MONTGOMERY
& ASSOCIATES
Water Resource Consultants

REPORT

October 18, 2017

Prepared for: RESOLUTION COPPER

Construction, Development, & Testing of Hydrologic Test Wells at the Near West Tailings Site

RESOLUTION COPPER, PINAL COUNTY, ARIZONA

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

October 18, 2017

REPORT

Construction, Development, & Testing of Hydrologic Test Wells at the Near West Tailings Site

RESOLUTION COPPER, PINAL COUNTY, ARIZONA

Contents

Contents – continued

Contents – continued

Contents – continued

Contents – continued

Tables

Illustrations

Illustrations – continued

Appendices

1 INTRODUCTION

At the request of Resolution Copper (RC), Montgomery & Associates (M&A) has prepared this report to summarize results of drilling, construction, and testing of hydrologic test wells DS16-01 through DS17-17, and piezometers DS17-18 and DS17-19 at the Near West Site. The wells were drilled to provide hydrogeologic characterization of the groundwater system in the vicinity of the proposed tailings storage facility currently planned by RC northwest of Superior, Arizona. Results of the drilling program will be used as baseline information to support the development of the RC Environmental Impact Statement (EIS).

Figure 1 is a geologic map for the Near West area and shows locations of the hydrologic test wells. Well construction details are summarized in **Table 1** and shown on **Figures 2 through 19**.

1.1 Objectives

In general, the purpose of the hydrogeologic investigation was to characterize: (1) the first groundwater encountered, (2) principal hydrogeologic units and structural features, (3) occurrence and movement of groundwater, (4) chemical quality of groundwater, and (5) hydraulic properties of the principal aquifers. In most cases the wells were completed to target groundwater occurrence; however, in a few cases, the wells were completed to provide locations where vertical gradients could be examined with collocated geotechnical piezometers.

1.2 Location

The Near West Site encompasses an area of approximately 20 square miles west-northwest from Superior, Arizona. The site is shown on **Figure 1** and includes all or parts of Sections 13, 22, 23, 24, 25, 26, 27, 35, and 36, T. 1 S., R. 11 E., all or parts of Sections 19, 21, 28, 29, 30, 31, and 33, T. 1 S., R. 12 E., parts of Sections 1 and 2, T. 2 S., R. 11 E., and part of Section 6, T. 2 S., R. 12 E., in Pinal County, Arizona. The Near West Site is located on land managed by the U.S. Forest Service, Tonto National Forest.

1.3 Project Planning and Coordination

The wells were drilled in accordance with technical specifications prepared by RC. RC coordinated drilling contractor activities. Daily drilling reports were prepared by drilling contractor personnel and were submitted to RC for review. M&A provided daily summaries of drilling progress during drilling and testing operations. Daily summary reports are provided in **Appendix A**.

1.4 Drilling and Construction Contractors

Wells DS16-01 through DS17-16 were drilled and constructed during the period September 10, 2016 through February 3, 2017, by National EWP (National), Gilbert, Arizona, using a Schramm T685WS top-head drive rotary drill rig. Multiple drilling methods were used depending on drilling conditions encountered and goals for each well. Drilling methods included:

1. Conventional air rotary
2. Dual-wall air reverse circulation
3. Dual-wall air-assisted flooded-reverse circulation

Surface boreholes were drilled using the conventional air rotary drilling method. The production boreholes were primarily drilled using dual-wall air reverse circulation. In a few instances, when borehole stability or management of air-lifted formation fluids became a concern, the dual-wall air-assisted flooded reverse circulation method was used.

Wells DS17-17 through DS17-19 were drilled by National using a Boart Longyear LS^{TM}600 sonic core rig. Wells were drilled and constructed during the period February 7 through 11, 2017.

Other contractors involved during well installation phases include:

- Southwest Exploration Services, LLC (SWE), Gilbert, Arizona: SWE provided borehole geophysical logging services.
- Jonovich Company, Inc., Globe, Arizona: Jonovich provided fluid management services for removal of drill cuttings and drilling fluids.
- Shephard-Wesnitzer, Inc. (SWI), Flagstaff, Arizona: SWI conducted wellhead coordinate surveys.

1.5 Permits

1.5.1 Notices of Intent to Drill

National obtained drill cards from the Arizona Department of Water Resources on behalf of RC. National filed Notice of Intent to Drill forms using the electronic filing system.

1.5.2 AZPDES De Minimis Discharge Authorization

RC amended the Project-wide De Minimis Discharge Authorization (AZDGP-60821) under the Arizona Pollutant Discharge Elimination System to include testing and periodic sampling of the Near West wells.

2 FIELD PROCEDURES AND INVESTIGATIONS

2.1 Monitoring of Drilling Conditions

During drilling of DS16-01 through DS17-16, drill penetration rate was monitored by National by recording drill start and stop times for each 20-foot drill rod. In addition to drill penetration rate, National monitored rotational torque and zones of variable or increasing torque were noted as a potential indicator of fracturing. The technical data sheets (Bit Run Sheets) recorded by National were provided to M&A. Bit Run Sheets for each well are provided in **Appendix B**.

During drilling of DS16-01 through DS17-16, water was added as needed to maintain circulation and remove drill cuttings. Drilling fluid additives were not used except during drilling of DS16-08, DS16-09, and DS16-13. At these locations, the borehole became unstable during geophysical logging or well construction and bentonite or polymer-based additives were used to stabilize the borehole after drilling to total depth. Wells DS17-17 through DS17-19 were drilled without drilling fluid additives so that field personnel could document depth of saturation in the near surface alluvium.

2.2 Monitoring of Lithologic Conditions

During drilling of DS16-01 through DS17-16, drill cuttings samples were collected for 10-foot composite intervals and placed in labeled bags. During drilling of DS17-17 through DS17-19, continuous soil and rock core samples were extruded into plastic sleeves. The core sleeves were cut open and the cores were photographed prior to preparing descriptions.

Lithologic descriptions were prepared by M&A field personnel. For DS16-01 through DS17-16, sample descriptions were prepared for each bagged sample. For the DS17-17 through DS17-19 cores, sample descriptions were prepared for each notable change in cored material. Samples for each described interval were placed in plastic chip trays and were provided to RC. Bulk cuttings samples were bagged and provided to RC for subsequent analyses. Five-gallon bulk samples were provided to Klohn Crippen Berger for geotechnical testing. Detailed lithologic descriptions for each well based on drill cuttings samples or cores are provided in **Appendix C**. Core photographs for DS17-17 through DS17-19 are also included in **Appendix C**. Depths to contacts for principal hydrogeologic units at DS16-01 through DS17-16 were refined using sample descriptions in combination with borehole geophysical logs. Summary geologic units encountered at each well are shown on **Figures 2 through 20**.

2.3 Borehole Geophysical Logging

Borehole geophysical logging was conducted after the borehole for each well was drilled to total depth, except for wells DS17-17 through DS17-19 where geophysical logging was not conducted because a casing advancement drilling method was used. The SWE standard borehole geophysical logging suites generally included: natural gamma ray, caliper, fluid resistivity, temperature, E-logs (single point resistance, focused resistivity, and spontaneous potential), dual induction, sonic, acoustic borehole imaging (ABI), optical borehole imaging (OBI), and borehole deviation. In general, E-logs, sonic, and ABI logs were obtained in the saturated part of the boreholes, and dual induction and OBI logs were obtained in the unsaturated part of the boreholes. Nuclear magnetic resonance (NMR) logging was included as a part of the suite for selected wells. At DS17-18 (GT-43), NMR logging was conducted in June 2017 after the well was completed. A borehole video was obtained at DS17-16 to view water inflow to the borehole.

SWE provided field and final data in digital format to M&A and RC staff. Final borehole geophysical logs are provided in **Appendix D**.

2.3.1 Log Interpretation

Preliminary borehole geophysical logs were used in combination with lithologic descriptions for placement depths of perforated intervals and locations for annular grouted-in vibrating-wire piezometers (VWPs). Final geophysical logs were reviewed to refine formation contacts. The summary lithologic logs shown on **Figures 2 through 17** reflect the adjusted formation and sub-unit contacts based on interpretation of geophysical logs. Quantitative analyses of image logs (ABI and OBI) for fracture intensity and orientation were conducted by RC staff and SWE.

2.4 Monitoring of Groundwater Conditions

When the dual-wall air reverse circulation drilling method was used it was possible to monitor for the presence of groundwater and to determine approximately where groundwater inflow zones were encountered. Observations of groundwater production rate were made after drilling each 20-foot drill rod at depths where groundwater was anticipated. Three methods of groundwater monitoring were used to determine groundwater inflow during drilling operations:

- After drilling to the bottom of a drill rod, injection water was cut off from the airstream, and air circulation was continued for 10 to 15 minutes. When discharge stabilized, discharge rate was measured using a staff gauge in a calibrated storage tank. Water production could not be monitored when drilling with the dual-wall flooded reverse method.

- The presence or absence of groundwater in the borehole was periodically verified using an electronic sounder when groundwater production was not observed during drilling. A sounder was lowered through the center of the dual wall drill pipe to measure water level above the drill bit.

- Short-term (2 to 3-hour) recovery tests were conducted through the drill string in the open borehole approximately every 100 feet during drilling. A sounder was used to determine presence/absence of water in the borehole, and to measure the rate of water level recovery.

Water levels could not be obtained while drilling with the sonic core method. Approximate water levels were determined by observing the moisture content of the soil core.

Selected wells were temporarily equipped with Level TROLL integrated pressure transducer and datalogger (Level TROLL) units following well construction and development to monitor groundwater level recovery where the recovery was anticipated to be slow based on groundwater monitoring during drilling operations.

After each well was constructed and developed, it was incorporated into weekly water level monitoring rounds directed by RC staff. **Appendix E** includes hydrographs of the wells and the paired geotechnical piezometers. The Level TROLL data is included on the hydrographs provided in **Appendix E**.

2.5 Well Construction Materials

Well construction materials were procured by National on behalf of RC. For DS16-01 through DS17-16, surface casing consists of 20 feet of 12-inch diameter blank low carbon steel well casing. Production casing consists of 4-inch ID (4-1/2-inch OD) flush threaded (HWT) blank and perforated steel. Perforations consist of 2-1/2-inch long by 1/8-inch wide machine cut slots, 2 slots per round, 4 rounds per foot, staggered. Filter pack consists of 1/4-inch by 1/8-inch diameter well sorted sub-rounded gravel.

For DS17-17 through DS17-19, well casing consists of Schedule 40 flush-threaded blank and slotted PVC. Slotted casing consists of factory-slotted 0.020-inch screen. DS17-17 was completed with 4-inch diameter casing, and DS17-18 and DS17-19 were completed with 2-inch diameter casing. Filter pack consists of Colorado Silica Sand (10-20).

A mixture of cement (95 percent) and bentonite (5 percent), and/or bentonite chips (3/8-inch) were used for annular seals.

Grouted-in VWPs were installed in the annular space at wells DS16-05, DS16-12, DS16-13, and DS17-16. The depths and locations of the VWPs were selected to measure vertical gradients within specific units at the Near West Site. Geokon Model 4500S Standard Piezometers (VW) were installed at all locations with pressure ratings selected based on the depth of the installation. The VWP was strapped to the 4-1/2-inch HWT well casing and steel casing centralizers were placed at a minimum of every 100 feet to protect the VWP cable. After the casing and VWPs were installed in the borehole, a pressure grout mixture was emplaced in the annulus by National consisting of the following ratio by weight: 2.5 parts water: 1 part cement: 0.3 part bentonite. All VWPs are connected to an RST DT2485 DT-BUS Data Logger for transducer communication and data retrieval.

2.6 Well Development

Following casing installation at wells DS16-01 through DS17-16, the perforated interval(s) of each well was (were) developed by air-lift surging and pumping to remove fine particles from the aquifer and gravel pack immediately around the well screen in order to increase permeability and thus to decrease the resistance to flow of water into the well. In most cases, a short-term air-lift test was conducted at the end of development to further develop the well, obtain preliminary aquifer parameters for specification of dedicated pump equipment, and obtain a water quality screening sample.

Water levels were measured during air-lifting using a Level TROLL strapped to the airline (open-ended drill pipe) approximately 5 feet above the bottom of the airline. Following air-lift development and testing, water levels were allowed to recover for a period of time equal to pumping prior to removing the airline and Level TROLL. During air-lift pumping the discharge head did not allow for manual measurement of water levels. During recovery, water levels were also manually measured using an electric sounder.

During development M&A measured discharge water quality parameters including temperature, pH, and specific electrical conductance using a Myron L® Ultrameter II, measured turbidity using a Hach DS/850 Colorimeter, and measured sediment content using an Imhoff cone. Development was conducted until water quality parameters stabilized and discharge water was sediment free.

Wells DS17-17 through DS17-19 were developed by swabbing and pumping during the period March 14 to 15, 2017. Each well was initially developed using a portable Geotech bladder pump to remove fill at the bottom of the well. Following removal of fill material, each well was swabbed using a 4-foot length of PVC pipe filled with sand. After swabbing, the Geotech pump was re-installed and pumped until water quality parameters stabilized and discharge water was sediment free, generally between 2 and 6 hours. During development, field staff measured discharge water quality parameters and sediment content.

2.7 Dedicated Pumping Equipment

M&A conducted a preliminary evaluation of air-lift development data, and provided recommendations for dedicated pumping equipment for testing and sampling. National procured and installed dedicated pumps during the period February 21 through March 2, 2017.

Each well was equipped with one 1-inch Schedule 40 PVC sounder/transducer access tube which extends from the wellhead to the top of the pump. The access tube was capped on the bottom and perforated with two drilled holes every foot in the lowermost 20 feet.

3 WELL DRILLING, CONSTRUCTION, AND EQUIPPING

Seventeen hydrologic test wells and two piezometers were drilled in support of baseline data collection for the Near West tailings site. The wells were completed in the following hydrogeologic units:

Formation	Screened Wells	Grouted-in Vibrating Wire Transducers
Quaternary Alluvium (Qal)	**1 well:** DS17-17	NA
Gila Conglomerate (Tg)	**2 wells:** DS16-10, DS16-14	**1 well:** DS17-16
Tertiary Tuff (Tt)	NA	**1 well:** DS16-13
Perlite (Tfp)	**1 well:** DS16-03	NA
Tertiary Basalt (Tb)	**3 wells:** DS16-01 (partial), DS17-15, DS17-16	NA
Apache Leap Tuff (Tal)	**3 wells:** DS16-02, DS16-11, DS16-13	NA
Diabase (pCdiab)	**1 well:** DS16-12	NA
Mescal Limestone (pCmls)	**2 wells:** DS16-01 (partial), DS16-04	**1 well:** DS16-12
Dripping Spring Quartzite (pCds)	**2 wells:** DS16-07, DS16-08 (partial)	NA
Pinal Schist (pCpi)	**6 wells:** DS16-05, DS16-06, DS16-08 (partial), DS16-09, DS17-18, DS17-19 (weathered schist)	**1 well:** DS16-05

NA = Not applicable

The following criteria were considered in designing the wells:

- drill cuttings or core samples
- drillers' bit run sheets
- borehole geophysical logs
- water production during drilling
- groundwater levels monitored during drilling
- potential pairing with a geotechnical piezometer

At wells DS16-01 through DS17-16, well installation operations began by drilling a surface borehole to approximately 20 feet below land surface (bls) using the conventional air rotary method. Following drilling of the surface borehole, 12-inch diameter blank steel surface casing was centered in the borehole and cemented in place. The cement was allowed to cure a minimum 6 hours prior to commencement of drilling of the production interval of the well.

3.1.1 Wellhead Completion

Wells DS16-01 through DS17-16 were secured with a surface completion consisting of an extension of the 12-inch diameter steel surface casing to approximately 3 feet above land surface. The casing extension is cemented in place and secured with a locking cap.

Wells DS17-17 through DS17-19 were secured with a surface completion consisting of a 5-foot length blank steel casing that was installed after the wells were constructed. An area around each well casing was excavated to allow for placement of a steel monument vault. Each monument vault extends 2 feet bls and 3 feet above land surface. The vaults are cemented in place and secured with a locking cap. At DS17-17 and DS17-18, the monument vaults consist of 10-inch diameter steel, and at DS17-19, the monument vault is 8-inch diameter steel.

3.1.2 Well Completion Reports

A Well Completion Report for each well was submitted to ADWR by National after review by M&A. Imaged records on file with ADWR are given in **Appendix F**.

3.1.3 Wellhead Survey

A wellhead coordinate survey was conducted by SWI. Results of the wellhead survey are given in **Appendix G**. Survey results are summarized in **Table 1**.

3.2 Well DS16-01

DS16-01 was drilled and constructed during the period September 10 through 17, 2016. The location for DS16-01 is shown on **Figure 1**. A schematic diagram of well construction for DS16-01 is shown on **Figure 2**. A photograph of the drill site is shown below:

Drill Site Layout at Well DS16-01

3.2.1 Drilling Operations

At DS16-01, the production interval of the borehole was drilled using the dual-wall air reverse circulation method until high water production rates and onsite fluid management beginning at a depth of 450 feet made it necessary to change to the air-assisted flooded reverse method.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 2** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 450	dual-wall, air reverse circulation	hammer	10-3/4
450 – 875	dual-wall, flooded reverse circulation	tricone	9-7/8

3.2.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log are summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 800
Caliper	0 – 876
Natural Gamma Ray	0 – 876
Temperature	50 – 876
Fluid Resistivity	50 – 876
E-Log	80 – 876
Borehole Imaging Acoustic Televiewer	49 – 876
Sonic	48 – 876

Final borehole geophysical logs for DS16-01 are provided in **Appendix D**.

3.2.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-01 are given in **Appendix C; Table C-1**. A summary log of geologic units encountered at DS16-01 is shown on **Figure 2** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 338	Gila Conglomerate (Tg)
338 – 352	Sandstone (Tss)
352 – 440	Basalt (Tb)
440 – 528	Mescal Limestone (pCmls)
528 – 636	Dripping Spring Quartzite – Upper (pCdsu)
636 – 681	Dripping Spring Quartzite – Lower (pCdsl)
681 – 830	Pioneer Formation (pCp)
830 – 875	Diabase (pCdiab)

3.2.4 Well Construction

Well construction details for DS16-01 are provided in **Table 1** and on **Figure 2**.

DS16-01 was constructed with a perforated interval from 419 to 499 feet bls, and a gravel pack interval from 409 to 535 feet bls in the Tb and pCmls. This interval was selected to target:

- first groundwater encountered in the pCmls at 450 feet bls
- high water production rate measured at 190 gallons per minute (gpm) at 450 feet bls
- aquifer parameters for the pCmls
- water quality for the pCmls
- a fracture zone observed in geophysical logs

3.2.5 Well Development

Following casing installation, the production interval at well DS16-01 was developed by 4 hours of air-lift pumping on September 18, 2016. Depth to pre-pumping water level was 38.6 feet bls. The discharge rate ranged from 38 to 72 gpm; average rate was 53 gpm. Water level recovery was measured for 4 hours; groundwater level recovered to the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at 190 gpm at 450 feet bls prior to changing to the flooded reverse circulation drilling method. The maximum air-lift pumping rate measured in the completed well was 72 gpm, which is substantially lower the rate measured during drilling.

3.2.6 Pump Installation

A dedicated pump assembly for DS16-01 was installed by National on March 2, 2017. The pump information is summarized below:

	DS16-01
Grundfos Model	77 S100-17
Motor Type	Three-phase Grundfos Electric Motor
Motor Horsepower	10
Motor Voltage	460
Schedule 120 PVC Pump Column Diameter (inches)	1.5
Approximate Depth to Pump Intake (feet bls)	403.7

3.3 Well DS16-02

DS16-02 was drilled and constructed during the period September 19 through 23, 2016. The location for DS16-02 is shown on **Figure 1**. A schematic diagram of well construction for DS16-02 is shown on **Figure 3**. A photograph of the drill site is shown below:

Drill Site Layout at Well DS16-02

3.3.1 Drilling Operations

At DS16-02, the production interval of the borehole was drilled using the dual-wall air reverse circulation method to a total depth of 500 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 3** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 500	dual-wall, air reverse circulation	hammer	10-3/4

3.3.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 400
Caliper	0 – 495
Temperature	0 – 503
Fluid Resistivity	220 – 497
Natural Gamma Ray	0 – 494
E-log	220 – 500
Borehole Imaging Acoustic Televiewer	208 – 497
Borehole Imaging Optical Televiewer	18 – 230
Sonic	213 – 494

Final borehole geophysical logs for DS16-02 are provided in **Appendix D**.

3.3.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-02 are given in **Appendix C; Table C-2**. A summary log of geologic units encountered at DS16-02 is shown on **Figure 3** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 172	Gila Conglomerate (Tg)
172 – 447	Apache Leap Tuff (Tal)
447 – 500	Pinal Schist (pCpi)

3.3.4 Well Construction

Well construction details for DS16-02 are provided in **Table 1** and on **Figure 3**.

DS16-02 was constructed with two perforated intervals from 290 to 330 feet bls and 390 to 450 feet bls. The open intervals are from 277 to 346 feet bls and 367 to 455 feet bls in the Tal. The upper open interval was selected to target:

- first groundwater encountered in the Tal at 300 feet bls
- high water production rate (approximately 25 gpm) measured at 300 feet bls
- aquifer parameters for the Tal
- water quality for the Tal

- minor fractures observed in the geophysical logs where groundwater production was first encountered

The lower open interval was selected to target:

- sustained production rate (14 gpm) within the Tal
- highly fractured zone observed in the geophysical logs from 400 to 440 feet bls

3.3.5 Well Development

Following casing installation, the production intervals at well DS16-02 were developed by 4 hours of air-lift pumping on September 23, 2016. A 3.5-hour air-lift test was conducted after allowing water level to recover for 1.2 hours. Depth to pre-pumping water level was 165 feet bls. The discharge rate ranged from 7 to 17 gpm; average rate was 10 gpm. Water level recovery was measured for 3.5 hours; groundwater level recovered to 88 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 11.5 to 27.6 gpm over the screened intervals. The maximum air-lift pumping rate measured in the completed well was 17 gpm, which is within the range of rates measured during drilling.

3.3.6 Pump Installation

A dedicated pump assembly for DS16-02 was installed by National on February 23, 2017. The pump information is summarized below:

	DS16-02
Grundfos Model	15SQ-290
Motor Type	Single-phase Grundfos
Motor Horsepower	1.5
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.25
Approximate Depth to Pump Intake (feet bls)	278.8

3.4 Well DS16-03

DS16-03 was drilled and constructed during the period September 25 through October 4, 2016. The location for DS16-03 is shown on **Figure 1**. A schematic diagram of well construction for DS16-03 is shown on **Figure 4**. A photograph of the drill site is shown below:

Drill Site Layout at Well DS16-03

3.4.1 Drilling Operations

At DS16-03, the production interval of the borehole was drilled using the dual-wall air reverse circulation method until high water production rates and onsite fluid management beginning at a depth of 140 feet made it necessary to change to the air-assisted flooded reverse method.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 4** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 140	dual-wall, air reverse circulation	hammer	10-3/4
140 – 715	dual-wall, flooded reverse circulation	tricone	9-7/8

3.4.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 650
Caliper	0 – 717
Temperature	0 – 717
Natural Gamma Ray	0 – 717
Fluid Resistivity	33 – 717
E-Log	0 – 717
Borehole Imaging Acoustic Televiewer	30 – 717
Sonic	35 – 717

Final borehole geophysical logs for DS16-03 are provided in **Appendix D**.

3.4.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-03 are given in **Appendix C; Table C-3**. A summary log of geologic units encountered at DS16-03 is shown on **Figure 4** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 121	Gila Conglomerate (Tg)
121 – 400	Picketpost Mountain Felsic Lava Flows – Perlite (Tfp)
400 – 612	Picketpost Mountain Felsic Lava Flows – Rhyolite (Tfp)
612 – 689	Picketpost Mountain Felsic Tuffs – Ashflow Tuff (Tfpt)
689 – 715	Picketpost Mountain Felsic Tuffs (Tfpt)

3.4.4 Well Construction

Well construction details for DS16-03 are provided in **Table 1** and on **Figure 4**.

DS16-03 was constructed with a perforated interval from 130 to 220 feet bls, and a gravel pack interval from 119 to 252 feet bls in the Tfp. This interval was selected to target:

- first groundwater encountered in perlite (Tfp) at 140 feet bls
- high production rate measured at 47 gpm at 140 feet bls
- aquifer parameters for the Tfp
- water quality for the Tfp
- fractures observed in geophysical logs

3.4.5 Well Development

Following casing installation, the production interval at well DS16-03 was developed by 4.5 hours of air-lift pumping and surging on October 4, 2016. Depth to pre-pumping water level was 26.7 feet bls. The discharge rate ranged from 8 to 11 gpm; average rate was 9 gpm. Water level recovery was measured for 4.5 hours; groundwater level recovered to the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at 47 gpm at 140 feet bls prior to changing to the flooded reverse circulation drilling method. The maximum air-lift pumping rate measured in the completed well was 11 gpm, which is substantially lower the rate measured during drilling.

3.4.6 Pump Installation

A dedicated pump assembly for DS16-03 was installed by National on February 22, 2017. The pump information is summarized below:

	DS16-03
Grundfos Model	10 SQ-160
Motor Type	Single-phase Grundfos Electric Motor
Motor Horsepower	0.5
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.25
Approximate Depth to Pump Intake (feet bls)	130.2

3.5 Well DS16-04

DS16-04 was drilled and constructed during the period October 5 through 9, 2016. The location for DS16-04 is shown on **Figure 1**. A schematic diagram of well construction for DS16-04 is shown on **Figure 5**. A photograph of the drill site is shown below:

Drill Site Layout at Well DS16-04

3.5.1 Drilling Operations

At DS16-04, the production interval of the borehole was drilled using the dual-wall air reverse circulation method.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 5** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 620	dual-wall, air reverse circulation	hammer	10-1/2

3.5.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 550
Caliper	0 – 620
Natural Gamma Ray	0 – 620
Temperature	115 - 620
Fluid Resistivity	115 - 620
E-Log	0 – 620
Borehole Imaging Acoustic Televiewer	48 – 620
Borehole Imaging Optical Televiewer	16 – 75
Sonic	80 – 620

Final borehole geophysical logs for DS16-04 are provided in **Appendix D**.

3.5.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-04 are given in **Appendix C; Table C-4**. A summary log of geologic units encountered at DS16-04 is shown on **Figure 5** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 415	Gila Conglomerate (Tg)
415 - 440	Tertiary Younger Volcanics - Tuff (Tt)
440 - 481	Gila Conglomerate (Tg)
481 - 543	Precambrian Diabase (pCdiab)
543 - 590	Mescal Limestone (pCmls)
590 - 620	Precambrian Diabase (pCdiab)

3.5.4 Well Construction

Well construction details for DS16-04 are provided in **Table 1** and on **Figure 5**.

DS16-04 was constructed with a perforated interval from 538 to 598 feet bls, and a gravel pack interval from 517 to 620 feet bls in the pCmls and pCdiab. This interval was selected to target:

- first groundwater encountered in the pCdiab at 540 feet bls
- aquifer parameters for the pCmls
- water quality for the pCmls
- fractures observed in geophysical logs

3.5.5 Well Development

Following casing installation, the production interval of well DS16-04 was developed by 4 hours of air-lift pumping on October 9, 2016. Depth to pre-pumping water level was 10.8 feet bls. The discharge rate ranged from 7.0 to 7.5 gpm; average rate was 7.1 gpm. Water level recovery was measured for 4 hours; groundwater level recovered to 96 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 1 to 7.4 gpm from 540 to 620 feet bls. The maximum air-lift pumping rate measured in the completed well was 7.5 gpm, which is similar the maximum rate measured during drilling.

3.5.6 Pump Installation

A dedicated pump assembly for DS16-04 was installed by National on March 2, 2017. The pump information is summarized below:

	DS16-04
Grundfos Model	5 SQ-450
Motor Type	Single-phase Grundfos Electric Motor
Motor Horsepower	1.5
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.25
Approximate Depth to Pump Intake (feet bls)	499.7

3.6 Well DS16-05

DS16-05 was drilled and constructed during the period October 15 through 19, 2016. The location for DS16-05 is shown on **Figure 1**. A schematic diagram of well construction for DS16-05 is shown on **Figure 6**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-05

3.6.1 Drilling Operations

Drilling operations at DS16-05 began with the installation of a 12-inch diameter blank steel surface casing. The surface casing was installed to a depth of 20 feet bls. The production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 320 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 6** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 320	dual-wall, air reverse circulation	hammer	10-1/2

3.6.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 250
Caliper	0 – 320
Natural Gamma Ray	0 – 320
Temperature	48 – 320
Fluid Resistivity	48 – 320
E-Log	0 – 320
Borehole Imaging Acoustic Televiewer	54 – 320
Borehole Imaging Optical Televiewer	15 – 56
Sonic	50 – 320
Nuclear Magnetic Resonance	22 – 320

Final borehole geophysical logs for DS16-05 are provided in **Appendix D**.

3.6.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-05 are given in **Appendix C; Table C-5**. A summary log of geologic units encountered at DS16-05 is shown on **Figure 6** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 15	Quaternary Alluvium (Qal)
15 – 320	Pinal Schist (pCpi)

3.6.4 Well Construction

Well construction details for DS16-05 are provided in **Table 1** and on **Figure 6**.

DS16-05 was constructed with a perforated interval from 188 to 298 feet bls, and a gravel pack interval from 184 to 320 feet bls in the pCpi. This interval was selected to target:

- first groundwater encountered in pCpi at 200 feet bls
- aquifer parameters for the pCpi
- water quality for the pCpi
- fractures observed in geophysical logs

A deeper completion in the pCpi at DS16-05 was selected to measure vertical gradients within the pCpi at this location. An annular grouted-in VWP was installed at 150 feet bls in the pCpi between the static water level and the open interval to measure the vertical gradients in the pCpi at this location.

3.6.5 Well Development

Following casing installation, the production interval at well DS16-05 was developed by 6 hours of air-lift pumping and surging on October 19, 2016. Depth to pre-pumping water level was 30.3 feet bls. The discharge rate ranged from 2 to 3 gpm; average rate was 2.3 gpm. Water level recovery was measured for 6 hours; groundwater level recovered to 77 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 3.5 to 5.2 gpm from 200 to 320 feet bls. The maximum air-lift pumping rate measured in the completed well was 3 gpm, which is slightly lower than the maximum rate measured during drilling.

3.6.6 Pump Installation

A dedicated pump assembly for DS16-05 was installed by National on February 21, 2017. The pump information is summarized below:

	DS16-05
Grundfos Model	5 SQ-230
Motor Type	Single-phase Grundfos Electric Motor
Motor Horsepower	0.75
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.0
Approximate Depth to Pump Intake (feet bls)	180.1

3.7 Well DS16-06

DS16-06 was drilled and constructed during the period October 21 through 22, 2016. The location for DS16-06 is shown on **Figure 1**. A schematic diagram of well construction for DS16-06 is shown on **Figure 7**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-06

3.7.1 Drilling Operations

At DS16-06, the production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 120 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 7** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 120	dual-wall, air reverse circulation	hammer	10-1/2

3.7.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 50
Caliper	0 – 120
Natural Gamma Ray	0 – 120
Temperature	33 – 120
Fluid Resistivity	33 – 120
E-Log	0 – 120
Borehole Imaging Acoustic Televiewer	32 – 120
Sonic	32 – 120
Nuclear Magnetic Resonance	30 – 120

Final borehole geophysical logs for DS16-06 are provided in **Appendix D**.

3.7.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-06 are given in **Appendix C; Table C-6**. A summary log of geologic units encountered at DS16-06 is shown on **Figure 7** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 15	Quaternary Alluvium (Qal)
15 – 120	Pinal Schist (pCpi)

3.7.4 Well Construction

Well construction details for DS16-06 are provided in **Table 1** and on **Figure 7**.

DS16-06 was constructed with a perforated interval from 19 to 99 feet bls, and a gravel pack interval from 19 to 120 feet bls in the pCpi. This interval was selected to target:

- first groundwater encountered at 60 feet bls in pCpi
- water level measured at 32 feet bls during drilling operations
- aquifer parameters for the pCpi
- water quality for the pCpi
- paired testing with the adjacent geotechnical piezometer
- fractures observed in the geophysical logs

3.7.5 Well Development

Following casing installation, the production interval at well DS16-06 was developed by 4 hours of air-lift pumping and surging on October 22, 2016. Depth to pre-pumping water level was 31.7 feet bls. The discharge rate ranged from 17 to 20 gpm; average rate was 18.1 gpm. Water level recovery was measured for 4 hours; groundwater level recovered to 91percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 1 to 18.8 gpm from 60 to 120 feet bls. The maximum air-lift pumping rate measured in the completed well was 20 gpm, which is slightly higher than the maximum rate measured during drilling.

