		GILA CONGL. (INTERBEDDED SILTSTONE/MUDSTONE)	Not enough sample for paste pH and cond.	420
430	Silt with sand; brown; sand, well-graded; fine fraction predominantly silt with approx. 40% low plasticity clay; moist. (0/10/90)		ML	S			8" BORHOLE (0'–440')			Not enough sample for paste pH and cond.	430
440										TD @ 440' BLS	440
380											380
390											390
400											400
410											410
420											420

DRILL RIG: SCHRAMM/ DUAL WALL REVERSE CIRCULATION
DRILLING CONTRACTOR: LAYNE CHRISTENSEN
DRILLER: MARK HALAGER

LOGGED: JJM
CHECKED:
DATE:

Golder Associates

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ARIZONA DEPARTMENT OF WATER RESOURCES
Records Management Section
500 N. 3rd Street * Phoenix, Arizona 85004
(602) 417-2405 * (800) 352-8488
www.water.az.gov

Well Driller Report and Well Log

RECEIVED MAY 13 2002 RECORDS MGT

FILE NUMBER: D(1-12) 34 ADD
WELL REGISTRATION NUMBER: 55- 591860
PERMIT NUMBER (IF ISSUED):

- Review instructions prior to completing form
- This report should be prepared by the driller in detail and filed with the Department within 30 days following completion of the well.

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION OR INDIVIDUAL: BHP BILLITON

MAILING ADDRESS: P O BOX 37

CITY / STATE / ZIP: SUPERIOR, AZ 85273

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER: 520-689-5158

FAX:

Location of Well

WELL LOCATION ADDRESS (IF KNOWN):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12 E	34	NE 1/4	SE 1/4	SE 1/4

LATITUDE: ° ' "N
LONGITUDE: ° ' "W

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF LATITUDE / LONGITUDE (CHECK ONE): ☐ Hand-Held ☐ USGS Quad Map ☐ Conventional Survey ☐ GPS : ☐ Survey-Grade

COUNTY ASSESSOR'S PARCEL ID NUMBER
BOOK: 106 MAP: 8 PARCEL: 006

COUNTY WHERE WELL IS LOCATED: PINAL

SECTION 2. DRILLING AUTHORIZATION

Drilling Firm

NAME: LAYNE CHRISTENSEN COMPANY

DWR LICENSE NUMBER: 7

TELEPHONE NUMBER: 480-895-9404

FAX:

SECTION 3. WELL CONSTRUCTION DETAILS

DATE WELL CONSTRUCTION STARTED: 4-23-02

DATE WELL CONSTRUCTION COMPLETED: 4-30-02

IF FLOWING WELL, METHOD OF FLOW REGULATION: ☐ Valve ☐ Other

Drill Method

CHECK ONE

- ☒ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development

CHECK ONE

- ☐ Airlift
- ☒ Bail
- ☐ Surge Back
- ☐ Surge Pump
- ☐ Other (please specify)

Water Level Information

STATIC WATER LEVEL: 187 Feet Below Land Surface

DATE MEASURED: 4/29

Method of Sealing at Reduction Points

CHECK ONE

- ☒ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

ANSWERED MAY 21 2002

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55- 591860

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Borehole			Installed Casing														
DEPTH FROM SURFACE		BOREHOLE DIAMETER (inches)	DEPTH FROM SURFACE		OUTER DIAMETER (inches)	MATERIAL TYPE (X)				PERFORATION TYPE (X)						SLOT SIZE IF ANY (inches)
FROM (feet)	TO (feet)		FROM (feet)	TO (feet)		STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	
0	440	8"														
			0	20		X				X						
			20	166			X			X						
			166	195			X							X		.020
			195	200			X			X						

Installed Annular Material											
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (X)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	20				X							
20	145					X			ENVIRO GROUT			
145	150							X				1/4"
150	206									X		10-20
206	440					X						

DEPTH OF BORING		DEPTH OF COMPLETED WELL	
440'	Feet Below Land Surface	200'	Feet Below Land Surface

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55- 591860

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	TO (feet)	DESCRIPTION Describe material, grain size, color, etc.	Check (X) every interval where water was encountered
0	40	WELL GRADED SAND W/GRAVEL	
40	170	SILTY SAND	
170	220	WELL GRADED SAND (WATER 184')	X
220	370	SILTY SAND	
370	440	SANDY SILT	

ANSWERED MAY 2 1 2002

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55- 591860

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
BHP BILLITON	106	8	006

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the proposed well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

N
W E
S

1" = _____ ft

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

DRILLING FIRM	SIGNATURE OF QUALIFYING PARTY	DATE
LAYNE CHRISTENSEN		5-9-02

DWR-55-55 (Rev. 10/11/01)

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-591860

AUTHORIZED DRILLER: LAYNE CHRISTENSEN COMPANY LICENSE NO: 7

NOTICE OF INTENTION TO DRILL A MONITOR WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP BILLITON P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

SE ¼ of the SE ¼ of the NE ¼ Section 34 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 3RD DAY OF APRIL, 2003

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA	B	SB
Phx		06
RECEIVED DATE	WS	15
ISSUED DATE	WQARF CERCLA	

FILE NUMBER: D(1-12)34 add
WELL REGISTRATION NUMBER: 55-591860

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type (CHECK ONE)
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action (CHECK ONE)
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well
WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	34	NE ¼	SE ¼	SE ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 MAP 08 PARCEL 006
COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2. OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Billiton
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160 FAX: 689-5158

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER: FAX:

RECEIVED APR 4 2002

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm
NAME: Layne Christensen
DWR LICENSE NUMBER: 7
ROC LICENSE CATEGORY: 071734 class A04
TELEPHONE NUMBER: (480) 895-9336 FAX: 895-8699

Consultant (if applicable)
CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818 FAX: (520) 888-8817
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4.

Questions	Yes	No	Explanation:
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
3. Are you requesting a variance to use thermoplastic casing in lieu of steel casing in the surface seal?		X	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
4. Is there another well name or identification number associated with this well?		X	IF YES, PLEASE STATE
5. Have construction plans been coordinated with the Arizona Department of Environmental Quality?		X	IF YES, PLEASE STATE AGENCY CONTACT & PHONE NUMBER
6. For monitor wells, is dedicated pump equipment to be installed?		X	IF YES, PLEASE STATE DESIGN PUMP CAPACITY Gallons per Minute
7. Will the well registration number be stamped on the vault cover or on the upper part of the casing?		X	IF NO, WHERE WILL THE REGISTRATION NUMBER BE PLACED? Etched into cement pad before drying w/ nail.

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

WELL REGISTRATION NUMBER
55 -

SECTION 5. WELL CONSTRUCTION DETAILS

RECEIVED APR 4 2002

Drill Method

CHECK ONE

- [x] Air Rotary
- [ ] Bored or Augered
- [ ] Cable Tool
- [ ] Dual Rotary
- [ ] Mud Rotary
- [ ] Reverse Circulation
- [ ] Driven
- [ ] Jetted
- [ ] Air Percussion / Odex Tubing
- [ ] Other (*please specify*):

Method of Well Development

CHECK ONE

- [ ] Airlift
- [x] Bail
- [ ] Surge Block
- [ ] Surge Pump
- [ ] Other (*please specify*):

Grout Emplacement Method

CHECK ONE

- [ ] Gravity
- [ ] Pressure Grout
- [x] Tremie
- [ ] Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE

- [x] None
- [ ] Welded
- [ ] Swedged
- [ ] Packed
- [ ] Other (*please specify*):

Surface or Conductor Casing

CHECK ONE

- [ ] Flush Mount in a vault
- [x] Extend 1' above grade

SECTION 6. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

DATE CONSTRUCTION TO BEGIN: 4/15/02

Attach a well construction diagram labeling all specifications below.

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	400	8

Casing

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	OUTER DIAMETER (inches)	MATERIAL TYPE (X): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (X): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
400	380	4									X		0.020
380	20	4		X									
20	0	4	X										

Annular Material

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	ANNULAR MATERIAL TYPE (X): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
400	370									X		10-20
370	360						X					
360	20					X						
20	0			X								

IF THIS WELL HAS NESTED CASINGS, SPECIFY NUMBER OF CASING STRINGS:

EXPECTED DEPTH TO WATER: 385 Feet Below Ground Surface

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: William Gray Env. Project Mgr.

SIGNATURE OF WELL OWNER OR LANDOWNER: William Gray - BHP Copper

DATE:

GROUNDWATER MONITORING WELL

Golder Associates

SITE NAME: Superior	LOCATION: North well	
CLIENT:	SURFACE ELEVATION:	
GEOLOGIST:	NORTHING:	EASTING:
DRILLER:	STATIC WATER LEVEL:	COMPLETION DATE:
DRILLING COMPANY:	DRILLING METHODS:	

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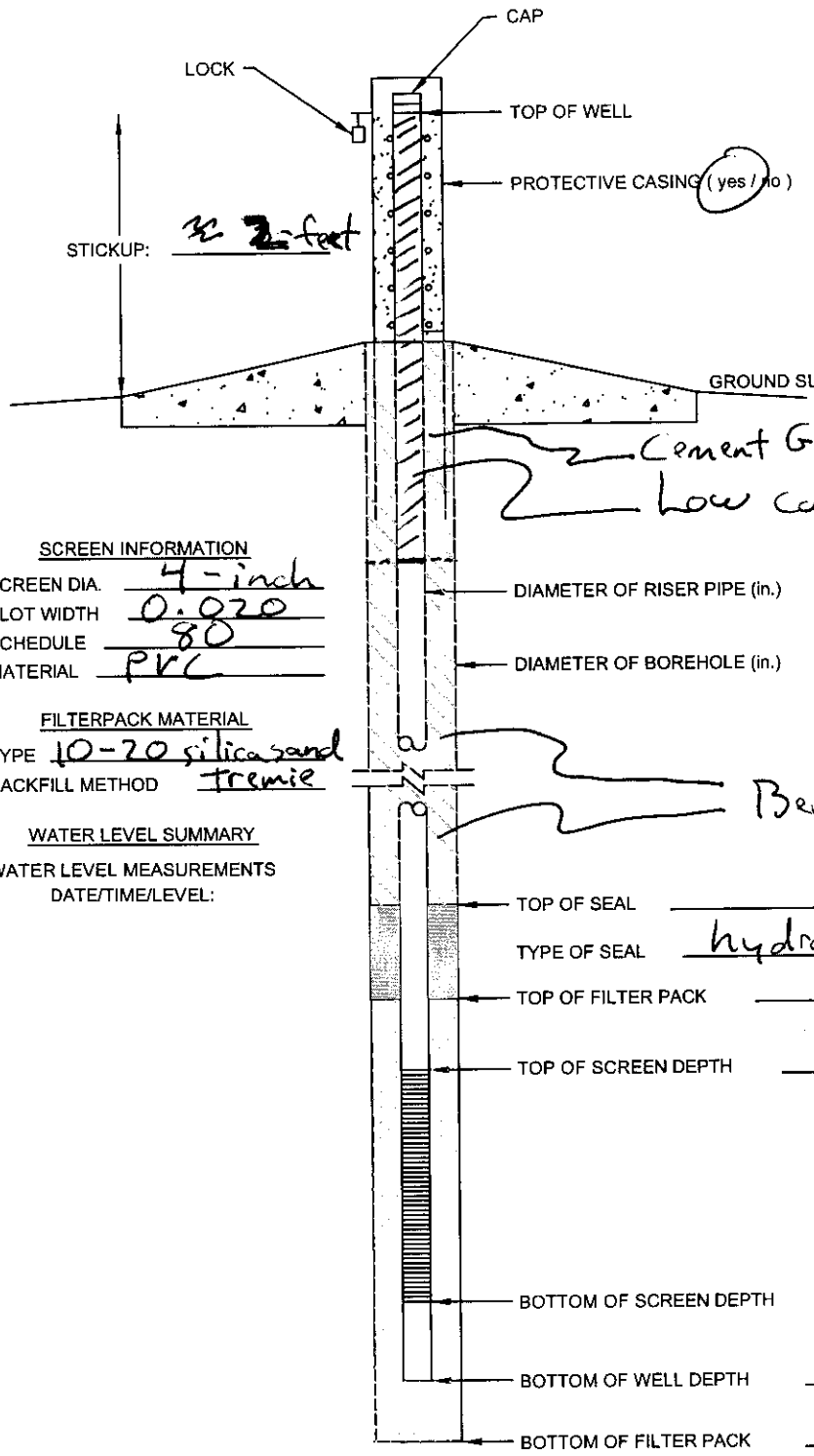
APR 4 2002
GROUNDWATER MGT

DEPTHS MEASURED FROM GROUND SURFACE



locking steel monument

SCREEN INFORMATION

SCREEN DIA. 4-inch
SLOT WIDTH 0.020
SCHEDULE 80
MATERIAL PVC

FILTERPACK MATERIAL

TYPE 10-20 silica sand
BACKFILL METHOD tremie

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS
DATE/TIME/LEVEL:

DIAMETER OF RISER PIPE (in.) 4

DIAMETER OF BOREHOLE (in.) 8

TOP OF SEAL 360 FT. BGS.

TYPE OF SEAL hydrated bentonite chips

TOP OF FILTER PACK 370 FT. BGS.

TOP OF SCREEN DEPTH 380 FT. BGS.

BOTTOM OF SCREEN DEPTH 400 FT. BGS.

BOTTOM OF WELL DEPTH 400 FT. BGS.

BOTTOM OF FILTER PACK 400 FT. BGS.

RECEIVED APR 4 2002 GROUNDWATER MGT

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA	B	SB
RECEIVED DATE	WS	
ISSUED DATE	WQARF	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER 55 -

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type (CHECK ONE)
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action (CHECK ONE)
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well
WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
2S	12E	3	NW ¼	NW ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 11 MAP 105 PARCEL 40A

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2. OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Billiton
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160 FAX: (520) 689-5158

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER: FAX:

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm

Consultant (if applicable)
CONSULTING FIRM: [illegible]

REMOVE THIS STUB BEFORE CASHING

M 74482-I

920 (10/01) 500/5000

TravelersExpressMoneyGram
INTERNATIONAL MONEY ORDER

75-53
919

CIRCLE K STORES INC.
Issuing Agent

IMPORTANT - SEE BACK BEFORE CASHING

PAY TO THE ORDER OF Arizona Department of Water Resources

PURCHASER, BY SIGNING YOU AGREE TO THE SERVICE CHARGE AND OTHER TERMS ON THE REVERSE SIDE

Golder Associates
PURCHASER, SIGNER FOR DRAWER

4730 N. Oracle Rd, Suite 210 - Tucson AZ 85705
ADDRESS

Payable Thru
WF National Bank
South Central
Faribault, MN

ISSUER/DRAWER
TRAVELERS EXPRESS COMPANY, INC.

[redacted]

988801822 03

DETACH HERE

988801822 03

EMPLOYEE

TRAVELERS EXPRESS COMPANY, INC. DRAWER
P.O. BOX 9476, MINNEAPOLIS, MN 55480
1-800-542-3590
PLEASE SEE TERMS ON REVERSE SIDE

DATE/AMOUNT

KEEP THIS STUB FOR YOUR RECORDS

installed?

7. Will the well registration number be stamped on the vault cover or on the upper part of the casing? [X] Etched in cement pour [illegible] drying w/ mill

BHP - Billiton

VARIANCE CHECKLIST - HYDROLOGY

DATE RECEIVED 4-5-02
DATE TO HYDRO 4-8-02
DATE TO GMSS _____

POTENTIAL REG. Nº 55-_____

55- 591860 THRU 55- 591861

FRONT OF N.O.I COMPLETE/CORRECT: YES _____ NO _____

VARIANCE (?) LETTER RECEIVED YES _____ NO ✓
WELL DIAGRAM (?) RECEIVED YES ✓ NO _____
SITE PLAN (?) RECEIVED YES _____ NO _____

TYPE AND NUMBER OF WELLS:

2 MONITOR
_____ PIEZOMETER
_____ GEOTECHNICAL
_____ MINERAL EXPLORATION
_____ WATER PRODUCTION
_____ CATHODIC PROTECTION
_____ GROUNDING
_____ HEAT PUMP
____ OTHER _____
DESCRIBE TYPE OF WELL

VARIANCE:

_____ REQUIRED
✓ NOT REQUIRED
_____ GRANTED
_____ NOT GRANTED
_____ LETTER ISSUED

ATTENTION!!! NOTICE OF INTENT TEAM:

_____ HARD COPY OF LETTER TO FOLLOW
_____ CALL FOR PICKUP

COMMENTS: OK-bah

NOI Variance Checklist for Hydrology - 01/12/00

HB

Transmission Report

Date/Time 4-19-02; 1:52PM
Local ID 6024172422
Local Name
Company Logo

This document was confirmed.
(reduced sample and details below)
Document Size Letter-S

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-901860

AUTHORIZED DRILLER: LAYNE CHRISTENSEN COMPANY LICENSE NO: 7

NOTICE OF INTENTION TO DRILL A MONITOR WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP BILLITON P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

SE ¼ of the SE ¼ of the NE ¼ Section 34 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 3RD DAY OF APRIL, 2003

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL
WITHIN 30 DAYS OF COMPLETION OF DRILLING

Total Pages Scanned : 2 Total Pages Confirmed : 2

No.	Doc	Remote Station	Start Time	Duration	Pages	Mode	Comments	Results
1	819	LAYNE CHRISTENSEN	4-19-02; 1:51PM	34"	2/ 2	EC		CP 24.0

Notes :

EC: Error Correct	RE: Resend	PD: Polled by Remote	MB: Receive to Mailbox
BC: Broadcast Send	MP: Multi-Poll	PG: Polling a Remote	PI: Power Interruption
CP: Completed	RM: Receive to Memory	DR: Document Removed	TM: Terminated by user
HS: Host Scan	HP: Host Print	FO: Forced Output	WT: Waiting Transfer
HF: Host Fax	HR: Host Receive	FM: Forward Mailbox Doc.	WS: Waiting Send

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

April 19, 2002

JANE DEE HULL
Governor

JOSEPH C. SMITH
Director

BHP BILLITON
P O BOX 37
SUPERIOR, AZ 85273

Registration No. 55- 591860
File No. D(1-12) 34 ADD

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended drilling card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Sylvia Valdez
Water Resource Technician
Groundwater Management Support Section

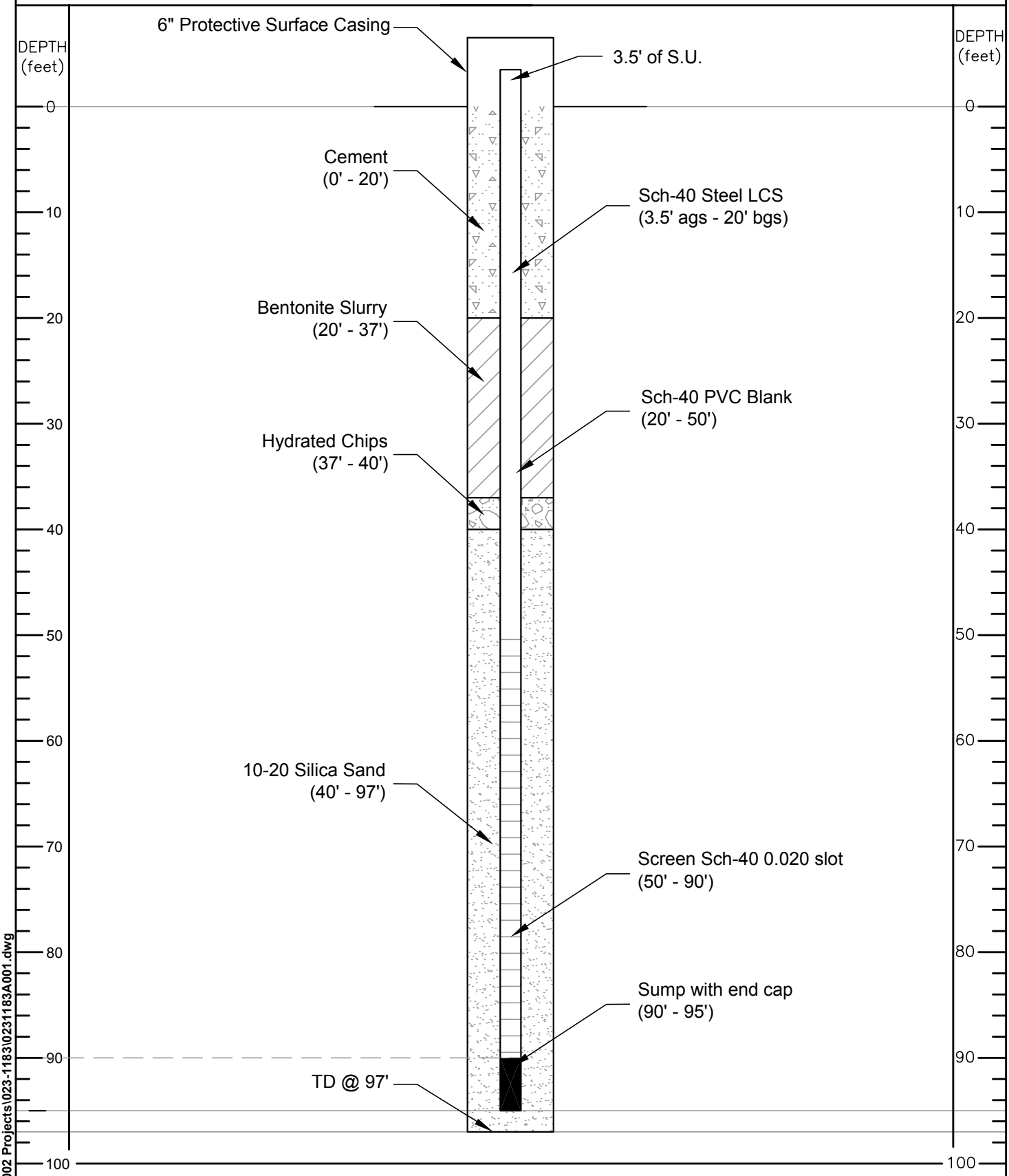
Enclosures

WELL CONSTRUCTION LOG

GAI-02-09

PROJECT NUMBER: 023-1183
WELL LOCATION: NORTH ARM OF TP-6
COORDINATES **N:** 3684757 **E:** 489414
DRILL RIG: PROSONIC **DRILLING CONTRACTOR:** PROSONIC

SHEET: 1 OF 1
CONSTRUCTION DATE: 9/9 - 9/10/02
DRILLER: DON



LOGGED: JJM **CHECKED:** JM **DATE:** 1/13/03

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SUPERIOR TAILINGS CHARACTERIZATION BOREHOLE LOG

GAI-02-09

PROJECT NUMBER: 023-1183

BOREHOLE LOCATION: NORTH ARM OF TP-6

SHEET: 1 OF 3

COORDINATES **N:** 3684757 **E:** 489414

BORING DATE: 9/9 - 9/10/02

DRILL RIG: PROSONIC **DRILLING CONTRACTOR:** PROSONIC **DRILLER:** DON

CORE RUN DEPTH (feet)	SAMPLE TYPE	RECOVERY	PASTE pH	PASTE COND. (µS/cm)	HCl REACTIVITY	ASTM CLASS.	GRAPHIC LOG	SAMPLE DESCRIPTION AND BORING NOTES PARTICLE SIZE DISTRIBUTION (Gravel/Sand/Fine)	LITHOLOGY DEPTH (feet)
0	Lexan Tube	88%	7.08	2590	strong	CL		Logged via soil pit down to ~7 ft. Lean clay; dusky red (10 R 3/2); ~40% silt and 60% lean clay; trace very fine sand (pyretic); laminated to massive and mottled; trace desiccation mud clacks in bedding planes; moist. **(0/TR/100)**	0
5	Lexan Tube	20%	7.48	1949	strong	ML		Silt; dusky red (10 R 3/2); ~60% silt predominantly composed of pyrite, clay lean, moist; laminated (0.5 to 2 cm). **(0/TR/100)** 5' to 10' liner - poor return probably due to compression	5
10	Lexan Tube	93%						No log between bottom of soil pit and bottom of lexan tube samples. (7' - 15')	10
15	Boxed Core	87%	6.34	2850	weak	ML		Silt; dusky red (2.5 YR 3/2); ~30% low plasticity clay; moist, finely laminated with occasional sand lenses - light _____ brown (2.5 Y 5/3) - - lenses at 17' BLS 11111 - 2 dark gray sand lenses (2.5 Y 4/1) at 19.5' and 21' BLS ~5 cm thick. **(TR/10/90)**	15
20						CL		Sand clay; oxidized - three layers; sand; pyretic/gold color; clay, dusk red (2.5 YR 4/3) and silt, light olive brown (2.5 Y 5/3); moist **(0/40/60)**	20
						SC		Clayey sand; brown (10 YR 4/3) and gray (2.5 Y 5/1) with clay interbed, dusk red (2.5 YR 3/2), moist **(0/60/40)**	
25						CL			25
30	Boxed Core	85%	6.90	2540	weak	CL		Lean clay with sand; dusky red (2.5 YR 3/3) with dark gray sand (7.5 YR 4/1); sand, fine to very fine, predominantly in lenses and between 29.5' to 32' BLS; clays are laminated while sand lenses are massive in lenses that average between 1 to 2 cm thick; moist **(0/20/80)**	30
35									35
40						CL			40

LOGGED: JJM **CHECKED:** JM **DATE:** 1/13/03

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SUPERIOR TAILINGS CHARACTERIZATION BOREHOLE LOG

GAI-02-09

PROJECT NUMBER: 023-1183

BOREHOLE LOCATION: NORTH ARM OF TP-6

SHEET: 2 OF 3

COORDINATES **N:** 3684757 **E:** 489414

BORING DATE: 9/9 - 9/10/02

DRILL RIG: PROSONIC **DRILLING CONTRACTOR:** PROSONIC **DRILLER:** DON

CORE RUN DEPTH (feet)	SAMPLE TYPE	RECOVERY	PASTE pH	PASTE COND. (µS/cm)	HCl REACTIVITY	ASTM CLASS.	GRAPHIC LOG	SAMPLE DESCRIPTION AND BORING NOTES PARTICLE SIZE DISTRIBUTION **(Gravel/Sand/Fine)**	LITHOLOGY DEPTH (feet)
40									40
45	Boxed Core	20%	8.09	2610	strong	CL		Lean clay; dusk red (10 R 3/2); fine fraction ~40% silt and ~60% clay - - no laminations, sample is probably heaving material - - - samples are questionable - - saturated **(0/0/100)**	45
50	Boxed Core	50%	8.09	2610	strong	CL		Extremely low return from 37' to 57' - - - material too "soupy" - - -falls out of core barrel - - also, material has heaved up to 23' in casing - - wait to resume drilling with check valve on core barrel	50
55									55
60	Boxed Core	90%	8.25	1624	strong	CL		Lean clay with sand; dusky red (2.5 YR 3/2); fine fraction predominantly lean clay with ~30% silt; sand fraction predominantly in lenses at (61' to 61.5') and (66.75' to 67'); sand is very fine to fine, pyrite; saturated and finely laminated **(0/20/80)**	60
65									65
70	Boxed Core	85%	8.51	2300		CL		Sand lenses (72.5' to 72.75') Sand lenses (75' to 75.25')	70
75									75
80	Lexan Tube	95%						No description / Lexan Tube	80

LOGGED: JJM **CHECKED:** JM **DATE:** 1/13/03

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SUPERIOR TAILINGS CHARACTERIZATION BOREHOLE LOG

GAI-02-09

PROJECT NUMBER: 023-1183

BOREHOLE LOCATION: NORTH ARM OF TP-6

SHEET: 3 OF 3

COORDINATES **N:** 3684757 **E:** 489414

BORING DATE: 9/9 - 9/10/02

DRILL RIG: PROSONIC **DRILLING CONTRACTOR:** PROSONIC **DRILLER:** DON

CORE RUN DEPTH (feet)	SAMPLE TYPE	RECOVERY	PASTE pH	PASTE COND. (µS/cm)	HCl REACTIVITY	ASTM CLASS.	GRAPHIC LOG	SAMPLE DESCRIPTION AND BORING NOTES PARTICLE SIZE DISTRIBUTION **(Gravel/Sand/Fine)**	LITHOLOGY DEPTH (feet)
80	Lexan Tube							No description / Lexan Tube	80
	Boxed Core	110%	7.79	954	weak	CL		Lean clay; dusk red (2.5 YR 3/2); fine fraction predominantly clay with ~25 % silt, low plasticity, laminated; saturated **(0/0/100)**	
85					weak	CH		Gila Conglomerate: Sandy fat clay with gravel; very dusky red (2.5 YR 2.5/2) and very dark grayish brown (2.5 Y 3/2) with assorted colored clasts; sand well sorted; gravel, well graded, angular; fine fraction ~40 % silt; moist; **probably Gila conglomerate** that has had the calcite cement dissolved out of it **(30/30/40)**	85
90	Boxed Core	150%	7.90	1038	weak - strong	SM		Top 50 inches looks like slough - consist of dusk red lean clays. Gila Conglomerate: Silty sand with gravel; light yellowish brown (10 YR 6/4), grayish brown (2.5 Y 5/2), gravel, well-graded angular; sand, well graded; fine fraction predominately silt with ~40 % clay, moist - - acid RX varies from weak to strong - suggest calcite buffering has been consumed in certain locations **(30/40/30)**	90
95								Additional 2' drilled into Gila to allow for surface casing position that makes for easy well completion	95
								TD @ 97' bls Gila Conglomerate @ 84' bls	
100									100
105									105
110									110
115									115
120									120

LOGGED: JJM **CHECKED:** JM **DATE:** 1/13/03

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ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street
Phoenix, Arizona 85004

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-594159

AUTHORIZED DRILLER: BOART LONGYEAR COMPANY LICENSE NO: 83

NOTICE OF INTENTION TO DRILL A MONITOR WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER INC P O BOX 37 SUPERIOR, AZ 85273

The well(s) is/are to be located in the:

SW ¼ of the SE ¼ of the NE ¼ Section 34 Township 1 SOUTH Range 12 EAST

No. of wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 14TH DAY OF AUGUST, 2003

GROUNDWATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

AMA / HA	B	SB
Phx	06	
RECEIVED DATE 8-15-02	WS 15	
ISSUED DATE 8-22-02	WQARF CERCLA —	

FILE NUMBER: D(1-12)34ADC
WELL REGISTRATION NUMBER: 55-594159

SECTION 1: REGISTRY INFORMATION

Well Type
CHECK ONE
- [X] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action
CHECK ONE
- [X] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well
WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 | MAP 08 | PARCEL 006
COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2: OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.
MAILING ADDRESS: PO Box 37
CITY / STATE / ZIP CODE: Superior AZ 85273-0037
CONTACT PERSON NAME AND TITLE: William Gray
TELEPHONE NUMBER: (520) 689-5160
FAX: (520) 689-5158

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER:
FAX:

RECEIVED AUG 15 [illegible] GROUNDWATER MGT

SECTION 3: DRILLING AUTHORIZATION

Drilling Firm
NAME: Boart Longyear
DWR LICENSE NUMBER: ~~87~~ 83
ROC LICENSE CATEGORY: A-04
TELEPHONE NUMBER: 1-800-808-2420
FAX: 602-486-1885

Consultant (if applicable)
CONSULTING FIRM: Golder Associates
CONTACT PERSON NAME: John Malusa
TELEPHONE NUMBER: (520) 888-8818
FAX: (520) 888-8818
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4

Questions	Yes	No	Explanation:
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
3. Are you requesting a variance to use thermoplastic casing in lieu of steel casing in the surface seal?		X	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
4. Is there another well name or identification number associated with this well?		X	IF YES, PLEASE STATE
5. Have construction plans been coordinated with the Arizona Department of Environmental Quality?		X	IF YES, PLEASE STATE AGENCY CONTACT & PHONE NUMBER
6. For monitor wells, is dedicated pump equipment to be installed?		X	IF YES, PLEASE STATE DESIGN PUMP CAPACITY Gallons per Minute
7. Will the well registration number be stamped on the vault cover or on the upper part of the casing?		X	IF NO, WHERE WILL THE REGISTRATION NUMBER BE PLACED? Etched in cement pad w/ nail prior to cement drying.

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

55-594159

SECTION 5: WELL CONSTRUCTION DETAILS

Drill Method

CHECK ONE

- [ ] Air Rotary
- [ ] Bored or Augered
- [ ] Cable Tool
- [ ] Dual Rotary
- [ ] Mud Rotary
- [ ] Reverse Circulation
- [ ] Driven
- [ ] Jetted
- [ ] Air Percussion / Odex Tubing
- [x] Other (*please specify*):

Sonic

Method of Well Development

CHECK ONE

- [ ] Airlift
- [x] Bail
- [ ] Surge Block
- [ ] Surge Pump
- [ ] Other (*please specify*):

Grout Emplacement Method

CHECK ONE

- [ ] Gravity
- [ ] Pressure Grout
- [x] Tremie
- [ ] Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE

- [x] None
- [ ] Welded
- [ ] Swedged
- [ ] Packed
- [ ] Other (*please specify*):

Surface or Conductor Casing

CHECK ONE

- [ ] Flush Mount in a vault
- [x] Extend 1' above grade

RECEIVED
AUG 15 2002
GROUNDWATER MGT

SECTION 6: PROPOSED WELL CONSTRUCTION PLAN (attach additional pages if needed)

DATE CONSTRUCTION TO BEGIN

Attach a well construction diagram labeling all specifications below.

Borehole			Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (X)				PERFORATION TYPE (X)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	110	8	90	110	4									X		0.020
			20	90	4		X									
			0	20	4	X										

Annular Material												
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (X)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
85	110									X		10-20
80	85						X					
20	80					X						
0	20			X								

IF THIS WELL HAS NESTED CASINGS, SPECIFY NUMBER OF CASING STRINGS	EXPECTED DEPTH TO WATER
	100 Feet Below Ground Surface

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

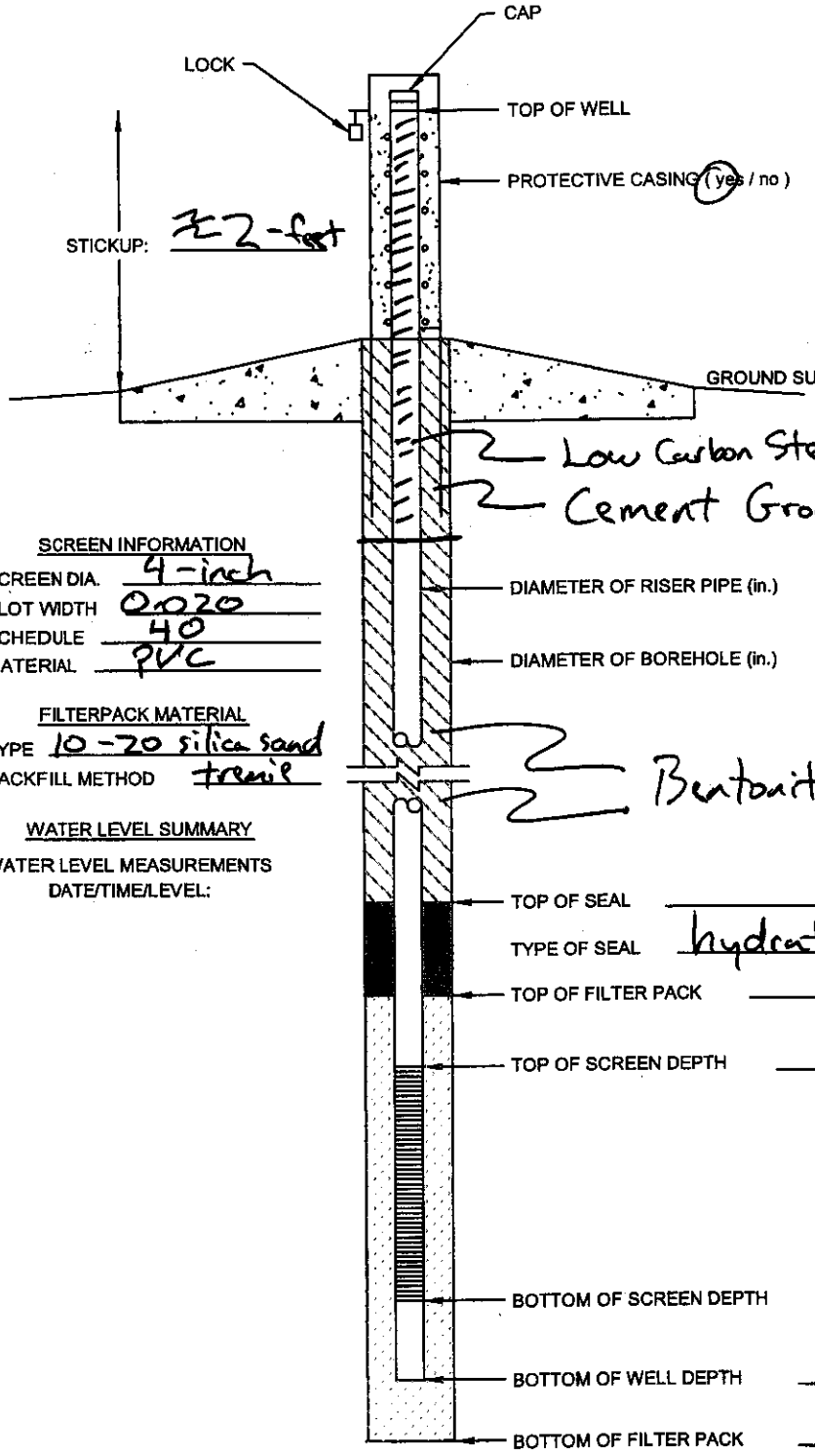
TYPE OR PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER OR LANDOWNER	DATE
William Gray - Env. Project Mgr	William Gray	8-14-02

GROUNDWATER MONITORING WELL

Golder Associates

SITE NAME: Superior	LOCATION: Tailing #6	
CLIENT:	SURFACE ELEVATION:	
GEOLOGIST:	NORTHING:	EASTING:
DRILLER:	STATIC WATER LEVEL:	COMPLETION DATE:
DRILLING COMPANY:	DRILLING METHODS:	

DEPTHS MEASURED FROM GROUND SURFACE



Locking Steel Monument

SCREEN INFORMATION

SCREEN DIA. 4-inch
SLOT WIDTH 0.020
SCHEDULE 40
MATERIAL PVC

FILTERPACK MATERIAL

TYPE 10-20 silica sand
BACKFILL METHOD tremie

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS
DATE/TIME/LEVEL:

DIAMETER OF RISER PIPE (in.) 4

DIAMETER OF BOREHOLE (in.) 8

TOP OF SEAL 80 FT. BGS.

TYPE OF SEAL hydrated bentonite chips

TOP OF FILTER PACK 85 FT. BGS.

TOP OF SCREEN DEPTH 90 FT. BGS.

BOTTOM OF SCREEN DEPTH 110 FT. BGS.

BOTTOM OF WELL DEPTH 110 FT. BGS.

BOTTOM OF FILTER PACK 110 FT. BGS.

RECEIVED
AUG 1 5 2002

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North 3rd Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

August 22, 2002

JANE DEE HULL
Governor

JOSEPH C. SMITH
Director

BHP COPPER INC
P O BOX 37
SUPERIOR, AZ 85273

Registration No. 55-594159
File No. D(1-12) 34 ADC

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended drilling card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Monica Ortiz
Water Resource Technician
Groundwater Management Support Section

Enclosures

$10 FEE

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

AMA / INA		B	SB
RECEIVED	DATE	WS	
ISSUED	DATE	WQARF	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER 55-

- Review instructions prior to completing form
- You must include with your Notice:
  - $10 check or money order for the processing fee
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-113(B), A.A.C. R12-15-151(B)(4)(a)

** PLEASE PRINT CLEARLY **

SECTION 1 REGISTRY INFORMATION

Well Type — CHECK ONE
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action — CHECK ONE
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
T1S	R12E	34	NE ¼	SE ¼	SW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK 106 | MAP 08 | PARCEL 006

COUNTY WHERE WELL IS LOCATED: Pinal

SECTION 2 OWNER INFORMATION

Well Owner		Landowner (if different from Well Owner)	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc.		FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:	
MAILING ADDRESS: PO Box 37		MAILING ADDRESS:	
CITY / STATE / ZIP CODE: Superior AZ 85273-0037		CITY / STATE / ZIP CODE:	
CONTACT PERSON NAME AND TITLE: William Gray		CONTACT PERSON NAME AND TITLE:	
TELEPHONE NUMBER: (520) 689-5160	FAX: (520) 689-5158	TELEPHONE NUMBER:	FAX:

SECTION 3 DRILLING AUTHORIZATION

Drilling Firm		Consultant (if applicable)	
NAME: Boart Longyear		CONSULTING FIRM: Golder Associates	
DWR LICENSE NUMBER: 87	ROC LICENSE CATEGORY: A-04	CONTACT PERSON NAME: John Malusa	
TELEPHONE NUMBER: 1-800-808-2420	FAX: 602-486-1885	TELEPHONE NUMBER: (520) 888-8818	FAX: (520) 888-8818
		E-MAIL ADDRESS: jmalusa@golder.com	

SECTION 4

Questions	Yes	No	Explanation
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	X		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		X	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).

GOLDER ASSOCIATES, INC.
4730 N. ORACLE RD., STE. 210 520-888-8818
TUCSON, AZ 85705

91-552/1221 6056 806

PAY TO THE ORDER OF Arizona Dept of Water Resources DATE Aug. 14, 2002

$ 80.00

Eighty and no/100 DOLLARS

WELLS FARGO
Wells Fargo Bank
7080 North Oracle Road
Tucson, AZ 85704
www.wellsfargo.com

Security features included. Details on back.

© DELUXE RDF

VARIANCE CHECKLIST – HYDROLOGY

DATE RECEIVED 8-15-02
DATE TO HYDRO 8-19-02
DATE TO GMSS 8-20-02

POTENTIAL REG. # 55-_____

55-594157 THRU 55-594160

FRONT OF NOI COMPLETE/CORRECT: YES X NO _____

VARIANCE LETTER RECEIVED	YES _____	NO X
WELL DIAGRAM RECEIVED	YES X	NO _____
SITE PLAN RECEIVED	YES _____	NO X

TYPE AND NUMBER OF WELLS:

4	MONITOR	_____	CATHODIC PROTECTION
_____	PIEZOMETER	_____	GROUNDING
_____	GEOTECHNICAL	_____	HEAT PUMP
_____	MINERAL EXPLORATION	_____	OTHER_____
_____	WATER PRODUCTION		DESCRIBE TYPE OF WELL

GROUNDWATER REVIEW:

WOULD ROUTE:	IF YES, AT WHAT STEP	DECISION TIME
YES X	#2	1 min
NO _____		

RETURN TO: Monica

VARIANCE:

_____	REQUIRED	_____	GRANTED
✓	NOT REQUIRED	_____	NOT GRANTED
		_____	LETTER ISSUED

COMMENTS: OK-bah

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: **BHP Superior** Project Number: **3800.05**

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: **MCC-1** Sheet **1** of **4**

Boring Location: **331809.82N(Lat) 1110653.44W(Long)**		Elevation and Datum: **2964.0 msl**	
Drilling Contractor: **Boyles Brothers**	Driller:	Date Started: **3/23/95**	Date Finished: **3/27/95**
Drilling Equipment: **Schramm**	Borehole Diameter: **7.5"**	Completed Depth: (feet) **483.0**	Water Depth: (feet) **153.2**
Sampling Method: California Method ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION	
Drilling Method: **Air Rotary**	Drilling Fluid: **Air**	Type and Diameter of Well Casing: **4-inch Low Carbon Steel**	
Backfill Material: **Type 5 Cement Grout**		Slot Size: **0.02"**	Filter Material: **10-20 CSSI**
Logged By: **Jim Clarke**	Checked By:	Development Method: **Pump and Surge**	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
		FILL MATERIAL Composed of cobbles, boulders and gravels.							
		GILA CONGLOMERATE Strongly cemented, dense, dry, with clasts composed of schist, granite, metavolcanics and limestone.							
20									
40									
60									
		Local increase in sand at 65 feet bls.							
80									
100									4-inch low carbon steel casing from 0 to 443 feet bls

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: **BHP Superior** Project Number: **3800.05**

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: **MCC-1** Sheet 2 of 4

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
120									
		First water encountered during drilling at 135 feet bls.							
140		GILA CONGLOMERATE Gray-brown, damp, very dense, gravelly sand. Rock composed of 70% sand and 30% gravel.							
		GILA CONGLOMERATE Gray-brown, slightly damp, well cemented, very dense, sandy gravel. Rock composed of 70% gravel and 30% sand.							
		Measured Groundwater Level (July, 1998) = 154.15'.							
160									
		GILA CONGLOMERATE as above with an increase in sand (60% sand, 40% gravel). Cuttings are still slightly damp with no indication of water.							
180		Increase in gravel content (90% gravel, 10% sand).							
		Rock contains 40-50% sand with little to no moisture.							
		Rock contains 60-70% sand with no indication of water.							
200									
		Rock contains 50% sand.							
220									
240									4-inch low carbon steel casing from 0 to 443 feet bls
260		Rock appears dry and is dominated by very fine sand and silt reaching 80%, angular rock fragments reaching							

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: **BHP Superior** Project Number: **3800.05**

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: **MCC-1** Sheet 3 of 4

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
		20%.							
		Rock contains significant small, well rounded pebbles grading to no pebbles at 300 feet with 80% fine sand and silt with 20% angular rock fragments.							
280									
300									
		Interbedded sandy interval at 310 feet bls.							
320									
		Interbedded sandy interval at 330 feet bls.							
340									
		Rock contains very fractured/angular clasts with 35-45% sand.							
		GILA CONGLOMERATE as above with a decrease in sand fraction.							
360		Unit is very sandy (~90%) and dry.							
		Significant increase in rock fragments (approximately 60%) with a dry, sandy matrix.							
		Same as above except small rock fragments.							
		Increase in rock fragments (80%). Appears dry with a steady decrease in the sand fraction.							
380		Increase in sand content with no increase in moisture.							
		Increase in sand fraction (fine to medium grained, ~80%), slight moisture content.							
		Slight moisture, sand content ~25%, rounded pebbles with fractured rocks observed.							
		Rock fragments greatly reduced to ~5%, very fine sand and silt observed with slight moisture content.							
400		Rock fragments and rounded pebbles comprise ~60% of the rock, sand and silt, slight moisture detected.							
		Increase in sand fraction to ~70% with slight moisture.							
		Rounded small pebbles with some rock fragments, slightly darker color, sand and silt content ~60%, slight							