3.7.6 Pump Installation

A dedicated pump assembly for DS16-06 was installed by National on February 21, 2017. The pump information is summarized below:

	DS16-06
Grundfos Model	22 SQ-160
Motor Type	Single-phase Grundfos Electric Motor
Motor Horsepower	1
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.5
Approximate Depth to Pump Intake (feet bls)	99.5
Shroud	Yes

3.8 Well DS16-07

DS16-07 was drilled and constructed during the period October 23 through 25, 2016. The location for DS16-07 is shown on **Figure 1**. A schematic diagram of well construction for DS16-07 is shown on **Figure 8**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-07

3.8.1 Drilling Operations

At DS16-07, the production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 320 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 8** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 320	dual-wall, air reverse circulation	hammer	10-1/2

3.8.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 280
Caliper	0 – 320
Natural Gamma Ray	0 – 320
Temperature	70 – 320
Fluid Resistivity	70 – 320
E-Log	70 – 320
Borehole Imaging Acoustic Televiewer	70 – 320
Sonic	20 – 70

Final borehole geophysical logs for DS16-07 are provided in **Appendix D**.

3.8.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-07 are given in **Appendix C; Table C-7**. A summary log of geologic units encountered at DS16-07 is shown on **Figure 8** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 52	Precambrian Diabase (pCdiab)
52 – 201	Mescal Limestone (pCmls)
201 – 320	Dripping Springs Quartzite – Upper (pCdsu)

3.8.4 Well Construction

Well construction details for DS16-07 are provided in **Table 1** and on **Figure 8**.

DS16-07 was constructed with a perforated interval from 238 to 308 feet bls, and a gravel pack interval from 226 to 320 feet bls in the pCdsu. This interval was selected to target:

- first groundwater encountered at 260 feet bls in pCdsu
- increasing production up to 70 gpm within the pCdsu
- aquifer parameters for the pCdsu
- water quality for the pCdsu
- fractures observed in geophysical logs

3.8.5 Well Development

Following casing installation, the production interval at well DS16-07 was developed by 4 hours of air-lift pumping on October 25, 2016. Depth to pre-pumping water level was 68.2 feet bls. The discharge rate ranged from 14 to 15 gpm; average rate was 14.8 gpm. Water level recovery was measured for 4 hours; water level recovered to 95 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 1 to 69 gpm from 260 to 320 feet bls. The maximum air-lift pumping rate measured in the completed well was 15 gpm, which is substantially lower than the maximum rate measured during drilling.

3.8.6 Pump Installation

A dedicated pump assembly for DS16-07 was installed by National on March 2, 2017. The pump information is summarized below:

	DS16-07
Grundfos Model	77 S75-13
Motor Type	Three-phase Grundfos Electric Motor MS 4000
Motor Horsepower	7.5
Motor Voltage	460
Schedule 120 PVC Pump Column Size (in)	1.5
Approximate Depth to Pump Intake (feet bls)	223.6

3.9 Well DS16-08

DS16-08 was drilled and constructed during the period October 26 through 31, 2016. The location for DS16-08 is shown on **Figure 1**. A schematic diagram of well construction for DS16-08 is shown on **Figure 9**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-08

3.9.1 Drilling Operations

At DS16-08, the production interval of the borehole was drilled using dual-wall air reverse circulation a total depth of 400 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 9** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 400	dual-wall, air reverse circulation	hammer	10-1/2

During geophysical logging, the borehole sloughed back to 320 feet. National used flooded reverse and conventional drilling methods with polymer-based drilling fluid to clean the borehole back to a depth of 380 feet bls.

3.9.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 300
Caliper	0 – 344
Natural Gamma Ray	0 – 344
Temperature	291 – 350
Fluid Resistivity	291 – 350
E-Log	32 – 323
Dual Induction	20 – 348
Borehole Imaging Acoustic Televiewer	211 – 307
Borehole Imaging Optical Televiewer	20 – 221
Sonic	20 – 310
Nuclear Magnetic Resonance	40 – 320

Final borehole geophysical logs for DS16-08 are provided in **Appendix D**.

3.9.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-08 are given in **Appendix C; Table C-8**. A summary log of geologic units encountered at DS16-08 is shown on **Figure 9** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 240	Diabase (pCdiab)
240 – 257	Dripping Spring Quartzite – Upper (pCdsu)
257 – 293	Diabase (pCdiab)
293 – 310	Dripping Spring Quartzite – (pCds)
310 – 345	Pinal Schist (pCpi)
345 – 355	Fault Zone – Pinal Schist (pCpi)
355 – 400	Pinal Schist (pCpi)

3.9.4 Well Construction

Well construction details for DS16-08 are provided in **Table 1** and on **Figure 9**.

DS16-08 was constructed with a perforated interval from 297 to 377 feet bls, and a gravel pack interval from 279 to 378 feet bls in the pCds, pCpi, and a fault zone within the pCpi. This interval was selected to target:

- the hanging wall of the Roblas Canyon fault zone
- increased water production up to approximately 3 gpm near the fault zone measured at 360 feet bls
- aquifer parameters for the fault zone

3.9.5 Well Development

Following casing installation, the production interval at well DS16-08 was developed by 12 hours of alternating air-lift pumping and surging, and water injection and swabbing on October 31 through November 1, 2016. After water level was allowed to partially recover, a 4-hour air-lift test was conducted. Depth to pre-pumping water level was 313.9 feet bls. The discharge rate ranged from 0.3 to 5 gpm; average rate was 0.5 gpm. Water level recovery was measured for 4 hours; groundwater level recovered to 77 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 0.5 to 3.3 gpm from 280 to 380 feet bls. The maximum air-lift pumping rate measured in the completed well was 5 gpm; average rate was 0.5 gpm, which is similar to the rates measured during drilling.

Static water level at DS16-08 was 45 feet bls in July 2017 which is substantially higher than water level at the time of well development. A dedicated sampling pump was not installed because of low production rate.

3.10 Well DS16-09

DS16-09 was drilled and constructed during the period November 2 through 6, 2016. The location for DS16-09 is shown on **Figure 1**. A schematic diagram of well construction for DS16-09 is shown on **Figure 10**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-09

3.10.1 Drilling Operations

At DS16-09, the production interval of the borehole was drilled using dual-wall air reverse circulation to a total depth of 400 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 10** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 400	dual-wall, air reverse circulation	hammer	10-1/2

During geophysical logging, the borehole sloughed. Numerous attempts to clean the borehole back to total depth using flooded reverse and conventional drilling methods with water and polymer-based drilling fluids were unsuccessful.

3.10.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 300
Caliper	0 – 348
Natural Gamma Ray	0 – 348
Temperature	20 – 348
E-Log	40 – 274
Dual Induction	20 – 350
Borehole Imaging Optical Televiewer	20 – 207
Sonic	20 – 273

Final borehole geophysical logs for DS16-09 are provided in **Appendix D**.

3.10.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-09 are given in **Appendix C; Table C-9**. A summary log of geologic units encountered at DS16-09 is shown on **Figure 10** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 10	Quaternary Alluvium (Qal)
10 – 400	Pinal Schist (pCpi)

At a depth of 170 feet, the Pinal Schist showed an increase in the secondary quartz veining and increased indication of fracturing. The increased quartz veining coincides with the depth at which borehole instability occurred.

3.10.4 Well Construction

Well construction details for DS16-09 are provided in **Table 1** and on **Figure 10**.

DS16-09 was constructed with a perforated interval from 37 to 177 feet bls, and a gravel pack interval from 26 to 178 feet bls in the pCpi. This well location was selected to target aquifer parameters in the pCpi in the footwall of the Roblas Canyon fault zone. During drilling, groundwater was first encountered at 340 feet bls within the pCpi. The well was going to be completed in the deeper part of the borehole to bracket the inflow; however, the deeper part of the borehole could not be stabilized and a shallow well was completed instead.

3.10.5 Well Development

Following casing installation, the production interval at well DS16-09 was developed by 23 hours of alternating air-lift pumping and surging, and water/dispersant injection and swabbing on November 6 and 7, 2016. After water level was allowed to partially recover, an air-lift test was attempted to see if pumping could be sustained. The discharge rate ranged from 0.1 to 2 gpm; average rate was 0.3 gpm. Pumping was not sustainable and a water quality screening sample was not collected. The day after development was completed, a sample was bailed from the well. A dedicated sampling pump was not installed because pumping was not sustainable.

3.11 Well DS16-10

DS16-10 was drilled and constructed during the period November 8 through 12, 2016. The location for DS16-10 is shown on **Figure 1**. A schematic diagram of well construction for DS16-10 is shown on **Figure 11**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-10

3.11.1 Drilling Operations

At DS16-10, the production interval of the borehole was drilled using dual-wall air reverse circulation to a total depth of 540 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 11** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 540	dual-wall, air reverse circulation	hammer	10-1/2

3.11.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 300
Caliper	0 – 540
Natural Gamma Ray	0 – 540
Temperature	370 – 540
Fluid Resistivity	370 – 540
E-Log	90 – 540
Dual Induction	20 – 540
Borehole Imaging Acoustic Televiewer	229 – 534
Borehole Imaging Optical Televiewer	20 – 319
Sonic	50 – 532
Nuclear Magnetic Resonance	40 – 380

Final borehole geophysical logs for DS16-10 are provided in **Appendix D**.

3.11.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-10 are given in **Appendix C; Table C-10**. A summary log of geologic units encountered at DS16-10 is shown on **Figure 11** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 298	Gila Conglomerate (Tg)
298 – 410	Apache Leap Tuff – Gray Unit (Talg)
410 – 477	Apache Leap Tuff – Brown Unit (Talb)
477 – 492	Apache Leap Tuff – Undifferentiated (Tal)
492 – 540	Whitetail Conglomerate (Tw)

3.11.4 Well Construction

Well construction details for DS16-10 are provided in **Table 1** and on **Figure 11**.

DS16-10 was constructed with a perforated interval from 233 to 293 feet bls, and a gravel pack interval from 214 to 296 feet bls in the Tg. Although groundwater was first encountered at 420 feet bls in the Tal, a completion interval within the Tg was selected to obtain aquifer parameters for the Tg at this location within the footprint of the proposed TSF. A completion in the lower Tg was designed to measure vertical gradients with the paired geotechnical piezometer at this location.

3.11.5 Well Development

Following casing installation, the production interval at well DS16-10 was developed by 8 hours of alternating air-lift pumping and surging, and water injection and swabbing on November 13, 2016. Pumping was not sustainable and a water quality screening sample was not collected. A dedicated sampling pump was not installed because pumping was not sustainable.

3.12 Well DS16-11

DS16-11 was drilled and constructed during the period November 14 through 19, 2016. The location for DS16-11 is shown on **Figure 1**. A schematic diagram of well construction for DS16-11 is shown on **Figure 12**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-11

3.12.1 Drilling Operations

At DS16-11, the production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 640 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 12** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 - 640	dual-wall, air reverse circulation	hammer	10-1/2

3.12.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 600
Caliper	0 – 640
Natural Gamma Ray	0 – 640
Temperature	524 – 640

Logging Tool	Depth Interval(s) (feet bls)
Fluid Resistivity	524 – 640
E-Log	30 – 640
Dual Induction	20 – 640
Borehole Imaging Acoustic Televiewer	448 – 638
Borehole Imaging Optical Televiewer	20 – 528
Sonic	116 – 640
Nuclear Magnetic Resonance	40 – 204

Final borehole geophysical logs for DS16-11 are provided in **Appendix D**.

3.12.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-11 are given in **Appendix C; Table C-11**. A summary log of geologic units encountered at DS16-11 is shown on **Figure 12** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 147	Gila Conglomerate (Tg)
147 – 570	Apache Leap Tuff – Gray Unit (Talg)
570 – 640	Apache Leap Tuff – Brown Unit (Talb)

3.12.4 Well Construction

Well construction details for DS16-11 are provided in **Table 1** and on **Figure 12**.

DS16-11 was constructed with a perforated interval from 449 to 619 feet bls, and a gravel pack interval from 437 to 640 feet bls in the Tal. This interval was selected to target:

- first groundwater encountered at 560 feet bls in Tal
- aquifer parameters for the Tal
- water quality for the Tal
- fractures observed in geophysical logs

3.12.5 Well Development

Following casing installation, the production interval at well DS16-11 was developed by 5.5 hours of alternating air-lift pumping and surging, and water injection and swabbing on November 19 and 20, 2016. Pumping was not sustainable and a water quality screening sample was not collected. A dedicated sampling pump was not installed because pumping was not sustainable.

3.13 Well DS16-12

DS16-12 was drilled and constructed during the period November 22 through 25, 2016. The location for DS16-12 is shown on **Figure 1**. A schematic diagram of well construction for DS16-12 is shown on **Figure 13**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-12

3.13.1 Drilling Operations

At DS16-12, the production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 340 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 13** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 - 340	dual-wall, air reverse circulation	hammer	10-1/2

3.13.2 Borehole Geophysical Logging

A summary of logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 300
Caliper	0 – 340
Natural Gamma Ray	0 – 340
Temperature	108 – 340
Fluid Resistivity	108 – 340
E-Log	66 – 340
Dual Induction	20 – 340
Borehole Imaging Acoustic Televiewer	63 – 339
Borehole Imaging Optical Televiewer	20 – 107
Sonic	50 – 340
Nuclear Magnetic Resonance	40 – 322

Final borehole geophysical logs for DS16-12 are provided in **Appendix D**.

3.13.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-12 are given in **Appendix C; Table C-12**. A summary log of geologic units encountered at DS16-12 is shown on **Figure 13** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 10	Gila Conglomerate (Tg)
10 – 170	Apache Leap Tuff – Brown Unit (Talb)
170 – 238	Mescal Limestone (pCmls)
238 – 340	Diabase (pCdiab)

3.13.4 Well Construction

Well construction details for DS16-12 are provided in **Table 1** and on **Figure 13**.

DS16-12 was constructed with a perforated interval from 258 to 338 feet bls, and a gravel pack interval from 250 to 340 feet bls in the pCdiab. This interval was selected to obtain aquifer parameters for the pCdiab. An annular grouted-in VWP was installed at 216 feet bls to target fractures in the pCmls observed in the geophysical logs.

3.13.5 Well Development

Following casing installation, the production interval at well DS16-12 was developed by 9 hours of alternating air-lift pumping and surging, and water injection and swabbing on November 26, 2016. Pumping was not sustainable and a water quality screening sample was not collected. A dedicated sampling pump was not installed because pumping was not sustainable.

3.14 Well DS16-13

DS16-13 was drilled and constructed during the period November 27 through December 4, 2016. The location for DS16-13 is shown on **Figure 1**. A schematic diagram of well construction for DS16-13 is shown on **Figure 14**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-13

3.14.1 Drilling Operations

At DS16-13, the production interval of the borehole was drilled using dual-wall air reverse circulation to total depth of 540 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 14** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 - 540	dual-wall, air reverse circulation	hammer	10-1/2

Prior to geophysical logging, a formation bridge within an unwelded tuff unit was encountered at about 150 feet bls. An unsuccessful attempt was made to clear the bridge using water and the flooded reverse drilling method. Ultimately, National used polymer-based drilling fluid and the flooded reverse drilling method to stabilize the borehole for geophysical logging and well construction.

3.14.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 450
Caliper	0 – 540
Natural Gamma Ray	0 – 540
Temperature	10 – 540
Fluid Resistivity	10 – 540
E-Log	40 – 540
Borehole Imaging Acoustic Televiewer	33 – 540
Sonic	25 – 540
Nuclear Magnetic Resonance	42 – 292

Final borehole geophysical logs for DS16-13 are provided in **Appendix D**.

3.14.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-13 are given in **Appendix C; Table C-13**. A summary log of geologic units encountered at DS16-13 is shown on **Figure 14** and provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 73	Gila Conglomerate (Tg)
73 – 157	Unwelded Light Gray Tuff (Tt)
157 – 199	Unwelded Pink Tuff (Tt)
199 – 310	Apache Leap Tuff – Gray Unit (Talg)
310 – 435	Apache Leap Tuff – Brown Unit (Talb)
435 – 444	Apache Leap Tuff – Vitrophyre (Talv)
444 – 470	Basalt (pCbas)
470 – 482	Diabase (pCdiab)
482 – 510	Mescal Limestone (pCmls)
510 – 540	Diabase (pCdiab)

3.14.4 Well Construction

Well construction details for DS16-13 are provided in **Table 1** and on **Figure 14**.

DS16-13 was constructed with a perforated interval from 250 to 420 feet bls, and a gravel pack interval from 209 to 438 feet bls in the Tal. This interval was selected to target:

- water production in the Tal at 380 feet bls
- aquifer parameters for the Tal and unwelded tuff
- water quality for the Tal
- fractures observed in geophysical logs

An annular grouted-in VWP was installed at 130 feet bls in Tt to target a fracture observed in geophysical logs.

3.14.5 Well Development

Following casing installation, the production interval at well DS16-13 was developed by 5.5 hours of alternating air-lift pumping and surging, and drilling fluid dispersant injection and swabbing on December 7, 2016. After water level was allowed to partially recover, a 4.3 hour air-lift test was conducted. Depth to pre-pumping water level was 65.8 feet bls. The discharge rate ranged from 15 to 35 gpm; average rate was 18.9 gpm. Water level recovery was measured for 4.3 hours; groundwater level recovered to 85 percent of the pre-development water level. Static water level at DS16-13 was 30 feet bls in July 2017 which is substantially higher than the water level at the time of well development.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 1.4 to 39 gpm for the interval from 260 to 420 feet bls. The maximum air-lift pumping rate measured in the completed well was 35 gpm, which is similar to the maximum rate measured during drilling.

3.14.6 Pump Installation

A dedicated pump assembly for DS16-13 was installed by National on February 23, 2017. The pump information is summarized below:

	DS16-13
Grundfos Model	15 SQ-290
Motor Type	Single-phase Grundfos Electric Motor
Motor Horsepower	1.5
Motor Voltage	230
Schedule 120 PVC Pump Column Size (in)	1.25
Approximate Depth to Pump Intake (feet bls)	239.4

3.15 Well DS16-14

DS16-14 was drilled and constructed during the period December 6 through 17, 2016. The location for DS16-14 is shown on **Figure 1**. A schematic diagram of well construction for DS16-14 is shown on **Figure 15**. A photograph of the drill site is shown below:

Drill Site Layout at site DS16-14

3.15.1 Drilling Operations

At DS16-14, the production interval of the borehole was drilled using the dual-wall air reverse circulation method until high water production rates and onsite fluid management beginning at a depth of 415 feet made it necessary to change to the air-assisted flooded reverse drilling method.

Depths, drilling methods, bit types, and water production rates measured during drilling operations are summarized on **Figure 15** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 410	dual-wall, air reverse circulation	hammer	10-1/2
410 – 895	dual-wall, flooded reverse circulation	tricone	9-7/8

3.15.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 800
Caliper	0 – 895
Natural Gamma Ray	0 – 895
Temperature	56 – 895
Fluid Resistivity	56 – 895
E-Log	88 – 895
Borehole Imaging Acoustic Televiewer	54 – 892
Sonic	58 – 895

Final borehole geophysical logs for DS16-14 are provided in **Appendix D**.

3.15.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS16-14 are given in **Appendix C; Table C-14**. A summary log of geologic units encountered at DS16-14 is shown on **Figure 15** and is provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 290	Gila Conglomerate (Tg)
290 – 620	Basalt and Paleosol (Tb)
620 – 690	Gila Conglomerate (Tg)
690 – 760	Tertiary Younger Volcanics – Tuff (Tt)
760 – 895	Apache Leap Tuff – Gray Unit (Talg)

3.15.4 Well Construction

Well construction details for DS16-14 are provided in **Table 1** and on **Figure 15**.

DS16-14 was constructed with a perforated interval from 39 to 279 feet bls, and a gravel pack interval from 31 to 284 feet bls in the Tg. This interval was selected to target:

- first groundwater encountered at 100 feet bls in Tg
- sustained production in the Tg
- aquifer parameters for the Tg
- water quality for the Tg

3.15.5 Well Development

Following casing installation, the production interval at well DS16-14 was developed by 3.5 hours of alternating air-lift pumping and surging on December 18, 2016. After water level recovered, a 2-hour air-lift test was conducted. Depth to pre-pumping water level was 54.2 feet bls. The average discharge rate was approximately 1.1 gpm. Water level recovery was measured for 2 hours; groundwater level recovered to 94 percent of the pre-development water level.

During drilling, airlift water production rate in the open borehole was measured at rates ranging from 0 to 40.6 gpm for the interval from 40 to 280 feet bls. The air-lift pumping rates measured in the completed well ranged from 1 to 1.4 gpm, which is substantially lower that the maximum rate measured during drilling.

The airlift development data were used for a preliminary evaluation of aquifer transmissivity and specific capacity of the well. At the end of airlifting, a sample was collected for water quality screening. A dedicated sampling pump was not installed.

3.16 Well DS17-15

DS17-15 was drilled and constructed during the period January 17 through 23, 2017. The location for DS17-15 is shown on **Figure 1**. A schematic diagram of well construction for DS17-15 is shown on **Figure 16**. A photograph of the drill site is shown below:

Drill Site Layout at site DS17-15

3.16.1 Drilling Operations

At DS17-15, the production interval of the borehole was drilled using dual-wall air reverse circulation to a total depth of 680 feet.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 16** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 20	conventional air rotary (surface)	tricone	17-1/2
20 – 680	dual-wall, air reverse circulation	hammer	10-1/2

3.16.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 650
Caliper	0 – 680
Natural Gamma Ray	0 – 680
Temperature	590 – 680
Fluid Resistivity	590 – 680
Dual Induction	20 – 680
Borehole Imaging Optical Televiewer	20 – 625

Final borehole geophysical logs for DS17-15 are provided in **Appendix D**.

3.16.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS17-15 are given in **Appendix C; Table C-15**. A summary log of geologic units encountered at DS17-15 is shown on **Figure 16** and provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 221	Basalt and Paleosol (Tb)
221 – 265	Tertiary Early Sediments (Tss)
265 – 273	Tertiary Tuffaceous Volcanics (Tt)
273 – 608	Basalt and Paleosol (Tb)
608 – 613	Weathered Basalt and Sediments (Tb)
613 – 680	Apache Leap Tuff – Gray Unit (Talg)

3.16.4 Well Construction

Well construction details for DS17-15 are provided in **Table 1** and on **Figure 16**.

DS17-15 was constructed with a perforated interval from 288 to 438 feet bls, and a gravel pack interval from 278 to 458 feet bls in the Tb. This interval was selected to target:

- aquifer parameters for the Tb
- water quality for the Tb
- first groundwater encountered at 280 feet bls in Tb
- fractures observed in geophysical logs

3.16.5 Well Development

Following casing installation, the production interval at well DS17-15 was developed by 8.5 hours of alternating air-lift pumping and surging, along with fresh water injection and swabbing on January 24, 2017. Pumping was not sustainable; however a water quality screening sample was collected. A dedicated sampling pump was not installed because pumping was not sustainable.

3.17 Well DS17-16

DS17-16 was drilled and constructed during the period January 26 through February 2, 2017. The location for DS17-16 is shown on **Figure 1**. A schematic diagram of well construction for DS17-16 is shown on **Figure 17**. A photograph of the drill site is shown below:

Drill Site Layout at site DS17-16

3.17.1 Drilling Operations

At DS17-16, the production interval of the borehole was drilled using dual-wall air reverse circulation to a total depth of 600 feet. At 502 feet bls, the drill bit was changed from a hammer to a tricone due to slow drilling rate.

Depths, drilling methods, and bit types used during drilling are summarized on **Figure 17** and below:

Depth Interval (feet bls)	Drilling Method	Bit Type	Borehole Diameter (inches)
0 – 21	conventional air rotary (surface)	tricone	17-1/2
21 – 502	dual-wall, air reverse circulation	hammer	10-1/2
502 – 600	dual-wall, flooded reverse circulation	tricone	6-1/2

3.17.2 Borehole Geophysical Logging

A summary of geophysical logs obtained and depth intervals for each type of log is summarized below:

Logging Tool	Depth Interval(s) (feet bls)
Gyro	0 – 500
Caliper	0 – 502
Natural Gamma Ray	0 – 544
Dual Induction	20 – 548
Borehole Imaging Optical Televiewer	20 – 528
Borehole Video	0 – 489

Final borehole geophysical logs for DS17-16 are provided in **Appendix D**.

3.17.3 Lithologic Conditions

Detailed lithologic descriptions for drill cuttings samples for well DS17-16 are given in **Appendix C; Table C-16**. A summary log of geologic units encountered at DS17-16 is shown on **Figure 17** and provided below:

Depth Interval (feet bls)	Geologic Unit/Sub-unit
0 – 98	Gila Conglomerate (Tg)
98 – 511	Basalt (Tb)
511 – 532	Apache Leap Tuff – Gray Unit (Talg)
532 – 600	Pinal Schist (pCpi)

3.17.4 Well Construction

Well construction details for DS17-16 are provided in **Table 1** and on **Figure 17**.

DS17-16 was constructed with a perforated interval from 115 to 155 feet bls, and a gravel pack interval from 102 to 175 feet bls in the Tb. This interval was selected to target:

- a water-producing fracture in the Tb observed at 119 feet bls
- an open fracture observed at 130 feet bls
- recovery tests during drilling operations indicating a static water level less than 200 feet bls
- aquifer parameters for the Tb
- water quality for the Tb

An annular grouted-in VWP was installed at 73 feet bls within the Tg.

3.17.5 Well Development

Following casing installation, the production interval at well DS17-16 was developed by 6.5 hours of alternating air-lift pumping and surging, along with fresh water injection and swabbing on February 2, 2017. Pumping was not sustainable; however a water quality screening sample was collected. A dedicated sampling pump was not installed because pumping was not sustainable.

3.18 Wells DS17-17 through DS17-19

Wells DS17-17 through DS17-19 are located on private property near the confluence of Bear Tank Canyon wash and Queen Creek. Locations for the wells are shown on **Figure 1**. The project team wanted to install wells at this location in stream channel alluvium and shallow Pinal Schist to understand conditions below the TSF footprint. The alluvium geochemistry, alluvial groundwater quality, vertical hydraulic gradients, and formation hydraulic properties are the targets for these wells.

Well DS17-17 is completed in alluvium, DS17-18 is completed in weathered Pinal Schist, and DS17-19 is completed in competent Pinal Schist. The wells are located on the same drill pad. Schematic diagrams of well construction are shown on **Figures 18 through 20**. A photograph of the site is shown below:

Drill Site Layout at site DS17-17

DS17-17 was drilled and constructed on February 9; DS17-18 was drilled and constructed on February 7 and 8; and DS17-19 was drilled and constructed on February 11, 2017.

3.18.1 Drilling Operations

The boreholes were drilled using the sonic core drilling method. DS17-17 was drilled from surface to a total depth of 33 feet bls; DS17-18 was drilled to 65 feet bls; and DS17-19 was drilled to 58 feet bls.

3.18.2 Lithologic Conditions

Detailed lithologic descriptions for sonic cores and core photographs for wells DS17-17 through DS17-19 are given in **Appendix C; Tables C-17 through C-19**. Thickness of the alluvium ranged from 31 feet at DS17-17 to 34 feet at DS17-19. The weathered Pinal Schist was 21 feet thick at DS17-18 and DS17-19.

3.18.3 Well Construction

Well construction details for DS17-17 through DS17-19 are provided in **Table 1** and on **Figures 18 through 20**. DS17-17 was constructed with a perforated interval from 10 to 30 feet bls, and a filter pack interval from 7 to 31 feet bls in Qal. DS17-18 was constructed with a perforated interval from 55 to 65 feet bls, and a filter pack interval from 51 to 65 in competent pCpi. DS17-19 was constructed with a perforate interval from 36 to 56 feet bls, and a filter pack interval from 35 to 58 feet bls in weathered pCpi.

3.18.4 Well Development

The perforated intervals at wells DS17-17 through DS17-19 were developed by swabbing and pumping using a Geotech bladder pump on March 14, 2017. Water levels were measured before and after development.

For DS17-17, depth to pre-pumping water level was 7.6 feet bls. The well was developed for approximately 5.5 hours. Approximately 120 gallons of water (4.3 well volumes) were purged before a water chemistry sample was collected. A dedicated sampling pump will be installed at a later date.

For DS17-18, depth to pre-pumping water level was 7.5 feet bls. The well was developed for 2.8 hours. A total of 45 gallons (3 well volumes) were purged and water chemistry sample was collected.

For DS17-19, depth to pre-pumping water level was 7.5 feet bls. The well was developed for 2.3 hours. A total of 55 gallons (3.2 well volumes) were purged and a water chemistry sample was collected.

4 HYDRAULIC TESTING

4.1 Constant-rate Pumping Tests

4.1.1 Introduction

Eight constant-rate pumping tests were conducted during the period April 1 to May 17, 2017. Wells that were identified as most permeable during drilling were selected for pumping tests. Pump operation and data collection was carried out by M&A with the help of Oddonetto Construction (Oddonetto) of Globe, Arizona. The tests were conducted in hydrologic test wells DS16-01, DS16-02, DS16-03, DS16-04, DS16-05, DS16-06, DS16-07 and DS16-13. Pumping periods lasted between 8.9 and 72 hours and pumping rates varied from 1.5 to 64.7 gpm. Tests at DS16-04 and DS16-06 were prematurely terminated due to electrical malfunctions.

The locations of the constant-rate pumping tests are shown on **Figure 21**. Well construction diagrams for the hydrologic test wells are presented in **Figures 2 through 8 and 14**. A summary of well construction characteristics and hydrogeologic units tested is provided below for the eight hydrologic test wells:

Well ID	Total Depth (ft bls)	Grouted VWP Depth (feet)	Open Interval[a] (ft bls)	Hydrogeologic Unit Tested[b]
DS16-01	520	---	409 – 535	Mescal Limestone (pCmls)
DS16-02	451	---	277 – 346 367 – 455	Apache Leap Tuff (Tal)
DS16-03	241	---	119 – 252	Felsic Lava Flows / Perlite (Tfp)
DS16-04	619	---	517 – 620	Mescal Limestone (pCmls)
DS16-05	319	150 (pCpi)	226 – 320	Pinal Schist (pCpi)
DS16-06	120	---	19 – 120	Pinal Schist (pCpi)
DS16-07	319	---	226 – 320	Drip. Spring Quartzite (pCds)
DS16-13	431	130 (Tt)[c]	250 – 420[d]	Apache Leap Tuff (Tal)

[a] Includes well screen and gravel pack
[b] Hydrogeologic units above and below the open interval are shown on **Figures 2 through 8 and 14**
[c] Tertiary tuff
[d] Top of screen to bottom of screen

Pre-test water level depth varied from 9.39 to 152.15 feet bls. Maximum water level drawdown at the wells varied from approximately 53.8 feet in perlite

(DS16-03) to 263.4 feet in Mescal Limestone (DS16-04). A summary of hydraulic characteristics of the constant-rate pumping tests is presented is below:

Well ID	Test Duration (hours)	Pumping Rate (gpm)	Pre-Test Water Level[a] (ft bls)	Maximum Water Level Drawdown (ft)
DS16-01	71	64.7	44.08	61.6
DS16-02	24	7.0	152.15	100.5
DS16-03	24	12.5	31.82	53.8
DS16-04	8.9[b]	4.1	9.39	263.4
DS16-05	24	1.5	29.08	82.8
DS16-06	21.8[c]	24.9	26.39	50.6
DS16-07	72	40	67.71	89.6
DS16-13	24	7.5	28.68	109.4

[a] Does not indicate static conditions
[b] Pumping stopped after 8.9 hours due to technical issues
[c] Pumping stopped after 21.1 hours on 23 October at 07:07 due to technical issues; pumping resumed from 07:18 to 07:46 (28 minutes) in order to collect water quality sample

4.1.2 Field Methods and Equipment

Prior to conducting the constant-rate pumping tests, discharge assemblies were constructed and attached to the wellheads. The discharge assemblies utilized 1-inch to 2-inch diameter galvanized steel pipes; once fully assembled the horizontal lengths ranged from 21.8 to 22.3 feet. The assemblies were equipped with Blancett Model 1100 turbine flowmeters with digital monitor displays, in-line pressure gauges located near the wellheads, gate valves to adjust flow rates and hose bibs for measuring field parameters and collecting samples for water quality analysis. Pumping rates and discharge line pressures were regularly monitored and recorded during testing activities. Approximately 200 feet of 2-inch diameter lay flat hose was attached to the ends of the assemblies and used to convey discharged water away from the wells toward the nearest ephemeral stream channel.