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: BHP Superior Project Number: 3800.05

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MCC-1 Sheet 4 of 4

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
		moisture.							
420									Bentonite seal from 400 to 450 feet bls
		GILA CONGLOMERATE as above with an increase in water content.							
		GILA CONGLOMERATE as above with a decrease in water content and slightly more sand.							
440		GILA CONGLOMERATE as above with slightly less sand.							
		GILA CONGLOMERATE as above with well rounded to sub rounded pebbles.							4-inch PVC casing from 443 to 453 feet bls
		GILA CONGLOMERATE as above with an increase in moisture content, clay/silt coatings on chips, and comprised of 80% chips and sub-rounded pebbles.							Specified 10-20 Mesh sand filter pack from 450 to 483 feet bls
		Moist with an increase in sand to ~70%.							
460		Increase in pebble content, silt and fine sands reach 50-60%, rock coated with fines.							4-inch diameter slotted PVC screen (0.02" slot size) from 453 to 483 feet bls
		Unit is saturated, contains very clean, subangular to subrounded gravel and rock fragments with little to none sand or silt.							
480		GILA CONGLOMERATE as above with increased silt but no sand.							Total cased depth = 483 feet bls
		Unit comprised of 80% silt and clay with rock fragments and small sub-angular pebbles. Decrease in water content.							
		GILA CONGLOMERATE as above with an increase in pebble and rock fragment fraction.							
		Unit is moist and comprised predominantly of silt and clay (80%), pebbles and rock fragments (15%), and sand (1-5%).							Total depth hole at 500 feet bls

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-548184

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	34	A ¼	D ¼	B ¼

LATITUDE Degrees	Minutes	Seconds N	LONGITUDE Degrees	Minutes	Seconds W
°	'	"	°	'	"

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

☐ Change of Well Drilling Contractor *(Fill out Section 2)*
☒ Change of Well Ownership *(Fill out Section 3)*
☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

$10 FEE

Current Well Drilling Contractor		New Well Drilling Contractor	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	
DWR LICENSE NUMBER		DWR LICENSE NUMBER	ROC LICENSE CATEGORY
TELEPHONE NUMBER	FAX	TELEPHONE NUMBER	FAX

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

Previous Well Owner		New Well Owner	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL	
BHP Copper, Inc. (See Note 1)		Resolution Copper Mining LLC	
MAILING ADDRESS		MAILING ADDRESS	
200 South Veterans Memorial Blvd		2525 East Arizona Biltmore Circle Suite c-135	
CITY / STATE / ZIP CODE		CITY / STATE / ZIP CODE	
San Manuel, AZ 85631		Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE		CONTACT PERSON NAME AND TITLE	
Carla Consoli, Counsel		F. D. Hegner	
TELEPHONE NUMBER	FAX	TELEPHONE NUMBER	FAX
602-364-7000	602-364-7070	602-956-0223	602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner V.P, G M	F. D. Hegner	2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkey, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By _____
Vice President

ATTEST:

_____
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-1[illegible]

FILE NUMBER

WELL REGISTRATION NUMBER
55-(See attached list)

PLEASE PRINT CLEARLY

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET

PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

NO FEE

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

ARIZONA DEPARTMENT OF WATER RESOURCES
Operations Division
500 North 3rd Street
Phoenix, Arizona 85004

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. Owner Name: MAGMA COPPER CO.
   Address: P.O. BOX 37 (Street) SUPERIOR (City) AZ. (State) 85273 (Zip)

2. Driller Name: BOYLES BROS. DRILLING COMPANY
   Address: 6527 W. NORTHVIEW AVE. GLENDALE, (Street, City) AZ. (State) 85301 (Zip)

3. Location: 1.0 (Township) N/S 12.0 (Range) E/W 34 (Section) ¼ NW. (10-acre) ¼ S.E. (40-acre) ¼ N.E. (160-acre)

4. Well Registration No. 55- 548184 (Required)

5. Permit No. _____ (If issued)

DEPARTMENT OF WR
MAY 3 - 1995
OPERATIONS DIV.

DESCRIPTION OF WELL

6. Total depth of hole 93' FEET ft.
7. Type of casing STEEL & P.V.C.
8. Diameter and length of casing 4" in. from 0' to 20', 4" in from 20' to 35'
9. Method of sealing at reduction points FLUSH THREADED.
10. Perforated from 35' to 85', from _____ to _____ from _____ to _____
11. Size of cuts _____ Number of cuts per foot _____
12. If screen was installed: Length 50' ft. Diam 4" .020 in. Type P.V.C.
13. Method of construction DRILLED, ROTARY, & ODEX.
    (drilled, dug, driven, bored, jetted, etc)
14. Date started MARCH (Month) 20, (Day) 95 (Year)
15. Date completed MARCH (Month) 21, (Day) 95 (Year)
16. Depth to water 42' ft. (If flowing well, so state)
17. Describe point from which depth measurements were made, and give sea-level elevation if available
    GROUND SURFACE
18. If flowing well, state method of flow regulation: _____
19. Remarks: _____

DO NOT WRITE IN THIS SPACE
OFFICE RECORD
Registration No. 55-548184
File No. D(1-12)34adb
Received _____ By _____
Entered ENTERED MAY 4 1995 By _____

DWR-55-55-10/94 (Rev.)

LOG OF WELL MCC-3

Indicate depth at which water was first encountered, and the depth and thickness of water bearing beds. If water is artesian, indicate depth at which encountered, and depth to which it rose in well.

From (feet)	To (feet)	Description of formation material
0	15	Fill - tailings
15	28	Alluvium - Silty SAND to Clayey SAND, gray-brown.
~~28~~	~~56~~	~~Gila Conglomerate - Sandy SILT, with Clay binder~~
		~~Some angular to subrounded fragments of limestone, light gray~~
		Perched water encountered at 23 feet. Thickness of
		bed about 3-5 feet
28	56	Gila Conglomerate - Sandy SILT with clay binder,
		angular to subrounded fragments of quartzite, light gray,
		very hard, moderately to strongly cemented. Relatively
		dry to slightly damp from 28 to 40 feet. Water
		reported at 40 feet.
56	59	CLAY
59	73	Gila Conglomerate
73	82	CLAY
82	93	Gila Conglomerate

I hereby certify that this well was drilled by me(or under my supervision), and that each and all statements herein contained are true to the best of my knowledge and belief.

Driller Name: [signature]

Street

City State Zip Phone No.

Date

MONITOR/PIEZOMETER WELL

FILING FEE $10.00

ARIZONA DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
500 NORTH THIRD STREET
PHOENIX, ARIZONA 85004 (602) 417-2470

MONITOR/PIEZOMETER W

FILING FEE $1

MCC-MW-1

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

Section § 45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. **WELL LOCATION:**

1 N/S | 12 E/W | 34
Township | Range | Section

NW 1/4 SE 1/4 NE 1/4
10 ACRE 40 ACRE 160 ACRE

2. Position location of the well on the land:

Latitude 33 0 18 ' 00 "

Longitude 111 0 06 ' 40 "

3. County:

4. **Owner of the land of wellsite:**
Magma Copper Co.
Name
P.O. Box 37
Address
Superior, Az. 85273
City State Zip

5. **Lessee of the land of wellsite:**
Name
Address
City State Zip

6. **Owner of well:**
Magma Copper Co.
Name
P.O. Box 37
Address
Superior, Az. 85273
City State Zip

7. Consulting Firm: Brown & Caldwell
Contact Person: Jim Clarke
Phone: 222-4444

8. Purpose of well drilled pursuant to this notice
Monitor X
Piezometer

9. If for deepening or modifying, Well Registration Number
55-

DO NOT WRITE IN THIS SPACE
OFFICE RECORD
File No. D(1-12)34ADB
Filed 2-17-95 By ek
Input ENTERED MAR By 7 1995
DUPLICATE
Mailed 3-2-95 By ek
Registration 55- 548184
AMA/INA PHX
W/S 28 S/B 06

10. Construction will start:
2 06 95
Month Day Year

11. Period well will remain in use 10 Months/Years

12. For monitoring wells, is pump equipment to be installed?
Yes No X
(a) If yes, design pump capacity
(b) What use will be made of the water

13. **Drilling firm:**
Bovles Brothers
Name
6527 West Northview Ave.
Address
Phoenix, Arizona 85031
City State Zip
DWR License No. 28
A4 ROC
ROC License classification

14. Is the proposed wellsite within 100 fee of a septic tank system, sewage disposal area, landfill, hazardous wast facility, storage area of hazardous material or petroleum storage areas and tanks?
Yes No X

FEB 17 1995

16. Proposed method of abandonment of well after project is completed: According to Regulation R-12-15-816

17. Is this well to monitor existing contamination? Potential contamination X . Please explain: Contamination Undetermined.

GENERAL INSTRUCTIONS

1. Fill out this form in DUPLICATE and send WITH $10.00 FEE to 500 NORTH THIRD STREET, PHOENIX, AZ 85004
2. For specific instructions, limitations and conditions, see the reverse side of this form.
3. **Must be signed by land owner or lessee.**
4. Section §45-596(D), provides that the Director shall determine that all information required on form has been submitted. If not, the person filing will be notified and the drilling, deepening, or modification of the well may not proceed.

I state that Notice is filed in compliance with Section § 45-596 and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Jeff J. Parker
Typed or Printed Name

Jeffrey J. Parker
Signature [X] Land Owner [ ] Lessee of wellsite

2/9/95
Date

DWR 55-41 922 (Rev.)

18. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? N/A

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact? N/A

19. WELL CONSTRUCTION PLAN

a) Drilling method (mud rotary, hollow-stem auger, etc.) Air Rotary

b) Borehole diameters: 8 inches from 0 feet to 100 feet.

____ inches from ____ feet to ____ feet.

c) Casing materials (PVC, steel, hollow-stem auger, etc.)

material Steel diameter 9 5/8 inches from 0 feet to 20 feet

material PVC diameter 4 inches from 0 feet to 100 feet

d) Method of sealing at reductions N/A

e) Annular seal materials (cement, grout, etc.); method of placement (tremied, circulated)

material Grout method Tremie from 0 feet to 42 feet

material Beutonite method Tremie from 42 feet to 45 feet

f) Filter packs (state material):

material Colorado Silica Sand from 45 feet to 100 feet

material #8-12 from ____ feet to ____ feet

g) Perforations or screen specifications:

type PVC 020 from 50 feet to 100 feet

type ____ from ____ feet to ____ feet

h) Method of well development (bail, air lift, surge) Pump

i) Will surface or conductor casing extend above grade: Yes X No ____

20. Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.

CONDITIONS

I. Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.

II. Drilling of the well shall be completed within one (1) year after the date of Notice.

III. A Well Driller Report, is required within 30 days of completion of drilling. A Completion Report, is required to be filed with the Department within 30 days after installation of pump equipment for monitor wells.

IV. Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.

V. A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."

VI. Special construction standards required pursuant to A.A.C. Rule R12-15-821: ____

RECEIPT

17771

MAGMA COPPER CO.
P O BOX 37
SUPERIOR, AZ. 85273

STATE OF ARIZONA
DEPARTMENT OF WATER RESOURCES
OPERATIONS DIVISION
15 SOUTH 15TH AVENUE
PHOENIX, ARIZONA 85007
(602) 542-1581

ENTRY CODE 55

FILE NO. VARIOUS 548184 **THRU** 548188

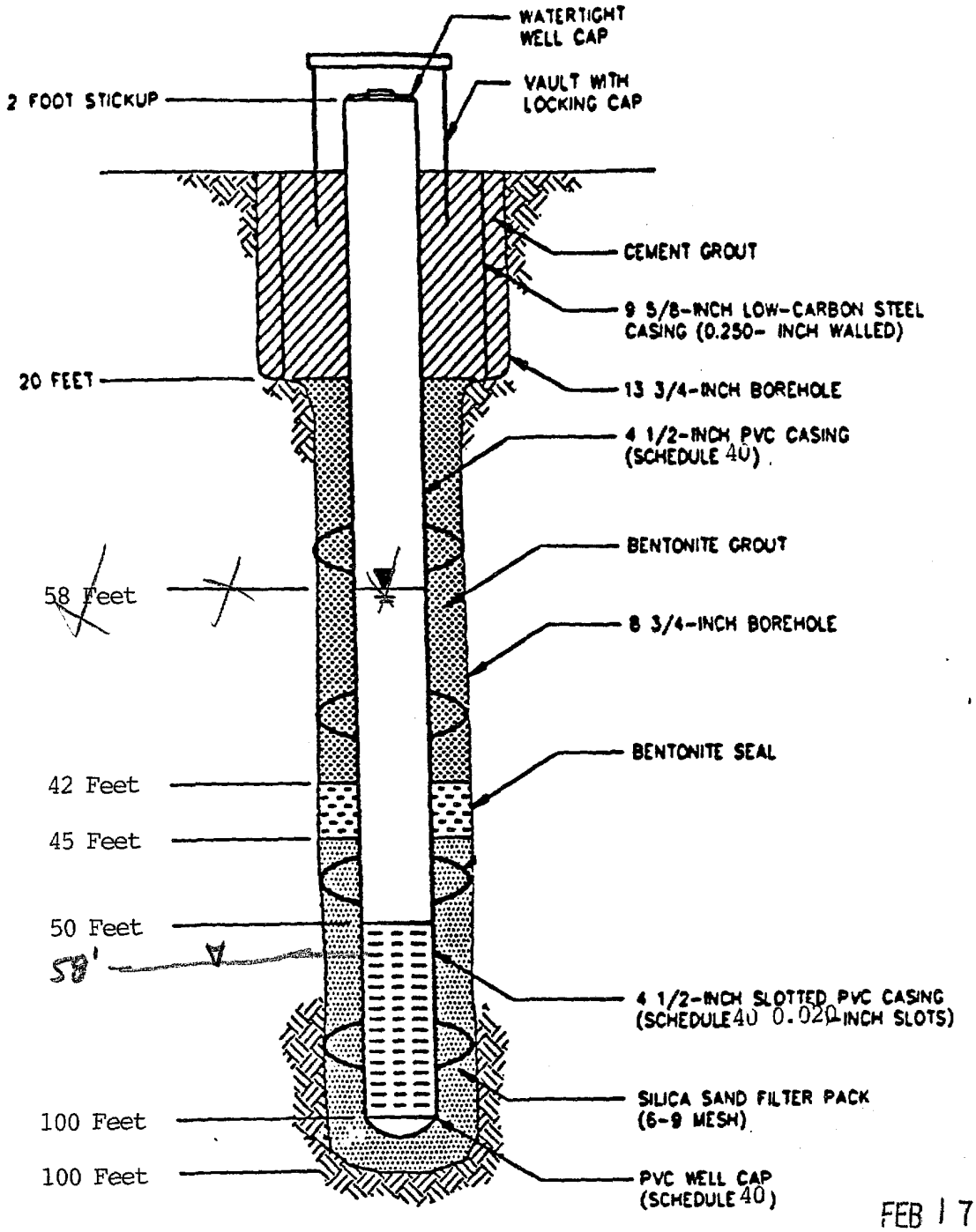
ITEM DESCRIPTION	RATE	AMOUNT
FILING FEE FOR NOI TO DRILL WELLS	$10.00	$50.00
3/1/95/ek XXXXX CHIT#5191		$50.00

PAID
FEB 28 1995
PAID

CHECK NO. _____ FEE ACCOUNT NO. _____ TOTAL $ _____

CHIT NO. _____ RECEIVED BY _____ DATE _____

IPS 1821 – Rev. 4/91



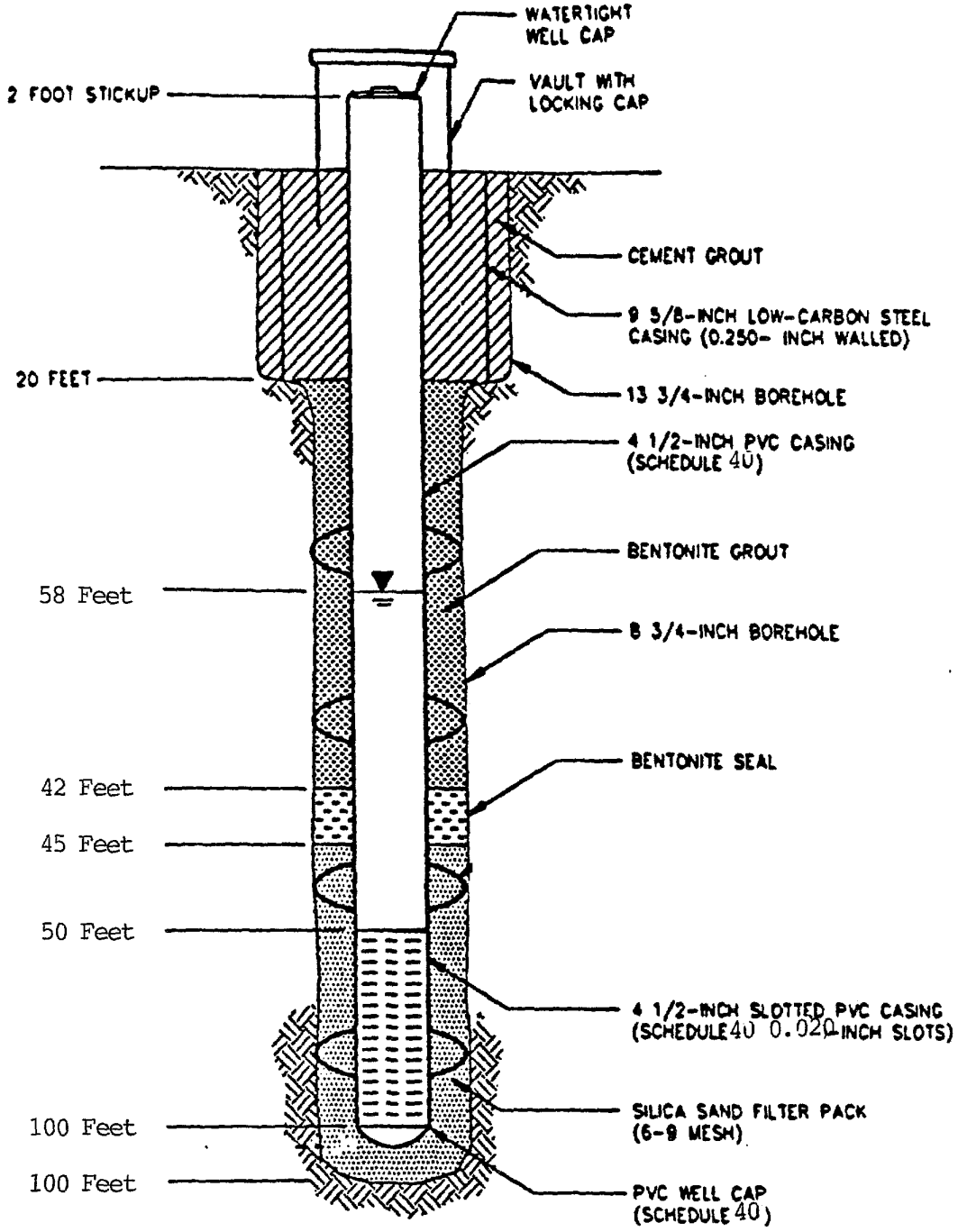
FEB 17 1995

N.T.S.

NOTES:
1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER

WELL DESIGN

BROWN AND CALDWELL



N.T.S.

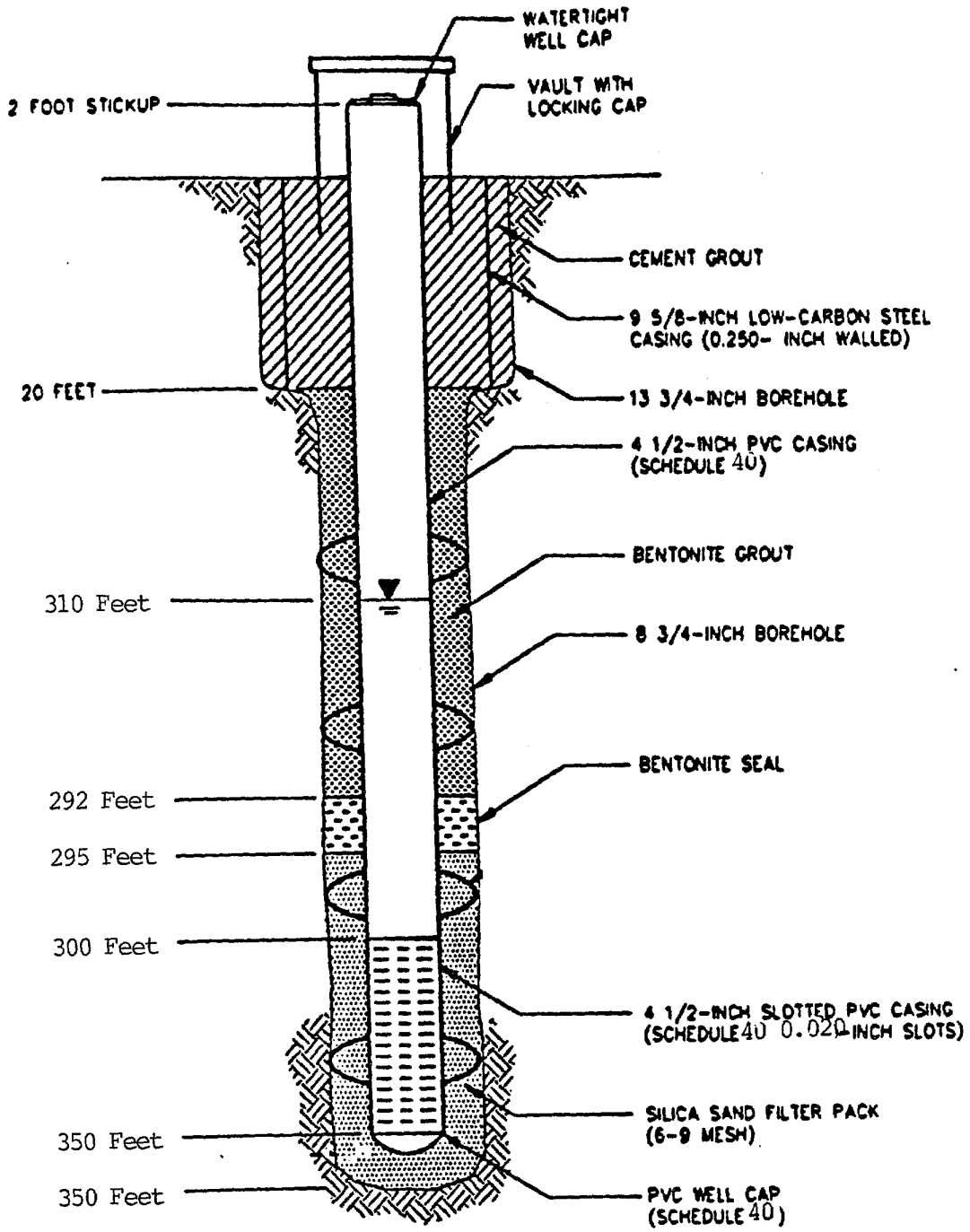
FEB 17 1995

NOTES:

1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER

WELL DESIGN

BROWN AND CALDWELL



N.T.S.