Pumping test discharge assembly and equipment at DS16-07

In accordance with discharge authorization number AZDGP – 60821 under the *Arizona Pollutant Discharge Elimination System General Permit for De Minimus Discharges to Waters of the U.S.*, best management practices were employed to manage the discharge of pumped groundwater. For most tests, discharged groundwater was directed onto plastic sheeting to prevent scouring and the mobilization of sediment. In addition, rows of straw wattles were installed downstream of the plastic sheeting to disperse the discharge stream. During pumping, flow rates and water quality parameters were monitored daily. Photo documentation of pre-discharge and post-discharge conditions for all test sites is available upon request.

Plastic sheeting and straw wattles used as erosion controls at DS16-07

During the constant-rate pumping tests, water level pressures in pumped wells and observation wells were recorded using non-vented In-Situ Level TROLL integrated dataloggers/pressure transducers (Level TROLLs). In pumped wells, Level TROLLs were installed below anticipated water level maximum drawdowns and programmed to record pressures at 10-second intervals for the first 100 minutes of pumping, followed by 1-minute intervals for the remainder of testing operations. Additional water level measurements were collected manually with Solinst water level sounders and used to confirm Level TROLL measurements.

At “paired” well sites, where observation wells were typically located within 50 feet of pumped wells, Level TROLLs were installed below water level and programmed at a measurement frequency of 1-minute intervals. At all other observation wells, Level TROLLs were programmed at 10-minute intervals. Following completion of the constant-rate pumping periods, water level recoveries were in most cases monitored for a period equal to the duration of pumping or longer.

Barometric pressures were monitored with In-Situ BaroTROLL integrated dataloggers/pressure transducers (BaroTROLLs) installed in the vaults of wells DS16-02, DS16-07 and DS17-15. The BaroTROLLs recorded barometric pressure at 1-minute intervals during testing activities. Following completion of the tests, the barometric pressure measurements were used to correct Level TROLL measurements and distinguish water level stresses due to pumping from stresses caused by changes in atmospheric pressure.

Field instruments were used to collect water quality data and were calibrated daily in accordance with manufacturer recommendations. Myron L Ultrameter II instruments were used to collect field water quality parameters of discharge water, including pH, specific electrical conductance (Specific Conductance or EC) and temperature. Turbidity was monitored using a Hach 2100Q turbidimeter and Hach DR 890 colorimeter. A YSI Multiparameter with flow-through cell was used to monitor dissolved oxygen (DO) and oxidation-reduction potential (ORP) for some of the tests. The DO and ORP measurements are considered approximate because of difficulties during operation of the flow-through cell with entrapped air. In addition to these field parameters, pumped water was periodically collected in a 1-liter Imhoff cone to measure sand content.

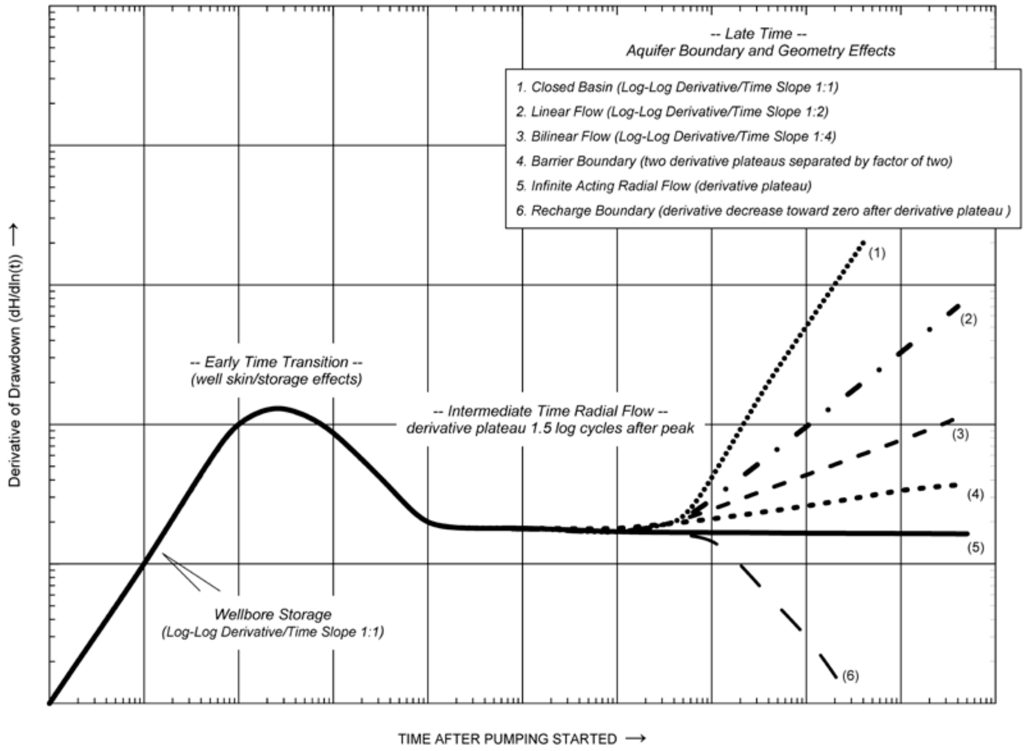
4.1.3 Analytical Methods

Work flow for development of a conceptual model for testing activities included reviewing local-scale geologic setting, well construction details, observations from well drilling and lithologic descriptions, and geophysics. Data processing of pumping tests routinely included construction of hydrographs showing linear time versus linear water level axes for pumped well and observation well data. Included on the analytical hydrographs are pumping rate data for the pumped well and barometric pressure data for observation wells. Barometric corrections were computed for water level measurements at observation wells using the Barometric Response Function method described by Butler and others (2011). The correction method was only applied to observation well data showing discernable water level response during pumping tests. Similarly, observation well water levels were corrected for antecedent water level trends if required.

After data processing, further development of the conceptual model for analysis of testing results included preparation of diagnostic flow plots and derivative analysis using the aquifer testing analysis software program AQTESOLV (HydroSOLVE, 2012). Diagnostic flow and derivative analysis plots included analysis of radial flow conditions for identifying infinite acting radial flow (IARF) behavior and wellbore storage. On semi-logarithmic (log-linear) axes, late-time data exhibiting a straight line on a radial flow plot are indicative of IARF conditions. This late-time behavior on a semi-log plot is the basis for the

Cooper-Jacob (1946) straight-line method of analysis. On log-log axes, early-time data exhibiting a unit slope on a radial flow plot are indicative of wellbore storage.

The pressure derivative method, developed by Bourdet and others (1989) and expanded by Ehlig-Economides and others (1994), is used to delineate early, intermediate, and late-time curves related to various well and aquifer types and flow geometries. Derivative analysis as described by Renard and others (2009) identifies important trends or characteristics not readily apparent in the water level drawdown data. Interpretation of derivative-time plots typically are used to identify wellbore storage, aquifer boundaries, leakage and delayed gravity response. Type curves on the diagnostic pressure derivative graph are shown in the following illustration -which highlights identification of some typical well, aquifer, and boundary conditions.



Characteristic Derivative Plot Patterns for Selected Flow-Regime Conditions (adapted from Walker and Roberts, 2002)

The peak or hump observed in the derivative data at early time (above) is diagnostic of wellbore storage. Typically, stabilization of the derivative is approximately 1.5 log cycles after the peak. At intermediate time, the derivative is observed to nearly stabilize which is indicative of infinite-acting radial flow (i.e., IARF or Theis conditions). This trend either continues through late-time or depending on aquifer geometries, diverts from IARF conditions. Plotting the derivative on a log-log plot has the advantage of making the identification of the IARF period more evident, as well as other late-time aquifer effects. Derivative data was processed in AQTESOLV according to methods described by Spane and Wurstner (1993) and Bourdet and others (1983 and 1989).

Analytical methods for estimating aquifer parameters included use of analytical solutions by Theis (1935) and Cooper and Jacob (1946) for initial screening of processed data. Subsequent further analysis using analytical solutions included methods by Hantush (1960), Papadopulos and Cooper (1967), Moench (1984, 1985 and 1997), Dougherty and Babu (1984) and Barker (1988). Using AQTESOLV (HydroSOLVE, 2012), visual curve matching methods were conducted to estimate aquifer properties on combined drawdown and derivative plots, as well as automatic curve matching to estimate aquifer properties using nonlinear least squares fitting procedure.

The principal objective of the constant-rate pumping tests was to provide site-wide hydraulic property characterization of aquifer conditions. This objective was accomplished, however it should be noted that in some instances analytical methods included assumptions that limited parameter certainty. These assumptions included equilibration of water levels prior to testing and, when antecedent water levels were available, applying linear corrections if water level trends were evident. Additionally, given that the wells were exploratory, well completions typically resulted in conditions of partial penetration of the aquifer, variable aquifer thicknesses and, in fractured-rock settings, other spatial complexity for groundwater flow to wells. These non-ideal conditions imposed on some of the test well locations, as well as short-duration testing, large water level drawdowns due to low permeability, and aquifer heterogeneities reduced the confidence level of aquifer hydraulic parameter estimation when considering the inherent limiting assumptions of conventional analytical methods. Higher parameter certainty and confidence in the fit of the aquifer model could be accomplished for some of the test well locations, especially for determination of aquifer storage properties, by conducting longer duration testing using pumping and observation wells located and constructed specifically for testing.

4.1.4 Well DS16-01

Construction and Hydraulic Characteristics

Well DS16-01 is near the southwest toe of the proposed TSF. The open interval of the well, which includes the well screen and gravel pack, fully penetrates 88 feet of Mescal Limestone (pCmls) from 440 to 528 feet bls (**Figure 2**). Approximately 88 feet of Tertiary Basalt (Tb) overlies pCmls from 352 to 440 feet bls. Drilling records shows water production starting once the pCmls was penetrated. Geophysical logs collected from the DS16-01 borehole indicate that pCmls contains irregularly-spaced fractures occurring across the length of the open interval. Based on air-lift measurements collected during drilling, pCmls is considered hydraulically confined by overlaying Tb at the well site. A network of fractured rock in the pCmls is believed to contribute substantially to the average permeability of the unit at the well site.

Field Methods and Results

A 71-hour, constant-rate pumping test was conducted at well DS16-01 at an average pumping rate of 64.7 gpm. Maximum water level drawdown at the pumped well was 61.6 feet and occurred near the end of the pumping period. Operational parameters for the DS16-01 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)[a]
11-Apr-2017 09:30	71	64.7	44.08	61.6	1.05

[a] gpm/ft = gallons per minute per foot of drawdown

Field measurements of EC, temperature, pH, ORP, DO and turbidity of discharge water were collected during the pumping period. The data is presented graphically in **Appendix H**, **Figure 1** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)[a]	Temp (°C)	pH (s.u.)[b]	ORP (mV)[c,d]	DO (mg/L)[d,e]	Turbidity (NTU)[f]
880	28.6	7.71	-124.7	0.04	1

[a] microsiemens per centimeter
[b] standard units
[c] millivolts
[d] ORP and DO measured using flow-through cell; measurements are considered approximate because of difficulties during operation of the flow-through cell with entrapped air
[e] milligrams of oxygen per liter of water
[f] Nephelometric Turbidity Units

During the constant-rate pumping test and recovery period, water levels were monitored at wells DH16-01, DH16-06, DH17-26, DH17-37 and DH17-38. The locations of the observation wells and DS16-01 are shown on **Figure 22**. A summary of horizontal distances of observation wells from DS16-01 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval[a]	Elevation of Open Interval (ft amsl)[b]
DS16-01	---	pCmls, Tb	1997.8 – 1871.8
DH16-01	12.9	pCmls	1981.9 – 1955.7
DH16-06	3624	Tg	2439.8 – 2364.4
DH17-26	4400	Tb	2206.0 – 2133.8
DH17-37	13110	Tg	2615.6 – 2536.6
DH17-38	3051	Tg	2384.5 – 2279.3

[a] Includes well screen and gravel pack
[b] feet above mean sea level

Water level hydrographs of pumped well DS16-01 and observation wells are provided in **Appendix I, Figures 1 and 2**.

Water level response due to pumping was evident at observation well DH16-01. DH16-01 is located approximately 12.9 feet from DS16-01 and constructed to a total depth of 451 feet bls. The open interval of DH16-01 penetrates 11 feet of the pumped unit, pCmls, from 440 to 451 feet bls (**Appendix J**). Maximum water level drawdown at DH16-01 at the end of pumping was approximately 54.5 feet. For analytical modeling purposes, the wells were assumed to fully penetrate the aquifer thickness. Water level response due to pumping was not discernable at the other observation wells.

Analytical Results

Plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 1 and 2**. Semi-log plots of drawdown and recovery for the pumped well show steep trends indicative of low permeability conditions. Incomplete water level recovery shown in the water level hydrographs and concave of upward of the recovery curve is believed to be indicative of decreasing storage coefficient at distance from the pumped well.

An analytical solution is provided in AQTESOLV using the Barker (1988) generalized radial flow (GRF) model for unsteady, n-dimensional flow to a fully penetrating source in an isotropic, single- or double-porosity fractured aquifer. The source is an n-dimensional sphere (projected through three-dimensional space) of finite radius (r_w), storage capacity (b) and well skin factor (S_w). The spatial dimension (n) determines the change in conduit area with distance from the source. In a two-dimensional system (n=2), the source is a finite cylinder, the typical configuration for analyzing radial flow to a well. The GRF model also includes linear flow (n=1) and spherical flow (n=3). Essentially the general radial flow approach defines the dimension of a conductor as the power relationship at which the conducting area grows with radial distance from the pumping well (Doe and Geier, 1991).

The drawdown and derivative of drawdown results provide useful means of determining flow dimension (Beauheim and others, 2004). For constant rate tests, the slope of drawdown curve in logarithmic plots will be equal to (1-n/2) for flow dimensions less than 2 and occurring for duration of one log cycle of time or more. Thus a linear flow conductor will have a characteristic half-slope as indicated by analysis of log-log plots occurring at early time (**Appendix K.1**, **Figure 2)**. Therefore, a flow dimension corresponding to linear flow was used in order to best match drawdown and drawdown derivative data of both pumped well DS16-01 and observation well DH16-01.

A summary of DS16-01 pumping test results is included in **Table 2** and as follows:

Well ID	Hydrogeologic Unit Tested	Analytical Method	Specific Storage (ft-1)[a]	Hydraulic Conductivity	
				(ft/day)	(cm/s)[b]
DS16-01	Mescal Limestone (pCmls)	Barker (1988)	3.9E-04	1.7E+00	6.0E-04

[a] per foot
[b] centimeters per second

4.1.5 Well DS16-02

Construction and Hydraulic Characteristics

Well DS16-02 is within the area of the proposed TSF, near the western edge of the Gila Group outcrop belt and adjacent to outcrops of Apache Leap Tuff. DS16-02 was constructed to a total depth of 451 feet bls and completed with two open intervals of well screen located within Apache Leap Tuff (Tal) (**Figure 3**). The upper open interval was constructed based on air-lift water production during drilling with 40 feet of well screen from 290 to 330 feet bls and 69 feet of gravel pack from 277 to 346 feet bls filling the annulus between the well casing and borehole wall. The lower open interval was constructed with 60 feet of well screen from 390 to 450 feet bls and 88 feet of gravel pack from 367 to 455 feet bls. The lower screen and gravel pack penetrate the underlying pCpi to a small extent by 4 and 8 feet, respectively. Gila Conglomerate (Tg) overlies Tal from ground surface to 172 feet bls. A network of fractured rock in the Tal is believed to contribute substantially to the average permeability of the unit. For analytical modeling, full thickness of the aquifer was assumed to be equivalent to 186 feet, equivalent to the length of the gravel pack interval.

Field Methods and Results

A 24-hour, constant-rate pumping test was conducted at well DS16-02 at an average pumping rate of 7.0 gpm. Maximum water level drawdown at the pumped well was 100.5 feet and occurred near the end of pumping. Operational parameters for the DS16-02 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
03-May-2017 13:00	24	7.0	152.15	100.5	0.07

Field measurements of EC, temperature, pH, ORP, DO and turbidity of discharge water were collected during the pumping period. The data is presented graphically in **Appendix H**, **Figure 2** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	ORP (mV)[a]	DO (mg/L)[a]	Turbidity (NTU)
648	28.2	7.76	138.1	3.40	0

[a] ORP and DO measured using flow-through cell; measurements are approximate

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-04, DH16-04, DH16-15, DH17-23 and DH17-25. The locations of the observation wells and pumped well DS16-02 are shown on **Figure 23**. Geotechnical piezometer DH16-03, located 13.1 feet from DS16-02 and completed to 60.2 feet bls in overlying Tg, was dry during testing and therefore not monitored. A summary of horizontal distances of observation wells from DS16-02 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-02[a]	---	Tal	2210.8 – 2141.6, 2120.8 – 2033.2
DS16-04	4799	pCmls, pCdiab	1924.8 – 1823.1
DH16-04	2100	pCpi	2175.0 – 2144.2
DH16-15	3274	Tg	2477.7 – 2377.7
DH17-23	1538	Tal	2384.8 – 2276.6
DH17-25	3577	pCp	2325.2 – 2243.0

[a] DS16-02 has two open intervals separated by blank casing and annular seals

Hydrographs of the observation wells and DS16-02 during testing activities are provided in **Appendix I, Figures 3 and 4**. Due to the large distances of the observation wells from the pumped well, water level response due to pumping was not discernable during the testing period. Therefore, analysis for aquifer parameter estimation was conducted using single-well test methods.

Analytical Results

Plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 3 and 4**. Semi-log plots of drawdown and recovery for the pumped well show steep trends indicative of low permeability conditions. Incomplete water level recovery shown in the water level hydrographs and the concave upward recovery curve is believed to indicate decreasing storage coefficient at distance from the pumped well.

An analytical solution is provided in AQTESOLV using the Barker (1988) generalized radial flow (GRF) model for unsteady, n-dimensional flow to a fully penetrating source in an isotropic, single- or double-porosity fractured aquifer. In order to best match the drawdown response of early-time data, a pumping rate of 13.5 gpm for the first 18 seconds of the test was included in the solution based on initial pumping rates recorded in field notes. Following the first 18 seconds, the pumping rate decreased to 7.04 gpm before stabilizing at 7.0 gpm one minute after the start of pumping and remaining at that rate for the remainder of the test.

The drawdown and derivative of drawdown results show a linear flow with a characteristic half-slope as indicated by analysis of log-log plots occurring at early time (**Appendix K.1**, **Figure 4)**. Therefore, a flow dimension corresponding to linear flow was used in order to best match drawdown and drawdown derivative data of both pumped well DS16-01 and observation well DH16-01.

Tabulated results of the DS16-02 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Unit Tested	Analytical Method	Hydraulic Conductivity	
			(ft/day)	(cm/s)
DS16-02	Apache Leap Tuff (Tal)	Barker (1988)	2.7E-03	9.5E-07

It is important to note that for single well tests, as given in the Theis (1935) solution for the variable "u", storage coefficient (S) and skin factor (Sw) are shown to be correlated - when substituting for radius of the well (r).

$u = r^2S/4Tt$ or $u = (r_we^{-Sw})^2S/4Tt$

Therefore, it is not possible to independently determine S and Sw from a single well test due to non-uniqueness (however, because adjustments for Sw only affect the pumping well curve fit, both parameters can be uniquely determined by using observation well data).

For single-well tests, typical procedure using AQTESOLV includes adjusting S and Sw to practical values based on literature values and professional experience and alternatively setting these parameters as "inactive" during curve fitting to allow for a best estimates fits to drawdown and derivative of drawdown plots. Determination of Sw involves best judgement for effective well radius (r_w) and balancing plausible minimum values for S using distance-drawdown modeling for potential drawdown at distances similar to nearest observation wells (e.g, distance to DH17-23). From experience involving similar diameter wells drilled and completed in fractured rock settings, Sw values less than zero result from enhancement of permeability near the well bore and controlled flow by discrete fracturing. Conversely positive values of Sw are the result of plugging that can occur by a variety of factors – most commonly drilling mud invasion and inadequate well development.

4.1.6 Well DS16-03

Construction and Hydraulic Characteristics

Well DS16-03 is near the eastern edge of the proposed TSF. The open interval of the well, including the well screen and gravel pack, partially penetrates 131 feet of Perlite (Tfp) from 121 to 252 feet bls, and includes the Tfp contact with Gila Conglomerate (Tg) at approximately 121 feet bls (**Figure 4**). Below Perlite, at a depth of 400 feet, is Picketpost Mountain Felsic Lava Flows – Rhyolite (Tfp). Air-lift measurements collected during drilling showed a significant increase in water production at the Tg-Tfp contact. Based on air-lift measurements and water level monitoring data, Tfp is considered hydraulically confined by overlying Tg at the well site. The thickness of the Perlite unit is approximately 279 feet, assuming a relatively homogenous unit of perlite to the lower contact at a depth of 400 feet.

Field Methods and Results

A 24-hour, constant-rate pumping test was conducted at well DS16-03 at an average pumping rate of 12.5 gpm. Maximum water level drawdown at the pumped well was 53.8 feet and occurred near the end of pumping. Operational parameters for the DS16-03 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
05-Apr-2017 17:00	24	12.5	31.82	53.8	0.23

Field measurements of EC, temperature, pH, and turbidity were collected from discharge water during the pumping period. The data is presented graphically in **Appendix H**, **Figure 3** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
520	26.1	7.31	0

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-04, DS16-10, DH16-06, DH16-07, DH16-09 and DH16-10. The locations of the observation wells and pumped well DS16-03 are shown on **Figure 24**. A summary of horizontal distances of observation wells from DS16-03 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-03	---	Tfp, Tg (2ft)	2377.5 – 2245.0
DS16-04	3627	pCmls, pCdiab	1924.8 – 1823.1
DS16-10	4375	Tg	2455.0 – 2373.5
DH16-06	2379	Tg	2439.8 – 2364.4
DH16-07	10.9	Tg	2479.6 – 2443.6
DH16-09	2313	Tr	2495.8 – 2448.3
DH16-10	4285	Tr	2499.4 – 2445.5

Hydrographs of the observation wells and DS16-03 are provided in **Appendix I, Figures 5 and 6**. The water level in observation well DH16-07, located 10.9 feet from DS16-03 and completed to 50 feet bls in the overlying Tg unit, showed no discernable response to pumping. Similarly, there were no discernible water level responses due to pumping at any of the remaining observation wells. Therefore analytics for aquifer parameter estimation was conducted using single-well test methods.

Analytical Results

Analytical plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 5 and 6**. An analytical solution is provided in AQTESOLV using the mathematical model by Dougherty and Babu (1984) for unsteady flow to a well in a confined aquifer. The model allows for partial penetration, wellbore storage and skin effects. A plot of the analytical solution showing both drawdown and drawdown derivative data for pumped well DS16-03 is shown in **Appendix K.1**, **Figure 6**.

During approximately the first three minutes of the test, water level drawdown in the well is attributed to pumping of wellbore storage water, identifiable as a linear 1:1 slope of drawdown data on a logarithmic plot. During the period from approximately three to 50 minutes after the start of pumping a transition period from wellbore storage to IARF begins. The transition period is noted by the shape of the derivative as affected by both storativity and skin effects. After 50 minutes of pumping, the derivative data flattens indicating a period of IARF conditions. Fluctuations in the drawdown derivative are attributed to small changes in pumping rate during the test and low specific capacity of the well.

A minimum storage coefficient was used in the analytical model corresponding to potential drawdown during the test at an equivalent radial distance from the pumped well to the nearest observation, well DH16-09. The results of the DS16-03 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DS16-03	Perlite (Tfp)	Dougherty-Babu (1984)	8.4E-01	3.0E-04

[a] Calculated using ratio of transmissivity parameter estimate and aquifer thickness penetrated by the pumped well

4.1.7 Well DS16-04

Construction and Hydraulic Characteristics

Well DS16-04 is located near the eastern edge of the proposed TSF. The open interval of the well, which includes the well screen and gravel pack, fully penetrates 47 feet of Mescal Limestone (pCmls) from 543 to 590 feet bls, and extends into Precambrian diabase (pCdiab) intrusions above and below pCmls (**Figure 5**). Based on air-lift measurements collected during drilling, pCmls is considered hydraulically confined by pCdiab at the well site. Thickness of the pCmls unit is approximately 47 feet.

Field Methods and Results

An 8.9-hour, constant-rate pumping test was conducted at well DS16-04 at an average pumping rate of 4.1 gpm. Maximum water level drawdown at the pumped well was 263.4 feet and occurred near the end of pumping. Operational parameters for the DS16-04 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
21-Apr-2017 10:45	8.9	4.1	9.39	263.4	0.02

Field measurements of EC, temperature, pH, ORP, DO and turbidity of discharge water were collected during the pumping period. The data is presented graphically in **Appendix H**, **Figure 4** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	ORP (mV)[a]	DO (mg/L)[a]	Turbidity (NTU)
288	29.4	8.51	-236	0.01	2

[a] ORP and DO measured using flow-through cell; measurements are approximate

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-01, DH16-06, DH16-08 and DH16-15. The locations of the observation wells and DS16-04 are shown on **Figure 25**. A summary of horizontal distances of observation wells from DS16-04 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-04	-	pCmls, pCdiab	1924.8 - 1823.1
DS16-01	3798	pCmls, Tb	1997.8 - 1871.8
DH16-06	2092	Tg	2439.8 - 2364.4
DH16-08	16.4	Tg	2423.6 - 2330.4
DH16-15	3936	Tg	2477.7 - 2377.7

Hydrographs of the observation wells and DS16-04 and are provided in **Appendix I, Figures 7 and 8**. The water level in DH16-08, located 16.4 feet away from DS16-04 and completed to 110.2 feet bls in Tg, showed no discernable response to pumping, indicating that the hydraulic connection between Tg and pCmls is poor locally at the well site. Similarly, there were no discernible water level responses due to pumping at any of the other more distant observation wells. Therefore aquifer parameter estimation was conducted using single-well test methods.

Analytical Results

Analytical plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 7 and 8**. An analytical solution is provided in AQTESOLV using the mathematical model by Dougherty and Babu (1984) for unsteady flow to a well in a confined aquifer. The model allows for partial penetration, wellbore storage and skin effects. A plot of the analytical solution showing both drawdown and drawdown derivative data for pumped well DS16-04 is shown in **Appendix K.1**, **Figure 8**.

During approximately the first 10 minutes of the test, water level drawdown in the well is attributed to wellbore storage, identified as a 1:1 slope of drawdown data on a logarithmic plot. During the remaining period of the test the curvature of the derivative data signals transition from wellbore storage to IARF conditions. Due to the relatively short duration of pumping, the subsequent IARF part the drawdown plot is not well defined and causes some uncertainty in the selection of the analytical model.

A minimum storage coefficient was used in the analytical model corresponding to potential drawdown during the test at an equivalent radial distance from the pumped well to the nearest observation in the pCmls, well DS16-01. The results of the DS16-04 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DS16-04	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	8.7E-02	3.1E-05

a) calculated based on the ratio of transmissivity and thickness of the pCmls penetrated by the pumped well

4.1.8 Well DS16-05

Construction and Hydraulic Characteristics

Well DS16-05 is located west of the proposed TSF in Roblas Canyon. The open interval of the well, which includes the well screen and gravel pack, partially penetrates 134 feet of Pinal Schist (pCpi) from 186 to 320 feet bls (**Figure 6**). A thin veneer of Quaternary Alluvium (Qal) overlies pCpi from the ground surface to approximately 15 feet bls. Aquifer conditions of the pCpi are characterized as a hydraulically unconfined groundwater system comprised of a network of fractured rock and rock matrix represented as an equivalent porous medium.

Field Methods and Results

A 24-hour, constant-rate pumping test was conducted at well DS16-05 at an average pumping rate of 1.5 gpm. Maximum water level drawdown at the pumped well was 82.8 feet and occurred near the end of pumping. Operational parameters for the DS16-05 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
09-Apr-2017 10:00	24	1.5	29.08	82.8	0.02

Field measurements of EC, temperature, pH, ORP, DO and turbidity were collected from discharged water during the test. The field parameters are presented graphically in **Appendix H**, **Figure 5** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	ORP (mV)[a]	DO (mg/L)[a]	Turbidity (NTU)
2010	26.9	8.08	-235	0.01	0

[a] ORP and DO measured using flow-through cell; measurements are approximate

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-06, DH16-14, DH16-18, DH16-22 and DH17-24. The locations of the observation wells and DS16-05 are shown on **Figure 26**. A summary of horizontal distances of observation wells from DS16-05 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-05	---	pCpi	2038.1 – 1902.4
DS16-06	4081	pCpi	2272.4 – 2164.6
DH16-14	4091	pCpi	2254.7 – 2189.3
DH16-18	13.1	pCpi	2200.0 – 2134.0
DH16-22	2900	pCpi	2197.5 – 2090.7
DH17-24	2896	pCpi	2280.4 – 2238.6

Hydrographs of the observation wells and DS16-05 are provided in **Appendix I, Figures 9 and 10**.

Water level response due to pumping was measured at observation well DH16-18. DH16-18 is located 13.1 feet from DS16-05 and constructed to a total depth of 85 feet bls, with an open interval that partially penetrates approximately 66 feet of the pumped unit, pCpi, from 22 to 88 feet bls (**Appendix J**). Maximum water level drawdown at DH16-18 was approximately 9.1 feet.

Additionally, pressure measurements were collected from a VWP attached to DS16-05 well casing at a depth of 150 feet bls (**Figure 6**). The VWP response to pumping activities, converted to head of water in feet, is shown with the DS16-05 hydrograph in **Appendix I, Figure 9**. Maximum drawdown measured at the VWP was approximately 49 feet, indicating a significant pressure response at the location of the VWP that may be the result of a hydraulic response from adjacent pCpi at the depth of the transducer and/or a vertical translation of pressure drop through the grouted annulus of the borehole. Water levels monitored at the other observation wells showed no discernible response to pumping at DS16-05.

Analytical Results

Plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 9 and 10**. Semi-log plots of drawdown and recovery for the pumped well show steep trends indicative of low permeability conditions. Incomplete water level recovery is believed to indicate decreasing storage coefficient at distance from the pumped well.

For aquifer parameter estimation, an analytical solution in AQTESOLV was used incorporating the mathematical model derived by Moench (1997) for unsteady flow to a well in an unconfined aquifer. The model is suitable for partially and fully penetrating wells and allows for wellbore storage and skin effects. A plot of the analytical solution showing drawdown and drawdown derivative data for both pumped well DS16-05 and observation well DH16-18 is shown in **Appendix K.1**, **Figure 10**.

During the first minute of pumping, the water level drawdown in the pumped well has a slope of approximately 1:1 on a logarithmic plot consistent with a wellbore storage response. The slope of the drawdown data then decreases slightly as the pumping rate is adjusted from around 5 to 1.5 gpm within the first few minutes of pumping. Between 60 and 1,000 minutes after the start of pumping, the slope of the derivative plateaus, representing an IARF period lasting approximately one log cycle.

Included in the analytical solution are model curves matching water level drawdown and drawdown derivative data from observation well DH16-18. Drawdown at DH16-18 begins approximately 100 minutes after the start of pumping and continues following the end of the pumping period. The shape of the drawdown and recovery response is likely a dampened response due to the vertical separation of approximately 100 feet between the DH16-18 well screen and the open interval of pumped well DS16-05 and well skin effects.

The analytical solution approximates the water level drawdown responses at both the pumped well and observation well over the entire pumping period. The magnitude of drawdown observed at the observation well is approximately reproduced using a specific yield of 0.005, a storativity value of 1.9E-04 and a negative well skin of approximately 2.5 feet. In addition, the model match to observed data was improved for early-time drawdown data by including a downhole equipment radius of 0.07 feet to account for the pump and discharge tubing. A negative skin factor (Sw) at the pumped well was incorporated in the analytical solution indicating enhanced flow near the borehole due to drilling effects. The parameter certainty for estimated specific yield is low due the short duration of the test and effects of delayed gravity drainage which were not fully developed. Attempts to analyze the VWP response to pumping activities were unsuccessful.

The results of the DS16-05 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Specific Yield	Storage Coefficient	Hydraulic Conductivity[a] (ft/day)	Hydraulic Conductivity[a] (cm/s)
DS16-05	Pinal Schist (pCpi)	Moench (1997)	0.005	0.00019	1.3E-02	4.7E-06

[a] calculated based on the ratio of transmissivity and saturated thickness of pCpi

4.1.9 Well DS16-06

Construction and Hydraulic Characteristics

Well DS16-06 is west of the proposed TSF in Roblas Canyon. The open interval of the well, which includes the well screen and gravel pack, penetrates 101 feet of Pinal Schist (pCpi) from 19 to 120 feet bls (**Figure 7**). A thin veneer of Quaternary Alluvium (Qal) overlies pCpi from the ground surface to approximately 15 feet bls. Aquifer conditions of the pCpi are characterized as a groundwater system comprised of a network of fractured rock and rock matrix.

Field Methods and Results

A 21.8-hr pumping test was conducted at well DS16-06 with an average pumping rate of 24.9 gpm. During the first 21.1 hours of the test, pumping was maintained at a constant rate; during the final 0.7 hours of the test the pump shut off for a period of 11 minutes due to a malfunction of the electrical control box. Pumping was re-started and continued for approximately 28 minutes in order to collect samples for water quality analyses. Operational parameters for the DS16-06 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
18-Apr-2017 10:00	21.8	24.9	26.39	50.6	0.49

Field measurements of EC, temperature, pH, ORP, DO and turbidity were collected from discharged water during the pumping period. The data is presented graphically in **Appendix H**, **Figure 6** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	ORP (mV)[a]	DO (mg/L)[a]	Turbidity (NTU)
1421	23.9	6.94	28.0	2.6	78

[a] ORP and DO measured using flow-through cell; measurements are approximate

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-05, DS16-07, DH16-14, DH16-16, DH16-22, DH17-24 and DH17-25. The locations of the observation wells and pumped well DS16-06 are shown on **Figure 27**. A summary of horizontal distances of observation wells from DS16-06 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-06	---	pCpi	2272.4 – 2164.6
DS16-05	4081	pCpi	2038.1 – 1902.4
DS16-07	2591	pCdsu	2143.6 – 2050.0
DH16-14	2302	pCpi	2254.7 – 2189.2
DH16-16	14.3	pCpi	2259.5 – 2161.7
DH16-22	3570	pCpi	2197.5 – 2090.7
DH17-24	3579	pCpi	2280.4 – 2238.6
DH17-25	2728	pCpi	2325.2 – 2243.0

Hydrographs of the observation wells and DS16-06 are provided in **Appendix I, Figures 11 and 12**.

Water level response due to pumping was measured at observation well DH16-16. DH16-16 is located approximately 14.3 feet from DS16-06 and also constructed to a total depth of 120 feet bls and with an approximately equivalent screen interval depth to that of DS16-06 (**Appendix J**). Both DH16-06 and DS16-06 have open intervals that penetrate pCpi and have similar static water levels of around 26 feet bls. During the DS16-06 constant-rate pumping test, maximum water level drawdown at DH16-16 was approximately 34.6 feet. For analytical modeling purposes, the wells were assumed to fully penetrate the aquifer. There was no discernible water level response due to pumping at the other observation wells.

Analytical Results

Plots of drawdown and recovery are provided in **Appendix K.1**, **Figures 11 and 12**. Semi-log plots of drawdown and recovery for the pumped well show steep trends indicative of low permeability conditions. Incomplete water level recovery shown in the water level hydrographs is believed to indicate decreasing storage coefficient at distance from the pumped well.

The analytical solution provided in AQTESOLV using the Barker (1988) generalized radial flow (GRF) model for unsteady, n-dimensional flow to a fully penetrating source in an isotropic, single- or double-porosity fractured aquifer was used for parameter estimation. A plot of the analytical solution showing drawdown and drawdown derivative data for both pumped well DS16-06 and observation well DH16-16 is shown in **Appendix K.1**, **Figure 12**.

The analytical solution was optimized to match late-time drawdown and derivative data for pumped well DS16-06 and drawdown at DH16-06. Due to the pump on/off period near the end of pumping period and large amount of drawdown that potentially dewatered the aquifer complicating the recovery period, only drawdown data was incorporated in the analysis. The slope of the drawdown derivative curve on the logarithmic plots is approximately one-half. Therefore, a flow dimension corresponding to linear flow was used in order to best match drawdown and drawdown derivative data of both the pumped well and the observation well.

Tabulated results of the DS16-06 pumping test are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Unit Tested	Analytical Method	Specific Storage (ft^{-1})	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-06	Pinal Schist (pCpi)	Barker (1988)	1.1E-04	3.7E-01	1.3E-04

4.1.10 Well DS16-07

Construction and Hydraulic Characteristics

Well DS16-07 is near the western edge of the proposed TSF. The open interval of the well, including the well screen and gravel pack, penetrates 94 feet of Upper Dripping Springs Quartzite (pCdsu) from 226 to 320 feet bls (**Figure 8**). The fractured rock pCdsu unit underlies approximately 149 feet of Mescal Limestone (pCmls). Based on air-lift measurements collected during drilling, pCdsu appears to be confined by overlying lower-permeability pCmls at the well site.

Field Methods and Results

A 72-hour, constant-rate pumping test was conducted at well DS16-07 with an average pumping rate of 40.0 gpm. Maximum water level drawdown at the pumped well was 89.6 feet and occurred near the end of the pumping period. Operational parameters for the DS16-07 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
01-Apr-2017 10:00	72	40.0	67.71	89.6	0.45

Field measurements of EC, temperature, pH, and turbidity were collected from discharged water during the pumping period. The data is presented graphically in **Appendix H**, **Figure 7** and summarized in **Table 3**. Field parameters recorded at the time of sample collection near the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
1056	25.6	7.94	0

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-02, DS16-06, DH16-19, DH16-20, DH16-21, DH17-23 and DH17-25. The locations of the observation wells and pumped well DS16-07 are shown on **Figure 28**. A summary of horizontal distances of observation wells from DS16-07 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-07	---	pCdsu	2143.6 – 2050.0
DS16-02 [a]	3553	Tal	2210.8 – 2141.6, 2120.8 – 2033.2
DS16-06	2591	pCpi	2272.4 – 2164.6
DH16-19	2113	pCdiab	2303.4 – 2194.4
DH16-20	14.9	pCmls	2309.4 – 2249.5
DH16-21	2343	pCmls, pCdiab	2341.6 – 2282.8
DH17-23	2029	Tal	2384.8 – 2276.6
DH17-25	1826	pCp	2325.2 – 2243.0

[a] DS16-02 has two open intervals separated by blank casing and annular seals

Hydrographs of the observation wells and DS16-07 and are provided in **Appendix I, Figures 13 and 14**. At pumped well DS16-07, Level TROLL data is available for the first two hours of recovery, during which the water level rose from approximately 157.3 at the end of pumping to 71.3 feet bls (96 percent recovered to pre-pumping water level). Water level data following the first two hours of recovery at DS16-07 was lost due to a malfunction of the Level TROLL software while downloading the data.

Water level response due to pumping was evident at observation well DH16-20. DH16-20 is located 14.9 feet from DS16-07 and completed in pCmls, which overlies pCdsu at the well site (**Appendix J**). The bottom of the DH16-20 open interval is located approximately 106 feet above the top of the DS16-07 open interval. Maximum water level drawdown at DH16-20 during the DS16-07 constant-rate test was approximately one foot. The water level response at DH16-20 indicates that pCmls and pCdsu are poorly hydraulically connected at the test location and that pCmls acts essentially as an upper confining unit of pCdsu. There was no discernible water level response due to pumping at the other observation wells. Aquifer parameter estimation was conducted using single-well test methods.

Analytical Results

Plots of semi-log and log-log drawdown and recovery are provided in **Appendix K.1**, **Figures 13 and 14**. The semi-log plots show effects of borehole storage and well bore skin. Collection of recovery data was incomplete due to a logging malfunction, however the early-time data indicates concave downward curvature of the recovery data. This can be caused by a constant, but unequal storage coefficient during the drawdown and recovery periods, which is largely the result of the imperfect elasticity of the hard-rock aquifer; the storage coefficient is larger during the drawdown period and smaller during the recovery period due to compaction caused by the pressure drop during pumping.

An analytical solution provided in AQTESOLV using the mathematical model by Dougherty and Babu (1984) for unsteady flow to a well in a confined aquifer was used to analyze the DS16-07 pumping test. The model allows for partial penetration, wellbore storage and skin effects. Although a small amount of drawdown was detected at nearby observation well DH16-20, the water level response could not be analyzed using analytical modeling methods. A plot of the analytical solution showing both drawdown and drawdown derivative data for pumped well DS16-07 is shown in **Appendix K.1**, **Figure 14**.

Early-time drawdown data show an approximate 1:1 slope on the logarithmic plot during the first minute of pumping, consistent with a wellbore storage response. Subsequently, the slope of the drawdown derivative decreases representing a transitional period from well bore storage effects to IARF. After approximately one and a half log cycles, the derivative slope flattens, delineating an IARF period that lasts for more than one log cycle. After approximately 800 minutes to the end of the pumping test a negative hydraulic boundary is interpreted in the data, where the rate of drawdown in the well increases and the magnitude of the drawdown derivative plateau roughly doubles by the end of the test.

The analysis was optimized for the period that approximated stabilizing IARF conditions from approximately 20 to 800 minutes. The results of the DS16-07 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DS16-07	Dripping Spring Quartzite (pCds)	Dougherty-Babu (1984)	3.4E+00	1.2E-03

a) calculated using ratio of transmissivity parameter estimate and aquifer thickness penetrated by the pumped well

4.1.11 Well DS16-13

Construction and Hydraulic Characteristics

Well DS16-13 is located east of the proposed TSF in Happy Camp Canyon. The open interval of the well, including the well screen and gravel pack, partially penetrates 229 feet of Apache Leap Tuff (Tal) from 209 to 438 feet bls (**Figure 14**). Approximately 73 feet of Gila Conglomerate (Tg) and 126 feet of Tertiary Tuff (Tt) overlay Tal at the well site. Air-lift measurements and water level monitoring data collected during drilling suggest Tal is confined at the well site by lower-permeability upper units. Airlift measurements of discharge rate indicate the majority of production occurs from 360 feet to 420 feet within the Brown Unit of the Tal.

Field Methods and Results

A 24-hour, constant-rate pumping test was conducted at well DS16-13 with an average pumping rate of 7.5 gpm. Maximum water level drawdown at the pumped well was 109.4 feet and occurred near the end of pumping. Operational parameters for the DS16-13 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Average Pumping Rate (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
29-Apr-2017 09:00	24	7.5	28.68	109.4	0.07

Field measurements of EC, temperature, pH, ORP, DO and turbidity were collected from discharged water during the test. The data is presented graphically in **Appendix H**, **Figure 8** and summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	ORP (mV)[a]	DO (mg/L)[a]	Turbidity (NTU)
616	26.4	7.24	-55.2	1.19	2

[a] ORP and DO measured using flow-through cell; measurements are approximate

During the constant-rate pumping test and recovery period, water levels were monitored at wells DS16-14, DH17-31, DH17-33, DH17-35 and DH17-37. The locations of the observation wells and pumped well DS16-13 are shown on **Figure 29**. A summary of horizontal distances of observation wells from DS16-13 and open interval elevations follows:

Well ID	Horizontal Distance from Pumped Well (ft)	Geologic Units Intersected by Open Interval	Elevation of Open Interval (ft asl)
DS16-13	---	Tal	2495.1 – 2266.1
DS16-14	4855	Tg	2608.0 – 2355.0
DH17-31	4091	Tal, pCmls	2796.3 – 2662.0
DH17-33	13.4	Tg	2679.0 – 2631.0
DH17-35	3593	pCdiab, pCmls	2658.9 – 2536.9
DH17-37	2897	Tg	2615.6 – 2536.6

Hydrographs of the observation wells and DS16-13 and are provided in **Appendix I, Figures 15 and 16**.

A small water level response due to pumping was observed at DH17-33, located 13.4 feet from DS16-13. DH17-33 is constructed to a total depth of 70 feet bls and has an open interval that extends from 25 to 73 feet bls in Tg. Maximum water level drawdown was approximately 0.2 feet at the end of pumping; however, water level recovery was not evident. Overall, the drawdown observed at DH17-33 and water level monitoring data collected during drilling suggest a weak hydraulic connection (e.g., semi-confining) between Tg and Tal at the well sites.

Additionally, pressure measurements were collected from a VWP attached to DS16-13 well casing 130 feet bls (**Figure 14**). The VWP response to pumping activities, converted to head of water in feet, is shown with the DS16-13 hydrograph in **Appendix I, Figure 15**. Water level drawdown measured at the VWP was approximately 0.3 feet during the DS16-13 constant-rate pumping test, indicating a weak pressure decrease at the location of the VWP that may be the result of a hydraulic response from adjacent Tertiary tuff (Tt) at this depth and/or vertical translation of pressure through the borehole annulus. There was no discernible water level response due to pumping at the other observation wells. Aquifer parameter estimation was conducted using single-well test methods, and based on drawdown responses at DH17-33, the grouted VWP, and the pumped well, conceptualizing the aquifer response using leaky aquifer analytics.

Analytical Results

Plots of semi-log and log-log drawdown and recovery are provided in **Appendix K.1**, **Figures 15 and 16**. The analytical model developed by Moench (1985) was used in AQTESOLV that provides a solution for unsteady flow to a fully penetrating finite-diameter well with wellbore storage and skin in a homogeneous, isotropic leaky confined aquifer. Although small drawdown due to pumping was detected at nearby observation well DH17-33, the water level response could not be analyzed quantitatively for hydraulic parameters using analytical methods. A plot of the analytical solution showing both drawdown and drawdown derivative data for pumped well DS16-13 is shown in **Appendix K.1**, **Figure 9**.

A well-defined wellbore storage response is not observed during the early portion of the test. An upward-sloping derivative during the first 200 minutes of the test indicates that the rate of water level drawdown is increasing. Following the first 200 minutes of pumping, the derivative begins to stabilize and then decreases; the decrease is interpreted as leakage from overlying units.

The solution was optimized to account for wellbore skin using a negative skin to simulate relatively higher permeability in the immediate vicinity the well due to alterations in the hydraulic characteristics of Tal units resulting from drilling and development activities. Optimization of the wellbore skin factor was conducted while maintaining a reasonable estimation of storage coefficient. The results of the DS16-13 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DS16-13	Apache Leap Tuff (Tal)	Moench (1985)	1.7E-02	6.0E-06

[a] Calculated using transmissivity estimate and Tal aquifer thickness

4.1.12 Summary of Results

Constant-rate pumping tests were conducted at eight wells during the period April 1 to May 17, 2017 **(Figure 21)**. Pumping periods lasted between 8.9 and 72 hours and pumping rates varied from 1.5 to 64.7 gpm. Results for hydraulic conductivity derived from analysis of the constant-rate pumping tests are presented in **Table 2** and summarized as follows:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-01	Mescal Limestone (pCmls)	Barker (1988)	1.7E+00	6.0E-04
DS16-02	Apache Leap Tuff (Tal)	Barker (1988)	2.7E-03	9.5E-07
DS16-03	Perlite (Tfp)	Dougherty-Babu (1984)	8.4E-01	3.0E-04
DS16-04	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	8.7E-02	3.1E-05
DS16-05	Pinal Schist (pCpi)	Moench (1997)	1.3E-02	4.7E-06
DS16-06	Pinal Schist (pCpi)	Barker (1988)	3.7E-01	1.3E-04
DS16-07	Dripping Spring Quartzite (pCds)	Dougherty-Babu (1984)	3.4E+00	1.2E-03
DS16-13	Apache Leap Tuff (Tal)	Moench (1985)	1.7E-02	6.0E-06

4.2 Short-duration Pumping Tests

4.2.1 Introduction

To augment the constant-rate pumping tests described in the previous section, five short-duration pumping tests were conducted during well purging and sampling activities during the period May 8 to 17, 2017. The tests were conducted in four geotechnical piezometers: DH16-09, DH16-21, DH17-26 and DH17-35, and one hydrologic test well: DS16-14. The pumping periods lasted between 1.9 and 3.3 hours and pumping rates varied from 0.41 to 6.25 gpm. Two of the tests were constant-rate pumping tests while the other three tests involved variable pumping rates.

Short-duration pumping test locations are shown on **Figure 30**. Well construction diagrams for hydrologic test well DS16-14 and the geotechnical piezometers involved in testing are included on **Figure 15 and Appendix J**, respectively. A summary of construction characteristics for the well and piezometers is presented below:

Well ID	Type[a]	Diameter (inches)	Total Depth (ft bls)	Open Interval (ft bls)[b]	Geologic Unit(s) Intersected by Open Interval
DS16-14	HTW	4	279	31 – 284	Gila Conglomerate (Tg)
DH16-09	GP	2	170.3	123.9 – 171.4	Felsic Lava Flows / Perlite (Tfp)
DH16-21	GP	2	120	65.3 – 124.1	Mescal Limestone (pCmls), Diabase (pCdiab)
DH17-26	GP	2	250	177.8 – 250	Tertiary Basalt (Tb)
DH17-35	GP	2	160	40.5 – 162.5	Mescal Limestone (pCmls), Diabase (pCdiab), Fault

[a] HTW = hydrologic test well; GP = geotechnical piezometer
[b] Includes well screen and gravel pack

Pre-test water level depth varied from 47.47 to 150.60 feet bls. Maximum water level drawdown at the wells varied from 0.7 feet in Perlite (DH16-09) to 91.6 feet in Mescal Limestone and Precambrian Diabase (DS16-04). A summary of the hydraulic characteristics of the constant-rate pumping tests is presented below:

Well ID	Test Duration (hours)	Pumping Rate (gpm)	Pre-Test Water Level (ft bls)[a]	Maximum Water Level Drawdown (ft)
DS16-14	3.3	5.5 - 6.25	39.66	1.3
DH16-09	1.9	1.17	150.60	0.7
DH16-21	2.5	0.41	47.47	43.5
DH17-26	2.1	0.75 - 1	95.17	67.9
DH17-35	3.2	0.43 - 1.1	41.13	91.6

[a] Due to well development activities prior to testing, the pre-test water level may not be representative of static water level conditions

4.2.2 Field Methods, Equipment, and Analytical Methods

Prior to testing, pumping rates were estimated for the geotechnical piezometers and hydrologic test well after evaluating drawdown and recovery observations collected during development activities conducted in February and March 2017. Maximum pumping rates achieved during testing were limited by the capacity of the pumping equipment for some of the tests.

Criteria for successful test completion included the following:

1. Maintain constant or near-constant pumping rate, without lowering the water level near the pump intake
2. Purge at least three well/piezometer borehole volumes (assuming 30 percent gravel pack porosity)
3. Observe stabilization of field water quality parameters (no clear increasing or decreasing trend in parameters, and varying within +/-10 percent for turbidity, +/- 5% for EC, and +/- 0.2 pH units), or turbidity below 25 NTUs

For the five tests conducted, the above criteria were met. At the end of each test, a water quality sample was collected and sent to SVL Analytical, Inc., of Coeur d'Alene, ID for analysis.

Tests conducted in 2-inch standpipe geotechnical piezometers utilized a variable-rate Grundfos Redi-Flo 2 submersible pump. The pump was powered by a Honda EU2000i portable inverter generator and operated with a Grundfos Variable Frequency Drive (VFD) control box. The pump discharge line consisted of 0.5-inch vinyl tubing, and discharge measurements were collected with a GPI low-flow turbine flowmeter. Water level drawdown during pumping operations was recorded with a non-vented Level TROLL installed below water level. Additional water level measurements were manually collected with a Waterline 500 sounder.

Pumping equipment for short-duration test at DH16-21

The test conducted in 4-inch hydrologic test well DS16-14 utilized the Grundfos Redi-Flo 3 submersible pump with 0.75-inch diameter vinyl discharge tubing. The pump was powered with a Honda EG4000 portable generator and operated with a Grundfos CU300 control box. Discharge rate was calculated using a stopwatch and calibrated bucket. Water level measurements were collected with a non-vented Level TROLL and a Waterline 500 sounder. Water quality parameters of the discharge water were measured during testing.

Work flow for data processing of the short-term pumping test data and analytical methods followed procedures described in the previous section for constant-rate pumping tests.

4.2.3 Well DS16-14

Well DS16-14 is located southeast of the proposed TSF between Happy Camp Canyon and Silver King Canyon. The perforated interval of the well is completed in Gila Conglomerate (Tg) from 39 to 279 feet bls (**Figure 15**). A contact with Tertiary Basalt (Tb) is assumed to confine Tg from below starting at 290 feet bls. At the well site, local groundwater in the Tg is characterized as hydraulically unconfined conditions in a network of fractured rock and rock matrix.

A 3.3-hour pumping test was conducted at well DS16-14 on May 17, 2017. The pumping rate varied from approximately 5.5 gpm at the start of pumping, to 6.25 gpm at the end of the test. Maximum water level drawdown at the pumped well was 1.3 feet and occurred near the end of the test. Operational parameters for the DS16-14 pumping test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Pumping Rates (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)[a]
17-May-2017 13:25	3.3	5.5 – 6.25	39.66	1.3	4.5

[a] Based on approximate average pumping rate of 5.88 gpm

Field measurements of EC, temperature, pH and turbidity were collected from discharged water during the pumping period, and are summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
1074	24.2	7.19	6.9

An analytical solution is provided in AQTESOLV using the mathematical model by Moench (1997) for unsteady flow to a well in an unconfined aquifer. The model allows for fully and partially penetrating well configurations and variable pumping rates, which were specified according to discharge rates measured during the test. A plot of the analytical solution is shown in **Appendix K.2**, **Figure 1**.

The analytical solution was optimized to fit the drawdown characteristics of the late-time portion of the test, from approximately 85 to 200 minutes, when the pumping rate remained relatively constant at approximately 6.25 gpm. In order to improve the early-time portion of the analytical solution, a negative skin was used to simulate relatively higher permeability in the immediate vicinity of the well due to alterations in the hydraulic characteristics of Tg resulting from drilling and development activities. Due to variable pumping rates and the short duration of the test, a well-defined IARF period did not develop.

The results of the DS16-14 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a] (ft/day)	Hydraulic Conductivity[a] (cm/s)
DS16-14	Gila Conglom. (Tg)	Moench (1997)	2.6E+00	9.1E-04

[a] equal to the transmissivity of the aquifer divided by saturated thickness

4.2.4 Piezometer DH16-09

Piezometer DH16-09 is in the northeastern part of the proposed TSF footprint in the area of outcropping Tertiary Felsic Lava Flows (Tfp). The open interval of the well (2-inch diameter PVC well screen) is completed in Tfp from 123.9 to 171.4 feet bls **(Appendix J)**. At the well site, Tfp extends from ground surface to at least 250 feet bls (total drilled depth of borehole). Local groundwater in the Tfp is characterized as hydraulically unconfined conditions in a network of fractured rock and rock matrix.

A 1.9-hour pumping test was conducted at well DH16-09 on May 9, 2017. After initial adjustments, the average pumping rate was approximately 1.17 gpm and remained relatively constant throughout the duration of the test. Maximum water level drawdown at the pumped well was 0.7 feet and occurred near the end of pumping. Operational parameters for the DH16-09 test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Pumping Rates (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
09-May-2017 12:40	1.9	1.17	150.62	0.7	0.60

Field measurements of EC, temperature, pH and turbidity were collected from discharged water during the pumping period, and are summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
634	26.7	6.96	0

The Moench (1997) analytical model for unsteady flow to a partially penetrating well in an unconfined aquifer was used to fit the pumped well response. A plot of the analytical solution is shown in **Appendix K.2**, **Figure 2**.

The analytical solution was optimized to fit the IARF period corresponding to a plateau in the drawdown derivative data at intermediate time from approximately 10 to 110 minutes after the start of pumping. In order to improve the match of the analytical solution, a negative skin was used to simulate increased permeability in the immediate vicinity of the well bore due to drilling and development activities. Due to the short-term duration of the test, the results of the DH16-09 pumping test analysis presented in **Table 2** and summarized below are considered approximate:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DH16-09	Felsic Lava Flows / Perlite (Tfp)	Moench (1997)	5.6E+00	2.0E-03

[a] equal to the transmissivity of the aquifer divided by saturated thickness

4.2.5 Piezometer DH16-21

Piezometer DH16-21 is located in the western part of the proposed TSF footprint in an area of outcropping Younger Precambrian geologic units. The open interval of the well (2-inch diameter PVC well screen) extends from 65.3 to 124.1 feet bls. The completion is in Precambrian Diabase (pCdiab) from 65.3 to 85.5 feet bls and 95 to 124.1 feet bls **(Appendix J)**. The open interval of the well also fully penetrates 9.5 feet of Mescal Limestone (pCmls) from 85.5 to 95 feet bls. At land surface, approximately 15 feet of Quaternary Alluvium (Qal) overlies pCdiab. Groundwater flow characterization at the completed well site is considered to primarily occur in pCmls, which is hydraulically confined by the pCdiab.

A 2.5-hour pumping test was conducted at well DH16-21 on May 16, 2017. The average pumping rate was approximately 0.41 gpm and remained relatively constant throughout the test. Maximum water level drawdown at the pumped well was 43.5 feet and occurred near the end of pumping. Operational parameters for the DH16-21 test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Pumping Rates (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)
16-May-2017 08:30	2.5	0.41	47.47	43.5	0.01

Field measurements of EC, temperature, pH and turbidity were collected from discharged water during the pumping period, and are summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
999	27.4	7.34	24

An analytical solution was developed using a solution proposed by Dougherty and Babu (1984) for unsteady flow to a pumped well in an isotropic, confined aquifer. The solution accounts for fully and partially penetrating wells, wellbore storage and wellbore skin. A plot of the analytical solution is shown in **Appendix K.2**, **Figure 3**.

The analytical solution was optimized to fit a plateau observed in the slope of the derivative data, corresponding to approximately 10 to 80 minutes after the start of pumping. During the first 2 minutes of the test, drawdown of the water level is indicative of wellbore storage (1:1 slope) and is accounted for in the analytical solution. A negative skin was included to improve the overall match of the solution to observed data. The results of the DH16-21 pumping test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DH16-21	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	7.4E-02	2.6E-05

[a] equal to the transmissivity of the aquifer divided by saturated thickness

4.2.6 Piezometer DH17-26

Piezometer DH17-26 is south of the proposed TSF footprint. The open interval of the well (2-inch diameter PVC well screen) extends from 177.8 to 250 feet bls in Tertiary Basalt (Tb) **(Appendix J)**. At the well site, Gila Conglomerate (Tg) overlies Tb from the ground surface to approximately 147 feet bls. Local groundwater flow is considered to occur primarily in the Tb and is characterized as hydraulically confined conditions in a network of fractured rock and rock matrix.

A 2.1-hour pumping test was conducted at well DH17-26 on May 8, 2017. The pumping rate was variable and decreased from approximately 1.0 to 0.75 gpm during the test. Maximum water level drawdown at the pumped well was 67.9 feet and occurred near the end of pumping. Operational parameters for the DH17-26 test are as follows:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Pumping Rates (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)[a]
08-May-2017 11:24	2.1	0.75 - 1.0	95.17	67.9	0.01

[a] Based on an average pumping rate of 0.88 gpm

Field measurements of EC, temperature, pH and turbidity were collected from discharged water during the pumping period, and are summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
1008	29.7	7.56	14.5

An analytical solution was developed using a solution proposed by Dougherty and Babu (1984) for unsteady flow to a pumped well in an isotropic, confined aquifer. The solution accounts for fully and partially penetrating wells, wellbore storage and wellbore skin. A plot of the analytical solution is shown in **Appendix K.2**, **Figure 4**.

While no well-defined period of IARF was observed, the test data was optimized for the majority of drawdown and derivative data that occurred following a change in pumping rate from 1.0 to 0.83 gpm that occurred approximately 35 minutes after the start of pumping until the end of the test. Drawdown during the first four minutes of pumping was greater than could be accounted for without significantly decreasing the casing radius; however, the solution was slightly improved by including a downhole equipment radius of 0.03 feet to account for the pump and discharge tubing. Due to the short-term duration of the test, variable pumping rate, and low specific capacity, the results of the DH17-26 pumping test analysis presented in **Table 2** and summarized below are considered approximate:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DH17-26	Tertiary Basalt (Tb)	Dougherty-Babu (1984)	7.7E-03	2.7E-06

[a] equal to the transmissivity of the aquifer divided by saturated thickness

4.2.7 Piezometer DH17-35

Piezometer DH17-35 is located east of the proposed TSF footprint, between Potts Canyon and Happy Camp Canyon. The open interval of the well (2-inch diameter PVC well screen) extends from 40.5 to 162.5 feet bls, and is completed across 95.5 feet of Precambrian Diabase (pCdiab) from 40.5 to 136 feet bls, and partially penetrates 26.5 feet of Mescal Limestone (pCmls) from 136 to 162.5 feet bls **(Appendix J)**. A thin veneer of Quaternary Alluvium (Qal) overlies pCdiab from the ground surface to 3 feet bls. Groundwater movement at the completed well site is considered to primarily occur through pCmls, which generally exhibits a much greater relative permeability than pCdiab in the region.

A 3.2-hour pumping test was conducted at well DH17-35 on May 15, 2017. The pumping rate was variable and decreased from approximately 1.1 to 0.43 gpm during the test. Maximum water level drawdown at the pumped well was approximately 91.6 feet and occurred near the end of pumping. Operational parameters for the DH17-35 pumping test are shown below:

Date and Time Pumping Started	Duration of Pumping Period (hours)	Pumping Rates (gpm)	Pre-pumping Water Level (ft bls)	Maximum Water Level Drawdown (ft)	Specific Capacity (gpm/ft)[a]
15-May-2017 10:10	3.2	0.43 - 1.1	41.13	91.6	0.01

[a] Based on an average pumping rate of 0.77 gpm

Field measurements of EC, temperature, pH and turbidity were collected from discharged water during the pumping period, and are summarized in **Table 3**. Field parameters recorded at the end of the pumping test are shown below:

EC (µS/cm)	Temp (°C)	pH	Turbidity (NTU)
820	29.4	7.50	8.7

An analytical solution was developed using a solution derived by Dougherty and Babu (1984) for unsteady flow to a pumped well in an isotropic, confined aquifer. The solution accounts for partially penetrating wells, wellbore storage and wellbore skin. A plot of the analytical solution is shown in **Appendix K.2**, **Figure 5**.

During the first three minutes of the test, a 1:1 slope of drawdown data consistent with wellbore storage is observed and accounted for by the analytical model. Several different pumping rates were used during the test, and are observed as abrupt changes the slope of drawdown. Due to the short duration of the test, variable pumping rate, and low specific capacity, no well-defined IARF period was observed during the test. Therefore parameter estimates for transmissivity and hydraulic conductivity should be considered approximate. Estimates for the DH17-35 test analysis are presented in **Table 2** and summarized below:

Well ID	Hydrogeologic Test Unit	Analytical Method	Hydraulic Conductivity[a]	
			(ft/day)	(cm/s)
DH17-35	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	9.3E-03	3.3E-06

[a] equal to the transmissivity of the aquifer divided by saturated thickness

4.2.8 Summary of Results

To augment the long-term, constant-rate pumping tests, five short-duration pumping tests were conducted during well purging and sampling activities during the period May 8 to 17, 2017. The tests were conducted in four geotechnical piezometers: DH16-09, DH16-21, DH17-26 and DH17-35, and one hydrologic test well: DS16-14 **(Figure 30)**. Two of the tests were constant-rate pumping tests while the other three tests involved variable pumping rates.

Results from the short-duration pumping tests are presented in **Table 2**. Hydraulic conductivity estimates are summarized as follows:

Well ID	**Hydrogeologic Test Unit**	**Analytical Method(s)**	**Hydraulic Conductivity**	
			(ft/day)	**(cm/s)**
DS16-14	Gila Conglomerate (Tg)	Moench (1997)	2.6E+00	9.1E-04
DH16-09	Felsic Lava Flows / Perlite (Tfp)	Moench (1997)	5.6E+00	2.0E-03
DH16-21	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	7.0E-02	2.6E-05
DH17-26	Tertiary Basalt (Tb)	Dougherty-Babu (1984)	7.7E-03	2.7E-06
DH17-35	Mescal Limestone (pCmls)	Dougherty-Babu (1984)	9.3E-03	3.3E-06

The hydraulic conductivity estimates for analytical methods range from 7.7E-03 ft/day for Tertiary Basalt (Tb) to 5.6 ft/day for Tertiary Felsic Lava Flows (Tfp). Due to the short duration of the tests, limited pumping rates due to small-diameter well construction, and lack of observation well data to constrain analytical modeling, the aquifer parameter estimates derived from these tests should be considered approximate, in particular for results of testing conducted at wells DH16-21, DH17-26, and DH17-35.