NOTES:
1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER

WELL DESIGN

BROWN AND CALDWELL

ARIZONA DEPARTMENT OF WATER RESOURCES

500 N 3RD ST., PHOENIX, AZ. 85004
Telephone (602) 417-2470
Fax (602) 417-2401

March 1, 1995

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

MAGMA COPPER CO.
P O BOX 37
SUPERIOR, AZ. 85273

RE: Registration No. 55-548184 THRU 55-548188

File No. VARIOUS

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

For additional information, you may contact the Operations Division at (602) 542-1581.

Sincerely,

Ellen Kane

Ellen Kane
Groundwater Permit Specialist

ARIZONA DEPARTMENT OF WATER RESOURCES

OPERATIONS DIVISION

500 North Third Street
Phoenix, Arizona 85004-3903
Phone (602) 417-2470

DUPLICATE

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO. 55-548184

AUTHORIZED DRILLER: BOYLES BROS. DRILLING CO. LICENSE NO. 28

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

Owner of Well(s)
MAGMA COPPER CO. P O BOX 37 SUPERIOR AZ 85273

The well(s) is/are to be located in:

NW 1/4	SE 1/4	NE 1/4	Section 34	Township 1.0 SOUTH	Range 12.0 EAST
10 acre	40 acre	160 acre			

NUMBER OF WELLS IN PROJECT: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON FEB 16TH, 1996

THE DRILLER SHALL FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING.

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

CHIEF, OPERATIONS DIVISION

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

REQUEST FORM TO CHANGE WELL INFORMATION
OWNERSHIP * DRILLER * VARIANCE

Please complete the appropriate section of this request form and return to the above address with applicable fee.
NOTE: A.R.S. § 45-593.C requires that the Department be notified of change of well ownership and that the new owner is required to keep the Department's Well Registration records current and accurate. Well data and ownership changes must be submitted within thirty days after changes take place.

SAVE THIS FORM TO REPORT FUTURE CHANGES IN OWNERSHIP, CHANGES IN ADDRESS, OR CHANGE IN WELL DATA SUCH AS PUMP CAPACITY, CORRECTION OF LEGAL DESCRIPTION, CHANGE OF WELL DRILLER AND AMENDING INFORMATION PREVIOUSLY FILED.

1. CHANGE OF WELL INFORMATION: (NO FEE REQUIRED)

NOTE: If the location of the proposed well changes after drilling authority has been issued, **attach a $10.00 reissue fee for each well.**

WELL REGISTRATION NO. 55- 548184 **FILE NO:** D(1-12)34ADB

If known, I/We request the following well information be changed: _____

NAME CHANGE ONLY

Date _____ **Signature of Current Well Owner** _____

2. STATEMENT OF CHANGE OF WELL OWNERSHIP: ($10.00 FEE REQUIRED)

NOTE: If this change consists of more than one well and the names are common: attach a $10.00 fee. Otherwise, each well requires a separate fee of $10.00.

I, _____, state that I am the **Previous/New Owner** of the well described below:

_____ ¼ (10 Acre) _____ ¼ (40 Acre) _____ ¼ (160 Acre) of Section _____ Township _____ Range _____

Well Registration No. 55- See attached File No.: _____ (if known)

Magma Copper Company	BHP Copper Inc.
PRINT Previous Owner's Name	**PRINT** New Owner's Name
7400 North Oracle Road, Suite 200	7400 North Oracle Road, Suite 200
Mailing Address	Mailing Address
Tucson / Arizona / 85704	Tucson / Arizona / 85704
City / State / Zip	City / State / Zip
520-575-5600	520-575-5600
Telephone Number	Telephone Number

Signature of Previous/New Well Owner By: x _____ **Date** x 4-23-96
Title: Land Manager

ENTERED APR 26 1996
MAG

DWR 55-71 (Rev 12/95)

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004-3903
Phone (602) 417-2470 Fax (602) 417-2422

3. REQUEST TO CHANGE WELL DRILLER **$10.00 FEE REQUIRED FOR EACH WELL**

This request must be received by this Department and the Drill Card issued to the new drilling firm prior to the drilling or completion of any well.

Well Registration No. 55- _____ **File No:** _____

Original Well Driller	**New Well Driller**
Mailing Address	**Mailing Address**
Telephone Number	**Telephone Number**
ADWR License Number	**ADWR License Number**
R.O.C. License Category	**R.O.C. License Category**
Typed or Printed Name of Well Owner	**Signature of Well Owner** **Date**

The fee charge for well ownership and reissue of drill card is authorized by R12-15-151, effective June 30, 1994.

4. REISSUE OF DRILLING AUTHORITY FOR VARIANCE REQUEST: ($10.00 EACH WELL)

NOTE: If extraordinary or unusual conditions exist, after the initial drilling authority has been issued, the well owner or well driller may request a variance from the provisions of R12-15-811.

WELL REGISTRATION NO. 55- _____ **FILE NO:** _____

I/WE REQUEST THE FOLLOWING WELL DRILLING AUTHORITY BE REISSUED PER THE ATTACHED VARIANCE REQUEST:

Signature of Well Owner/Well Driller _____ **Date** _____

NAME: MAGMA COPPER CO

GRID: M 09

REPORT NO: WL9020

ARIZONA DEPARTMENT OF WATER RESOURCES WELL REPORT
OPERATIONS DIVISION
**** WELLS SEQUENCED BY ALPHABETICAL ORDER ****

REPORT DATE: 1/31/96

FULL-NAME		QUAD	TOWN	RNGE	SECT	QTR 1 2 3	REG NO	WELL DEPTH	DEPTH CASED	CDAISAEM	WATER LEVEL	PUMP (GPM)	WELL DRILL DATE	DRL LIC NO.	WTR USE	WSAHTERD	LORGT	OWN
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28	C C C	55-549141					00014		314	M	U8	I X	
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28	D C C	55-549144	0880	0853	05	0124		5/25/1995	360	M	15	X N	
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28	D C C	55-549145	0880	0792	04	0124		5/20/1995	360	M	15	X N	
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28	D C C	55-549146							360	M	15	I N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D 85273	1.0	12.0	34	A D B	55-548184	0093	0035	04	0042		3/26/1995	028	M	15	X N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D 85273	2.0	12.0	35	A D A	55-548185	0255	0205	04	0025		3/25/1995	028	M	15	X N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D 85273	1.0	12.0	35	C D C	55-548186	0500	0500	04			3/23/1995	028	M	15	X N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D 85273	2.0	12.0	04	A D B	55-548187	0225	0135	04	0138		4/01/1995	028	M	15	X N	
MAGMA COPPER CO PO BOX 37 SUPERIOR	AZ	D 85273	1.0	12.0	35	C B B	55-548188	0325	0233	04	0059		3/29/1995	028	M	15	X N	
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28		55-548200							028	N	15	I N	
MAGMA COPPER CO 14605 W HUNT HWY FLORENCE	AZ	D 85232	4.0	9.0	28	D C C	55-549147	0800	0790	06	0125		5/22/1995	360	M	15	X N	

32 X 64 10-6

64 10-6

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: **BHP Superior** Project Number: **3800.05**

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: **MCC-5B** Sheet 1 of 2

Boring Location: **331757.14N(Lat) 1110617.37W(Long)**		Elevation and Datum: **2962.7 msl**	
Drilling Contractor: **Water Development**	Driller:	Date Started: **7/28/96**	Date Finished: **7/29/96**
Drilling Equipment: **Dresser T70W**	Borehole Diameter: **10 5/8"**	Completed Depth: (feet) **100.0**	Water Depth: (feet) **36.5**
Sampling Method: California Method ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION	
Drilling Method: **Air Rotary**	Drilling Fluid: **Air**	Type and Diameter of Well Casing: **4.77" ID Schedule 80 PVC**	
Backfill Material: **Type 5 Cement Grout with 3% bentonite**		Slot Size: **0.02"**	Filter Material: **10-20 CSSI**
Logged By: **John Eliades**	Checked By:	Development Method: **Bail/Swab and pump**	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
		TAILINGS Pale yellow (2.5yr (7/4), silty to clayey tailings material with slight stiffness.							Type 5 cement with 3% bentonite grout seal from 0 to 43 feet
10									
		TAILINGS Dark gray (10yr 4/1) silty tailings material.							
20									
									4.77" ID Schedule 80 PVC casing from 0 to 51 feet
30									
		Measured Groundwater Level (July, 1998) = 38.51 feet bls.							
40									
									Fine sand pack from 43 to 49 feet
50									
		First water encountered during drilling at 55 feet bls.							
60									10-20 Mesh Colorado Silica sand pack from 59 to 100 feet
70									4.77" ID Schedule 80 PVC screen (0.02" slot size) from 51 to 91 feet

BROWN AND CALDWELL
Phoenix, Arizona

BORING LOG

Project Name: **BHP Superior** Project Number: **3800.05**

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: **MCC-5B** Sheet 2 of 2

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample	Graphic Log: Lithology	Graphic Log: Well	Readings PPM	Remarks
		GILA CONGLOMERATE Fine to coarse grained, modereately sorted conglomerate with clasts composed predominantly of dusky red (2.5yr 4/5), medium grained dacite.							
80									
		GILA CONGLOMERATE as above with clasts composed predominantly of dark greenish black, medium grained igneous intrusives (possibly gabbro or diorite), dusky red, medium grained dacite, and dark quartzites.							
90									Total cased depth = 91 feet
		GILA CONGLOMERATE with clasts composed predominantly of dusky red, medium grained dacite, light gray dacite, and limestone.							
		GILA CONGLOMERATE with clasts composed predominantly of dusky red, medium grained dacite and light gray dacite.							
100									Stopped drilling at 100 feet

12/18/06

Job 81-7720

ARIZONA DEPARTMENT OF WATER RESOURCES
Records Management Section
P.O. Box 458, Phoenix, Arizona 85001-0458
(602) 771-8527 * (800) 352-8488
www.water.az.gov

Well Abandonment Completion Report

- Review instructions prior to completing form
- The drilling firm or single well licensee must file this report within 30 days of completion of abandonment (A.R.S. § 45-594, A.A.C. R12-15-816)

RECEIVED
FEB 14 2007

** PLEASE PRINT CLEARLY **

FILE NUMBER: D(1-12) 35 CAB
WELL REGISTRATION NUMBER: 55- 558207

SECTION 1 ABANDONMENT AUTHORIZATION

Mail To:

Drilling Firm

NAME: LAYNE CHRISTENSEN COMPANY	DWR LICENSE NUMBER: 7
ADDRESS: 12030 EAST RIGGS ROAD	TELEPHONE NUMBER: 480-895-9336
CITY / STATE / ZIP: CHANDLER, AZ 85249-3701	FAX:

SECTION 2 REGISTRY INFORMATION

Well Owner Information

FULL NAME OF COMPANY, ORGANIZATION OR INDIVIDUAL: RESOLUTION COPPER MINING LLC	CONTACT PERSON NAME AND TITLE:
MAILING ADDRESS: 102 MAGMA HEIGHTS	TELEPHONE NUMBER: 520-689-9382
CITY / STATE / ZIP: SUPERIOR, AZ 85273	FAX:

ENTERED
APR 23 2007

Location of Well

WELL LOCATION ADDRESS (IF ANY):

LATITUDE			LONGITUDE		
33 °	17 '	58 " N	110 °	06 '	17 " W
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	SW 1/4	NE 1/4	NW 1/4

LAND SURFACE ELEVATION AT WELL: Feet Above Sea Level

METHOD OF LATITUDE / LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

COUNTY ASSESSOR'S PARCEL ID NUMBER

BOOK	MAP	PARCEL
0	0	

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ☐ NAD-83 ☐ Other (please specify):

SECTION 3

Questions	Yes	No	Explanation
1. To your knowledge, is there any information that exists which indicates that the water in this well has been, may be or is contaminated ?	✓		IF YES, EXPLAIN (ATTACH ADDITIONAL PAGE IF NECESSARY) Low PH Levels
2. Is there another well name or identification number associated with this well? (e.g., MW-1, PZ-4, Lot 29 Well, Smith Well, etc.)	✓		IF YES, PLEASE STATE MCC-5B
3. Prior to abandonment, did the well have 20' of surface casing AND 20' of grout in the annular space surrounding the casing ?	✓		If No, was the top 20' of casing removed prior to setting the cement plug ? ☐ Yes ☐ No
4. Was the well backfilled above the cement plug ?	✓		
5. Was the well casing video logged ?		✓	
6. Why was the well abandoned ? New construction in Area			

Well Abandonment Completion Report

WELL REGISTRATION NUMBER
55- 558207

SECTION 4. ORIGINAL WELL CONSTRUCTION DESIGN (attach additional page if needed)

Existing Borehole | **Existing Casing** (to the best of your knowledge)

DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	DEPTH FROM SURFACE FROM (feet)	TO (feet)	OUTER DIAMETER (inches)	MATERIAL TYPE (X) STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (X) BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	100	10 5/8	0	92	5 9/16		✓							✓		.020

Condition of casing: ☐ Good ☐ Fair ☐ Poor

Existing Annular Material (to the best of your knowledge)

DEPTH FROM SURFACE FROM (feet)	TO (feet)	ANNULAR MATERIAL TYPE (X) NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK SAND	GRAVEL	SIZE

SECTION 5. ACTUAL WELL ABANDONMENT DESIGN (attach additional page if needed)

Refer to ADWR's Well Abandonment Handbook for additional information.

DEPTH TO WATER: Feet Below Land Surface

DATE ABANDONMENT COMPLETED: 11-28-06

Casing Treatment | **Sealing or Fill Material**

DEPTH FROM SURFACE FROM (feet)	TO (feet)	TREATMENT TYPE (X) SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING WAS PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS THAT WERE ADDED	DEPTH FROM SURFACE FROM (feet)	TO (feet)	MATERIAL TYPE (X) NEAT CEMENT	CONCRETE	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	HIGH SOLIDS BENTONITE GROUT	CHIPS	PELLETS	SAND	MIXING RATIO by (check one) ☒ Weight ☐ Volume	VOLUME OF MATERIAL USED (cubic feet)
							0	100	X	+	Fly	Ash	for	low	Pit			13

Actual Abandonment Method (See Well Abandonment Handbook)

CHECK ONE

- ☒ Standard Method
- ☐ Alternative 1
- ☐ Alternative 2
- ☐ Alternative 3
- ☐ Alternative 4:
  - ☐ Variance Option
- ☐ Alternative 5:
  - ☐ Variance Option 1
  - ☐ Variance Option 2
- ☐ Other (please specify)

REMARKS

Emplacement Method of Sealing or Fill Material

CHECK ONE

- ☐ Gravity
- ☐ Pressure Grouting
- ☒ Tremie Pumped
- ☐ Other (please specify)

I state that this notice is filed in compliance with A.R.S. § 45-594 and A.A.C. R12-15-816 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF QUALIFYING PARTY	DATE
	Larry G. Krall	2/9/07

ARIZONA DEPARTMENT OF WATER RESOURCES

WATER MANAGEMENT SUPPORT SECTION

3550 N. Central Avenue
Phoenix, Arizona 85012

ABANDON

SPECIAL REQUIREMENTS

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-558207 MCC -5B

AUTHORIZED DRILLER: LAYNE CHRISTENSEN COMPANY LICENSE NO: 7

NOTICE OF INTENTION TO ABANDON A MONITOR OR PIEZOMETER WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: RESOLUTION COPPER MINING LLC 102 MAGMA HEIGHTS SUPERIOR, AZ 85273

THE WELL(S) IS/ARE TO BE LOCATED IN THE:
NW ¼ OF THE NE ¼ OF THE SW ¼ SECTION 35 TOWNSHIP 1 SOUTH RANGE 12 EAST

NO. OF WELLS IN THIS PROJECT: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 21ST DAY OF NOVEMBER, 2007

Shannon L Ray

WATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A WELL ABANDONMENT
COMPLETION REPORT WITHIN 30 DAYS OF ABANDONMENT

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8500 • (800) 352-8488
www.azwater.gov

Notice of Intent to Abandon a Well

NO FEE

- Review instructions and the Well Abandonment Handbook prior to completing form with black or blue ink.
- You must include with your Notice:
  - Well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

** PLEASE PRINT CLEARLY **

AMA / INA	B	SB
PHX	6	
RECEIVED DATE	WS	
11/22/06	15	
ISSUED DATE	WQARF	CERCLA
11/30/06	000	

FILE NUMBER: D(1-12)35-CAB

WELL REGISTRATION NUMBER: 55 - 558207

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE

- ☐ Domestic
- ☐ Stock
- ☐ Irrigation
- ☐ Municipal
- ☑ Monitor / Piezometer
- ☐ Geotechnical
- ☐ Mineral Exploration
- ☐ Other (*please specify*):

ORIGINAL WELL OWNER (IF KNOWN): Magma Copper Co.

ORIGINAL WELL DRILLING FIRM (IF KNOWN): Water Development Corp.

DRILL DATE (IF KNOWN): July 29, 1996

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	SW ¼	NE ¼	NW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK / MAP / PARCEL

COUNTY WHERE WELL IS LOCATED:

LATITUDE			LONGITUDE		
33 ° Degrees	17 ' Minutes	58 " N Seconds	110 ° Degrees	06 ' Minutes	17 " W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ☐ NAD-83 ☐ Other (*please specify*):

SPECIAL REQUIREMENTS

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP CODE: Superior, AZ. 85273

CONTACT PERSON NAME AND TITLE: Casey McKeon-Environmental Supervisor

TELEPHONE NUMBER: 520-689-9374 Ext. 13

FAX: 520-689-2335

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:

MAILING ADDRESS:

CITY / STATE / ZIP CODE:

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER:

FAX:

RECEIVED NOV 22 2006 WATER MGMT

SECTION 3. ABANDONMENT AUTHORIZATION

Drilling Firm

NAME: LANNE

DWR LICENSE NUMBER: C-53 ; A-4

ROC LICENSE CATEGORY: 7

TELEPHONE NUMBER: 480-895-9404

FAX:

Consultant (if applicable)

CONSULTING FIRM:

CONTACT PERSON NAME:

TELEPHONE NUMBER:

FAX:

E-MAIL ADDRESS:

SECTION 4.

Questions	Yes	No	If Yes:
1. To your knowledge, is there any information that exists which indicates that the water in this well has been, may be, or is contaminated?	✓		EXPLAIN (ATTACH ADDITIONAL PAGE IF NECESSARY): Possible Low PH. Well screened within tailings, not in aquifer; quarterly sampled.
2. Is there another well name or identification number associated with this well? (e.g., Lot 3 Well, MW-1,etc.)	✓		PLEASE STATE: MCC-5B
3. Was the well casing video logged?		✓	
4. Why is the well being abandoned?	New construction in area.		

Notice of Intent to Abandon a Well

Provide a well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

WELL REGISTRATION NUMBER
55 - 558207

SECTION 5. ORIGINAL WELL CONSTRUCTION DESIGN (attach additional page if needed)

Existing Borehole / **Existing Casing** (to the best of your knowledge)

Borehole Depth From Surface FROM (feet)	Borehole Depth From Surface TO (feet)	Borehole Diameter (inches)	Casing Depth From Surface FROM (feet)	Casing Depth From Surface TO (feet)	Outer Diameter (inches)	Material Type (T): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	Perforation Type (T): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	100	10 5/8	0	92	5 9/16		✓							✓		.020

Condition of casing: ✓ Good ___ Fair ___ Poor

Existing Annular Material (to the best of your knowledge)

Depth From Surface FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
0	30			✓								
30	35					✓						
35	100									✓		#10-20

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WATER MGMT

SECTION 6. PROPOSED WELL ABANDONMENT DESIGN (attach additional page if needed)

Refer to ADWR's Well Abandonment Handbook for additional information.