4.3 Slug Tests

4.3.1 Introduction

Between February and May 2017, slug tests were carried out in eight hydrologic test wells and four geotechnical piezometers; slug testing locations are shown on **Figure 31**. Well construction diagrams for the hydrologic test wells are shown on **Figures 5**, **6**, **9**, **10**, **12, 13**, **16 and 17**; geotechnical piezometer diagrams are included in **Appendix J**. A summary of construction characteristics for the wells and piezometers is presented below:

Well ID	Type [a]	Well Diameter (in)	Total Depth (ft bls)	Open Interval (ft bls) [b]	Hydrogeologic Unit(s) at Open Interval
DS16-04	HTW	4	619	518 – 620	Mescal Limestone (pCmls), Diabase (pCdiab)
DS16-05	HTW	4	319	185 – 320	Pinal Schist (pCpi)
DS16-08	HTW	4	377.5	279 – 378.5	Fault (Roblas Canyon), Drip. Spring Quartzite (pCds), Pinal Schist (pCpi)
DS16-09	HTW	4	176.5	26.4 – 177.5	Pinal Schist (pCpi)
DS16-11	HTW	4	640	437 – 640	Apache Leap Tuff (Tal)
DS16-12	HTW	4	339	252 - 340	Diabase (pCdiab)
DS17-15	HTW	4	449	278 – 458	Tertiary Basalt (Tb)
DS17-16	HTW	4	165	102 – 175	Tertiary Basalt (Tb)
DH16-22	GP	2	215	109.1 – 215.9	Pinal Schist (pCpi)
DH17-24	GP	2	67	25.2 – 67	Pinal Schist (pCpi)
DH17-27	GP	2	110	25 – 112	Tertiary Basalt (Tb)
DH17-36	GP	2	92	21.3 – 100	Gila Conglomerate (Tg)

[a] HTW = hydrologic test well; GP = geotechnical piezometer
[b] Includes well screen and gravel pack

Two to six slug tests were conducted at each well or piezometer, for a total of 56 tests. Pre-test water level depth varied from 7.7 to 207.2 feet bls. Initial water level displacement varied from 0.78 feet to 3.27 feet for tests considered adequate for analysis. Test durations varied from approximately 0.1 to 15.4 days.
A summary of the hydraulic characteristics of the slug tests follows:

Well ID	Number of Slug Tests	Pre-Test Water Level (ft bls) [a]	Initial Water Level Displacement (ft) [b]	Test Duration (days)
DS16-04	4	7.6	1.46 – 3.27	0.1
DS16-05	6	28.7	1.48 – 2.96	0.1 - 0.3
DS16-08	6	45.8	0.83 – 3.21	0.7 - 4.0
DS16-09	6	46	0.21 – 0.96	--- [c]
DS16-11	4	207.3	0.93 – 2.42	0.6 – 2.1
DS16-12	2	136.7 – 126.3	1.07 – 1.21	14.9 – 15.4
DS17-15	4	71.7	1.48 – 3.10	0.6 – 6.3
DS17-16	4	70.9	0.98 – 2.09	2.1 – 3.0
DH16-22	4	27.8	1.47 – 2.90	0.4 – 1.4
DH17-24	4	23.9	1.29 – 2.48	0.3 – 0.9
DH17-27	6	24.1	1.05 – 2.12	0.1 – 0.3
DH17-36	6	37.6	0.78 – 1.82	0.4 – 0.9

[a] Approximate and does not indicate static conditions
[b] First record 10 seconds to 10 minutes after initiation of slug
[c] Slug test data collected from well DS16-09 was not adequate for analysis

Results showed the tests to be overdamped, typical of low to moderate hydraulic conductivity aquifers. During an overdamped slug test, response data measured in the test well decrease monotonically with increasing time since the start of the test. In contrast, response data from an underdamped slug test, typical of high hydraulic conductivity aquifers, exhibit oscillatory behavior.

4.3.2 Field Methods and Equipment

Falling-head and rising-head slug tests were conducted in each of the wells and piezometers tested. Falling-head tests consist of a near-instantaneous upward displacement of water level in a well or piezometer, and monitoring the subsequent water level response as a function of time. Rising-head tests consist of a near-instantaneous downward displacement of a water level and monitoring the subsequent water level response as a function of time. Upward and downward displacements were initiated using solid objects (“slugs”) of known volumes. To cause upward displacements, the slugs were quickly lowered from slightly above water level to slightly below water level; to cause downward displacements, fully submerged slugs were lifted out of the water. In both cases, pre-test water levels were monitored for antecedent trends.

Preparing to conduct falling head slug test at DS17-16

The slugs consisted of 1.25-inch to 2-inch diameter Schedule 40 PVC joints ranging from 1 to 4 feet in length. Each joint was filled with sand and sealed with PVC end caps. Braided nylon rope was used to lift and lower the slugs and was attached to the screw eyes installed on the end caps. Where larger water level displacements were desired, multiple slugs were linked together. Specifications for the slugs utilized during testing are shown below:

Slug ID	Sch. 40 PVC Nominal Dia. (in)	Length (in) [a]	Volume (ft^3) [b]	Calculated WL Displacement (ft)
A_{long}	2	4.18	0.132	1.515
B_{medium}	2	2.01	0.063	0.723
B_{long}	2	3.97	0.125	1.434
C_{medium}	2	2.65	0.084	0.960
D_{long}	2	4.11	0.130	1.491
F_{medium}	2	2.27	0.071	0.813
G_{short}	2	1.60	0.050	0.576
1A	1.25	12.00	0.015	0.724
1B	1.25	12.00	0.015	0.724
2A	1.25	24.00	0.030	1.448
2B	1.25	23.90	0.030	1.442
3A	1.25	36.00	0.045	2.172
3B	1.25	36.00	0.045	2.172
4A	1.25	48.00	0.059	2.896
4B	1.25	48.01	0.059	2.897

[a] Includes end caps
[b] Ignores extra diameter of end caps

PVC slug next to piezometer DH17-36 (formerly GT-14-3)

Water level data were collected using non-vented Level TROLLs. The Level TROLLs were programmed to collect measurements at 10-second to 1-minute intervals, depending on the expected rate of water level response at each well or piezometer. Barometric data was collected using a BaroTROLL which was maintained in well vaults near the test sites. The BaroTROLL collected measurements at 1-minute intervals during testing activities.

4.3.3 Analytical Methods

Butler (1998) developed guidelines for analytical methods for overdamped (non-oscillatory) water level displacement responses. The guidelines include procedures for single-well tests in fully and partially penetrating wells in confined and unconfined aquifers. The methodology includes screening the data by fitting the Cooper and others (1967) analytical solution to the test data. After evaluating initial estimates, alternative methods are investigated that include Hvorslev (1951), Bouwer and Rice (1976), Peres and others (1989), and Hyder and others (1994). The latter method is commonly referred to as the Kansas Geological Survey (KGS) Model.

AQTESOLV was used for aquifer parameter estimation using the available analytical methods for slug test analysis. In most cases, the open interval of the well or piezometer was used as the effective well screen length because the permeability of the filter pack was much greater than that of the surrounding formation (Fetter, 2001). However, for wells that required the use of additives during drilling, such as DS16-08 and DS16-09, the nominal screen length was used. Development can only remove additives from the aquifer adjacent to the perforated interval; the aquifer adjacent to the wellbore but away from the perforated interval is likely to have reduced permeability relative to its pre-drilling condition due to persistence of drilling additives around the wellbore.

The radius of the perforated interval was specified as the radius of the borehole, because the filter pack was much more permeable than the surrounding formation (Butler, 1998). The outer radius of the well skin was also specified as the radius of the borehole as no data were available regarding impact to a larger radius due to drilling operations. Static water column height was specified as the difference between the pre-test depth to water level and the depth to bottom of the specified screened interval.

Barometric effects were significant in a majority of the tests and required correction before the tests could be properly analyzed. Barometric corrections were computed using the Barometric Response Function (BRF) Software developed by the KGS and described by Butler and others (2011). Tests conducted in wells DS16-04 and DS16-05 were not corrected for barometric pressure due to short test durations and small hydraulic responses to barometric pressure in the geologic units tested. Tests conducted in well DS16-11 exhibited relatively long recovery times, but due to little barometric response, analysis could not be significantly improved with the BRF technique.

Additionally, diurnal sinusoids observed in water level data were identified as tidal effects. For tests that exhibited strong tidal effects, the software program TSOFT (Van Camp and Vauterin, 2005) was used to generate theoretical earth tides at the well locations. The earth tide values were then imported into the Barometric Response Function Software and used in conjunction with barometric data to calculate corrected water levels.

4.3.4 Well DS16-04

Well DS16-04 is located near the eastern edge of the proposed TSF. The perforated interval of the well extends from 538 to 598 feet bls and fully penetrates 47 feet of Mescal Limestone (pCmls) from 543 to 590 feet bls **(Figure 5)**. The perforated interval and gravel pack extend into overlaying and underlying units of Precambrian Diabase (pCdiab). Due to the low permeability of pCdiab, analysis of the slug tests assumed that nearly all groundwater movement into the well occurred through pCmls. Air-lift measurements and water level monitoring data collected during drilling suggest pCmls is hydraulically confined at the well site.

Four slug tests were conducted at well DS16-04 on February 8 and 9, 2017. Prior to testing, the water level in the well was located approximately 7.6 feet bls. Hydraulic parameter details for the DS16-04 tests are summarized as follows:

Test Start Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
07-Feb-17	Falling Head	7.66	0.130	1.46
07-Feb-17	Rising Head	7.62	0.130	1.51
07-Feb-17	Falling Head	7.66	0.264	3.19
08-Feb-17	Rising Head	7.61	0.264	3.27

AQTESOLV plots are shown in **Appendix K.3**, **Figures 1 through 4**. The screening methodology for a single well test in a fully penetrating well in a confined aquifer by Cooper and others (1967) method resulted in an implausibly low storativity value. The low storativity value indicates the presence of wellbore storage effects and suggests that the slug test data requires transformation into equivalent head data for a constant-rate pumping test with wellbore storage and skin effect using the method of Peres and others (1989). Through the use of an approximate deconvolution technique, the method eliminates wellbore storage from the transformed equivalent head data, thereby making it possible to analyze the equivalent heads using the Cooper-Jacob (1946) solution for a constant-rate pumping test.

Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and pCmls aquifer thickness, hydraulic conductivity parameters are estimated as follows:

			Hydraulic Conductivity	
Well ID	**Test Date**	**Analytical Method**	**(ft/day)**	**(cm/s)**
DS16-04	07-Feb-17	Peres and others (1989)	1.0E-01	3.5E-05
	07-Feb-17	Peres and others (1989)	1.1E-01	3.9E-05
	07-Feb-17	Peres and others (1989)	2.0E-01	7.1E-05
	08-Feb-17	Peres and others (1989)	8.0E-02	2.8E-05
		AVERAGE	**1.2E-01**	**4.2E-05**

4.3.5 Well DS16-05

Well DS16-05 is located west of the proposed TSF in Roblas Canyon. The open interval of the well is completed in Pinal Schist (pCpi) from 185 to 320 feet bls **(Figure 6)**. Approximately 15 feet of Quaternary Alluvium (Qal) overlies pCpi at surface. Aquifer conditions are characterized as a hydraulically unconfined groundwater system comprised of a network of fractured rock.

Six slug tests were conducted at well DS16-05 between January 31 and February 2, 2017. Prior to testing, the water level in the well was approximately 28.7 feet bls. Hydraulic parameter details for the DS16-05 tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
31-Jan-17	Falling Head	28.79	0.132	1.54
31-Jan-17	Rising Head	28.72	0.132	1.52
01-Feb-17	Falling Head	28.65	0.257	2.99
01-Feb-17	Rising Head	28.63	0.257	3.03
01-Feb-17	Falling Head	28.90	0.132	1.54
02-Feb-17	Rising Head	28.73	0.132	1.53

AQTESOLV plots are shown in **Appendix K.3**, **Figures 5 through 10**. Screening the results for a single well test using the Cooper and others (1967) method resulted in reasonable storativity values. Although the screening analysis method assumes a fully penetrating well, the estimates of storativity indicate an aquifer in which radial hydraulic conductivity (Kr) is much larger than vertical hydraulic conductivity (Kz) and the ratio Kz/Kr is small. Hence, flow is confined to the open interval of the well and the analysis can be performed using the procedure for fully penetrating wells and unconfined aquifer conditions.

Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and aquifer thickness of pCpi, hydraulic conductivity parameters are estimated as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-05	31-Jan-17	Cooper and others (1967)	2.9E-02	1.0E-05
	31-Jan-17	Cooper and others (1967)	2.8E-02	9.9E-06
	01-Feb-17	Cooper and others (1967)	2.8E-02	9.9E-06
	01-Feb-17	Cooper and others (1967)	2.6E-02	9.2E-06
	01-Feb-17	Cooper and others (1967)	2.4E-02	8.5E-06
	02-Feb-17	Cooper and others (1967)	2.5E-02	8.8E-06
		AVERAGE	**2.7E-02**	**9.5E-06**

4.3.6 Well DS16-08

Site DS16-08 is located near the northwest edge of the proposed TSF in the hanging wall of the Roblas Canyon fault. The perforated well interval extends from 297 to 379 feet bls and spans approximately 13 feet of Dripping Spring Quartzite (pCds), 79 feet of Pinal Schist (pCpi) and 10 feet of the Roblas Canyon fault **(Figure 9)**. Air-lift water production measurements collected during drilling indicated a majority of water production occurring near the Roblas Canyon fault zone. For analytical modeling, groundwater flow is assumed confined to the perforated interval of the well comprising pCds, pCpi and the Roblas Canyon fault.

Six slug tests were conducted at well DS16-08 between February 1 and 15, 2017. Prior to testing, the water level in the well was located approximately 45.8 feet bls. Hydraulic parameters for the tests are summarized below:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
01-Feb-17	Falling Head	45.85	0.063	0.85
02-Feb-17	Rising Head	45.78	0.063	0.87
03-Feb-17	Falling Head	45.86	0.209	1.96
04-Feb-17	Rising Head	45.70	0.209	2.03
08-Feb-17	Falling Head	45.80	0.264	3.32
15-Feb-17	Rising Head	45.82	0.264	3.31

AQTESOLV plots of the slug tests showing normalized water level displacements versus logarithmic time are shown in **Appendix K.3**, **Figures 11 through 16**.

The screening methodology using Cooper and others (1967) method was used to provide the best fit of test data. Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and aquifer thickness, hydraulic conductivity parameters are estimated as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-08	01-Feb-17	Cooper and others (1967)	2.0E-03	7.1E-07
	02-Feb-17	Cooper and others (1967)	1.4E-03	4.9E-07
	03-Feb-17	Cooper and others (1967)	1.8E-03	6.4E-07
	04-Feb-17	Cooper and others (1967)	1.3E-03	4.6E-07
	08-Feb-17	Cooper and others (1967)	1.9E-03	6.7E-07
	15-Feb-17	Cooper and others (1967)	2.0E-03	7.1E-07
		AVERAGE	**1.7E-03**	**6.0E-07**

The hydraulic conductivity estimates resulting from slug tests conducted at DS16-08 represent average values integrating the pCds, pCpi and Roblas Canyon fault present in the well open interval.

4.3.7 Well DS16-09

Well DS16-09 is located near the northwest edge of the proposed TSF in the foot wall of the Roblas Canyon fault. The perforated interval of the well extends from 26 to 178 feet bls and partially penetrates 152 feet of Pinal Schist (pCpi) **(Figure 10)**. Approximately 10 feet of Quaternary Alluvium (Qal) overlies pCpi at the ground surface. Groundwater movement through pCpi is characterized by a network of fractures and rock matrix.

Six slug tests were conducted at well DS16-09 between February 2 and 20, 2017. Prior to testing, the water level in the well was located approximately 46 feet bls. Hydraulic parameter details for the tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft³)	Initial Water Level Displacement (ft)
02-Feb-17	Falling Head	46.20	0.050	0.21
03-Feb-17	Rising Head	46.06	0.050	0.21
03-Feb-17	Falling Head	46.27	0.180	0.59
04-Feb-17	Rising Head	45.74	0.180	0.62
15-Feb-17	Falling Head	45.94	0.264	0.84
20-Feb-17	Rising Head	45.51	0.264	0.96

The first three tests were terminated when water levels did not recover. Tests four and five appeared to have recovered, but further investigation showed that the water level was erratic and strongly influenced by changes in barometric pressure, as exhibited most clearly in test six. Therefore, due to erratic water level responses to slug displacements and incomplete recovery to pre-test levels, the tests were not considered amenable to analysis.

4.3.8 Well DS16-11

Well DS16-11 is located near the northwest edge of the proposed TSF. The open interval of the well extends from 437 to 640 feet bls and partially penetrates 203 feet of Apache Leap Tuff (Tal) **(Figure 12)**. Approximately 147 feet of Gila Conglomerate (Tg) overlies Tal at the ground surface. Groundwater movement through Tal at the well site is characterized as hydraulically unconfined and primarily controlled by a network of fractured rock and rock matrix.

Four slug tests were conducted at well DS16-11 between February 1 and 9, 2017. Prior to testing, the water level in the well was located approximately 207.3 feet bls. Hydraulic parameter details for the DS16-11 tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft³)	Initial Water Level Displacement (ft)
01-Feb-17	Falling Head	207.24	0.071	0.93
02-Feb-17	Rising Head	207.27	0.071	0.98
03-Feb-17	Falling Head	207.30	0.196	2.40
04-Feb-17	Rising Head	207.21	0.196	2.46

AQTESOLV plots of the slug tests showing logarithmic normalized water level displacements versus linear time are shown in **Appendix K.3**, **Figures 17**

through 20. Analysis of the slug tests assumes that flow is confined to the open interval of the well. Analytical modeling using the Cooper and others (1967) method and the KGS method (Hyder and others, 1994) provided the best fit to the data. Analytical curve matching provides the following hydraulic conductivity estimates:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-11	01-Feb-17	KGS Model	2.9E-03	1.0E-06
	02-Feb-17	Cooper and others (1967)	7.2E-04	2.5E-07
	03-Feb-17	KGS Model	2.0E-03	7.1E-07
	04-Feb-17	Cooper and others (1967)	8.8E-04	3.1E-07
		AVERAGE	**1.6E-03**	**5.6E-07**

4.3.9 Well DS16-12

Well DS16-12 is located east of the proposed TSF and west of the Concentrator fault in Happy Camp Canyon. The open interval of the well spans 90 feet of Precambrian Diabase (pCdiab) from 250 to 340 feet bls **(Figure 13)**. Above the pCdiab is Mescal Limestone (pCmls) and Apache Leap Tuff (Talb). Based on production during drilling, groundwater flow is characterized as hydraulically confined in pCdiab by overlying less-permeable units pCmls and Talb.

During slug testing, the water level in DS16-12 was still recovering (rising) from development activities occurring six months prior in November 2016, at an average rate of approximately 0.4 ft/day.

Two slug tests were conducted at well DS16-12 on May 2 and 24, 2017. Water level recoveries were monitored for a period of at least 2 weeks following each of the tests. In order to analyze the tests, polynomial equations developed using antecedent water levels collected prior to slug initiations were subtracted from test data in order to account for continuing water level recovery. Corrected displacement data were used to estimate hydraulic parameters. Pre-test water levels varied by approximately 10 feet between the two tests due to ongoing water level recovery from development activities. Hydraulic parameter details for the tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft³)	Initial Water Level Displacement (ft)
02-May-17	Falling Head	136.69	0.084	1.07
24-May-17	Rising Head	126.30	0.084	1.21

AQTESOLV plots of the slug tests showing logarithmic normalized water level displacements versus linear time are shown in **Appendix K.3**, **Figures 21 through 22**. After screening analysis of the data, the Hvorslev (1951) straight-line analytical method was employed for the analysis of both tests.

For the first test, the straight line was fitted to early time, approximately the first 8 days of recovery, before the water level recovery deviates from trend. Fitting the solution to early-time rather than late-time data is considered to be a conservative approach given the assumptions associated with correcting for the antecedent water level trend in order to calculate displacement. For the second test, the straight-line solution was again fitted to the early-time data, or approximately the first 8 days of recovery. Analytical curve matching provides the following hydraulic conductivity estimates:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS16-12	02-May-17	Hvorslev (1951)	2.6E-05	9.2E-09
	24-May-17	Hvorslev (1951)	5.5E-05	1.9E-08
		AVERAGE	**4.1E-05**	**1.4E-08**

Given that the slug tests were conducted in very low permeable material and while water levels in DS16-12 were still recovering from well development, the hydraulic conductivity values should be considered approximate.

4.3.10 Well DS17-15

Well DS17-15 is located southeast of the proposed TSF in Happy Camp Canyon. The open interval of the well spans 180 feet of Tertiary Basalt (Tb) from 278 to 458 feet bls **(Figure 16)**. Groundwater movement through Tb at the well site is characterized as hydraulically confined and primarily controlled by a network of fractured rock and rock matrix.

Four slug tests were conducted at well DS17-15 between April 26 and May 17, 2017. Prior to testing, the water level in the well was located approximately 71.7 feet bls. Hydraulic parameter details are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
26-Apr-17	Falling Head	71.88	0.130	1.48
30-Apr-17	Rising Head	71.72	0.130	1.48
05-May-17	Falling Head	71.73	0.251	3.10
17-May-17	Rising Head	71.63	0.251	3.08

AQTESOLV plots of the slug tests showing normalized water level displacements in versus logarithmic time are shown in **Appendix K.3**, **Figures 23 through 26**.

The screening methodology using the Cooper and others (1967) method was used for three of the four tests. One of the tests provided a low storativity value suggesting wellbore skin effects and the requirement to transform the slug test data into equivalent head data for a constant-rate pumping test with wellbore storage and skin effect using the method of Peres and others (1989). Hydraulic conductivity estimates are summarized as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS17-15	26-Apr-17	Cooper and others (1967)	1.8E-04	6.4E-08
	30-Apr-17	Peres and others (1989)	4.1E-04	1.4E-07
	05-May-17	Cooper and others (1967)	2.2E-04	7.8E-08
	17-May-17	Cooper and others (1967)	5.4E-04	1.9E-07
		AVERAGE	**3.4E-04**	**1.2E-07**

4.3.11 Well DS17-16

Well DS17-16 is located southeast of the proposed TSF between Rice Water Canyon and Happy Camp Canyon. The perforated interval of the well extends from 102 to 175 feet bls and partially penetrates 73 feet of Tertiary Basalt (Tb) **(Figure 17)**. Approximately 98 feet of Gila Conglomerate (Tg) overlies Tb at the ground surface. Groundwater movement primarily through Tb at the well site is characterized as hydraulically unconfined and controlled by a network of fractured rock and rock matrix.

Four slug tests were conducted at well DS17-16 between April 25 and May 3, 2017. Prior to testing, the water level in the well was located approximately 70.9 feet bls. Hydraulic parameters for the tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
25-Apr-17	Falling Head	70.90	0.125	0.98
27-Apr-17	Rising Head	70.89	0.125	1.10
30-Apr-17	Falling Head	70.95	0.257	2.09
03-May-17	Rising Head	70.81	0.257	2.02

AQTESOLV plots of the slug tests showing logarithmic normalized water level displacement versus linear time are shown in **Appendix K.3**, **Figures 27 through 30**. Water level responses to slug displacements exhibited a double straight line effect. In addition, observed water level displacements were less than anticipated based on slug volumes. While most double straight line responses are observed in wells screened across the water table (Bouwer, 1989), the double straight line effect observed may be related to entrapped air in the upper portion of the gravel pack. In such a case, the vertical displacement of water in the well following slug initiation would be less than anticipated as the volume of entrapped air becomes compressed by the added pressure from the slug displacement. In most cases, slug tests that result in double straight line responses are analyzed according to the slope of the second segment.

Air-lift measurements and water level monitoring data collected during drilling suggest that Tb has a relatively low permeability at the well site. Taking this into account, analytical solutions were fitted to the second linear segment and considered more representative of the aquifer hydraulic response using the Bouwer and Rice (1976) straight-line method. Hydraulic conductivity estimates are summarized as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DS17-16	25-Apr-17	Bouwer-Rice	7.5E-04	2.6E-07
	27-Apr-17	Bouwer-Rice	1.5E-04	5.3E-08
	30-Apr-17	Bouwer-Rice	1.0E-04	3.5E-08
	03-May-17	Bouwer-Rice	1.0E-04	3.5E-08
		Average	**2.8E-04**	**9.7E-08**

4.3.12 Piezometer DH16-22

Piezometer DH16-22 is near the southwestern border of the proposed TSF, adjacent to piezometer DH17-24. The open interval of the well is completed from 109.1 to 215.9 feet bls in Pinal Schist (pCpi) **(Appendix J)**. A thin veneer of alluvium overlies pCpi between ground surface and 3 feet bls. Groundwater movement through pCpi at the well site is characterized as hydraulically unconfined and primarily controlled by a network of fractured rock and rock matrix.

Four slug tests were conducted at well DH16-22 between April 28 and May 17, 2017. Prior to testing, the water level in the well was located approximately 27.8 feet bls. Hydraulic parameters for the tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
28-Apr-17	Falling Head	27.85	0.009	1.47
05-May-17	Rising Head	27.72	0.009	1.47
11-May-17	Falling Head	27.77	0.019	2.90
17-May-17	Rising Head	27.86	0.019	2.90

AQTESOLV plots of DH16-22 slug tests are shown in **Appendix K.3**, **Figures 31 through 34**. Screening the results using the Cooper and others (1967) method resulted in reasonable storativity values. Although the method assumes a fully penetrating well, the estimate of storativity indicates an aquifer in which radial hydraulic conductivity (Kr) is much larger than vertical hydraulic conductivity (Kz) and the ratio Kz/Kr is small. Hence, flow is confined to the open interval of the well and the analysis can be performed using the procedure for fully penetrating wells and unconfined aquifer conditions.

Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and aquifer thickness of pCpi, hydraulic conductivity is estimated as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DH16-22	28-Apr-17	Cooper and others (1967)	5.9E-04	2.1E-07
	05-May-17	Cooper and others (1967)	5.9E-04	2.1E-07
	11-May-17	Cooper and others (1967)	6.7E-04	2.4E-07
	17-May-17	Cooper and others (1967)	6.4E-04	2.3E-07
		AVERAGE	**6.2E-04**	**2.2E-07**

4.3.13 Piezometer DH17-24

Piezometer DH17-24 is near the southwestern border of the proposed TSF, adjacent to piezometer DH16-22. The open interval of the well extends from 25.2 to 67 feet bls, penetrating approximately 42 feet of Pinal Schist (pCpi) **(Appendix J)**. At the well site, pCpi outcrops at land surface. Groundwater movement through pCpi at the well site is characterized as hydraulically unconfined and primarily controlled by a network of fractured rock and rock matrix.

Four slug tests were conducted at well DH17-24 between April 28 and May 11, 2017. Prior to testing, the water level in the well was located approximately 23.9 feet bls. Hydraulic parameters for the slug tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
28-Apr-17	Falling Head	23.88	0.019	2.40
02-May-17	Rising Head	23.90	0.019	2.48
05-May-17	Falling Head	23.88	0.009	1.32
11-May-17	Rising Head	23.85	0.009	1.29

AQTESOLV plots of the slug tests showing normalized water level displacements versus logarithmic time are shown in **Appendix K.3**, **Figures 35 through 38**.

The screening methodology using the Cooper and others (1967) method was used for data analysis. Estimates of storativity indicate radial hydraulic conductivity (Kr) is much larger than vertical hydraulic conductivity (Kz) and the ratio Kz/Kr is small. Hence, flow is confined to the open interval of the well and the analysis can be performed using the procedure for fully penetrating wells and unconfined aquifer conditions.

Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and aquifer thickness of pCpi, hydraulic conductivity is estimated as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DH17-24	28-Apr-17	Cooper and others (1967)	1.8E-02	6.4E-06
	02-May-17	Cooper and others (1967)	1.3E-02	4.6E-06
	05-May-17	Cooper and others (1967)	1.1E-02	3.9E-06
	11-May-17	Cooper and others (1967)	1.1E-02	3.9E-06
		Average	**1.3E-02**	**4.7E-06**

4.3.14 Piezometer DH17-27

Piezometer DH17-27 is south of the proposed TSF footprint, off of Hewitt Station Road near Schepers well. The open interval of the well extends from 25 to 112 feet bls, penetrating approximately 87 feet of Tertiary Basalt (Tb) **(Appendix J)**. A thin veneer of Quaternary Alluvium (Qal) overlies Tb from ground surface to 6.4 feet bls. Groundwater movement through Tb at the well site is characterized as hydraulically unconfined and primarily controlled by a network of fractured rock and rock matrix.

Six slug tests were conducted at well DH17-27 between April 26 and May 2, 2017. Prior to testing, the water level in the well was located approximately 24.1 feet bls. Hydraulic parameters for the slug tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft³)	Initial Water Level Displacement (ft)
26-Apr-17	Falling Head	24.10	0.009	1.05
26-Apr-17	Rising Head	24.11	0.009	1.08
27-Apr-17	Falling Head	24.15	0.019	2.07
28-Apr-17	Rising Head	24.16	0.019	2.12
30-Apr-17	Falling Head	24.11	0.009	1.06
02-May-17	Rising Head	24.12	0.009	1.05

AQTESOLV plots of the slug tests showing logarithmic normalized water level displacements versus linear time are shown in **Appendix K.3**, **Figures 39 through 44**.

The tests were analyzed using the Cooper and others (1967) method. The estimates of storativity indicate radial hydraulic conductivity (Kr) is much larger than vertical hydraulic conductivity (Kz) and the ratio Kz/Kr is small. Therefore groundwater flow is confined to the open interval of the well and the analysis can be performed using the procedure for fully penetrating wells and unconfined aquifer conditions.

Analytical curve matching provides transmissivity estimates. Using the transmissivity estimates and aquifer thickness of Tb, hydraulic conductivity is estimated as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DH17-27	26-Apr-17	Cooper and others (1967)	3.0E-02	1.1E-05
	26-Apr-17	Cooper and others (1967)	5.4E-03	1.9E-06
	27-Apr-17	Cooper and others (1967)	1.8E-02	6.4E-06
	28-Apr-17	Cooper and others (1967)	1.1E-02	3.9E-06
	30-Apr-17	Cooper and others (1967)	1.6E-02	5.6E-06
	02-May-17	Cooper and others (1967)	9.3E-03	3.3E-06
		AVERAGE	**1.5E-02**	**5.3E-06**

4.3.15 Piezometer DH17-36

Piezometer DH17-36 is in the southeastern part of the proposed TSF footprint, adjacent to paired wells DH16-01, DH17-29 and DS16-01. The perforated interval of the well is completed in Gila Conglomerate (Tg) from 21.3 to 100 feet bls **(Appendix J)**. Two feet of Quaternary Alluvium (Qal) overlay Tg at the ground surface. Groundwater movement through Tg at the well site is characterized as hydraulically unconfined and primarily controlled by a network of fractured rock and rock matrix.

Six slug tests were conducted at well DH17-36 between April 26 and May 5, 2017. Prior to slug tests, the water level in the DH17-36 was located within the well open interval at approximately 37.6 feet bls. Hydraulic parameters for the tests are summarized as follows:

Test Date	Type	Pre-Test Water Level (ft bls)	Slug Volume (ft^3)	Initial Water Level Displacement (ft)
26-Apr-17	Falling Head	37.65	0.019	1.50
27-Apr-17	Rising Head	37.66	0.019	1.75
28-Apr-17	Falling Head	37.67	0.009	0.78
30-Apr-17	Rising Head	37.56	0.009	0.85
02-May-17	Falling Head	37.61	0.019	1.53
05-May-17	Rising Head	37.61	0.019	1.82

AQTESOLV plots of the slug tests showing logarithmic normalized water level displacements versus linear time are shown in **Appendix K.3**, **Figures 45 through 50.** Examination of the response data from repeat slug tests with different initial displacements, H(0), indicates the response is not dependent on H(0). Furthermore, response data are linear and conventional methods can be applied. No double straight-line effect, indicative of filter pack drainage, is apparent therefore the data were processed using the KGS model for a well screened below the water table. Hydraulic conductivity estimates are summarized as follows:

Well ID	Test Date	Analytical Method	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity (cm/s)
DH17-36	26-Apr-17	KGS Model	2.6E-03	9.2E-07
	27-Apr-17	KGS Model	2.6E-03	9.2E-07
	28-Apr-17	KGS Model	3.3E-03	1.2E-06
	30-Apr-17	KGS Model	1.9E-03	6.7E-07
	02-May-17	KGS Model	2.9E-03	1.0E-06
	05-May-17	KGS Model	2.5E-03	8.8E-07
		AVERAGE	**2.6E-03**	**9.3E-07**

4.3.16 Summary of Results

During February through May 2017, slug tests were carried out in eight hydrologic test wells and four geotechnical piezometers **(Figure 31)**. Two to six slug tests were conducted at each well or piezometer for a total of 56 tests. A summary of test conditions and results is provided in **Table 4**. Hydraulic conductivity estimates are summarized as follows:

Well ID	Hydrogeologic Test Unit(s)	Number of Slug Tests	Average Hydraulic Conductivity (ft/day)	Average Hydraulic Conductivity (cm/s)
DS16-04	Mescal Limestone (pCmls)	4	1.2E-01	4.2E-05
DS16-05	Pinal Schist (pCpi)	6	2.7E-02	9.5E-06
DS16-08	Drip. Spring Quartzite (pCds), Pinal Schist (pCpi), Fault (Roblas Canyon)	6	1.7E-03	6.0E-07
DS16-09[a]	Pinal Schist (pCpi)	6	---	---
DS16-11	Apache Leap Tuff (Tal)	4	1.6E-03	5.6E-07
DS16-12	Diabase (pCdiab)	2	4.1E-05	1.4E-08
DS17-15	Tertiary Basalt (Tb)	4	3.4E-04	1.2E-07
DS17-16	Tertiary Basalt (Tb)	4	2.8E-04	9.7E-08
DH16-22	Pinal Schist (pCpi)	4	6.2E-04	2.2E-07
DH17-24	Pinal Schist (pCpi)	4	1.3E-02	4.7E-06
DH17-27	Tertiary Basalt (Tb)	6	1.5E-02	5.3E-06
DH17-36	Gila Conglomerate (Tg)	6	2.6E-03	9.3E-07

[a] Results of slug tests were insufficient for analysis

The hydraulic conductivity estimates range from 4.1E-05 ft/day for Diabase (pCdiab) to 1.2E-01 ft/day for Mescal Limestone (pCmls). The slug tests provide useful information regarding the spatial variability in hydraulic conductivity of the units tested. However, the estimates should be considered approximate for some of the tests where non-ideal conditions existed such as fractured rock settings, partially penetrating wells, and antecedent water level trends.

5 REFERENCES CITED

Barker, J.A., 1988, A generalized radial flow model for hydraulic tests in fractured rock: Water Resources Research, vol. 24, no. 10, pp. 1796-1804.

Beauheim, R.L., Roberts, R.M., and J.D. Avis, 2004, Well testing in fractured media: flow dimensions and diagnostic plots: Journal of Hydraulic Research, vol. 42, iss. Sup1: Groundwater

Bourdet, D., Whittle, T.M., Douglas, A.A. and Y.M. Pirard, 1983, A new set of type curves simplifies well test analysis: World Oil, May 1983, pp. 95-106.

Bourdet, D., Ayoub, J.A. and Y.M. Pirard, 1989, Use of pressure derivative in well-test interpretation: SPE Formation Evaluation, June 1989, pp. 293-302.

Bourdet, D., 2002, *Well Test Analysis: The Use of Advanced Interpretation Models*: Elsevier, New York, 426 p.

Bouwer, H., 1989, The Bouwer and Rice slug test--an update: Ground Water, vol. 27, no. 3, pp. 304-309.

Bouwer, H. and R.C. Rice, 1976, A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells: Water Resources Research, vol. 12, no. 3, pp. 423-428.

Butler, J.J., Jr., 1998, The Design, Performance, and Analysis of Slug Tests: Lewis Publishers, New York, 252 p.

Butler, J.J., Jr., W. Jin, G. Mohammed, and E.C. Reboulet, 2011, New insights from well responses to fluctuations in barometric pressure: Ground Water, 49(4), pp. 525-533.

Cooper, H.H. and C.E. Jacob, 1946, A generalized graphical method for evaluating formation constants and summarizing well field history: Am. Geophys. Union Trans., vol. 27, pp. 526-534.

Cooper, H.H., J.D. Bredehoeft and S.S. Papadopulos, 1967, Response of a finite-diameter well to an instantaneous charge of water: Water Resources Research, vol. 3, no. 1, pp. 263-269.

Doe, T.W. and J.E. Geier, 1991, Interpretation of fracture system geometry using well test data: Stripa Project Tech. Rep. 93-01, Swedish Nuclear Fuel and Waste Management, Stockholm.

Dougherty, D.E and D.K. Babu, 1984, Flow to a partially penetrating well in a double-porosity reservoir: Water Resources Research, vol. 20, no. 8, pp. 1116-1122.

Ehlig-Economides CA, P Hegeman, and S Vik., 1994, Well Testing – 1: Guidelines Simplify Well Test Interpretation: Oil and Gas Journal July:33-40.

Fetter, C.W., 2001, Applied Hydrogeology (4th ed.: Prentice-Hall, Upper Saddle River, New Jersey, 598 p.

Hantush, M.S., 1960, Modification of the theory of leaky aquifers: Jour. of Geophys. Res., vol. 65, no. 11, pp. 3713-3725.

_____, M.S., 1961a, Drawdown around a partially penetrating well: Jour. of the Hyd. Div., Proc. of the Am. Soc. of Civil Eng., vol. 87, no. HY4, pp. 83-98.

_____, M.S., 1961b, Aquifer tests on partially penetrating wells: Jour. of the Hyd. Div., Proc. of the Am. Soc. of Civil Eng., vol. 87, no. HY5, pp. 171-194.

_____, M.S., 1964, Hydraulics of wells, in: Advances in Hydroscience, V.T. Chow (editor), Academic Press, New York, pp. 281-442.

Hvorslev, M.J., 1951, Time Lag and Soil Permeability, in: Ground-Water Observations: Bulletin No. 36, Waterways Exper. Sta. Corps of Engrs, U.S. Army, Vicksburg, Mississippi, pp. 1-50.

Hyder, Z., J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994, Slug tests in partially penetrating wells: Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

HydroSOLVE, Inc., 2012, AQTESOLV for Windows 95/98/NT/2000/XP/Vista: HydroSOLVE, Inc., Reston, Virginia, version 4.51.005 – Professional.

Moench, A.F., 1984, Double-porosity models for a fissured groundwater reservoir with fracture skin: Water Resources Research, vol. 20, no. 7, pp. 831-846.

_____, A.F., 1985, Transient flow to a large-diameter well in an aquifer with storative semiconfining layers: Water Resources Research, vol. 21, no. 8, pp. 1121-1131.

_____, 1988, The response of partially penetrating wells to pumpage from double-porosity aquifers: Proceedings of the International Conference on Fluid Flow in Fractured Rocks, Atlanta, GA, May 16-18, 1988.

_____, 1997, Flow to a well of finite diameter in a homogeneous, anisotropic water-table aquifer: Water Resources Research, vol. 33, no. 6, pp. 1397-1407.

_____, 1998. Correction to Flow to a well of finite diameter in a homogeneous, anisotropic water-table aquifer, Water Resources Research, vol. 34, no. 9, pp. 2431-2432.

Montgomery & Associates, 2017, Summary of 2016-2017 Well Installation Activities: technical memorandum prepared for Resolution Copper, April 10, 2017.

Papadopulos, I.S. and Cooper, H.H., 1967. Drawdown in a well of large diameter, Water Resources Research, vol. 3, no. 1, pp. 241-244.

Peres, A.M., Onur, M. and A.C. Reynolds, 1989, A new analysis procedure for determining aquifer properties from slug test data: Water Resources Research, vol. 25, no. 7, pp. 1591-1602.

Renard, P., Glenz, D. and M. Mejias, 2009, Understanding diagnostic plots for well-test interpretation: Hydrogeology Journal, vol. 17, pp. 589-600, doi:10.1007/s10040-008-0392-0.

Spane, F.A., Jr., and S.K. Wurstner, 1993, DERIV: A computer program for calculating pressure derivatives for use in hydraulic test analysis, Ground Water, vol. 31, no. 5, pp. 814-822.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

Van Camp, M., and P. Vauterin, 2005, TSOFT: graphical and interactive software for the analysis of time series and Earth tides, Computers & Geosciences, 31(5), 631-640.

TABLE 1. WELL CONSTRUCTION DETAILS
NEAR WEST SITE, RESOLUTION COPPER
PINAL COUNTY, ARIZONA

					….BOREHOLE….		…………CASING AND CONSTRUCTION…………						……SURVEY COORDINATES[d]…… (AZSPC, feet)			
WELL IDENTIFIER [PoO ID][a]	PAIRED GEOTECHNICAL PIEZOMETER(S) [PoO ID]	CADASTRAL	ADWR WELL REGISTRATION NUMBER 55-	DATE COMPLETED	BOREHOLE DIAMETER (inches)	BOREHOLE DEPTH (feet, bls)[b]	DIAMETER (inches)	DEPTH (feet, bls)	PERFORATED INTERVAL (feet, bls)	OPEN INTERVAL (feet, bls)	HYDROGEOLOGIC UNIT(S) AT THE PERFORATED INTERVAL	GROUTED VIBRATING-WIRE PIEZOMETER DEPTH[c] (feet)	NORTHING (feet)	EASTING (feet)	SURVEYED ELEVATION[e] (feet, amsl)[f]	LAND SURFACE ELEVATION (feet, amsl)
DS16-01 [N]	DH16-01 DH17-29 DH17-36 [GT-14]	(D-1-11) 36aca	919892	9/18/2016	17-1/2 10-3/4 9-7/8	0 - 30 30 - 450 450 - 875	12 4-1/2	0 - 30 0 - 520	--- 419 - 499	--- 409 - 535	Tertiary Basalt (Tb), Mescal Limestone (pCmls)	---	838446.230	923209.538	2,409.996	2,406.8
DS16-02 [M]	DH16-03 [GT-07]	(D-1-11) 26dba	919893	9/24/2016	17-1/2 10-3/4	0 - 20 20 - 500	12 4-1/2	0 - 20 0 - 451	--- 290 - 330 390 - 450	--- 277 - 346 367 - 455	Apache Leap Tuff (Tal)	---	842612.874	918065.700	2,491.341	2,487.8
DS16-03 [F]	DH16-07 [GT-20]	(D-1-12) 30bca	919894	10/4/2016	17-1/2 10-3/4 9-7/8	0 - 20 20 - 140 140 - 715	12 4-1/2	0 - 20 0 - 241	--- 130 - 220	--- 119 - 252	Perlite (Tfp)	---	843649.087	926185.385	2,499.754	2,496.5
DS16-04 [G]	DH16-08 [GT-15]	(D-1-11) 25dbb	919895	10/9/2016	17-1/2 10-1/2	0 - 20 20 - 620	12 4-1/2	0 - 20 0 - 619	--- 538 - 598	--- 517 - 620	Mescal Limestone (pCmls)	---	842227.217	922849.023	2,445.440	2,442.4
DS16-05 [O]	DH16-18 [GT-35]	(D-1-11) 27cbb	920012	10/19/2016	17-1/2 10-1/2	0 - 20 20 - 320	12 4-1/2	0 - 20 0 - 319	--- 188 - 298	--- 184 - 320	Pinal Schist (pCpi)	150 Pinal Schist (pCpi)	842326.475	909633.600	2,225.550	2,222.4
DS16-06 [L]	DH16-16 [GT-02]	(D-1-11) 27aba	920013	10/22/2016	17-1/2 10-1/2	0 - 19 19 - 120	12 4-1/2	0 - 19 0 - 120	--- 19 - 99	--- 19 - 120	Pinal Schist (pCpi)	---	845066.885	912657.744	2,287.728	2,284.6
DS16-07 [K]	DH16-20 [GT-03]	(D-1-11) 26bba	920014	10/24/2016	17-1/2 10-1/2	0 - 20 20 - 319	12 4-1/2	0 - 20 0 - 319	--- 238 - 308	--- 226 - 320	Dripping Spring Quartzite (pCds)	---	844753.747	915230.203	2,373.116	2,370.0
DS16-08 [I]	DH16-11 [GT-18]	(D-1-11) 24aab	920079	10/31/2016	17-1/2 10-1/2	0 - 20 20 - 400	12 4-1/2	0 - 20 0 - 378	--- 297 - 377	--- 279 - 378	Dripping Spring Quartzite (pCds), Pinal Schist (pCpi)	---	850317.104	924163.573	2,707.335	2,704.4
DS16-09 [P]	DH16-17 [GT-36]	(D-1-11) 13ddc	920076	11/7/2016	17-1/2 10-1/2	0 - 20 20 - 400	12 4-1/2	0 - 20 0 - 178	--- 37 - 177	--- 26 - 178	Pinal Schist (pCpi)	---	851183.525	924196.215	2,675.270	2,672.2
DS16-10 [H]	DH16-12 [GT-19]	(D-1-11) 24dbd	920080	11/13/2016	17-1/2 10-1/2	0 - 20 20 - 540	12 4-1/2	0 - 20 0 - 294	--- 233 - 293	--- 214 - 296	Gila Conglomerate (Tg)	---	847008.185	923382.922	2,672.045	2,669.0
DS16-11 [J]	DH16-13 [GT-17]	(D-1-11) 24bac	920077	11/19/2016	17-1/2 10-1/2	0 - 20 20 - 640	12 4-1/2	0 - 20 0 - 640	--- 449 - 619	--- 437 - 640	Apache Leap Tuff (Tal)	---	849365.737	921449.903	2,737.077	2,734.0
DS16-12 [A]	DH17-31 [GT-34]	(D-1-12)28aab	920153	11/24/2016	17-1/2 10-1/2	0 - 20 20 - 340	12 4-1/2	0 - 20 0 - 339	--- 258 - 338	--- 250 - 340	Diabase (pCdiab)	216 Mescal Limestone (pCmls)	845403.984	939691.268	2,880.731	2,877.5
DS16-13 [B]	DH17-33 [GT-29]	(D-1-12)28cab	920154	12/4/2016	17-1/2 10-1/2	0 - 20 20 - 540	12 4-1/2	0 - 20 0 - 431	--- 250 - 420	--- 209 - 438	Apache Leap Tuff (Tal)	130 Tertiary Tuff (Tt)	842132.686	937270.884	2,707.306	2,704.1
DS16-14 [C]	DH17-24 [GT-27]	(D-1-12)33caa	920155	12/15/2016	17-1/2 10-1/2 9-7/8	0 - 20 20 - 410 410 - 895	12 4-1/2	0 - 20 0 - 284	--- 39 - 279	--- 31 - 284	Gila Conglomerate (Tg)	---	837284.669	937527.062	2,641.993	2,639.0
DS17-15 [D]	---	(D-1-12)06acd	920156	1/22/2017	17-1/2 10-1/2	0 - 20 20 - 680	12 4-1/2	0 - 20 0 - 449	--- 288 - 438	--- 278 - 458	Tertiary Basalt (Tb)	---	834155.665	933025.014	2,532.432	2,529.4
DS17-16 [E]	---	(D-1-11)01adb	920157	2/3/2017	17-1/2 10-1/2 6-1/2	0 - 21 21 - 502 502 - 600	12 4-1/2	0 - 20 0 - 165	--- 115 - 155	--- 102 - 175	Tertiary Basalt (Tb)	73 Gila Conglomerate (Tg)	833042.083	929039.002	2,466.582	2,463.2
DS17-17 [Q]	DS17-18 DS17-19 [GT-43]	(D-1-11)35cbd	920368	2/9/2017	8	0 - 33	4	0 - 30	10 - 30	7 - 31	Quaternary Alluvium (Qal)	---	836969.002	915160.851	2,224.920	2,221.9
DS17-18 [GT-43]	NA	(D-1-11)35cbd	920363	2/8/2017	6	0 - 65	2	0 - 65	55 - 65	51 - 65	Pinal Schist (pCpi)	---	836971.190	915151.309	2,225.020	2,221.9
DS17-19 [GT-43-2]	NA	(D-1-11)35cbd	920364	2/11/2017	6	0 - 58	2	0 - 56	36 - 56	35 - 58	Pinal Schist (pCpi) (weathered)	---	836973.697	915141.797	2,224.916	2,221.9

[a] Plan of Operations identifier

[b] bls = below land surface

[c] grouted-in piezometers attached to 4-inch well casing

[d] Arizona State Plane Coordinates NAD83 U.S. feet

[e] Survey point at the center of the well vault with the lid closed; surveyed by Shephard-Wesintzer, Inc., Sedona, AZ

[f] amsl = above mean sea level

--- = none

NA = not applicable

TABLE 2. SUMMARY OF PUMPING TESTS RESULTS
NEAR WEST SITE, RESOLUTION COPPER
PINAL COUNTY, ARIZONA

											……HYDRAULIC PARAMETERS……						
WELL ID	TEST START	TEST END	PUMPING DURATION (hours)	PUMPING RATE (gpm)	PRE-TEST WATER LEVEL[a] (ft bls)	MAXIMUM WATER LEVEL DRAWDOWN (feet)	HYDROGEOLOGIC TEST UNIT(S)	AQUIFER TYPE AND WELL CONSTRUCTION	SATURATED THICKNESS OF UNIT(S) TESTED (feet)	ANALYTICAL METHOD	STORATIVITY S	SPECIFIC STORAGE Ss (ft^{-1})	SPECIFIC YIELD Sy	TRANSMISSIVITY T (ft^2/day)	TRANSMISSIVITY T (m^2/day)	HYDRAULIC CONDUCTIVITY[b] (ft/day)	HYDRAULIC CONDUCTIVITY (cm/s)
DS16-01 [DS-N]	11-Apr-17 09:30	14-Apr-2017 08:30	71	64.7	44.08	61.6	Mescal Limestone (pCmls)	Confined, Fully penetrating	88	Barker (1988)	NA[e]	3.9E-04	NA	NA	NA	1.7	6.0E-04
DS16-02 [DS-M]	03-May-17 13:00	04-May-2017 13:00	24	7.0	152.15	100.5	Apache Leap Tuff (Tal)	Confined, Fully penetrating	186	Barker (1988)	NA	NA	NA	NA	NA	2.7E-03	9.5E-07
DS16-03 [DS-F]	05-Apr-17 17:00	06-Apr-2017 17:00	24	12.5	31.82	53.8	Perlite (Tfp)	Confined, Fully penetrating	279	Dougherty-Babu (1984)	NA	NA	NA	235	22	8.4E-01	3.0E-04
DS16-04 [DS-G]	21-Apr-17 10:45	21-Apr-2017 19:36	8.9[c]	4.1	9.39	263.4	Mescal Limestone (pCmls)	Confined, Fully penetrating	47	Dougherty-Babu (1984)	NA	NA	NA	4.1	0.38	8.7E-02	3.1E-05
DS16-05 [DS-O]	09-Apr-17 10:00	10-Apr-2017 10:00	24	1.5	29.08	82.8	Pinal Schist (pCpi)	Unconfined, Partially penetrating	291	Moench (1997)	1.9E-04	NA	5.0E-03	3.9	0.36	1.3E-02	4.7E-06
DS16-06 [DS-L]	18-Apr-17 10:00	19-Apr-2017 07:46	21.8[d]	24.9	26.39	50.6	Pinal Schist (pCpi)	Confined, Fully penetrating	94	Barker (1988)	NA	1.1E-04	NA	NA	NA	3.7E-01	1.3E-04
DS16-07 [DS-K]	01-Apr-17 10:00	04-Apr-2017 10:00	72	40.0	67.71	89.6	Dripping Spring Quartzite (pCds)	Confined, Partially penetrating	119	Dougherty-Babu (1984)	NA	NA	NA	400	37.18	3.4E+00	1.2E-03
DS16-13 [DS-B]	29-Apr-17 09:00	30-Apr-2017 09:00	24	7.5	28.68	109.4	Apache Leap Tuff (Tal)	Leaky Confined, Fully pentrating	236	Moench (1985)	NA	NA	NA	4	0.37	1.7E-02	6.0E-06
DS16-14 [DS-C]	17-May-17 13:25	17-May-2017 16:45	3.3	5.5 - 6.25	39.66	1.3	Gila Conglomerate (Tg)	Unconfined, Fully penetrating	244	Moench (1997)	NA	NA	NA	630	59	2.6E+00	9.1E-04
DH16-09 [GT-32]	09-May-17 12:40	09-May-2017 14:31	1.9	1.17	150.62	0.7	Felsic Lava Flows / Perlite (Tfp)	Unconfined, Partially penetrating	100	Moench (1997)	NA	NA	NA	560	52	5.6E+00	2.0E-03
DH16-21 [GT-5]	16-May-17 8:30	16-May-2017 11:01	2.5	0.41	47.47	43.5	Mescal Limestone (pCmls)	Confined, Fully penetrating	9.5	Dougherty-Babu (1984)	NA	NA	NA	0.7	0.07	7.4E-02	2.6E-05
DH17-26 [GT-13]	08-May-17 11:24	08-May-2017 13:29	2.1	0.75 - 1	95.17	67.9	Tertiary Basalt (Tb)	Confined, Partially penetrating	155	Dougherty-Babu (1984)	NA	NA	NA	1.2	0.11	7.7E-03	2.7E-06
DH17-35 [GT-30]	15-May-17 10:10	15-May-2017 13:21	3.2	0.43 - 1.1	41.13	91.6	Mescal Limestone (pCmls)	Confined, Partially penetrating	27	Dougherty-Babu (1984)	NA	NA	NA	0.25	0.02	9.3E-03	3.3E-06

[a] Due to antecedent effects and water level trends, some values may not represent static water level conditions

[b] Calculated as ratio of transmissivity and saturated thickness for all tests except DS16-01, DS16-02, and DS16-06

[c] Pumping stopped after 8.9 hours due to generator failure

[d] Duration until pump first shuts off at 07:07 on 23 October is 21.1 hrs; at 07:18 pumping was resumed until 07:46 in order to collect water quality sample

[e] NA = analytical method not applicable for derivation of hydraulic parameter

gpm = gallons per minute
ft bls = feet below land surface
ft^{-1} = per foot
ft^2/day = square feet per day
m^2/day = square meters per day
cm/s = centimeters per second

TABLE 3. SUMMARY OF FIELD MEASUREMENTS OF WATER QUALITY PARAMETERS COLLECTED DURING PUMPING TESTS
NEAR WEST SITE, RESOLUTION COPPER
PINAL COUNTY, ARIZONA

	.....SPECIFIC CONDUCTANCE (µS/cm).....			............TEMPERATURE (°C)............			...................pH...................			......OXIDATION / REDUCTION POTENTIAL[b] (mV)......			........DISSOLVED OXYGEN[b] (mg/L)........			...............TURBIDITY (NTU).............		
WELL ID	MINIMUM	MAXIMUM	END OF TESTING PERIOD[a]	MINIMUM	MAXIMUM	END OF TESTING PERIOD	MINIMUM	MAXIMUM	END OF TESTING PERIOD	MINIMUM	MAXIMUM	END OF TESTING PERIOD	MINIMUM	MAXIMUM	END OF TESTING PERIOD	MINIMUM	MAXIMUM	END OF TESTING PERIOD
DS16-01 [DS-N]	868	888	880	26.6	30.5	28.6	7.64	7.82	7.71	-139.3	-111.8	-124.7	0.03	0.60	0.04	0	13	1
DS16-02 [DS-M]	569	652	648	24.1	28.9	28.2	7.76	8.41	7.76	138.1	194.7	138.1	2.77	3.97	3.4	0	7	0
DS16-03 [DS-F]	506	562	520	23.7	27.1	26.1	7.05	7.57	7.31	ND	ND	ND	ND	ND	ND	0	13	0
DS16-04 [DS-G]	286	296	288	28.6	30.3	29.4	8.40	8.65	8.51	-242.9	121.8	-236.0	0.01	0.18	0.01	2	14	2
DS16-05 [DS-O]	2002	2085	2010	20.3	28.7	26.9	7.16	8.13	8.08	-238.2	236.0	-235.0	0.01	0.31	0.01	0	3	0
DS16-06 [DS-L]	1392	1433	1421	23.6	24.4	23.9	6.87	6.96	6.94	-43.3	49.7	28.0	1.84	4.42	2.60	6	229	78
DS16-07 [DS-K]	1049	1361	1056	21.0	26.7	25.6	7.23	8.38	7.94	ND	ND	ND	ND	ND	ND	0	0	0
DS16-13 [DS-B]	563	618	616	26.0	26.9	26.4	7.31	8.05	7.24	-223.1	-61.7	-55.2	0.11	1.19	1.19	0	18	2
DS16-14 [DS-C]	952	1077	1074	23.7	26.6	24.2	7.19	7.66	7.19	ND	ND	ND	ND	ND	ND	7	934	7
DH16-09 [GT-32]	650	650	634	27.3	27.3	26.7	7.11	7.11	6.96	ND	ND	ND	ND	ND	ND	22	22	0
DH16-21 [GT-5]	997	1015	999	24.9	27.7	27.4	7.16	7.44	7.34	ND	ND	ND	ND	ND	ND	23	317	24
DH17-26 [GT-13]	821	1008	1008	27.7	29.7	29.7	7.35	7.88	7.56	ND	ND	ND	ND	ND	ND	10	124	15
DH17-35 [GT-30]	820	944	820	25.9	29.4	29.4	7.38	7.62	7.50	ND	ND	ND	ND	ND	ND	9	508	9

[a] Parameter measurement obtained at the time of sample collection at the end of the testing period

[b] Measurements are considered approximate because of difficulties during operation of the flow-through cell with entrapped air

µS/cm = microsiemens per centimeter
°C = degrees Celsius
mV = millivolts
mg/L = milligrams per liter
NTU = nephelometric turbidity units
ND = no data