DATE ABANDONMENT IS TO BEGIN

Casing Treatment

Depth From Surface FROM (feet)	TO (feet)	SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING IS TO BE PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS TO BE ADDED
SPECIAL REQUIREMENTS						

Sealing or Fill Material

Depth From Surface FROM (feet)	TO (feet)	Material Type (T): NEAT CEMENT	CONCRETE	SAND-CEMENT GROUT	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	HIGH SOLIDS BENTONITE: GROUT	CHIPS	PELLETS	SAND	MIXING RATIO by (check one) ☒ Weight ☐ Volume	ESTIMATED VOLUME OF MATERIAL (cubic feet)
0	100	X	+	FLY	ASH	For	Low	PH				12

Proposed Abandonment Method (See Well Abandonment Handbook)

CHECK ONE
- ☐ Standard Method
- ☐ Alternative 1
- ☐ Alternative 2
- ☒ Alternative 3
- ☐ Alternative 4: ☐ Variance Option *
- ☐ Alternative 5: ☐ Variance Option 1* ☐ Variance Option 2*
- ☐ Other (please specify):

* requires a letter requesting a variance

Emplacement Method of Sealing or Fill Material

CHECK ONE
- ☐ Gravity
- ☐ Pressure Grouting
- ☒ Tremie Pumped
- ☐ Other (please specify):

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WATER MGMT

REMARKS

I state that this notice is filed in compliance with A.R.S. § 45-594 and A.A.C. R12-15-816 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: Casey McKeon-Environmental Supervisor on behalf of RCM

SIGNATURE OF WELL OWNER: Casey McKeon DATE: 10-30-06

TYPE OR PRINT NAME AND TITLE:

SIGNATURE OF LANDOWNER, IF APPLICABLE (SEE INSTRUCTIONS) DATE

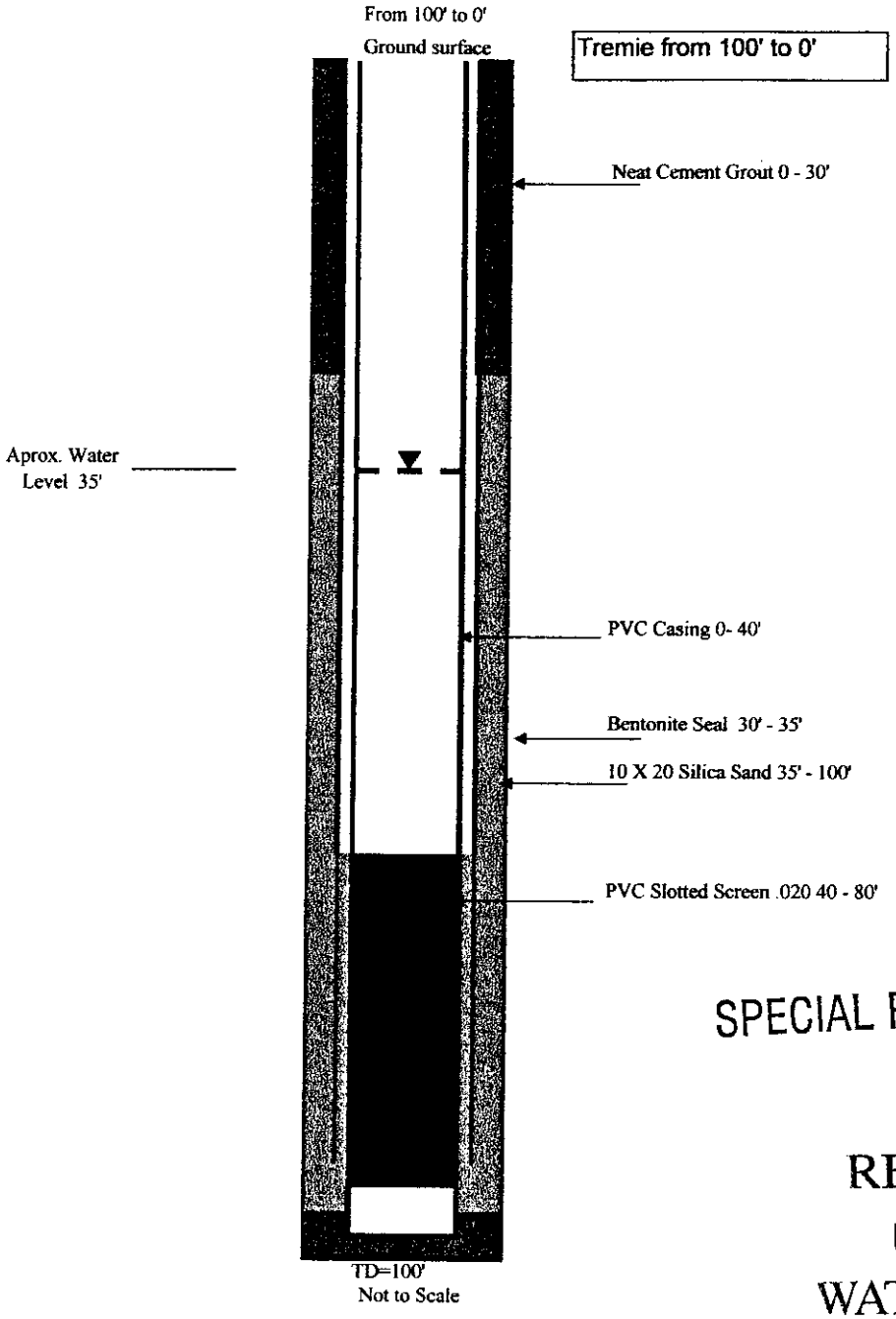
Resolution Copper Mining

55-558207

Proposed MonitorWell Abandonment

558207

Tremie Neat Cement mixed with Fly Ash in case of Low PH (94# cement / 74# fly ash / 10 gal Water)



SPECIAL REQUIREMENTS

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NOV 2 2 2006
WATER MGMT

ARIZONA DEPARTMENT OF WATER RESOURCES

WATER MANAGEMENT SUPPORT SECTION

3550 N. Central Avenue
Phoenix, Arizona 85012

ABANDON

SPECIAL REQUIREMENTS

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-558207 MCC -5B

AUTHORIZED DRILLER: LAYNE CHRISTENSEN COMPANY LICENSE NO: 7

NOTICE OF INTENTION TO ABANDON A MONITOR OR PIEZOMETER WELL(S) HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: RESOLUTION COPPER MINING LLC 102 MAGMA HEIGHTS SUPERIOR, AZ 85273

THE WELL(S) IS/ARE TO BE LOCATED IN THE:
NW ¼ OF THE NE ¼ OF THE SW ¼ SECTION 35 TOWNSHIP 1 SOUTH RANGE 12 EAST

NO. OF WELLS IN THIS PROJECT: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 21ST DAY OF NOVEMBER, 2007

Shannon L Rey

WATER MANAGEMENT SUPPORT

THE DRILLER MUST FILE A WELL ABANDONMENT
COMPLETION REPORT WITHIN 30 DAYS OF ABANDONMENT

ARIZONA DEPARTMENT OF WATER RESOURCES
3550 N. Central Avenue, Phoenix, Arizona 85012
Telephone (602) 771-8500
Fax (602) 771-8691

December 04, 2006

Janet Napolitano
Governor

Herbert R. Guenther
Director

RESOLUTION COPPER MINING LLC
102 MAGMA HEIGHTS
SUPERIOR, AZ 85273

Registration No. 55- 558207
File No. D(1-12) 35 CAB

Dear Applicant:

Enclosed is a copy of the Notice of Intent (NOI) to Abandon a Well. This NOI, which was recently filed with this Department is being returned to you as evidence of your compliance with ARS § 45-594; R12-15-816. The enclosed Well Owners Notification of Abandonment is to be submitted when the well has been properly abandoned. The well abandonment card and Abandonment Completion Report forms have been sent to your driller. He may not begin abandonment until he has received the well abandonment card. If you change drillers, you must supply this Department with the new driller's identity. Well abandonments shall be performed only by a licensed well drilling contractor or single well licensee.

ARS §45-594; R12-15-816(K) requires the registered well owner to submit a Well Owners Notification of Abandonment form within thirty (30) days after the abandonment of the well. It also requires the driller to furnish this Department a complete and accurate Well Abandonment Report within thirty (30) days after completion of abandonment. You should insist, and ensure, that both of these are done.

Sincerely,

Monica Phillips

Monica Phillips
NOI Unit
Water Management Support Section

Enclosures

Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8500 • (800) 352-8488
www.azwater.gov

Notice of Intent to Abandon a Well

NO FEE

- Review instructions and the Well Abandonment Handbook prior to completing form with black or blue ink.
- You must include with your Notice:
  - Well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

** PLEASE PRINT CLEARLY **

AMA / INA	B	SB
PHX	6	
RECEIVED DATE	WS	
11/22/06	15	
ISSUED DATE	WQARF	CERCLA
11/30/06	000	

FILE NUMBER: D(1-12)35 CAB

WELL REGISTRATION NUMBER: 55 - 558207

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE

- ☐ Domestic
- ☐ Stock
- ☐ Irrigation
- ☐ Municipal
- ☑ Monitor / Piezometer
- ☐ Geotechnical
- ☐ Mineral Exploration
- ☐ Other (*please specify*):

ORIGINAL WELL OWNER (IF KNOWN): Magma Copper Co.

ORIGINAL WELL DRILLING FIRM (IF KNOWN): Water Development Corp.

DRILL DATE (IF KNOWN): July 29, 1996

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	SW ¼	NE ¼	NW ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK / MAP / PARCEL

COUNTY WHERE WELL IS LOCATED:

LATITUDE			LONGITUDE		
33 ° Degrees	17 ' Minutes	58 " N Seconds	110 ° Degrees	06 ' Minutes	17 " W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ *GPS: Hand-Held ☐ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ☐ NAD-83 ☐ Other (*please specify*):

SPECIAL REQUIREMENTS

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP CODE: Superior, AZ. 85273

CONTACT PERSON NAME AND TITLE: Casey McKeon-Environmental Supervisor

TELEPHONE NUMBER: 520-689-9374 Ext. 13

FAX: 520-689-2335

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:

MAILING ADDRESS:

CITY / STATE / ZIP CODE:

CONTACT PERSON NAME AND TITLE:

TELEPHONE NUMBER:

FAX:

RECEIVED NOV 22 2006 WATER MGMT

SECTION 3. ABANDONMENT AUTHORIZATION

Drilling Firm

NAME: LANNE

DWR LICENSE NUMBER: C-53 ; A-4

ROC LICENSE CATEGORY: 7

TELEPHONE NUMBER: 480-895-9404

FAX:

Consultant (if applicable)

CONSULTING FIRM:

CONTACT PERSON NAME:

TELEPHONE NUMBER:

FAX:

E-MAIL ADDRESS:

SECTION 4.

Questions	Yes	No	If Yes:
1. To your knowledge, is there any information that exists which indicates that the water in this well has been, may be, or is contaminated?	✓		EXPLAIN (ATTACH ADDITIONAL PAGE IF NECESSARY) Possible Low PH. Well screened within tailings, not in aquifer; quarterly sampled.
2. Is there another well name or identification number associated with this well? (e.g., Lot 3 Well, MW-1,etc.)	✓		PLEASE STATE MCC-5B
3. Was the well casing video logged?		✓	
4. Why is the well being abandoned?	New construction in area.		

Notice of Intent to Abandon a Well

WELL REGISTRATION NUMBER
55 - 558207

Provide a well construction diagram showing all existing well construction features listed in Section 5 and the proposed abandonment specifications listed in Section 6.

SECTION 5. ORIGINAL WELL CONSTRUCTION DESIGN (attach additional page if needed)

Existing Borehole			Existing Casing (to the best of your knowledge)													
DEPTH FROM SURFACE		BOREHOLE DIAMETER (inches)	DEPTH FROM SURFACE		OUTER DIAMETER (inches)	MATERIAL TYPE (T)				PERFORATION TYPE (T)						SLOT SIZE IF ANY (inches)
FROM (feet)	TO (feet)		FROM (feet)	TO (feet)		STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	
0	100	10 5/8	0	92	5 9/16		✓							✓		.020

Condition of casing: ✓ Good ☐ Fair ☐ Poor

Existing Annular Material (to the best of your knowledge)

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	30			✓								
30	35					✓						
35	100									✓		#10-20

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SECTION 6. PROPOSED WELL ABANDONMENT DESIGN (attach additional page if needed)

DATE ABANDONMENT IS TO BEGIN

Refer to ADWR's Well Abandonment Handbook for additional information.

Casing Treatment

DEPTH FROM SURFACE		TREATMENT TYPE (T)				
FROM (feet)	TO (feet)	SONAR JET	BRUSH OR SCRAPE	MILLS KNIFE	CASING REMOVAL (explain in Remarks)	IF OTHER TYPE, DESCRIBE OR IF CASING IS TO BE PERFORATED, DESCRIBE SPACING AND SIZE OF PERFORATIONS TO BE ADDED
SPECIAL REQUIREMENTS						

Sealing or Fill Material

DEPTH FROM SURFACE		MATERIAL TYPE (T)									MIXING RATIO by (check one) ☒ Weight ☐ Volume	ESTIMATED VOLUME OF MATERIAL (cubic feet)
							HIGH SOLIDS BENTONITE					
FROM (feet)	TO (feet)	NEAT CEMENT	CONCRETE	SAND-CEMENT GROUT	CEMENT-BENTONITE GROUT	SAND-BENTONITE GROUT	GROUT	CHIPS	PELLETS	SAND		
0	100	X	+	FLY	ASH	For	Low	PH				12

Proposed Abandonment Method (See Well Abandonment Handbook)

CHECK ONE

- ☐ Standard Method
- ☐ Alternative 1
- ☐ Alternative 2
- ☒ Alternative 3
- ☐ Alternative 4:
  - ☐ Variance Option *
- ☐ Alternative 5:
  - ☐ Variance Option 1*
  - ☐ Variance Option 2*
- ☐ Other (please specify):

* requires a letter requesting a variance

Emplacement Method of Sealing or Fill Material

CHECK ONE

- ☐ Gravity
- ☐ Pressure Grouting
- ☒ Tremie Pumped
- ☐ Other (please specify):

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NOV 22 2006
WATER MGMT

REMARKS

I state that this notice is filed in compliance with A.R.S. § 45-594 and A.A.C. R12-15-816 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
Casey McKeon-Environmental Supervisor on behalf of RCM	Casey McKeon	10-30-06
TYPE OR PRINT NAME AND TITLE	SIGNATURE OF LANDOWNER, IF APPLICABLE (SEE INSTRUCTIONS)	DATE

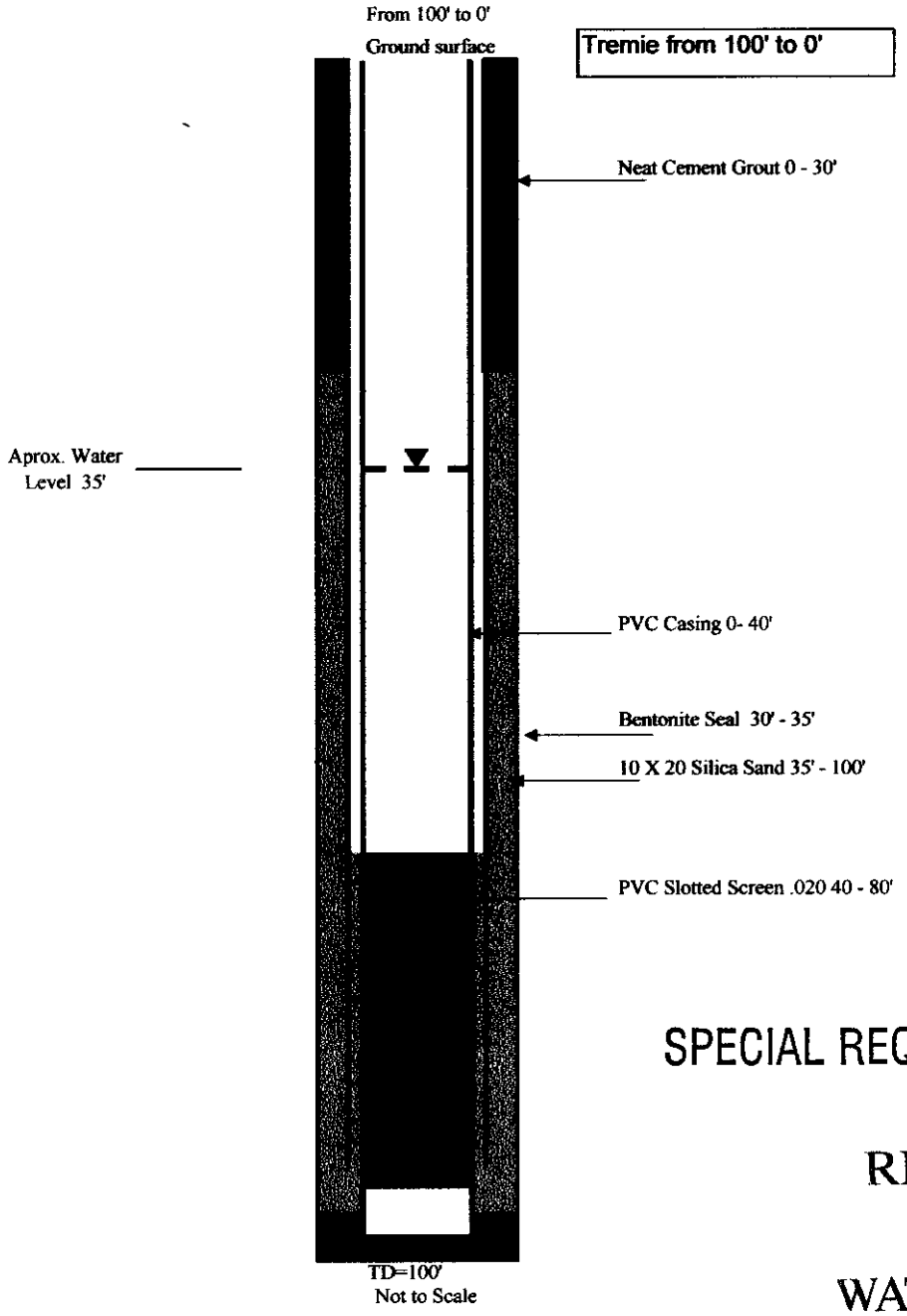
Resolution Copper Mining

55-558207

Proposed MonitorWell Abandonment

558207

Tremie Neat Cement mixed with Fly Ash in case of Low PH (94# cement / 74# fly ash / 10 gal Water)



SPECIAL REQUIREMENTS

RECEIVED
NOV 2 2 2006
WATER MGMT

558207

Resolution Copper Mining

102 Magma Heights - P.O. Box 1944
Superior, AZ 85273
Tel.: (520) 689-9374 - Fax: (520) 689-9304

ADWR Main Office
3550 N. Central Avenue
Phoenix AZ 85012
(602) 771-8500

To Whom It May Concern:

I, Casey McKeon, Environmental Supervisor, give Layne Christensen authorization to abandon wells 55-548188 and 55-558207 on behalf of Resolution Copper Mining, LLC. This is to include sign off on the Notice of Intent to Abandon (NOIA) and the actual well abandonment. Upon approval and the completion of the well abandonment Resolution Copper Mining, LLC will file a Notification of Abandonment within thirty days. The Well Abandonment Completion Report will be filed by Layne Christensen thirty days after the actual well abandonment. If you have any questions or concerns please don't hesitate to call me at 520-689-9374 Ext. 13 or Martin Navarrette at 520-689-9374 Ext. 18.

Best Regards,

Casey McKeon
Environmental Supervisor
Resolution Copper Mining, LLC.
520-689-9374 Ext. 13

RECEIVED
NOV 29 2006
WATER MGMT

558207

DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

MAIL TO: P.O. BOX 458, PHOENIX, ARIZONA 85001-0458
500 NORTH 3RD STREET, PHOENIX, ARIZONA 85004-3903
PHONE (602) 417-2470 FAX (602) 417-2422

RECEIVED JUN 6 1996 GROUNDWATER MGT

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

PLEASE READ GENERAL INSTRUCTIONS AND CONDITIONS ON REVERSE SIDE OF THIS FORM BEFORE COMPLETING.

Section §45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. **Well/land Location:**
   1 N/S 12 E/W 35
   Township Range Section
   NW ¼ NE ¼ SW ¼
   10 Acre 40 Acre 160 Acre

2. **Position location of the well on the land:**
   Latitude 33 o 17 ' 58 "
   Longitude 110 o 06 ' 17 "

3. **County:** PINAL

4. **Owner of the well:**
   BHP COPPER
   Name
   POST OFFICE BOX 37
   Mailing Address
   SUPERIOR AZ 85273
   City State Zip
   Telephone No. (602) 229-4202

5. **Lessee of the land of wellsite:**
   N/A
   Name
   Mailing Address
   City State Zip
   Telephone No.

6. **Owner of the Land of Wellsite:**
   BHP COPPER
   Name
   POST OFFICE BOX 37
   Mailing Address
   SUPERIOR AZ 85273
   City State Zip
   Telephone No. (602) 229-4202

7. **Consulting firm:**
   BROWN AND CALDWELL
   Name
   BRIAN ANDERSON
   Contact Person
   Telephone No. (602) 222-4444

8. **Purpose of well drilled pursuant to this notice:**
   Monitor ✓
   Piezometer

9. **If for deepening or modifying, list well registration number:**
   55-

FOR DEPARTMENT USE ONLY
File No. D(1-12)35 caB
Filed 6-6-96 By DB
Input By
ENTERED JUL - 2 1996
Mailed 6-27-96 By DB
Registration 55- 558207
AMA/INA Phx
W/S U8 S/B 06

10. **Will this proposed well be associated with a permit:** Yes ____ No ✓
    If yes, Permit No. ____

11. **Construction will start:**
    6 14 96
    Month Day Year

12. **Period well will remain in use:**
    10 Months/Years

13. **For monitoring wells, is pump equipment to be installed?**
    Yes ✓ No ____
    (a) If yes, design pump capacity:
    5 GPM
    (b) What use will be made of the water: ANALYTICAL TESTING

14. **Drilling Firm:**
    WATER DEVELOPMENT CORP.
    Name
    1202 KENTUCKY AVE.
    Mailing Address
    WOODLAND, CALIF. 95776
    City State Zip
    (916) 662-2829
    Telephone No.
    161
    DWR License Number
    A4
    ROC License Category

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VARIANCE GRANTED SPECIAL REQUIREMENT

15. **Proposed method of abandonment of well after project is completed:** PER AAC-R12-15-816, pursuant to R12-15-816.

16. **Is this well to monitor existing contamination?** No **Potential contamination** No. **Please explain:** monitor groundwater flow; may be used for water quality sampling (per B. Anderson 6/24/96 SM)

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(F), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Jeff J. Parker Sr. Enviro Engineer [signature] 5-30-96
Typed or Printed Name and Title Signature [✓] Land Owner [ ] Lessee of Wellsite, Title Date

DWR-55-44a (Rev 3/96)

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 417-2470 • (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED FEB 23 2005 Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

FILE NUMBER

WELL REGISTRATION NUMBER 55-558207

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

Location of Well

WELL LOCATION ADDRESS (IF ANY):

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	C ¼	A ¼	B ¼

LATITUDE Degrees	Minutes	Seconds N	LONGITUDE Degrees	Minutes	Seconds W
°	'	"	°	'	"

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

Type of Request (CHECK ONE)

- ☐ Change of Well Drilling Contractor *(Fill out Section 2)*
- ☒ Change of Well Ownership *(Fill out Section 3)*
- ☐ Change of Well Information (location, use, etc.) *(Fill out Section 4)*

SECTION 2. REQUEST TO CHANGE WELL DRILLING CONTRACTOR ($10 Fee Required)

- If drilling or abandoning a well, the Department must receive this request and issue authorization to the new drilling firm prior to the commencement of well drilling or abandonment.

$10 FEE

Current Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER:

TELEPHONE NUMBER: FAX:

New Well Drilling Contractor

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL:

DWR LICENSE NUMBER: ROC LICENSE CATEGORY:

TELEPHONE NUMBER: FAX:

COMPLETED MAR 03 2005

SECTION 3. STATEMENT OF CHANGE OF WELL OWNERSHIP ($10 Fee Required)

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

Previous Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: BHP Copper, Inc. (See Note 1)

MAILING ADDRESS: 200 South Veterans Memorial Blvd

CITY / STATE / ZIP CODE: San Manuel, AZ 85631

CONTACT PERSON NAME AND TITLE: Carla Consoli, Counsel

TELEPHONE NUMBER: 602-364-7000 FAX: 602-364-7070

New Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Mining LLC

MAILING ADDRESS: 2525 East Arizona Biltmore Circle Suite c-135

CITY / STATE / ZIP CODE: Phoenix, AZ 85016

CONTACT PERSON NAME AND TITLE: F. D. Hegner

TELEPHONE NUMBER: 602-956-0223 FAX: 602-956-0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN:

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: F. D. Hegner V.P, G M

SIGNATURE OF WELL OWNER: F D Hegner DATE: 2-22-05

NOTE 1

The well registration numbers followed by an asterisk are currently in the name of Magma Copper Company, a Delaware Corporation. On February 13, 1996, Magma Copper Company officially changed its name to BHP Copper, Inc. The name was not changed on the well registrations.

For your convenience, attached is the State of Delaware Certification officially changing the name.

Delaware

The First State

I, HARRIET SMITH WINDSOR, SECRETARY OF STATE OF THE STATE OF DELAWARE, DO HEREBY CERTIFY THE ATTACHED IS A TRUE AND CORRECT COPY OF THE CERTIFICATE OF AMENDMENT OF "MAGMA COPPER COMPANY", CHANGING ITS NAME FROM "MAGMA COPPER COMPANY" TO "BHP COPPER INC.", FILED IN THIS OFFICE ON THE THIRTEENTH DAY OF FEBRUARY, A.D. 1996, AT 2 O'CLOCK P.M.