TABLE 4. SUMMARY OF SLUG TESTS RESULTS
NEAR WEST SITE, RESOLUTION COPPER
PINAL COUNTY, ARIZONA

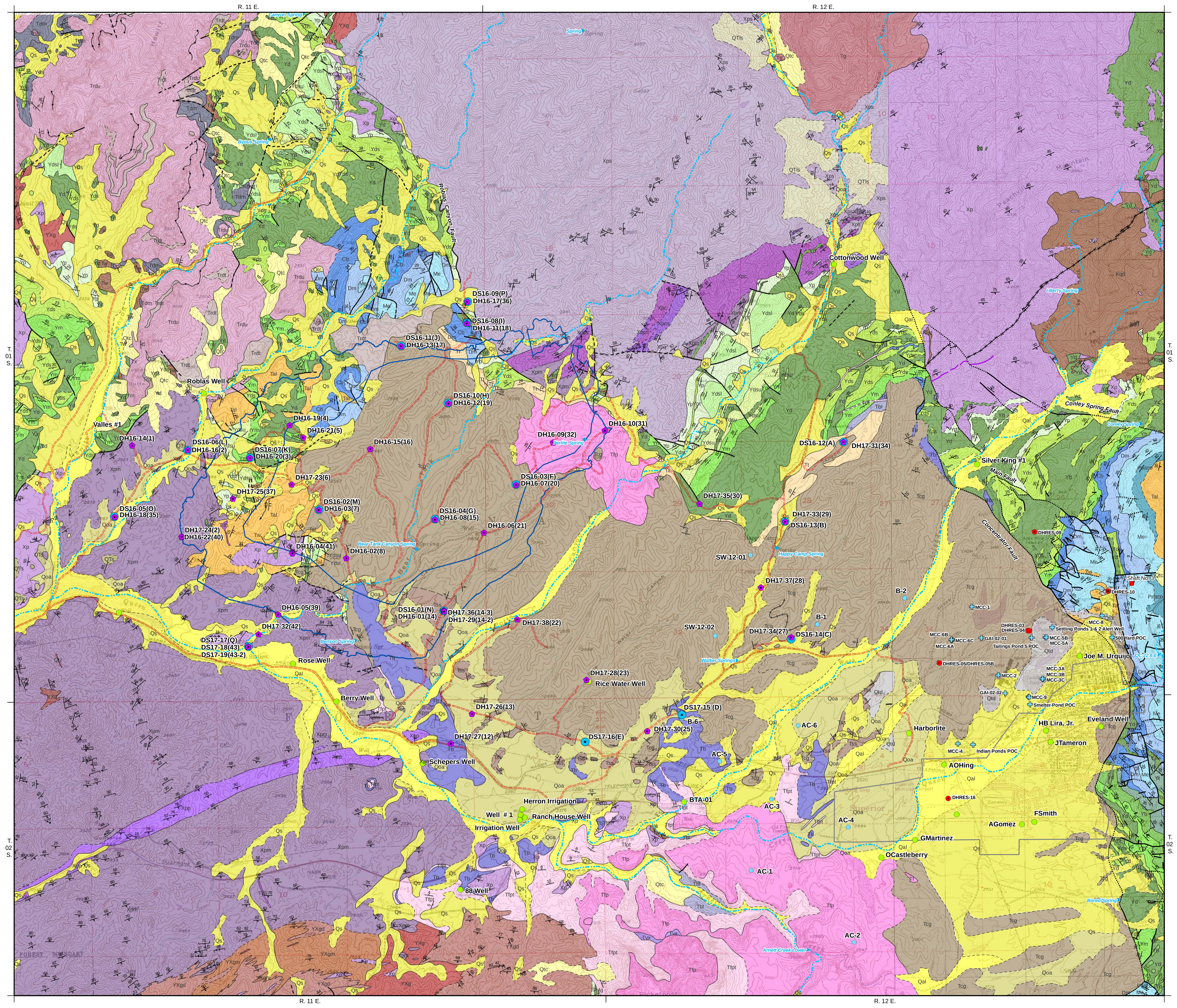
											…………ANALYTICAL METHODS AND HYDRAULIC PARAMETERS………..				
WELL ID	SLUG TEST TYPE	TEST START DATE	TEST START TIME	APPROX. TEST DURATION (days)	SLUG ID	SLUG VOLUME (cubic feet)	PRE-TEST WATER LEVEL[a] (feet bls)	CALCULATED INITIAL DISPLACEMENT[b] H_0 (feet)	OBSERVED INITIAL DISPLACEMENT H_0 (feet)	HYDROGEOLOGIC TEST UNIT(S)	ANALYTICAL METHOD	HYDRAULIC CONDUCTIVITY		AVERAGE HYDRAULIC CONDUCTIVITY	
												(ft/day)	(cm/s)	(ft/day)	(cm/s)
DS16-04	Falling Head	07-Feb-2017	13:55	0.09	D_{long}	0.130	7.66	1.49	1.46	Mescal Limestone (pCmls)	Peres and others (1989)	1.0E-01	3.5E-05	1.2E-01	4.2E-05
	Rising Head	07-Feb-2017	16:00	0.09	D_{long}	0.130	7.62	1.49	1.51		Peres and others (1989)	1.1E-01	3.9E-05		
	Falling Head	07-Feb-2017	18:10	0.07	$D_{long} + C_{medium} + G_{short}$	0.264	7.66	3.03	3.19		Peres and others (1989)	2.0E-01	7.1E-05		
	Rising Head	08-Feb-2017	10:15	0.11	$D_{long} + C_{medium} + G_{short}$	0.264	7.61	3.03	3.27		Peres and others (1989)	8.0E-02	2.8E-05		
DS16-05	Falling Head	31-Jan-2017	13:46	0.07	A_{long}	0.132	28.79	1.52	1.54	Pinal Schist (pCpi)	Cooper and others (1967)	2.9E-02	1.0E-05	2.7E-02	9.5E-06
	Rising Head	31-Jan-2017	15:46	0.13	A_{long}	0.132	28.72	1.52	1.52		Cooper and others (1967)	2.8E-02	9.9E-06		
	Falling Head	01-Feb-2017	9:12	0.15	$A_{long} + B_{long}$	0.257	28.65	2.95	2.99		Cooper and others (1967)	2.8E-02	9.9E-06		
	Rising Head	01-Feb-2017	12:55	0.18	$A_{long} + B_{long}$	0.257	28.63	2.95	3.03		Cooper and others (1967)	2.6E-02	9.2E-06		
	Falling Head	01-Feb-2017	17:16	0.28	A_{long}	0.132	28.90	1.52	1.54		Cooper and others (1967)	2.4E-02	8.5E-06		
	Rising Head	02-Feb-2017	8:04	0.15	A_{long}	0.132	28.73	1.52	1.53		Cooper and others (1967)	2.5E-02	8.8E-06		
DS16-08	Falling Head	01-Feb-2017	11:27	0.70	B_{medium}	0.063	45.85	0.72	0.85	Pinal Schist (pCpi), Upper Dripping Springs Quartzite (pCdsu), Fault (Roblas Canyon)	Cooper and others (1967)	2.0E-03	7.1E-07	1.7E-03	6.0E-07
	Rising Head	02-Feb-2017	8:25	1.02	B_{medium}	0.063	45.78	0.72	0.87		Cooper and others (1967)	1.4E-03	4.9E-07		
	Falling Head	03-Feb-2017	9:05	1.04	$B_{medium} + C_{medium}$	0.209	45.86	1.68	1.96		Cooper and others (1967)	1.8E-03	6.4E-07		
	Rising Head	04-Feb-2017	10:00	4.02	$B_{medium} + C_{medium}$	0.209	45.70	1.68	2.03		Cooper and others (1967)	1.3E-03	4.6E-07		
	Falling Head	08-Feb-2017	15:55	2.34	$D_{long} + C_{medium} + G_{short}$	0.264	45.80	3.03	3.32		Cooper and others (1967)	1.9E-03	6.7E-07		
	Rising Head	15-Feb-2017	12:20	1.71	$D_{long} + C_{medium} + G_{short}$	0.264	45.82	3.03	3.31		Cooper and others (1967)	2.0E-03	7.1E-07		
DS16-09	Falling Head	02-Feb-2017	13:20	---	G_{short}	0.050	46.20	0.58	0.21	Pinal Schist (pCpi)	NA	---	---	---	---
	Rising Head	03-Feb-2017	8:35	---	G_{short}	0.050	46.06	0.58	0.21		NA	---	---		
	Falling Head	03-Feb-2017	16:31	---	$G_{short} + D_{long}$	0.180	46.27	2.07	0.59		NA	---	---		
	Rising Head	04-Feb-2017	10:35	---	$G_{short} + D_{long}$	0.180	45.74	2.07	0.62		NA	---	---		
	Falling Head	15-Feb-2017	13:45	---	$D_{long} + C_{medium} + G_{short}$	0.264	45.94	3.03	0.84		NA	---	---		
	Rising Head	20-Feb-2017	15:27	---	$D_{long} + C_{medium} + G_{short}$	0.264	45.51	3.03	0.96		NA	---	---		
DS16-11	Falling Head	01-Feb-2017	10:22	0.64	F_{medium}	0.071	207.24	0.81	0.93	Apache Leap Tuff (Tal)	KGS Model	2.9E-03	1.0E-06	1.6E-03	5.6E-07
	Rising Head	02-Feb-2017	8:45	1.01	F_{medium}	0.071	207.27	0.81	0.98		Cooper and others (1967)	7.2E-04	2.5E-07		
	Falling Head	03-Feb-2017	9:25	0.97	$F_{medium} + B_{long}$	0.196	207.30	2.25	2.40		KGS Model	2.0E-03	7.1E-07		
	Rising Head	04-Feb-2017	8:55	2.09	$F_{medium} + B_{long}$	0.196	207.21	2.25	2.46		Cooper and others (1967)	8.8E-04	3.1E-07		
DS16-12	Falling Head	02-May-2017	17:10	14.85	C_{medium}	0.084	136.69	0.96	1.07	Diabase (pCdiab)	Hvorslev (1951)	2.6E-05	9.2E-09	4.1E-05	1.4E-08
	Rising Head	24-May-2017	8:25	15.44	C_{medium}	0.084	126.30	0.96	1.21		Hvorslev (1951)	5.5E-05	1.9E-08		
DS17-15	Falling Head	26-Apr-2017	15:15	0.81	D_{long}	0.130	71.88	1.49	1.48	Tertiary Basalt (Tb)	Cooper and others (1967)	1.8E-04	6.4E-08	3.4E-04	1.2E-07
	Rising Head	30-Apr-2017	10:40	4.90	D_{long}	0.130	71.72	1.49	1.48		Peres and others (1989)	4.1E-04	1.4E-07		
	Falling Head	05-May-2017	8:20	0.61	$D_{long} + F_{medium} + G_{short}$	0.251	71.73	2.88	3.10		Cooper and others (1967)	2.2E-04	7.8E-08		
	Rising Head	17-May-2017	11:00	6.33	$D_{long} + F_{medium} + G_{short}$	0.251	71.63	2.88	3.08		Cooper and others (1967)	5.4E-04	1.9E-07		
DS17-16	Falling Head	25-Apr-2017	14:55	2.09	B_{long}	0.125	70.90	1.43	0.98	Tertiary Basalt (Tb)	Bouwer-Rice (1976)	7.5E-04	2.6E-07	2.8E-04	9.7E-08
	Rising Head	27-Apr-2017	17:05	2.75	B_{long}	0.125	70.89	1.43	1.10		Bouwer-Rice (1976)	1.5E-04	5.3E-08		
	Falling Head	30-Apr-2017	11:05	2.95	$A_{long} + B_{long}$	0.257	70.95	2.95	2.09		Bouwer-Rice (1976)	1.0E-04	3.5E-08		
	Rising Head	03-May-2017	9:50	2.43	$A_{long} + B_{long}$	0.257	70.81	2.95	2.02		Bouwer-Rice (1976)	1.0E-04	3.5E-08		
DH16-22	Falling Head	28-Apr-2017	14:50	1.00	2B	0.009	27.85	1.44	1.47	Pinal Schist (pCpi)	Cooper and others (1967)	5.9E-04	2.1E-07	6.2E-04	2.2E-07
	Rising Head	05-May-2017	12:50	0.36	2B	0.009	27.72	1.44	1.47		Cooper and others (1967)	5.9E-04	2.1E-07		
	Falling Head	11-May-2017	8:55	1.08	4B	0.019	27.77	2.90	2.90		Cooper and others (1967)	6.7E-04	2.4E-07		
	Rising Head	17-May-2017	13:30	1.38	4B	0.019	27.86	2.90	2.90		Cooper and others (1967)	6.4E-04	2.3E-07		
DH17-24	Falling Head	28-Apr-2017	15:10	0.27	4A	0.019	23.88	2.90	2.40	Pinal Schist (pCpi)	Cooper and others (1967)	1.8E-02	6.4E-06	1.3E-02	4.7E-06
	Rising Head	02-May-2017	10:15	0.59	4A	0.019	23.90	2.90	2.48		Cooper and others (1967)	1.3E-02	4.6E-06		
	Falling Head	05-May-2017	13:15	0.91	2A	0.009	23.88	1.45	1.32		Cooper and others (1967)	1.1E-02	3.9E-06		
	Rising Head	11-May-2017	9:10	0.27	2A	0.009	23.85	1.45	1.29		Cooper and others (1967)	1.1E-02	3.9E-06		
DH17-27	Falling Head	26-Apr-2017	14:10	0.06	2A	0.009	24.10	1.45	1.05	Tertiary Basalt (Tb)	Cooper and others (1967)	3.0E-02	1.1E-05	1.5E-02	5.3E-06
	Rising Head	26-Apr-2017	16:00	0.16	2A	0.009	24.11	1.45	1.08		Cooper and others (1967)	5.4E-03	1.9E-06		
	Falling Head	27-Apr-2017	17:40	0.10	4B	0.019	24.15	2.90	2.07		Cooper and others (1967)	1.8E-02	6.4E-06		
	Rising Head	28-Apr-2017	9:40	0.26	4B	0.019	24.16	2.90	2.12		Cooper and others (1967)	1.1E-02	3.9E-06		
	Falling Head	30-Apr-2017	12:00	0.10	2A	0.009	24.11	1.45	1.06		Cooper and others (1967)	1.6E-02	5.6E-06		
	Rising Head	02-May-2017	11:35	0.17	2A	0.009	24.12	1.45	1.05		Cooper and others (1967)	9.3E-03	3.3E-06		
DH17-36	Falling Head	26-Apr-2017	13:25	0.62	4A	0.019	37.65	2.90	1.50	Gila Conglomerate (Tg)	KGS Model	2.6E-03	9.2E-07	2.6E-03	9.3E-07
	Rising Head	27-Apr-2017	18:00	0.67	4A	0.019	37.66	2.90	1.75		KGS Model	2.6E-03	9.2E-07		
	Falling Head	28-Apr-2017	10:10	0.38	2A	0.009	37.67	1.45	0.78		KGS Model	3.3E-03	1.2E-06		
	Rising Head	30-Apr-2017	11:30	0.94	2A	0.009	37.56	1.45	0.85		KGS Model	1.9E-03	6.7E-07		
	Falling Head	02-May-2017	11:55	0.73	4B	0.019	37.61	2.90	1.53		KGS Model	2.9E-03	1.0E-06		
	Rising Head	05-May-2017	11:25	0.82	4B	0.019	37.61	2.90	1.82		KGS Model	2.5E-03	8.8E-07		

[a] Based on processed data that may include corrections for barometric, tidal and and/or removal of antecedent water level trends; values may not indicate static water level

[b] Assumes fully submerged open intervals; does not include displacement due to rope volume

feet bls = feet below land surface
ft/day = feet per day
cm/s = centimeters per second

--- = Not available
NA = Not analyzed



EXPLANATION

- ⬟ Piezometer
- ● Hydrologic Test Well
- ● Private Well
- ● Apache LeapTuff Well
- ● Deep Well
- ● Exploration Borehole
- ■ Shaft
- ✚ West Plant Well
- ● Spring
- ===== General Access Road
- —— Proposed TSF Footprint

Geologic Structural Features

- Felsic Dike
- Fault
- Fault - approximate
- Fault - concealed
- Quartz Vein

Contact

- Contact
- Contact - approximate
- Contact - inferred
- Marker Horizon
- Contact Between Pinal Schist Clast-rich Congomerate Below and Dripping Spring Quartzite Clast-rich Conglomerate Above

FOLIATION; strike and dip

Broken and wavy lines may be used to indicate approximate measurments or curviplanar foliation in conjunction with any symbol

Primary foliation

BEDDING

upright vertical overturned irregular approximate

dots on strike line indicate facing direction based on primary features

FLOW FOLIATION

flow banding in lavas or hypabyssal intrusions, eutaxitic foliation in welded tuffs; igneous flow foliation in plutons

Tectonic foliations

- Generic foliation

Compositional banding, > 1 cm-scale

- Banding formed by transposed bedding
- Banding of uncertain or metamorphic origin

Compositional banding, < 1 cm-scale

- Banding of metamorphic origin
- Schistosity, continuous cleavage
- Disjunct cleavage (fracture cleavage)
- Disjunct cleavage parallel to bedding

Superimposed Fabrics symbols as above, double dip tics indicate that fabric is superimposed

- Axial surface to small-scale crenulation
- Disjunct cleavage
- Compositional layering <1cm thick, formed by transposition of thin compositional layering
- Similar to above, but fabric is very planar; quartz veins mostly transposed to concordant lenses

LINEAR FEATURES; trend and plunge

MINOR FOLD HINGE, showing plunge direction

- upright, symmetrical fold
- cascade fold
- asymmetrical fold showing vergence ('S' or 'Z').

LINEATIONS

- Mineral lineation in L-tectonites

APPARENT DIP

- Trace of bedding on cliffs or steep slopes

GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)

0 250 500 750 1,000
Meters

0 1,000 2,000 3,000 4,000
Feet

(Geology modified from Spencer and others, 1998;
Peterson, 1969, and Spencer
and Richard, 1995)

RESOLUTION
COPPER

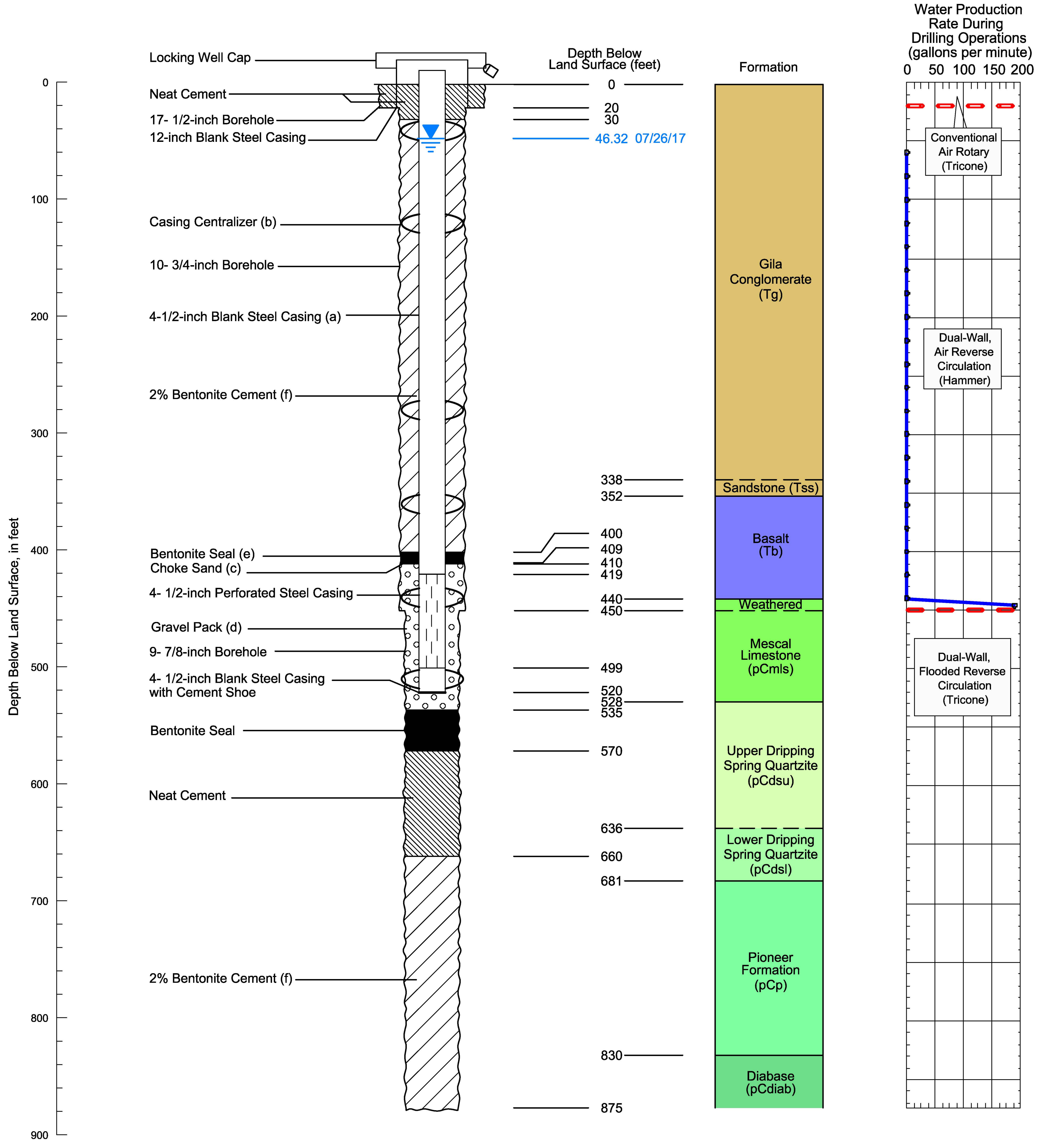
NEAR WEST LOCATION MAP

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

2017

FIGURE 1

GIS-TUC\605\605.78\NearWestLocationMapSP83\16Oct2017



REGISTERED GEOLOGIST CERTIFICATE NO. 59119 Megan M. Zivic Date Signed 10/13/2017 ARIZONA U.S.A.

Megan Zivic

EXPLANATION

- Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 40, 119, 199, 279, 359, 439 and 509 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)

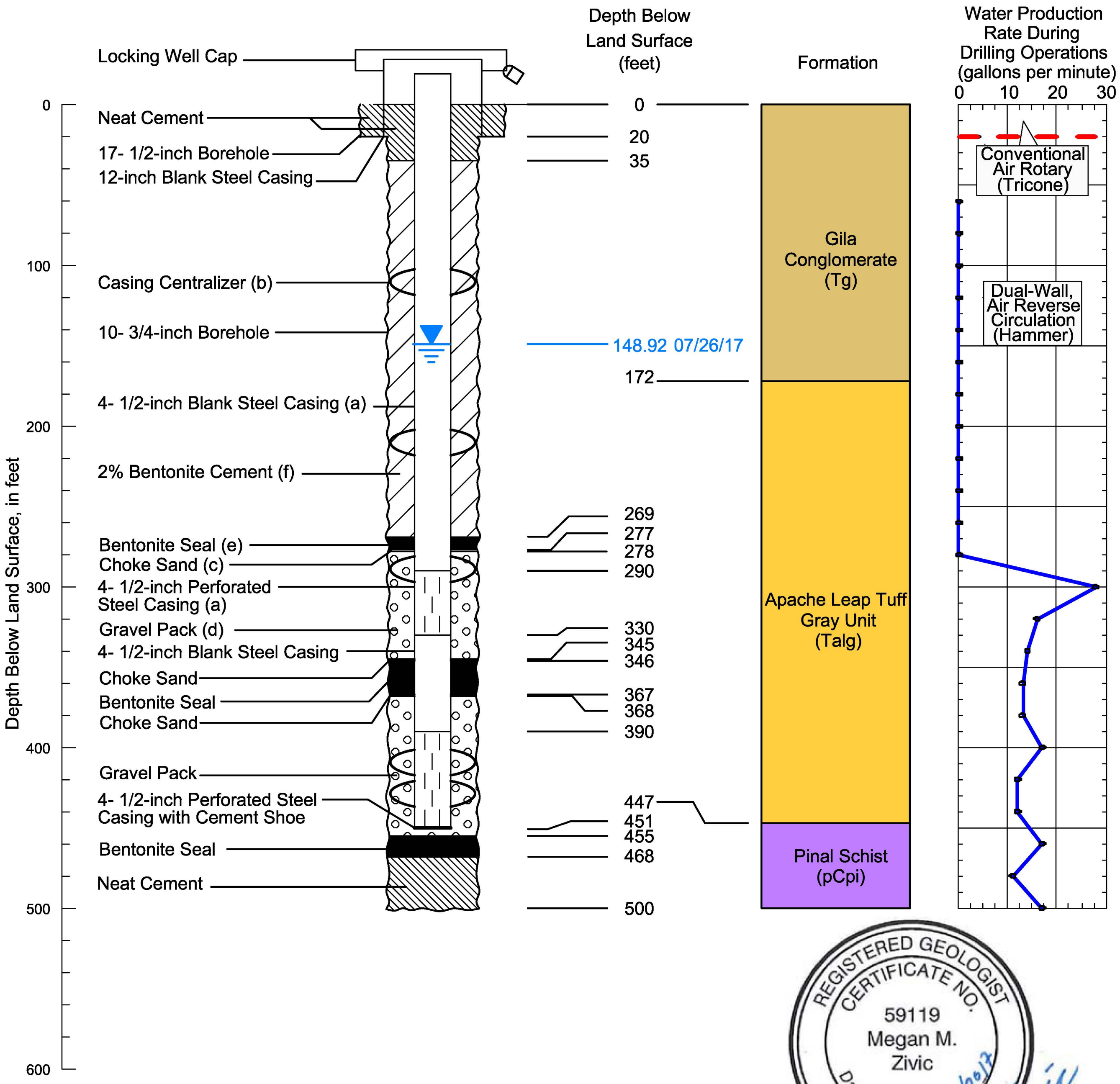
ADWR WELL NO: 55-919892	NORTHING: 838446.2
DATUM: AZSP83	EASTING: 923209.5
CLIENT: Resolution Copper	ELEVATION: 2,407 ft

DS16-01 [DS-N]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 2



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan Zivic

EXPLANATION

Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 40, 119, 199, 279, 359, 439 and 509 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)

ADWR WELL NO: 55-919893	NORTHING: 842612.9
DATUM: AZSP83	EASTING: 918065.7
CLIENT: Resolution Copper	ELEVATION: 2,488 ft

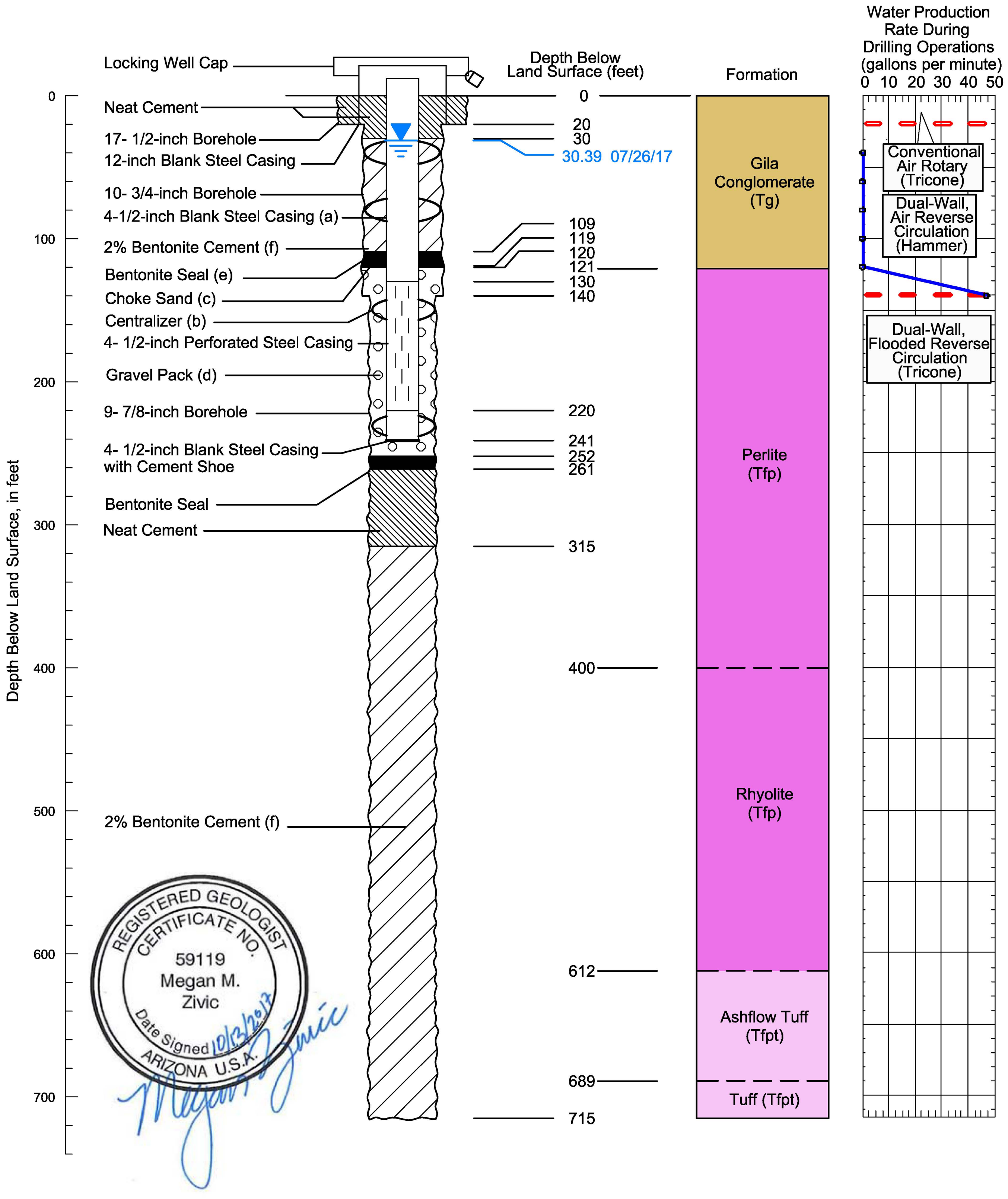
DS16-02 [DS-M]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 3

605.78\DS16-02_WS_LOG\16Oct2017



59119
Megan M. Zivic
Date Signed 10/13/2017

Megan M. Zivic

EXPLANATION

- Non-Pumping Water Level (ft.bls.)
- (a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
- (b) Centralizers installed at 40, 80, 150, and 230 ft. bls
- (c) 10-20 Sand (Fine)
- (d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
- (e) 3/8" Bentonite chips
- (f) Mixture of cement (98%) and Bentonite (2%)

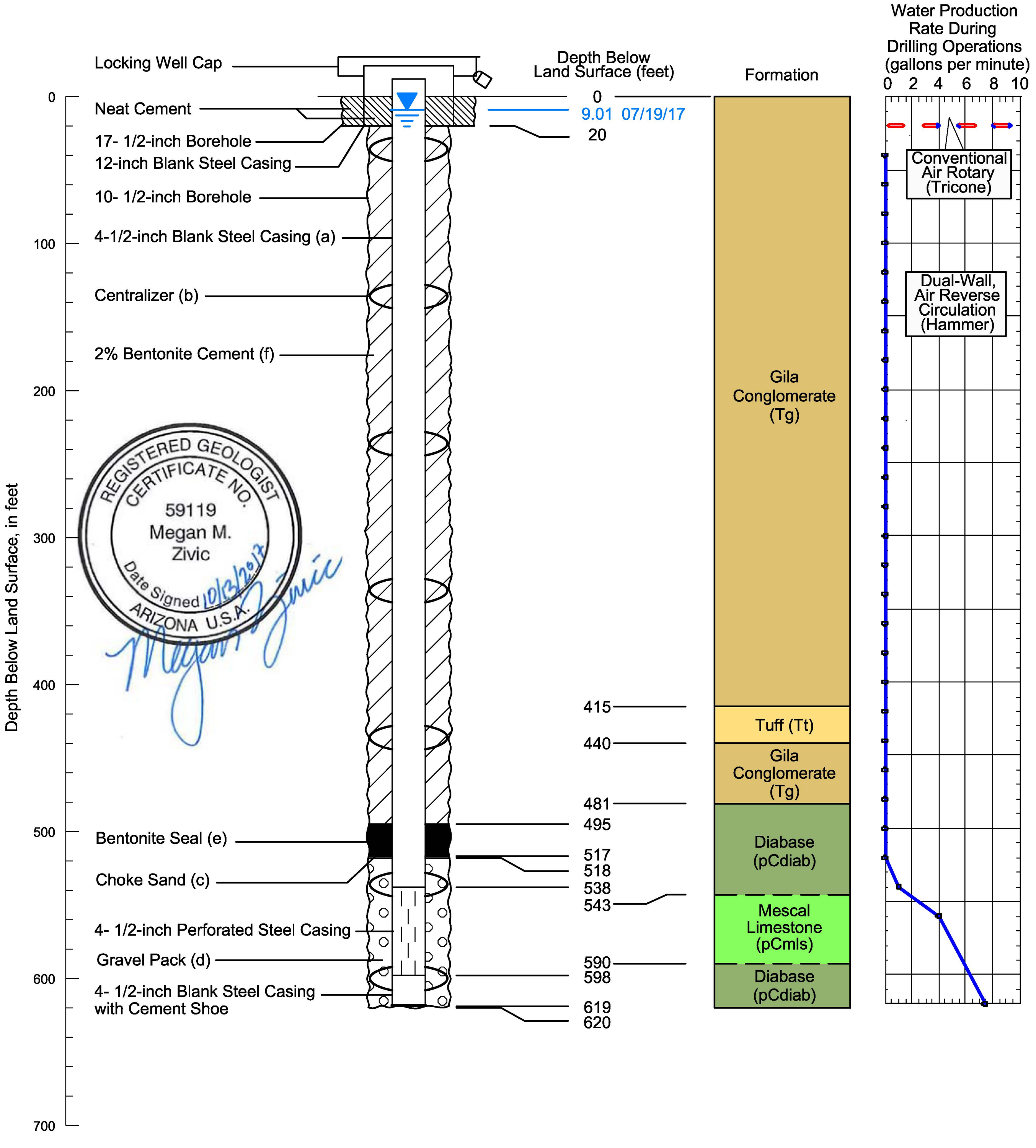
ADWR WELL NO: 55-919894	NORTHING: 843649.1
DATUM: AZSP83	EASTING: 926185.4
CLIENT: Resolution Copper	ELEVATION: 2,497 ft

DS16-03 [DS-F]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 4



59119
Megan M. Zivic
Date Signed 10/13/2017

Megan M. Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 36, 136, 236, 336, 436, 536, and 600 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)

ADWR WELL NO: 55-919895	NORTHING: 842227.2
DATUM: AZSP83	EASTING: 922849.0
CLIENT: Resolution Copper	ELEVATION: 2,442 ft

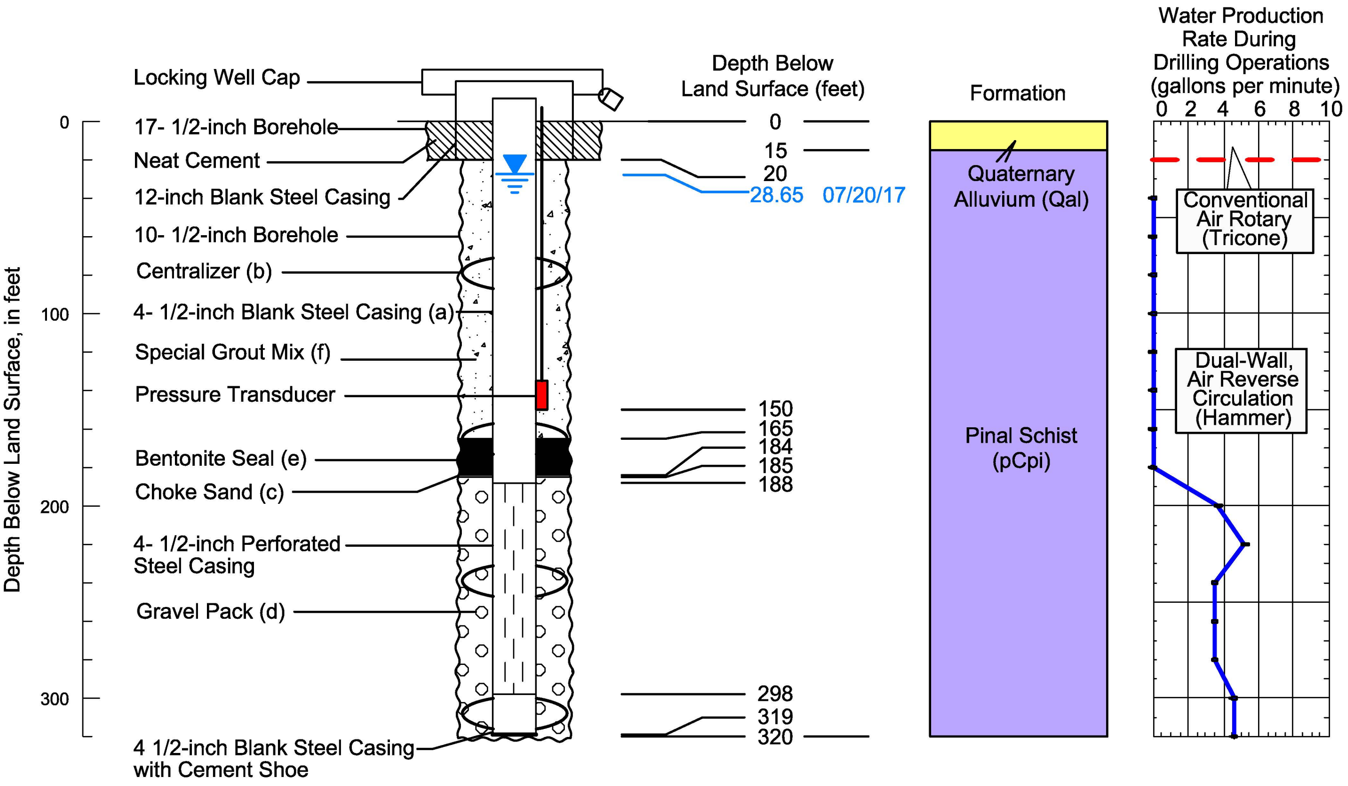
DS16-04 [DS-G]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 5

605.78\DS16-04_WS_LOG\16Oct2017



REGISTERED GEOLOGIST
CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 79, 165, 239, and 308 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (70%) and Bentonite (30%)

ADWR WELL NO: 55-920012	NORTHING: 842326.5
DATUM: AZSP83	EASTING: 909633.6
CLIENT: Resolution Copper	ELEVATION: 2,222 ft