Harriet Smith Windsor

Harriet Smith Windsor, Secretary of State

0701612 8100

AUTHENTICATION: 3090730

040325190

DATE: 05-04-04

STATE OF DELAWARE
SECRETARY OF STATE
DIVISION OF CORPORATIONS
FILED 02:00 PM 02/13/1996
960042015 - 701612

CERTIFICATE OF AMENDMENT

OF

RESTATED CERTIFICATE OF INCORPORATION

*****

MAGMA COPPER COMPANY, a corporation organized and existing under and by virtue of the General Corporation Law of the State of Delaware,

DOES HEREBY CERTIFY:

FIRST: That the Board of Directors of said corporation, by unanimous written consent of its members, filed with the minutes of the Board, adopted a resolution proposing and declaring desirable of the following amendment to the Restated Certificate of Incorporation of said corporation:

RESOLVED, that Article 1 of the Restated Certificate of Incorporation of this corporation be amended to read in its entirety:

"ARTICLE 1

The name of the corporation is BHP COPPER INC. (the "Corporation")."

SECOND: That in lieu of a meeting and vote of the stockholder, the stockholder has given unanimous written consent to said amendment in accordance with the provisions of Section 228 of the General Corporation Law of the State of Delaware.

THIRD: That the aforesaid amendment was duly adopted in accordance with the applicable provisions of Sections 242 and 228 of the General Corporation Law of the State of Delaware.

IN WITNESS WHEREOF said **MAGMA COPPER COMPANY** has caused this Certificate to be signed by Marsh Campbell, its Vice President and attested by Andrew Bradkay, its Secretary, this 9th day of February, 1996.

MAGMA COPPER COMPANY

By M H Campbell
Vice President

ATTEST:

Andrew L. Bradkay
Secretary

F:\USERS\AALE\AALETMP2\ANDY.96\CERTAMD.DOC

Arizona Department of Water Resources
Groundwater Management Support Section
P.O. Box 458 – Phoenix, Arizona 85001-0458
(602) 417-2470 (800) 352-8488
www.water.az.gov

Request to Change Well Information

RECEIVED
FEB - 3 2005
Information Management

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - Check or money order for any required fee(s)
- Authority for fee: A.A.C. R12-15-151(B)(4)(a), A.R.S. § 45-113(B)

PLEASE PRINT CLEARLY

WELL REGISTRATION NUMBER
55-(See attached list)

CHECK DATE	VENDOR NO.	VENDOR NAME	TOTAL AMOUNT
09/30/04	036924	ARIZONA DEPT. OF WATER RESOURCES	115.00

Resolution Copper Mining, LLC
2525 E. Arizona Biltmore Circle
Suite C-135
Phoenix, AZ 85016

Wells Fargo Bank, N.A.
Salt Lake City, UT 84111

11-24
1210

00002363

DATE 09/30/04

$ **********115.00

PAY ONE HUNDRED FIFTEEN DOLLARS AND ZERO CENTS

TO THE ORDER OF
ARIZONA DEPT. OF WATER RESOURCES
500 NORTH THIRD STREET
PHOENIX , AZ85004

AUTHORIZED SIGNATURE

THE SECURITY FEATURES INCLUDED ON THIS DOCUMENT ARE DETAILED ON BACK OF CHECK. IF THESE FEATURES ARE NOT PRESENT, DO NOT CASH

[redacted]

- If this change pertains to more than one well and the names are the same, only one $10 fee is required.

$10 FEE

PREVIOUS WELL OWNER		NEW WELL OWNER	
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL BHP Copper, Inc. (See Note 1)		FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper Mining LLC	
MAILING ADDRESS 200 South Veterans Memorial Blvd.		MAILING ADDRESS 2525 East Arizona Biltmore Circle, Suite C-135	
CITY / STATE / ZIP CODE San Manuel, AZ 85631		CITY / STATE / ZIP CODE Phoenix, AZ 85016	
CONTACT PERSON NAME AND TITLE Carla Consoli, Counsel		CONTACT PERSON NAME AND TITLE F. D. Hegner	
TELEPHONE NUMBER 602-364-7000	FAX 602-364-7070	TELEPHONE NUMBER 602 956 0223	FAX 602 956 0332

SECTION 4. CHANGE OF WELL INFORMATION (No Fee Required)

NO FEE

NOTE: Applies only to wells that have already been drilled. For proposed wells, an amended Notice of Intent to Drill a Well must be filed.

EXPLAIN

I HEREBY CERTIFY that the above statements are true to the best of my knowledge and belief.

TYPE OF PRINT NAME AND TITLE	SIGNATURE OF WELL OWNER	DATE
F. D. Hegner	F.D. Hegner	15 Sept. 04

461689.1

RECEIVED
SEP 6 1996
RECORDS MGT

*

ARIZONA DEPARTMENT OF WATER RESOURCES
500 North Third Street
Phoenix, Arizona 85004

WELL DRILLER REPORT

This report should be prepared by the driller in all detail and filed with the Department within 30 days following completion of the well.

1. W.D.C./WATER DEVELOPMENT
1202 KENTUCKY AVENUE
WOODLAND, CA 95776

2. Owner Name: BHP Copper
Address: 850 MAIN (Street) Superior (City) AZ (State) 85273 (Zip)

3. Location: 1 N/S (Township) 12 E/W (Range) 35 (Section) ¼ NW (10-acre) ¼ NE (40-acre) ¼ SW (160-acre)

4. Well Registration No. 55- 558207 (Required)

5. Permit No. _____ (If issued)

DESCRIPTION OF WELL

6. Total depth of hole 100' ft.
7. Type of casing PVC
8. Diameter and length of casing 5 in. from -2 to 92', _____ in from _____ to _____
9. Method of sealing at reduction points _____
10. Perforated from _____ to _____, from _____ to _____ from _____ to _____
11. Size of cuts _____ Number of cuts per foot _____
12. If screen was installed: Length 40 ft. Diam 5" in. Type PVC
13. Method of construction Drilled
(drilled, dug, driven, bored, jetted, etc)
14. Date started July 29 1996
Month Day Year
15. Date completed July 29 1996
Month Day Year
16. Depth to water 48' ft. (If flowing well, so state)

17. Describe point from which depth measurements were made, and give sea-level elevation if available
Ground level

18. If flowing well, state method of flow regulation: _____
19. Remarks: _____

DO NOT WRITE IN THIS SPACE
OFFICE RECORD

Registration No. 55-558207
File No. D(1-12)35 CAB
Received _____ **By** _____
Entered ENTERED SEP 17 1996 **By** _____

DWR-55-55-7/95 (Rev.)

DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION

MAIL TO: P.O. BOX 458, PHOENIX, ARIZONA 85001-0458
500 NORTH 3RD STREET, PHOENIX, ARIZONA 85004-3903
PHONE (602) 417-2470 FAX (602) 417-2422

RECEIVED JUN 6 1996 GROUNDWATER MGT

NOTICE OF INTENTION TO DRILL MONITOR/PIEZOMETER WELL

PLEASE READ GENERAL INSTRUCTIONS AND CONDITIONS ON REVERSE SIDE OF THIS FORM BEFORE COMPLETING.

Section §45-596, Arizona Revised Statutes provide: Prior to drilling a monitor or piezometer well, a Notice of Intention to Drill shall be filed with the Department.

1. Well/land Location:

1 N/S 12 E/W 35
Township Range Section

NW ¼ NE ¼ SW ¼
10 Acre 40 Acre 160 Acre

2. Position location of the well on the land:

Latitude 33 o 17 ' 58 "

Longitude 110 o 06 ' 17 "

3. County: PINAL

4. Owner of the well:

BHP COPPER
Name
POST OFFICE BOX 37
Mailing Address
SUPERIOR AZ 85273
City State Zip

Telephone No. (602) 229-4202

5. Lessee of the land of wellsite:

N/A
Name

Mailing Address

City State Zip

Telephone No.

6. Owner of the Land of Wellsite:

BHP COPPER
Name
POST OFFICE BOX 37
Mailing Address
SUPERIOR AZ 85273
City State Zip

Telephone No. (602) 229-4202

7. Consulting firm:

BROWN AND CALDWELL
Name
BRIAN ANDERSON
Contact Person

Telephone No. (602) 222-4444

8. Purpose of well drilled pursuant to this notice:

Monitor ✓
Piezometer

9. If for deepening or modifying, list well registration number:

55-

FOR DEPARTMENT USE ONLY
File No. 20(1-12)35 cab
Filed 6-6-96 By
Input By
ENTERED JUL - 2 1996
DUPLICATE
Mailed 6-27-96 By
Registration 55- 558207
AMA/INA PMA
W/S 48 S/B 06

10. Will this proposed well be associated with a permit: Yes____ No ✓
If yes, Permit No.

11. Construction will start:

6 14 96
Month Day Year

12. Period well will remain in use:

10 Months/Years

13. For monitoring wells, is pump equipment to be installed?

Yes ✓ No

(a) If yes, design pump capacity:

5 GPM

(b) What use will be made of the water: ANALYTICAL TESTING

14. Drilling Firm:

WATER DEVELOPMENT CORP.
Name
1202 KENTUCKY AVE.
Mailing Address
WOODLAND, CALIF. 95776
City State Zip
(916) 662-2829
Telephone No.
161
DWR License Number
A4
ROC License Category

VARIANCE GRANTED

SPECIAL REQUIREMENT

15. Proposed method of abandonment of well after project is completed: PER AAC-R12-15-816, **pursuant to R12-15-816.**

16. Is this well to monitor existing contamination? No **Potential contamination** No. **Please explain:** monitor groundwater flow; may be used for water quality sampling (per B. Anderson 6/24/96 SM)

I state that this Notice is filed in compliance with Rule A.A.C. R12-15-809 and R12-15-816(P), and is complete and correct to the best of my knowledge and belief and that I understand the conditions set forth on the reverse side of this form.

Jeff J. Parkon Sr. Enviro Engineer — Jeff Parkon — 5-30-96
Typed or Printed Name and Title — Signature [ ] Land Owner [ ] Lessee of Wellsite, Title — Date

DWR-55-44a (Rev 3/96)

17. If construction plans have been coordinated with Arizona Department of Environmental Quality, who is the agency contact? Ms. Lenny Bonchard

If construction plans have been coordinated with Arizona Department of Water Resources, who is the agency contact?

18. **WELL CONSTRUCTION PLAN:**

a) Drilling method (mud rotary, hollow-stem auger, etc.) DIRECT AIR

b) Borehole diameters: 10 5/8 inches from 0 feet to 85 feet.
inches from feet to feet.

c) Casing materials (PVC), steel, hollow-stem auger, etc.)
material PVC diameter 5 9/16 inches from 0 feet to 80 feet.
material diameter inches from feet to feet.

d) Method of sealing at reductions N/A

e) Annular seal materials (cement, grout, etc.,); method of placement (tremied, circulated):
material CEMENT GROUT method TREMIE from 0 feet to 30 feet.
material BENTONITE method TREMIE from 30 feet to 35 feet.

f) Filter packs (state material):
material SILICA SAND 10-20 MESH from 35 feet to 85 feet.
material from feet to feet.

g) Perforations or screen specifications:
Type 5 9/16" PVC SLOTTED .020" from 40 feet to 80 feet
Type from feet to feet

h) Method of well development (bail, air lift, surge) BAIL/SWAB AND PUMP

i) Will surface or conductor casing extend above grade?: Yes____ No ✓

19. **Include detailed construction diagram showing expected water depth in feet below land surface, and details of vault, if specified.**

GENERAL INSTRUCTIONS

1. **Please submit two original notices, with original signatures, and a check or money order (no cash) in the amount of $10.00, to P.O. Box 458, Phoenix, Arizona 85001-0458 or hand deliver to 500 North 3rd Street, Phoenix, Arizona 85004-3903.**

CONDITIONS

1. **If an individual other than the land owner or lessee, signs this notice, an original letter of authorization from the land owner/lessee, stating that the individual has permission to sign this specific Notice on their behalf, shall accompany the Notice of Intention to Drill a Monitor/Piezometer Well form.**

2. **Construction and abandonment standards for all wells shall be in accordance with A.A.C. R12-15-811 and R12-15-816.**

3. **Drilling of the well shall be completed within one year after the date of Notice.**

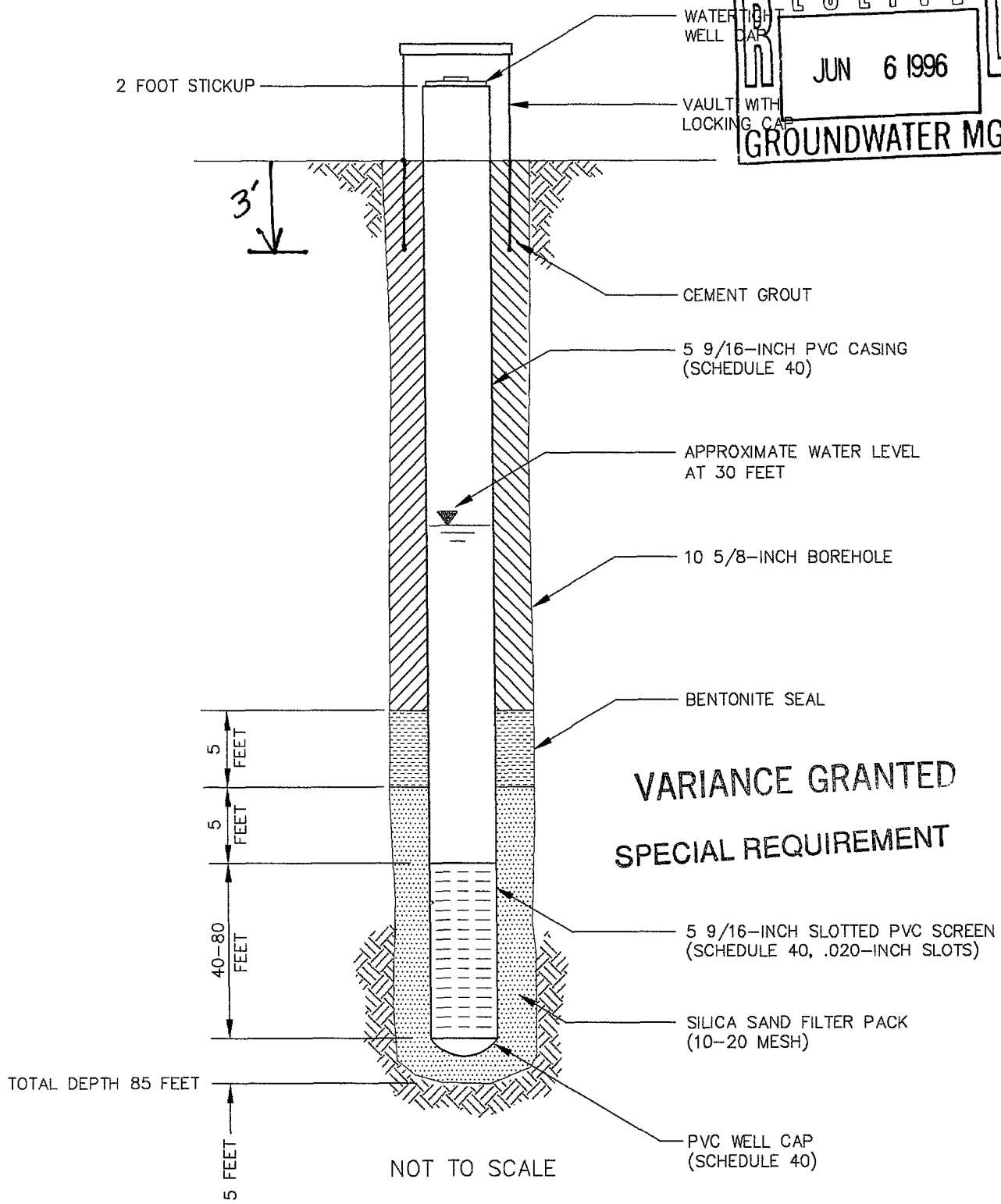
4. **A Well Driller Report is required within thirty days of completion of drilling. A Completion Report, is required to be filed with the Department within thirty days after installation of pump equipment for monitor wells.**

5. **Pump equipment may not be installed on a well drilled for piezometer purposes. If a monitor well is pumped, pumping is limited to the maximum amount required for monitor purposes, but in no case may exceed 35 gallons per minute and an annual volume of 10 acre feet total.**

6. **A.A.C. Rule R12-15-811.H.2, requires that: "A monitor well shall be identified as such on the vault cover or at the top of the steel casing. Identification information will include well registration number."**

7. **Special construction standards required pursuant to A.A.C. Rule R12-15-821:**

RECEIVED
JUN 6 1996
GROUNDWATER MGT



VARIANCE GRANTED

SPECIAL REQUIREMENT

NOTES:

1. PVC = POLYVINYL CHLORIDE
2. CASING DIMENSIONS ARE OUTSIDE DIAMETER
3. SLOTTED INTERVAL BASED ON SITE SPECIFIC GEOLOGICAL CONDITIONS AND TEST OBJECTIVES.

MONITOR WELL DESIGN
MCC-5B

BROWN AND CALDWELL
PHOENIX, ARIZONA

BHP
BHP Copper *Superior Operations*

L:\BHP\2126\WELL-5 (1=1) 05-29-96 JasonC

From [illegible]

To : Ground Water Management "Sir/Madam"

Enclosed are 8 WOIs for BHP/Superior Mining Project

6 are Monitorings Wells & 2 are abandonments

I have also enclosed Original Well Completion Diagrams &

a $60 Personal check for the well Permits

Please send Permits & Cards to the address mentioned on my business card

Regards

[illegible]

Water Development
CORPORATION

Environmental Drilling, Construction, Development and Well Abandonment Services.

June 13, 1996

Ms. Sharon Masek
Hydrology Division
Department of Water Resources
500 N Third Street
Phoenix, Arizona 85004-3903

Re: Request for Variance/Superior, AZ (BHP Copper Co.)

Dear Ms. Masek:

This letter is a formal request for variance at the project site located in Superior, Arizona (BHP Copper Co.).

Specifically, this variance pertains to the installation of six (6) monitoring wells. First, we anticipate installing Schedule 80 PVC screens and Schedule 80 PVC casing in all six (6) wells. Second, above ground completion will consist of 8" steel casing embedded three (3) feet into the ground and sticking up two and one-half (2½) feet from the ground surface. Four (4) inch crash post will be embedded two (2) feet into the ground and four (4) feet above, to approximately five (5) feet apart to protect the well head.

I hope that this information will satisfy the State requirements for compliance. Please contact me if you need additional information or if I may be of service in some other way. Thank you for your assistance with this matter.

Very truly yours:
Water Development Corporation

Gigi L. Marie

Gigi Louise Marie
Operations Manager

L.G.

GLM/lg

RECEIVED
JUN 20 1996
HYDROLOGY DIV.

(916) 662-2829
(916) 662-1592 *(FAX)*

1202 Kentucky Avenue • Woodland, CA 95776

ARIZONA DEPARTMENT OF WATER RESOURCES
Hydrology Division
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2448
Fax (602) 417-2425
June 25, 1996

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

Water Development Corporation
1202 Kentucky Avenue
Woodland, Claifornia 95776
ATTN: Gigi L. Marie

Re: Variance for Construction of Six Monitor Wells
Registration Numbers 55-558203 through 55-558208

Dear Mr. Marie:

The Arizona Department of Water Resources received your request dated June 13, 1996 for a variance for construction of six monitor wells to be located in Pinal County. The purpose of these wells will be to monitor groundwater flow and water quality.

The Arizona Department of Water Resources approves this request for the following variance:

- Thermoplastic casings (risers) with a watertight cap may be used in lieu of steel casings (R12-15-811.B.1).

The following *special requirements* are conditions for this variance (R12-15-821.):

- The wells shall be completed above ground with 8" diameter protective steel casing embedded 3 feet into the ground and sticking up 2 1/2 feet above ground surface as per your variance request letter.

- The PVC inner casings (risers) shall comply with ASTM Standard Guide D5092, Section 6.5.

- The wells shall be constructed per the "Variance Granted" Notice of Intention to Drill.

- The wells shall be abandoned (decommissioned) per ASTM Standard Guide D5299, Section 7.3.8.

If you have any questions, please contact Sharon Masek of my staff at (602) 417-2400 ext.# 7185.

Sincerely,

Greg Wallace
Chief Hydrologist

GW/SM/jh
502354

ARIZONA DEPARTMENT OF WATER RESOURCES
GROUNDWATER MANAGEMENT SUPPORT SECTION
500 North Third Street, Phoenix, Arizona 85004
Telephone (602) 417-2470
Fax (602) 417-2422

FIFE SYMINGTON
Governor

RITA P. PEARSON
Director

June 27, 1996

BHP COPPER
P.O. BOX 37
SUPERIOR, AZ 85273

RE: Registration No. 55-558207
File No. D(1-12)35 CAB

Dear Well Owner:

Enclosed for your records is an annotated copy of the Notice of Intention to Drill a well. This is returned to you as evidence of compliance with A.R.S. §45-596. A drilling card has been mailed to your designated driller. Prior to drilling he must have it in his possession.

Since this well is being drilled as a Monitor well, or for Cathodic Protection, Grounding, Geotechnical or Piezometer purposes, our standard driller report form is also being furnished to the driller. He is required to complete it and return it to the Department within 30 days after the completion of the well. A Completion Report form is being furnished for monitor wells where pump installation is authorized. This must be completed within thirty days of installation as required by A.R.S. §45-600.

A Change of Well Information form is enclosed for your future use . If you deem it necessary to change the location of the proposed well, please notify the Department on the enclosed form. A properly amended Drilling Card will then be issued and must be in possession of the driller before drilling begins. During the drilling of a new well, if it is determined that it must be abandoned, then a Well Abandonment Completion Report must be submitted per R12-15-816.F.

Per A.R.S. §45-593, the person to whom a well is registered shall notify this Department of a change of ownership of the well and/or information pertaining to the physical characteristics of the well, in order to keep the well registration file current and accurate.

Sincerely,

Toni M. Bergeman

Toni M. Bergeman
Water Resource Technician
Groundwater Management Support Section

ARIZONA DEPARTMENT OF WATER RESOURCES

GROUNDWATER MANAGEMENT SUPPORT SECTION

500 North Third Street
Phoenix, Arizona 85004-3903

VARIANCE GRANTED

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILL OPERATIONS

WELL REGISTRATION NO: 55-558207

AUTHORIZED DRILLER: W.D.C./WATER DEVELOPMENT LICENSE NO: 161

NOTICE OF INTENTION TO DRILL A MONITOR WELL HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: BHP COPPER

The well(s) is/are to be located in the:

NW 1/4 of the NE 1/4 of the SW 1/4 Section 35 Township 1 SOUTH Range 12 EAST

No. of Wells in this project: 1

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE 5TH DAY OF JUNE, 1997.

CHIEF, GROUNDWATER MANAGEMENT SUPPORT

GREAT SEAL OF THE STATE OF ARIZONA
DITAT DEUS
1912

THE DRILLER MUST FILE A LOG OF THE WELL WITHIN 30 DAYS OF COMPLETION OF DRILLING

SETTLING PONDS 1 & 2 ALERT WELL

AZ STATE PLANE CENTRAL NAD 83

NORTHING: 837767 ELEVATION (TOC):2976.2

EASTING: 948296

LITHOLOGY

TAILINGS - SAND: (SP) Poorly-graded sand. Very fine, rounded, dark gray sand, maximum particle size 0.5 mm. Color 5YR 4/3, 5YR 4/1, and 7.5YR 4/1. Soft consistency. Weak cementation. No plasticity. Interval is dry until 55-60 ft; cuttings are wet from 60 ft bls. Mine tailings.

TAILINGS - SANDY SILT: (ML) Sandy silt. Very fine, rounded, dark gray to charcoal sand. Silt has low plasticity, 7.5YR 4/1. Very soft to soft consistency. Weak to moderate cementation. Low plasticity in silt, firm plasticity for fat clay. Trace amount of fat clay occurs in balls up to 2 cm between 80-85ft. Mine tailings.

GILA CONGLOMERATE - GRAVEL AND SAND: (GP) Poorly-graded gravel and sand. Coarse grained sand and gravel size fragments, max particle size 1 cm, angular. Color 7.5YR 6/3. Hard consistency. Strong cementation. No plasticity. Gila Conglomerate contact at 91 ft bgs.

GILA CONGLOMERATE - SAND: (SP) Poorly-graded sand. Medium grained, rounded to subangular, reddish gray sand-sized fragments, max particle size 1.5 mm. Color ranges from 5YR 4/2 to 5YR 5/2. Hard consistency. Strong cementation. No plasticity. Gila Conglomerate.

AS-BUILT

8-inch locking monument

(2 ft ags - 20 ft bgs) 4-inch schedule 40 LCS blank

(0 - 23 ft bgs) Neat cement

(20 - 140) 4-inch schedule 40 PVC blank

(23 - 82) Bentonite grout

(77.35) Water level measured 6/19/2007

(82 - 123) Neat cement

(123 - 129) Bentonite chips, (129 - 130) #60 choke sand

(130 - 190) 10x20 mesh Colorado silica sand

(140 - 180) 4-inch schedule 40 PVC screen, 0.020" slots

(180 - 185) 4-inch PVC sump with bottom end cap

CUTTINGS SIZE: FINES, MEDIUM, COARSE

REACTION TO HCl: NONE, WEAK, MOD, STRONG

BOREHOLE No.	SETTLING PONDS 1 & 2 ALERT WELL	TOTAL DEPTH DRILLED	190	SCALE	AS SHOWN	TITLE
ADWR REG No.	55-907034	BIT DIAMETER	8.75"	DATE	06/07/2007	**BOREHOLE LOG AND AS-BUILT DRAWING**
LOCATION	SUPERIOR, AZ	DRILLING FLUID	AIR	DESIGN	JCR	
CLIENT	RESOLUTION COPPER MINE	LOGGED BY	KKH	CHECK	JJM	
DRILLING CO	YELLOW JACKET DRILLING	DATE STARTED	05/22/07	REVIEW	KJ	
DRILLING EQUIPMENT	SPEEDSTAR 50K-CH	DATE FINISHED	05/23/07	REV 1	FILE ALERT WELL.LDF	Golder Associates
DRILLING METHOD	AIR ROTARY CASING HAMMER	COMMENTS	USCS SCALE, MUNSELL COLOR CHART	PROJECT No.	073-92522	FIGURE 2-3

Arizona Department of Water Resources
Information Management Unit
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8627 • (800) 352-8488
www.water.az.gov

Well Driller Report and Well Log

COPY

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

FILE NUMBER: D(1-12)35 ADD

WELL REGISTRATION NUMBER: 55 - 907034

PERMIT NUMBER (IF ISSUED):

SECTION 1: DRILLING AUTHORIZATION

Drilling Firm — Mail To:

NAME: YELLOW JACKET DRILLING SERVICES L L C	DWR LICENSE NUMBER: 78
ADDRESS: P.O. BOX 801	TELEPHONE NUMBER: 602-453-3252
CITY / STATE / ZIP: GILBERT, AZ, 85299-0801	FAX: 602 - 453 - 3268

SECTION 2: REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Company

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP: Superior, AZ, 85273

CONTACT PERSON NAME AND TITLE: Casey McKeon

TELEPHONE NUMBER: 520 689-9374

FAX: 520-689-9304

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.): Settling Pond 1 + 2 / Alert Well

Location of Well

WELL LOCATION ADDRESS (IF ANY): 102 Magma Heights, Superior Az

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12 E	35	NW 1/4	SE 1/4	SE 1/4

LATITUDE			LONGITUDE		
33 °	18 '	.016 "N	111 °	06 '	.200 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ■ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2972 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ■ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ■ NAD-83 ☐ Other (please specify)

COUNTY: Pinal

ASSESSOR'S PARCEL ID NUMBER (MOST RECENT): BOOK — MAP — PARCEL —

SECTION 3: WELL CONSTRUCTION DETAILS

Drilling Method — CHECK ONE
- ■ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development — CHECK ONE
- ☐ Airlift
- ■ Bail
- ■ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points — CHECK ONE
- ■ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well — CHECK ONE
- ■ Capped
- ☐ Pump Installed

Construction Dates

DATE WELL CONSTRUCTION STARTED: 5/22/07

DATE WELL CONSTRUCTION COMPLETED: 5/24/07

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY: R. L. Dane

DATE: 7.1.07

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907034

SECTION 4: WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
190 Feet Below Land Surface	185 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
60 Feet Below Land Surface	5/24/07	—	☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)
0	190	10

Installed Casing

DEPTH FROM SURFACE FROM (feet)	TO (feet)	OUTER (inches)	MATERIAL TYPE (T): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (T): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	140	4.5		x			x						
140	180	4.5		x							x		.040
180	185	4.5		x			x						

Installed Annular Material

DEPTH FROM SURFACE FROM (feet)	TO (feet)	ANNULAR MATERIAL TYPE (T): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
0	20			x								
20	120				x							
120	130							x				
130	190									x		10-20

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907034

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	100	Tailings	X
100	190	Bed Rock - Gila Conglomerate - Very Hard	
		TD - 190'	
		▽ - 60'	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907034

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
Resolution Copper Company	BOOK —	MAP —	PARCEL —

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.

N
W E
S

1" = _____ ft

SEE ATTACHED MAP

Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8500 • (800) 352-8488
www.azwater.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

FEE

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
  - $150 check or money order for the filing fee.
  - Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-596.

AMA / INA	B	SB
RECEIVED DATE	WS	
ISSUED DATE	WQAR	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER
55 -

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type (CHECK ONE)
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action (CHECK ONE)
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER: 55 -

Location of Well
WELL LOCATION ADDRESS (IF ANY): 102 MAGMA HEIGHTS, SUPERIOR, AZ

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
15	12E	35	NW ¼	SE ¼	SE ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER: BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED: PINAL

SECTION 2. OWNER INFORMATION

Well Owner
FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: RESOLUTION COPPER COMPANY
MAILING ADDRESS: 102 MAGMA HEIGHTS
CITY / STATE / ZIP CODE: SUPERIOR AZ 85273
CONTACT PERSON NAME AND TITLE: CASEY McKEON
TELEPHONE NUMBER: 520-689-9374
FAX: 520-689-9304

Landowner (if different from Well Owner)
FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL:
MAILING ADDRESS:
CITY / STATE / ZIP CODE:
CONTACT PERSON NAME AND TITLE:
TELEPHONE NUMBER:
FAX:

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm
NAME:
DWR LICENSE NUMBER:
ROC LICENSE CATEGORY:
TELEPHONE NUMBER:
FAX:
E-MAIL ADDRESS:

Consultant (if applicable)
CONSULTING FIRM: GOLDER ASSOCIATES INC.
CONTACT PERSON NAME: JOHN J. MALUSA
TELEPHONE NUMBER: 520-888-8818
FAX: 520-888-8817
E-MAIL ADDRESS: jmalusa@golder.com

SECTION 4.

Questions	Yes	No	Explanation:
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	✓		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		✓	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
3. Are you requesting a variance to use thermoplastic casing in lieu of steel casing in the surface seal?		✓	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
4. Is there another well name or identification number associated with this well? (e.g., MW-1, PZ2, 06-04, etc.)		✓	IF YES, PLEASE STATE
5. Have construction plans been coordinated with the Arizona Department of Environmental Quality?	✓		IF YES, PLEASE STATE AGENCY CONTACT & PHONE NUMBER KRISTIE KILGORE - WQ DIVISION 602-771-4632
6. For monitor wells, is dedicated pump equipment to be installed?	✓		IF YES, PLEASE STATE DESIGN PUMP CAPACITY 15 Gallons per Minute
7. Is this well a new well located in an Active Management Area **AND** intended to pump water for the purpose of remediating groundwater?		✓	IF YES, UNLESS THE WELL IS A REPLACEMENT WELL AND THE TOTAL NUMBER OF OPERABLE WELLS ON THE SITE IS NOT INCREASING, YOU MUST ALSO FILE A SUPPLEMENTAL FORM A.R.S. § 45-454(C) & (F). *(See instructions)*
8. Will the well registration number be stamped on the vault cover or on the upper part of the casing?		✓	IF NO, WHERE WILL THE REGISTRATION NUMBER BE PLACED? ETCHED INTO CEMENT PAD PRIOR TO DRYING

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

WELL REGISTRATION NUMBER
55 -

SECTION 5. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ONE

- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☑ Air Percussion / Odex Tubing
- ☐ Other (*please specify*):

MAY 18, 2007
DATE CONSTRUCTION TO BEGIN

Method of Well Development

CHECK ONE

- ☐ Airlift
- ☑ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Grout Emplacement Method

CHECK ONE

- ☐ Gravity
- ☐ Pressure Grout
- ☑ Tremie
- ☐ Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE

- ☑ None
- ☐ Welded
- ☐ Swedged
- ☐ Packed
- ☐ Other (*please specify*):

Surface or Conductor Casing

CHECK ONE

- ☐ Flush Mount in a vault
- ☑ Extend 1' above grade

SECTION 6. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

Attach a well construction diagram labeling all specifications below.

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	190	8

Casing

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	OUTER DIAMETER (inches)	MATERIAL TYPE (T): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (T): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	20	4	✓										
20	140	4		✓			✓						
140	180	4		✓							✓		0.020

Annular Material

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	ANNULAR MATERIAL TYPE (T): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
0	22				✓							
22	125						✓					
125	130								# 60 CHOKE SAND			
130	190									✓		10-20

IF THIS WELL HAS NESTED CASINGS, SPECIFY NUMBER OF CASING STRINGS

EXPECTED DEPTH TO WATER 150 Feet Below Ground Surface

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: Casey McKeon, Environmental Supervisor

SIGNATURE OF WELL OWNER: Casey McKeon DATE: 5-11-07

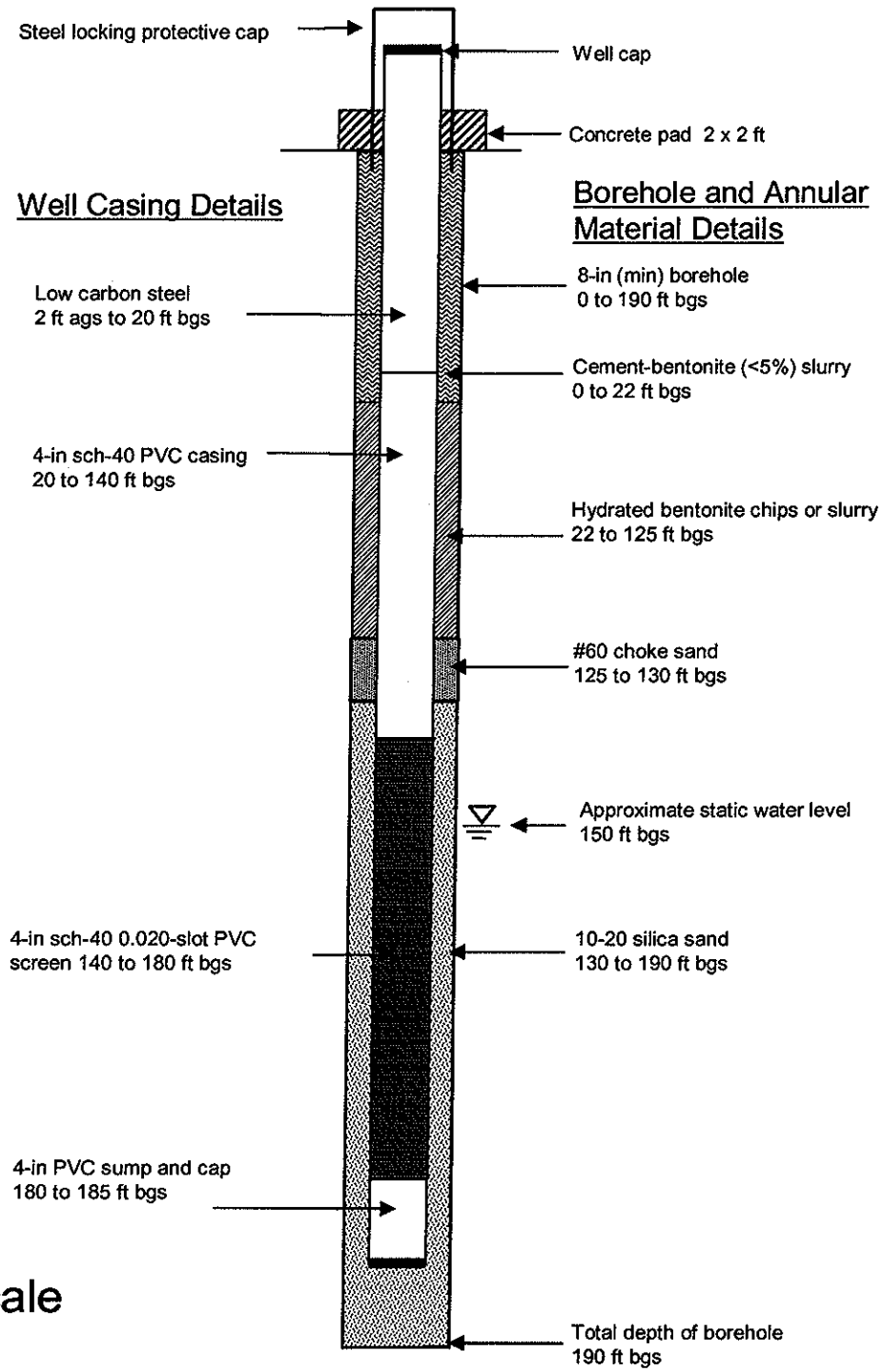
TYPE OR PRINT NAME AND TITLE

SIGNATURE OF LANDOWNER, IF APPLICABLE (SEE INSTRUCTIONS) DATE

SS-907034

Well Construction Schematic

Proposed **Settling Ponds 1 and 2**
Alert Well



Not to Scale

Notes:
ft ags = feet above ground surface
ft bgs = feet below ground surface

Golder Associates

Project number: 053-2519-100.000

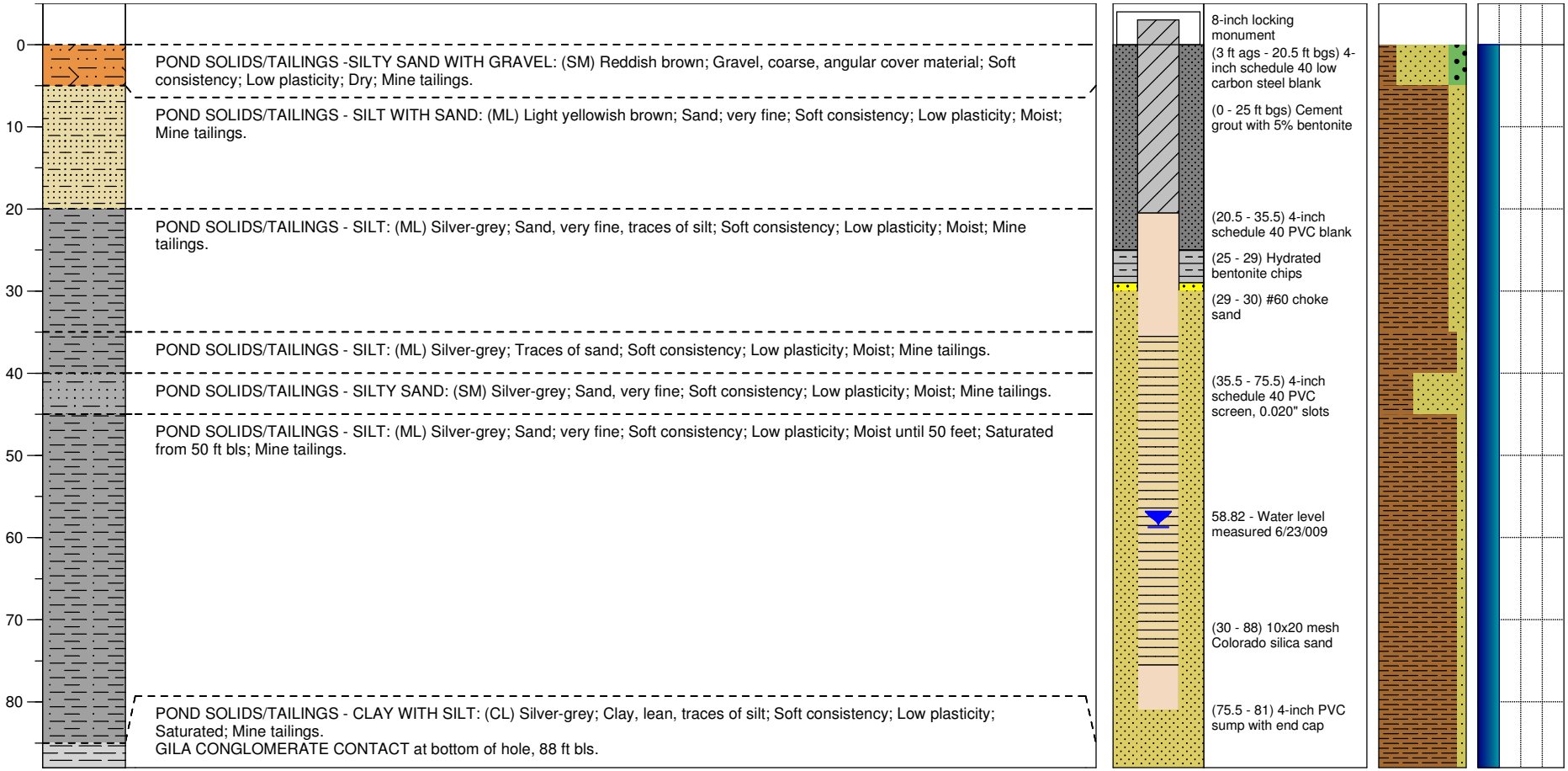
SETTLING PONDS 1 & 2 REPLACEMENT ALERT WELL -"SP 1 & 2-Alert-B"

Horizontal Datum, NAD 83; Vertical Datum NGVD29

LATITUDE:33° 18' 1.380" ELEVATION (TOC):2977.45 feet

LONGITUDE:111° 6' 14.415"

LITHOLOGY | **AS-BUILT** | **CUTTINGS SIZE** (FINES, MEDIUM, COARSE) | **REACTION TO HCl** (NONE, WEAK, MOD, STRONG)



BOREHOLE No.	SP 1 & 2- Alert- B	TOTAL DEPTH DRILLED	88	SCALE	AS SHOWN	TITLE	
ADWR REG No.	55-910699	BIT DIAMETER	8.75"	DATE	06/08/2009	**BOREHOLE LOG AND AS-BUILT DRAWING**	
LOCATION	SUPERIOR, AZ	DRILLING FLUID	AIR	DESIGN	CAP		
CLIENT	RESOLUTION COPPER MINE	LOGGED BY	JJM	CHECK	JJM		
DRILLING CO	YELLOW JACKET DRILLING	DATE STARTED	05/6/09	REVIEW	KJ		
DRILLING EQUIPMENT	SPEEDSTAR 50K-CH	DATE FINISHED	05/6/09	REV 1	FILE REPLACEMENT ALERT WELL.LDFX	Golder Associates	FIGURE 2
DRILLING METHOD	AIR ROTARY CASING HAMMER	COMMENTS	ags= above ground surface; bgs= below ground surface	PROJECT No.	073-92522-10		

TAILINGS POND 5 POC WELL

AZ STATE PLANE CENTRAL NAD 83

NORTHING: 837338 ELEVATION (TOC):2965.32

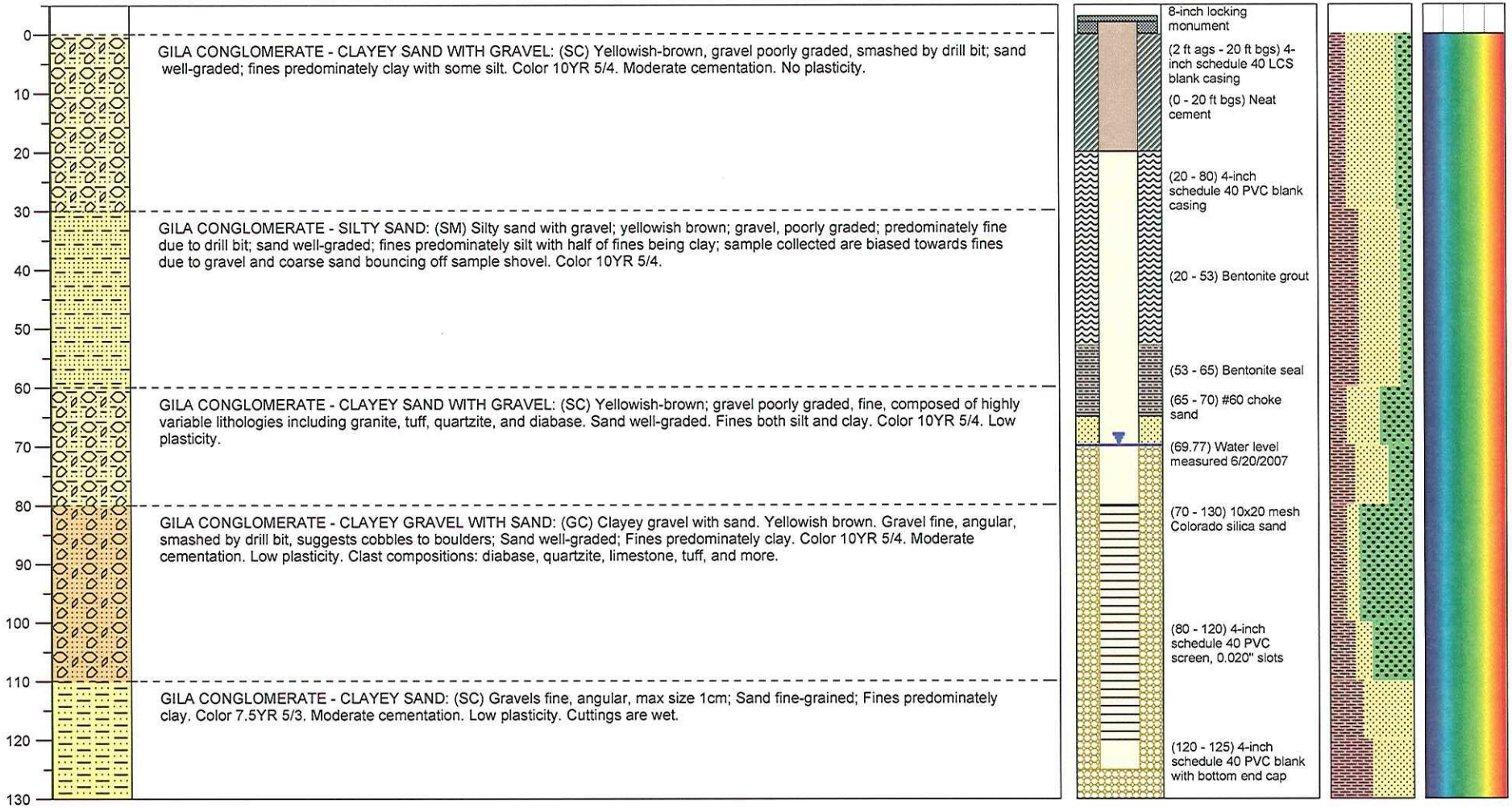
EASTING: 947439

LITHOLOGY

AS-BUILT

CUTTINGS SIZE FINES MEDIUM COARSE

REACTION TO HCI NONE WEAK MOD STRONG



BOREHOLE No.	TAILINGS POND 5 POC WELL	TOTAL DEPTH DRILLED	130 ft bgs	SCALE	AS SHOWN	TITLE
ADWR REG No.	55-907036	BIT DIAMETER	8.75"	DATE	06/07/07	**BOREHOLE LOG AND AS-BUILT DRAWING**
LOCATION	SUPERIOR, AZ	DRILLING FLUID	AIR	DESIGN	JCR	
CLIENT	RESOLUTION COPPER MINE	LOGGED BY	JJM AND KKH	CHECK	JJM	
DRILLING CO	YELLOW JACKET DRILLING	DATE STARTED	5/24/07	REVIEW	KJ	
DRILLING EQUIPMENT	SPEEDSTAR 50K-CH	DATE FINISHED	05/29/07	REV 1	FILE TP5 POC Well.ldf	Golder Associates
DRILLING METHOD	HAMMER, AIR ROTARY	COMMENTS	USCS SCALE, MUNSELL COLOR CHART	PROJECT No.	073-92522	FIGURE 2-5

Arizona Department of Water Resources
Information Management Unit
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8627 • (800) 352-8488
www.water.az.gov

Well Driller Report and Well Log

COPY

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

FILE NUMBER: D(1-12)35 CBA
WELL REGISTRATION NUMBER: 55 - 907036
PERMIT NUMBER (IF ISSUED):

SECTION 1: DRILLING AUTHORIZATION

Drilling Firm — Mail To:

NAME: YELLOW JACKET DRILLING SERVICES L L C	DWR LICENSE NUMBER: 78
ADDRESS: P.O. BOX 801	TELEPHONE NUMBER: 602-453-3252
CITY / STATE / ZIP: GILBERT, AZ, 85299-0801	FAX: 602- 453- 3258

SECTION 1: REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper Company

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP: Superior, AZ, 85273

CONTACT PERSON NAME AND TITLE: CASEY MCKEON

TELEPHONE NUMBER: 520 689-9374

FAX: 520 - 689 - 9304

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.): Tailing Pond 5

Location of Well

WELL LOCATION ADDRESS (IF ANY): 102 MAGMA HEIGHTS RD. SUPERIOR

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1 S	12 E	35	SW 1/4	NW 1/4	NE 1/4

LATITUDE			LONGITUDE		
33 °	17 '	.978 "N	111 °	06 '	.377 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ■ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2915 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ■ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*IF GPS WAS USED, GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ■ NAD-83 ☐ Other (please specify)

COUNTY: PINAL

ASSESSOR'S PARCEL ID NUMBER (MOST RECENT): BOOK – MAP – PARCEL –

SECTION 3: WELL CONSTRUCTION DETAILS

Drilling Method — CHECK ONE
- ■ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☐ Air Percussion / Odex Tubing
- ☐ Other (please specify)

Method of Well Development — CHECK ONE
- ☐ Airlift
- ■ Bail
- ■ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Method of Sealing at Reduction Points — CHECK ONE
- ■ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Condition of Well — CHECK ONE
- ■ Capped
- ☐ Pump Installed

Construction Dates
DATE WELL CONSTRUCTION STARTED: 5/25/07
DATE WELL CONSTRUCTION COMPLETED: 5/29/07

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY: R. LeBlanc
DATE: 7.1.07

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907036

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING	DEPTH OF COMPLETED WELL
130 Feet Below Land Surface	125 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
~ 120 Feet Below Land Surface	6/6/07		☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)
0	130	10

Installed Casing

DEPTH FROM SURFACE FROM (feet)	TO (feet)	OUTER (inches)	MATERIAL TYPE (T): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (T): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	80	4.5		x			x						
80	120	4.5		x							x		.040
120	125	4.5		x			x						

Installed Annular Material

DEPTH FROM SURFACE FROM (feet)	TO (feet)	ANNULAR MATERIAL TYPE (T): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
0	20			x								
20	55				x							
55	65						x					
65	130									x		10-20

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907036

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	1	Fill - Roadway AB	
1	130	BEDROCK - Gila Conglomerate	X
		TD - 130'	
		∇ - 120'	

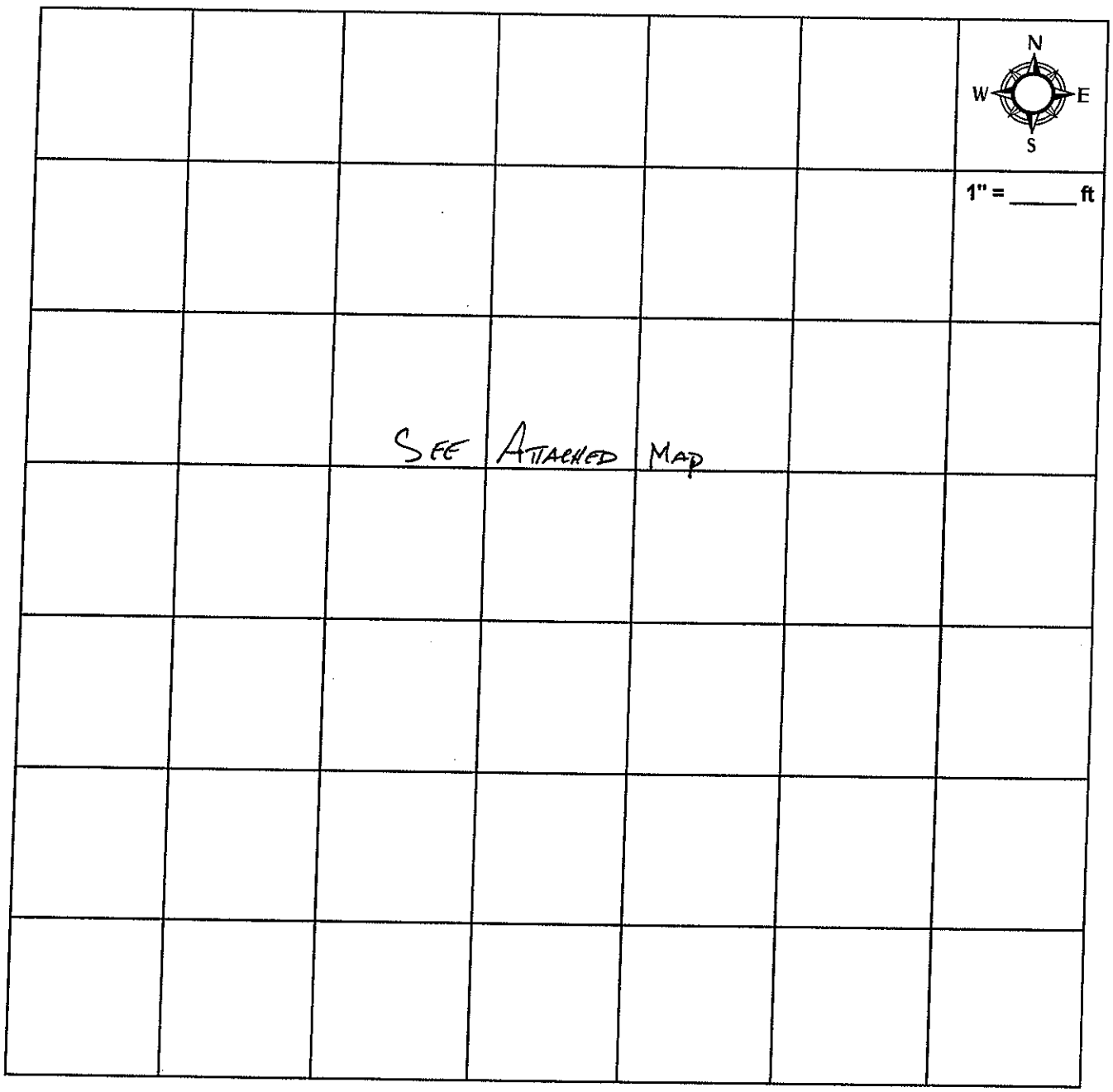
Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 907036

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
Resolution Copper Company	—	—	—

- Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- Please indicate the distance between the well location and any septic tank system or sewer system.



Arizona Department of Water Resources
Water Management Support Section
P.O. Box 458 • Phoenix, Arizona 85001-0458
(602) 771-8500 • (800) 352-8488
www.azwater.gov

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

FEE

- Review instructions prior to completing form in black or blue ink.
- You must include with your Notice:
- $150 check or money order for the filing fee.
- Well construction diagram, labeling all specifications listed in Section 6.
- Authority for fee: A.R.S. § 45-596.

AMA / INA	B	SB
RECEIVED DATE	WS	
ISSUED DATE	WQAR	CERCLA

FILE NUMBER

WELL REGISTRATION NUMBER
55 -

** PLEASE PRINT CLEARLY **

SECTION 1. REGISTRY INFORMATION

Well Type

CHECK ONE
- [x] Monitor
- [ ] Piezometer
- [ ] Vadose Zone
- [ ] Air Sparging
- [ ] Soil Vapor Extraction
- [ ] Other (*please specify*):

Proposed Action

CHECK ONE
- [x] Drill New Well
- [ ] Deepen
- [ ] Modify

If Deepening or Modifying:
WELL REGISTRATION NUMBER
55 -

Location of Well

WELL LOCATION ADDRESS (IF ANY)
102 MAGMA HEIGHTS, SUPERIOR, AZ

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	35	SW ¼	NW ¼	NE ¼

COUNTY ASSESSOR'S PARCEL ID NUMBER
BOOK | MAP | PARCEL

COUNTY WHERE WELL IS LOCATED
PINAL

SECTION 2. OWNER INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER COMPANY

MAILING ADDRESS
102 MAGMA HEIGHTS

CITY / STATE / ZIP CODE
SUPERIOR AZ 85273

CONTACT PERSON NAME AND TITLE
CASEY McKEON

TELEPHONE NUMBER: 520-689-9374
FAX: 520-689-9304

Landowner (if different from Well Owner)

FULL NAME OF COMPANY, GOVERNMENT AGENCY, OR INDIVIDUAL

MAILING ADDRESS

CITY / STATE / ZIP CODE

CONTACT PERSON NAME AND TITLE

TELEPHONE NUMBER | FAX

SECTION 3. DRILLING AUTHORIZATION

Drilling Firm

NAME

DWR LICENSE NUMBER | ROC LICENSE CATEGORY

TELEPHONE NUMBER | FAX

E-MAIL ADDRESS

Consultant (if applicable)

CONSULTING FIRM
GOLDER ASSOCIATES INC.

CONTACT PERSON NAME
JOHN J. MALUSA

TELEPHONE NUMBER: 520-888-8818
FAX: 520-888-8817

E-MAIL ADDRESS
jmalusa@golder.com

SECTION 4.

Questions	Yes	No	Explanation:
1. Are all annular spaces between the casing(s) and the borehole for the placement of grout at least 2 inches?	✓		2-inch annular spaces are special standards required for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
2. Is the screened or perforated interval of casing greater than 100 feet in length?		✓	100-foot maximum screen intervals are a special standard for wells located in and near groundwater contamination sites (such as CERCLA, WQARF, DOD, LUST).
3. Are you requesting a variance to use thermoplastic casing in lieu of steel casing in the surface seal?		✓	The wells must be constructed in a vault as defined in A.A.C. R12-15-801(27).
4. Is there another well name or identification number associated with this well? (e.g., MW-1, PZ2, 06-04, etc.)		✓	IF YES, PLEASE STATE
5. Have construction plans been coordinated with the Arizona Department of Environmental Quality?	✓		IF YES, PLEASE STATE AGENCY CONTACT & PHONE NUMBER KRISTIE KILGORE - WQ DIVISION 602-771-4632
6. For monitor wells, is dedicated pump equipment to be installed?	✓		IF YES, PLEASE STATE DESIGN PUMP CAPACITY 15 Gallons per Minute
7. Is this well a new well located in an Active Management Area **AND** intended to pump water for the purpose of remediating groundwater?		✓	IF YES, UNLESS THE WELL IS A REPLACEMENT WELL AND THE TOTAL NUMBER OF OPERABLE WELLS ON THE SITE IS NOT INCREASING, YOU MUST ALSO FILE A SUPPLEMENTAL FORM A.R.S. § 45-454(C) & (F). *(See instructions)*
8. Will the well registration number be stamped on the vault cover or on the upper part of the casing?		✓	IF NO, WHERE WILL THE REGISTRATION NUMBER BE PLACED? ETCHED INTO CEMENT PAD PRIOR TO DRYING

Notice of Intent to Drill, Deepen, or Modify a *Monitor / Piezometer / Environmental* Well

WELL REGISTRATION NUMBER
55 -

SECTION 5. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ONE

- ☐ Air Rotary
- ☐ Bored or Augered
- ☐ Cable Tool
- ☐ Dual Rotary
- ☐ Mud Rotary
- ☐ Reverse Circulation
- ☐ Driven
- ☐ Jetted
- ☑ Air Percussion / Odex Tubing
- ☐ Other (*please specify*):

MAY 18, 2007
DATE CONSTRUCTION TO BEGIN

Method of Well Development

CHECK ONE

- ☐ Airlift
- ☑ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Method of Sealing at Reduction Points

CHECK ONE

- ☑ None
- ☐ Welded
- ☐ Swedged
- ☐ Packed
- ☐ Other (*please specify*):

Grout Emplacement Method

CHECK ONE

- ☐ Gravity
- ☐ Pressure Grout
- ☑ Tremie
- ☐ Other (*please specify*):

Surface or Conductor Casing

CHECK ONE

- ☐ Flush Mount in a vault
- ☑ Extend 1' above grade

SECTION 6. PROPOSED WELL CONSTRUCTION PLAN (attach additional page if needed)

Attach a well construction diagram labeling all specifications below.

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	260	9

Casing

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	OUTER DIAMETER (inches)	MATERIAL TYPE (T): STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	PERFORATION TYPE (T): BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE IF ANY (inches)
0	20	5	✓										
20	210	5		✓			✓						
210	250	5		✓							✓		0.020

Annular Material

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	ANNULAR MATERIAL TYPE (T): NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE: GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	FILTER PACK: SAND	GRAVEL	SIZE
0	22				✓							
22	195						✓					
195	200								#60 CHOKE SAND			
200	260									✓		10-20

IF THIS WELL HAS NESTED CASINGS, SPECIFY NUMBER OF CASING STRINGS

EXPECTED DEPTH TO WATER 220 Feet Below Ground Surface

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

TYPE OR PRINT NAME AND TITLE: Casey McKeon, Environmental Supervisor

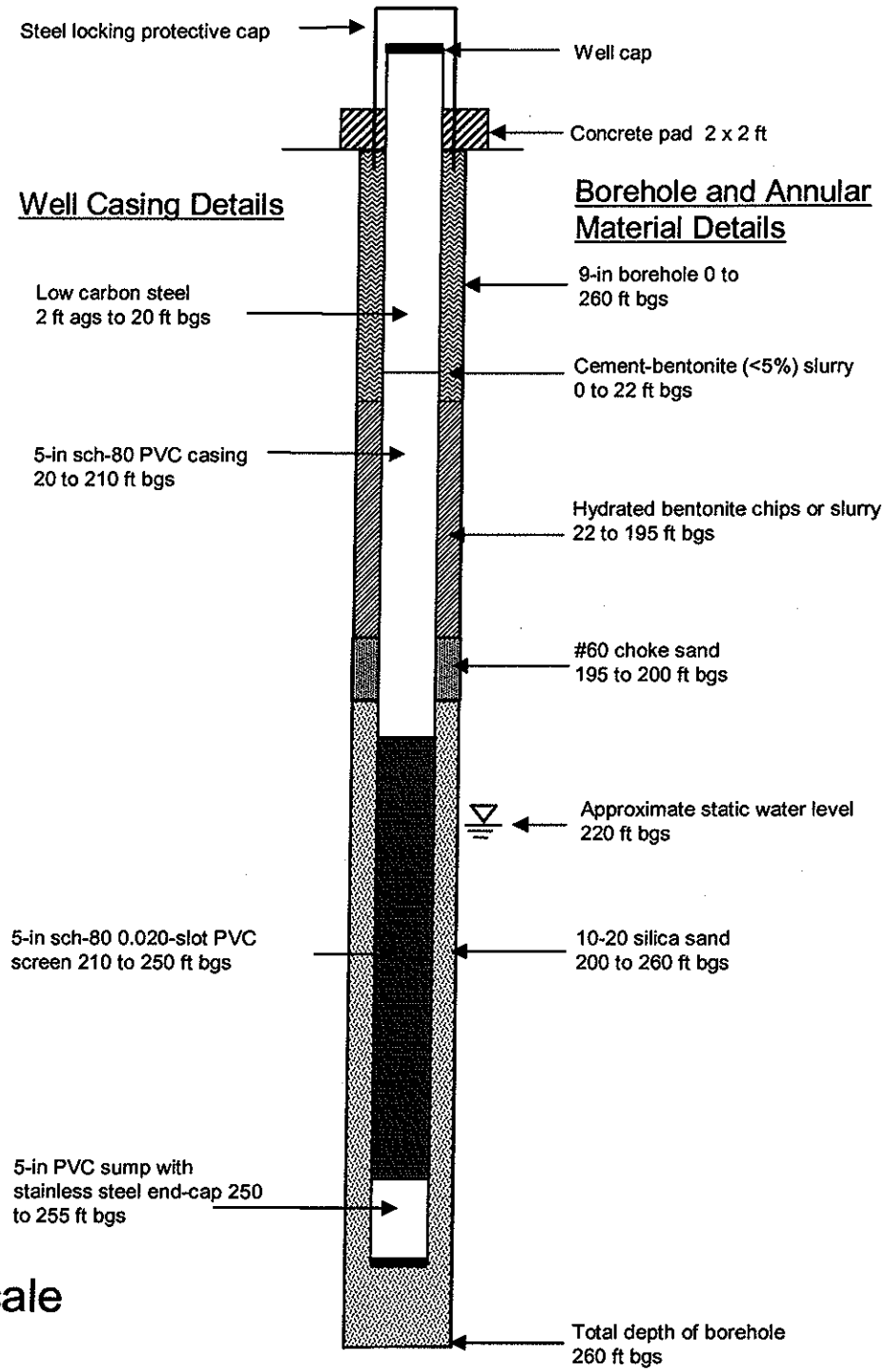
SIGNATURE OF WELL OWNER: Casey McKeon DATE: 5-11-07

TYPE OR PRINT NAME AND TITLE

SIGNATURE OF LANDOWNER, IF APPLICABLE (SEE INSTRUCTIONS) DATE

Well Construction Schematic

Proposed **Tailings Pond 5**
Point of Compliance Well



Not to Scale

Notes:
ft ags = feet above ground surface
ft bgs = feet below ground surface

Golder Associates

Project number: 053-2519-100.000

TAILING POND 5 REPLACEMENT POC WELL-"TP5-POC-B"

Horizontal Datum, NAD 83; Vertical Datum NGVD29

LATITUDE: 33° 18' 0.389" ELEVATION (TOC): 3024.58 feet

LONGITUDE: 111° 6' 25.805"

LITHOLOGY

SILTY SAND: (SM) Light brown; Gravel, fine; Sand, well-graded; Low plasticity; Dry.

SILTY SAND: (SM) Light brown; Sand, fine poorly-graded; No plasticity; Dry.

SILTY GRAVEL WITH SAND: (GM) Light brown;Gravel, fine; Sand, well-graded; Traces of calcite veins; No plasticity.

SILTY SAND: (SM) Light brown; Sand, fine, poorly-graded; No plasticity.

SILTY GRAVEL WITH SAND: (GM) Light reddish-brown; Gravel, fine; Sand, fine, poorly graded; No plasticity.

SILTY GRAVEL WITH SAND: (GM) Light grey-brown; Gravel, poorly-graded; No plasticity; Abundant limestone clasts.

GRAVEL WITH SILT AND SAND: (GM) Light grey-brown; Gravel, angular; No plasticity.

SILTY SAND AND GRAVEL: (SM) Light grey-brown; No plasticity.

SILTY SAND: (SM) Light brown sand; Gravel, fine, angular; Silt with trace clay, well-graded; Low plasticity.

SILTY SAND AND GRAVEL: (SM) Brown; Gravel, well-graded; Silt with trace clay, well graded; Low plasticity; Abundant limestone and Apache Leap clasts.

SILTY SANDY GRAVEL: (GM) Brown; Sand, well-graded; Silt with traces clay, angular, well-graded; Low plasticity.

AS-BUILT

8-inch locking monument

(3 ft ags - 20 ft bgs) 4-inch schedule 40 LCS blank

(0 - 20) 12-inch conductor casing

(0 - 72.5 ft bgs) Cement grout with 5% bentonite

(20 - 90) 4-inch schedule 40 PVC blank

(72.5 - 77.5) Hydrated bentonite pellets

(77.5 - 80.5) #60 choke sand

(90 - 130) 4-inch schedule 40 PVC screen, 0.020" slots

106.35 Water level measured 6/23/2009

(80.5 - 141) 10x20 mesh Colorado silica sand

(130 - 135.5) 4-inch PVC sump with bottom end cap

(141 - 182) 3/8" bentonite chip hole plug

CUTTINGS SIZE: FINES, MEDIUM, COARSE

REACTION TO HCl: NONE, WEAK, MOD, STRONG

BOREHOLE No.	TP5-POC-B	TOTAL DEPTH DRILLED	180	SCALE	AS SHOWN
ADWR REG No.	55-910698	BIT DIAMETER	16.5 down to 20'; 8.75 from 20-182'	DATE	06/22/2009
LOCATION	SUPERIOR, AZ	DRILLING FLUID	AIR	DESIGN	CAP
CLIENT	RESOLUTION COPPER MINE	LOGGED BY	JJM	CHECK	JJM
DRILLING CO	YELLOW JACKET DRILLING	DATE STARTED	05/7/09	REVIEW	KJ
DRILLING EQUIPMENT	SPEEDSTAR 50K-CH	DATE FINISHED	06/16/09	REV 1	FILE REPLACEMENT TP5 WELL.LDFX
DRILLING METHOD	AIR ROTARY	COMMENTS	ags: above ground surface; bgs: below ground surface	PROJECT No.	073-92522-10

TITLE

BOREHOLE LOG AND AS-BUILT DRAWING

Golder Associates

FIGURE 3

APPENDIX K
DEMONSTRATION OF FINANCIAL CAPABILITY