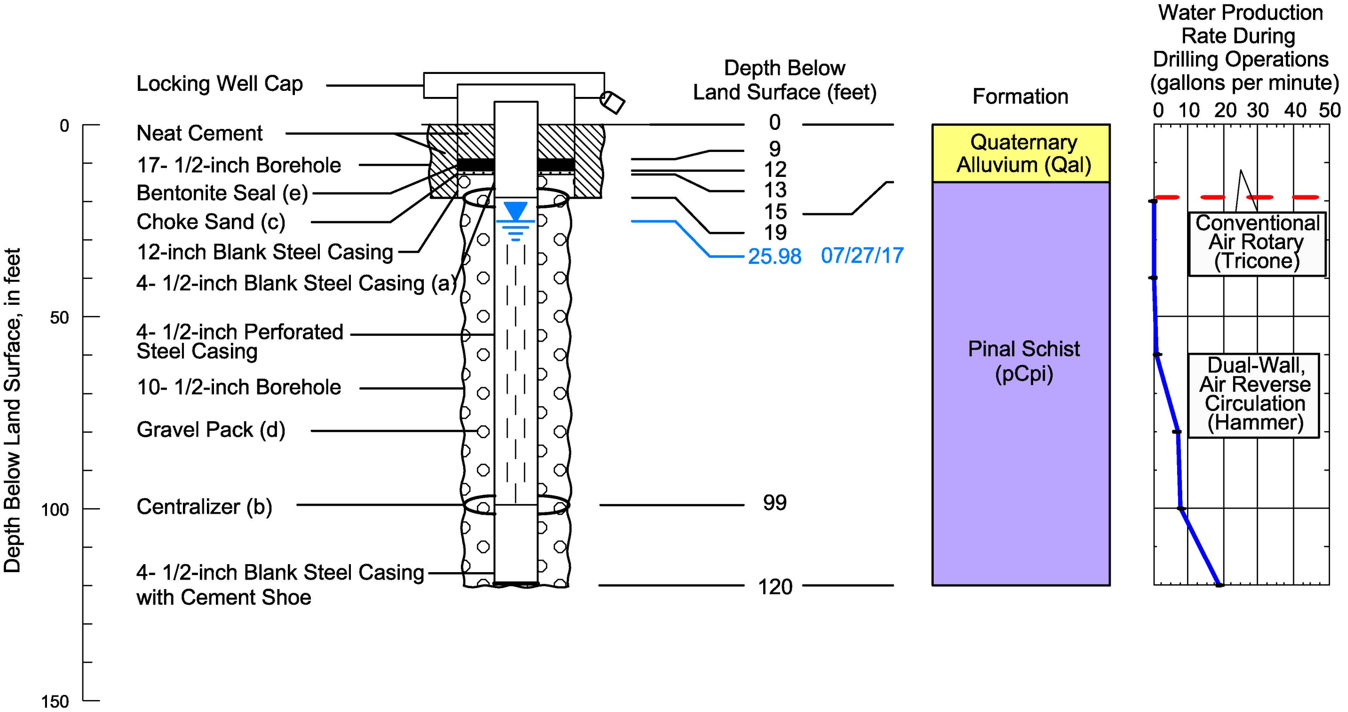
DS16-05 [DS-O]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 6

605.78\DS16-05_WS_LOG\16Oct2017



59119
Megan M.
Zivic
Date Signed 10/13/2017

Megan M. Zivic

EXPLANATION

▽ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 19 and 99 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips

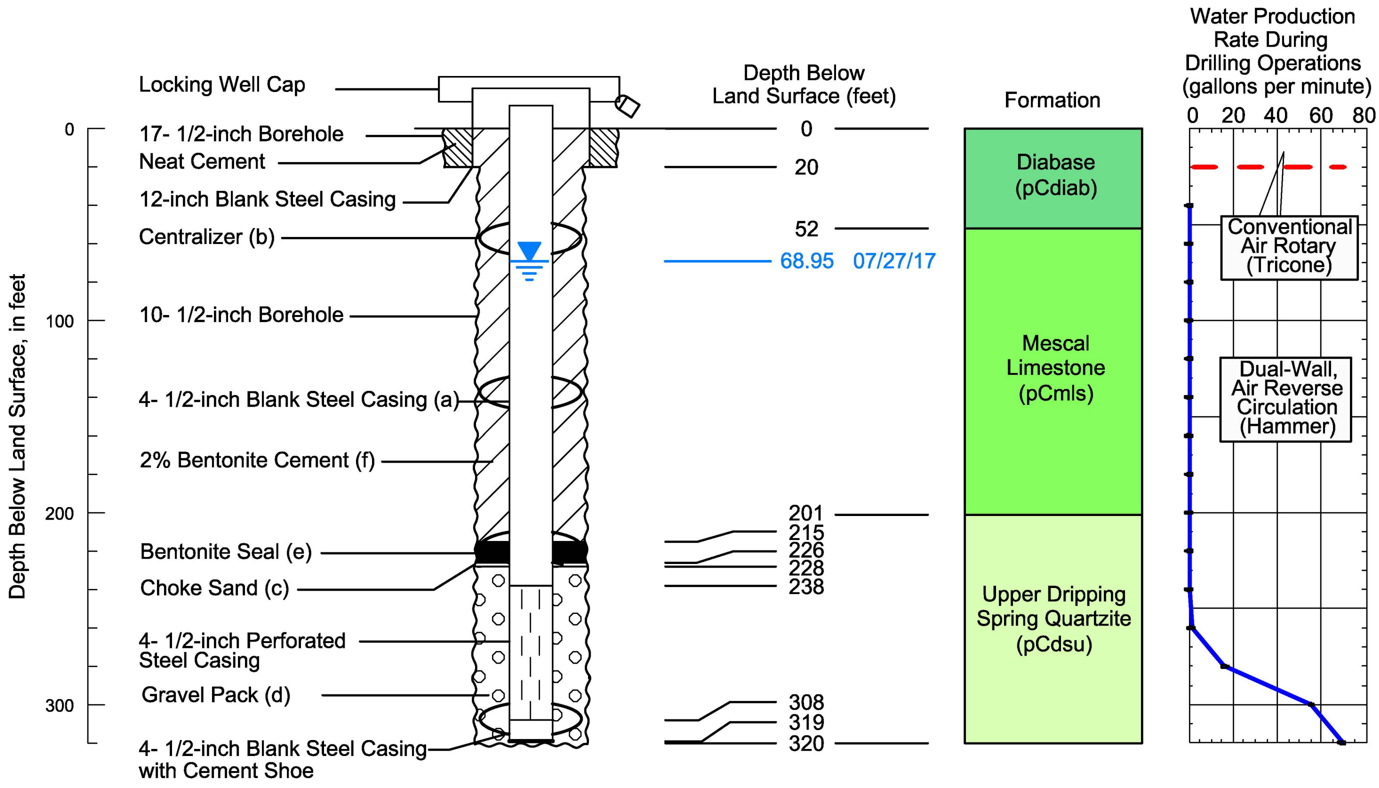
ADWR WELL NO: 55-920013	NORTHING: 845066.9
DATUM: AZSP83	EASTING: 912657.7
CLIENT: Resolution Copper	ELEVATION: 2,285 ft

DS16-06 [DS-L]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 7



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan Zivic

EXPLANATION

▽ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 58, 138, 218 and 308 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)

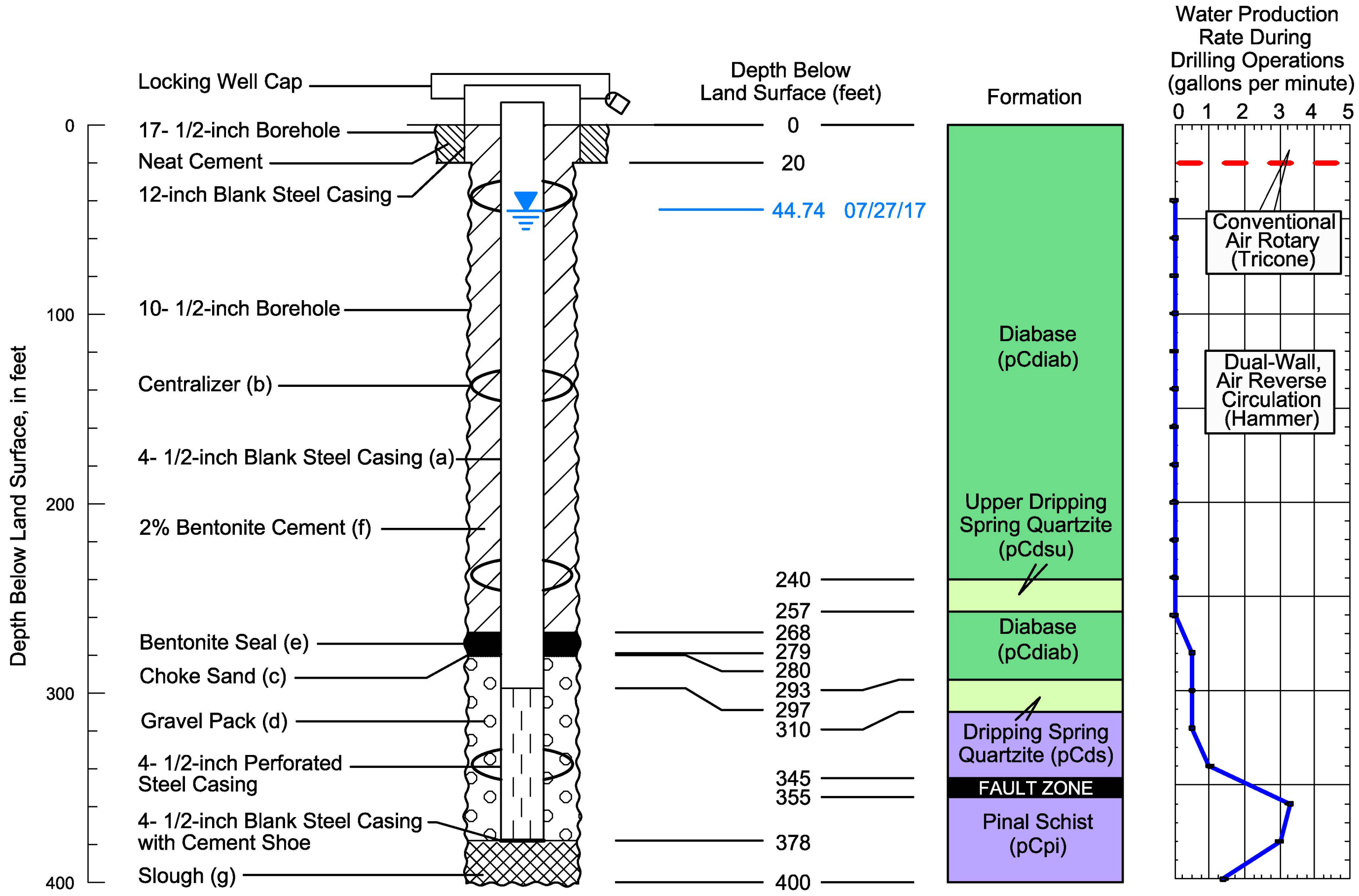
ADWR WELL NO: 55-920014	NORTHING: 844753.7
DATUM: AZSP83	EASTING: 915230.2
CLIENT: Resolution Copper	ELEVATION: 2,370 ft

DS16-07 [DS-K]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 8



REGISTERED GEOLOGIST CERTIFICATE NO. 59119 Megan M. Zivic Date Signed 10/13/2017 ARIZONA U.S.A.

Megan M. Zivic

EXPLANATION

Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 37.5, 137.5, 237.5 and 337.5 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)
(g) Sloughing noted during geophysics from washout zones below 300 ft. Reconditioned 326-400 ft. using conventional circulation with bentonite mud.

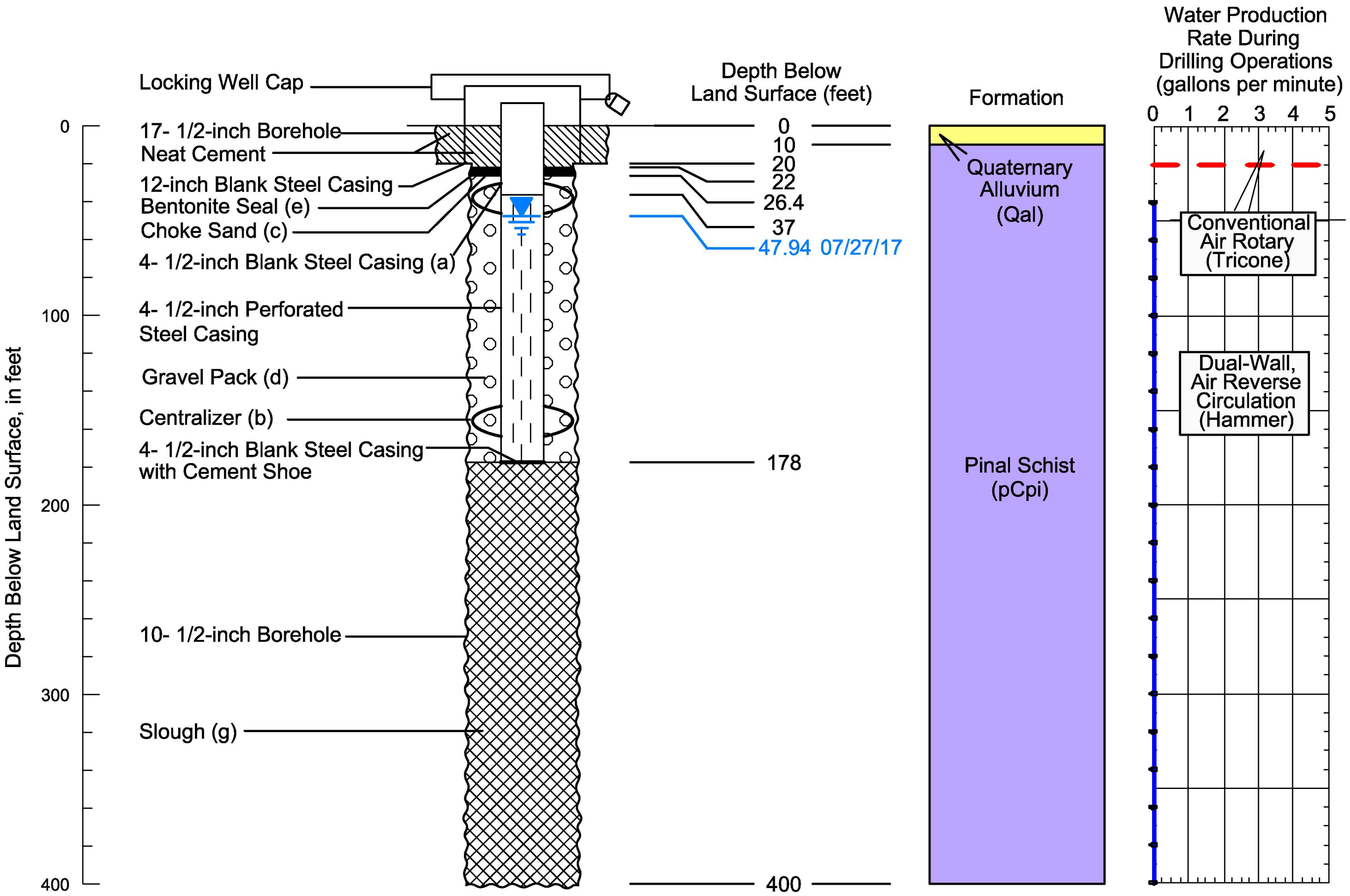
ADWR WELL NO: 55-920079	NORTHING: 850317.1
DATUM: AZSP83	EASTING: 924163.6
CLIENT: Resolution Copper	ELEVATION: 2,704 ft

DS16-08 [DS-I]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 9



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan Zivic

EXPLANATION

▽ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 36.5 and 156.5 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)
(g) Borehole sloughed to 146 ft. bls. Reconditioned to 180 ft. bls using conventional circulation with polymer mud.

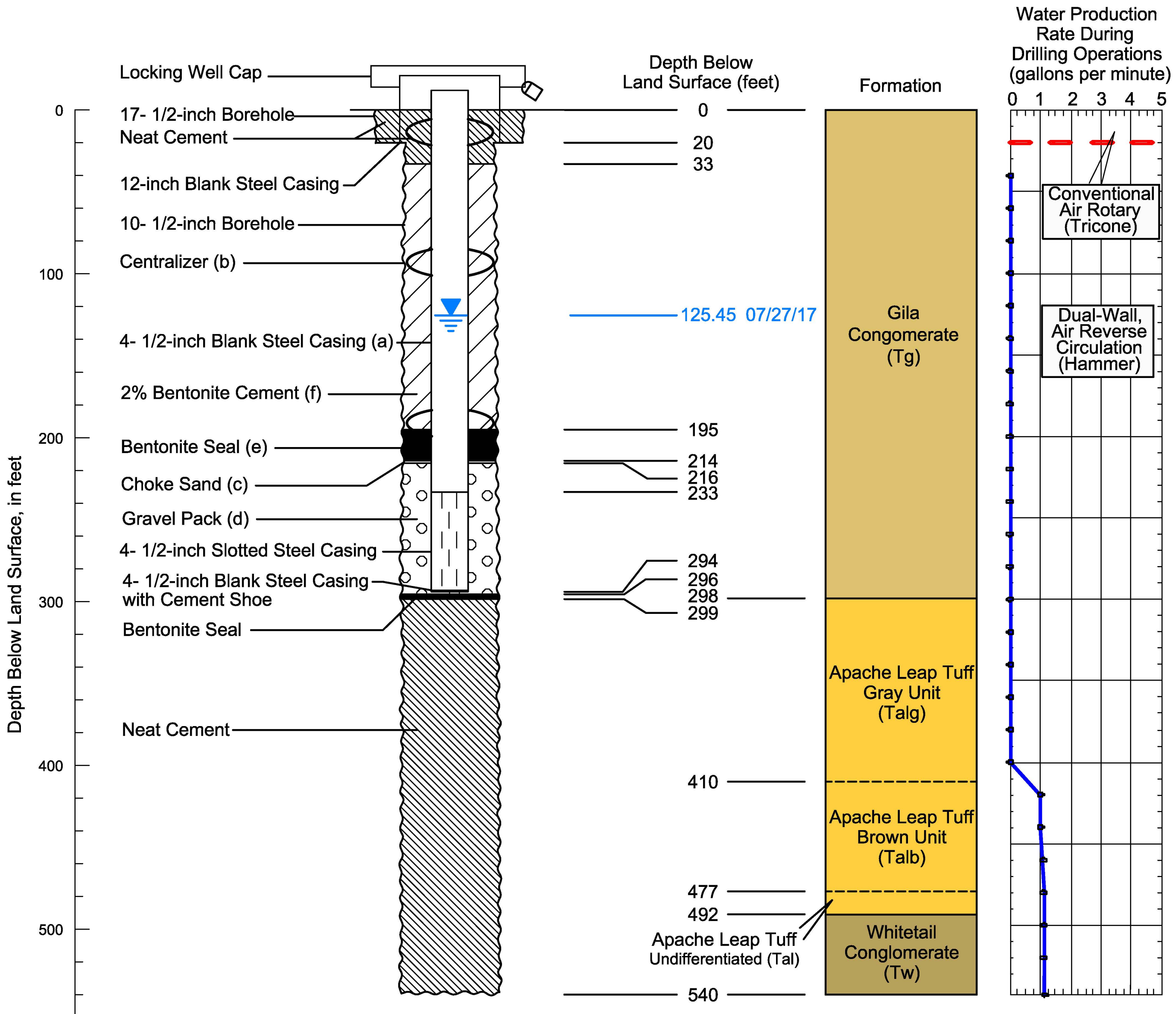
ADWR WELL NO: 55-920076	NORTHING: 851183.5
DATUM: AZSP83	EASTING: 924196.2
CLIENT: Resolution Copper	ELEVATION: 2,672 ft

DS16-09 [DS-P]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 10



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M. Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan M. Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 13, 93 and 193 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (98%) and Bentonite (2%)

ADWR WELL NO: 55-920080	NORTHING: 847008.2
DATUM: AZSP83	EASTING: 923382.9
CLIENT: Resolution Copper	ELEVATION: 2,669 ft

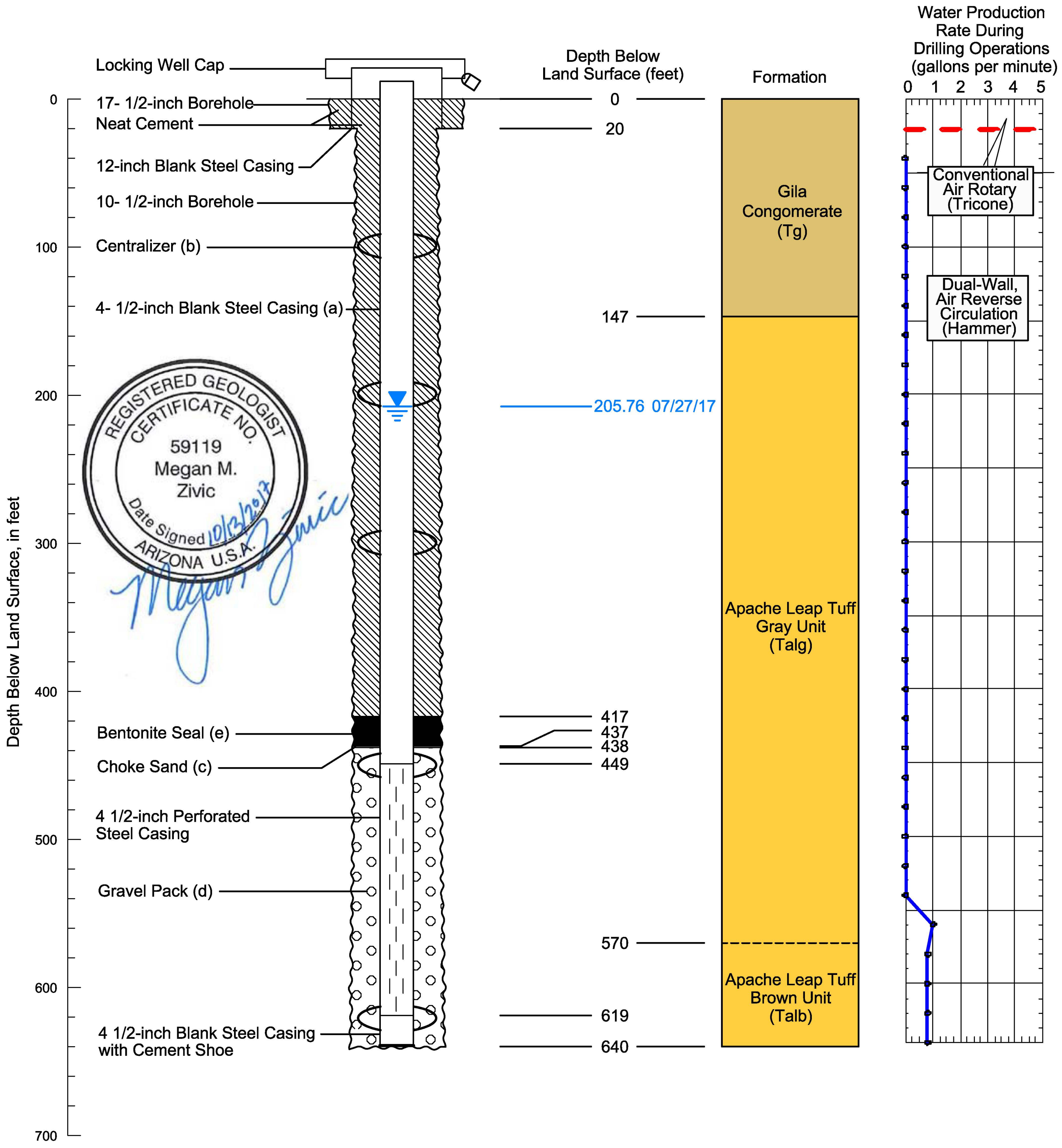
DS16-10 [DS-H]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 11

Drafting\605.78\DS16-10_WS_LOGS\16Oct2017



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M. Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan M. Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed 99, 199, 299, 449 and 619 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips

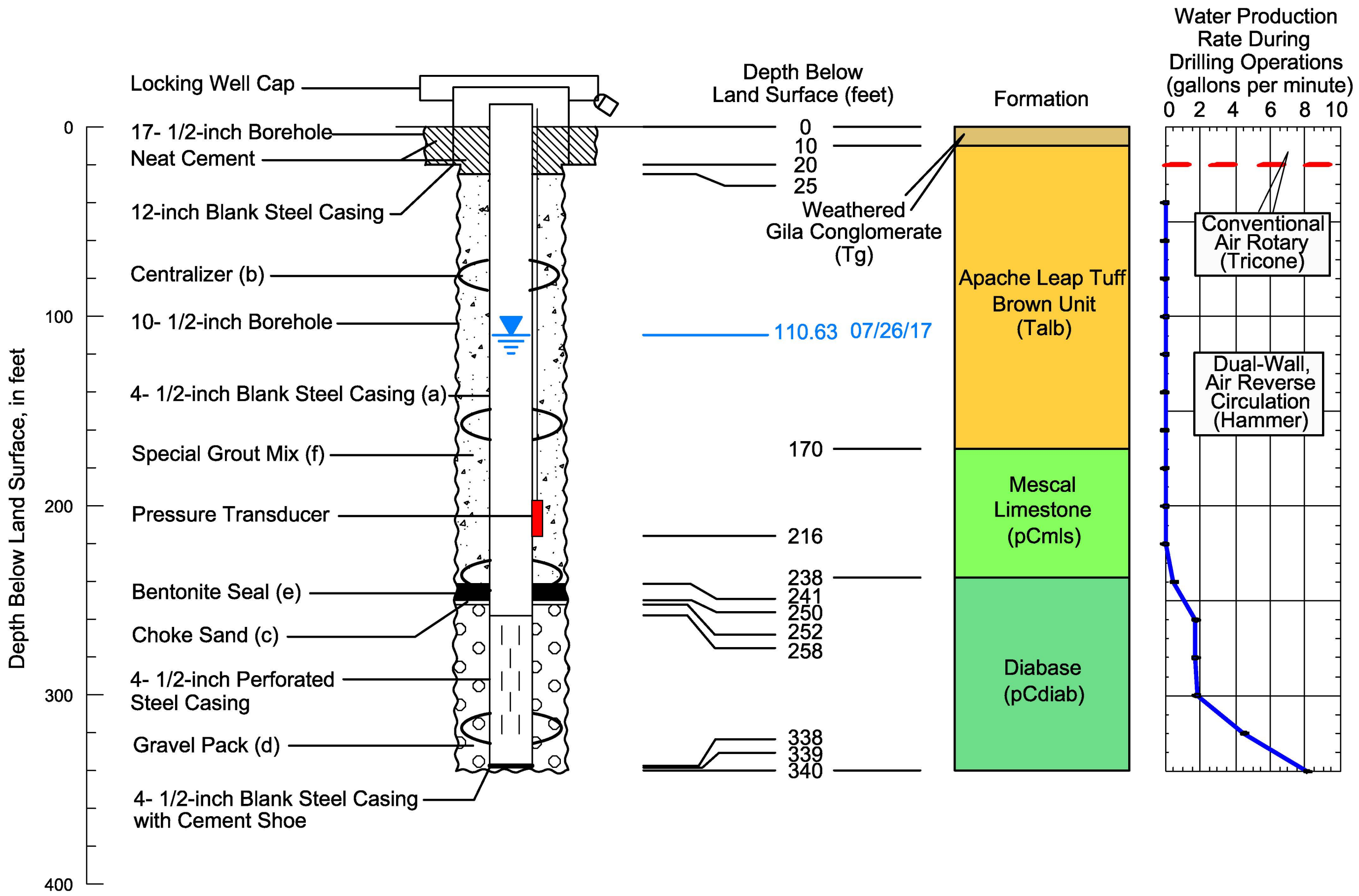
ADWR WELL NO: 55-920077	NORTHING: 849365.7
DATUM: NAD27 UTM 12 m	EASTING: 921449.9
CLIENT: Resolution Copper	ELEVATION: 2,734 ft

DS16-11 [DS-J]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 12



REGISTERED GEOLOGIST
CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed 78, 158, 238, and 318 ft bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (70%) and Bentonite (30%)

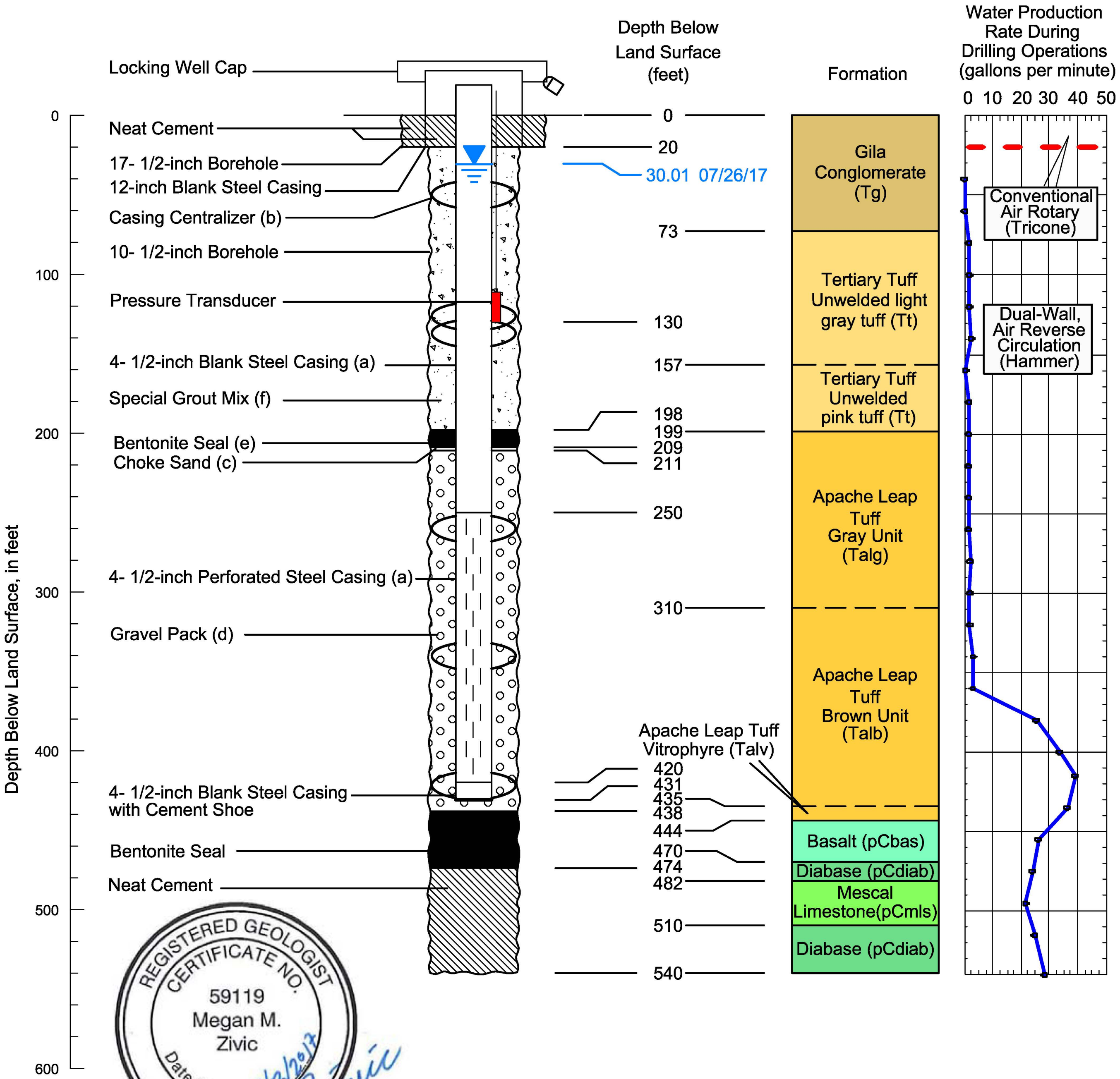
ADWR WELL NO: 55-920153	NORTHING: 845404.0
DATUM: AZSP83	EASTING: 939691.3
CLIENT: Resolution Copper	ELEVATION: 2,878 ft

DS16-12 [DS-A]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 13



59119
Megan M.
Zivic
Date Signed 10/13/2017

Megan Zivic

EXPLANATION

▽ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 50, 125, 135, 260, 340 and 420 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (70%) and Bentonite (30%)

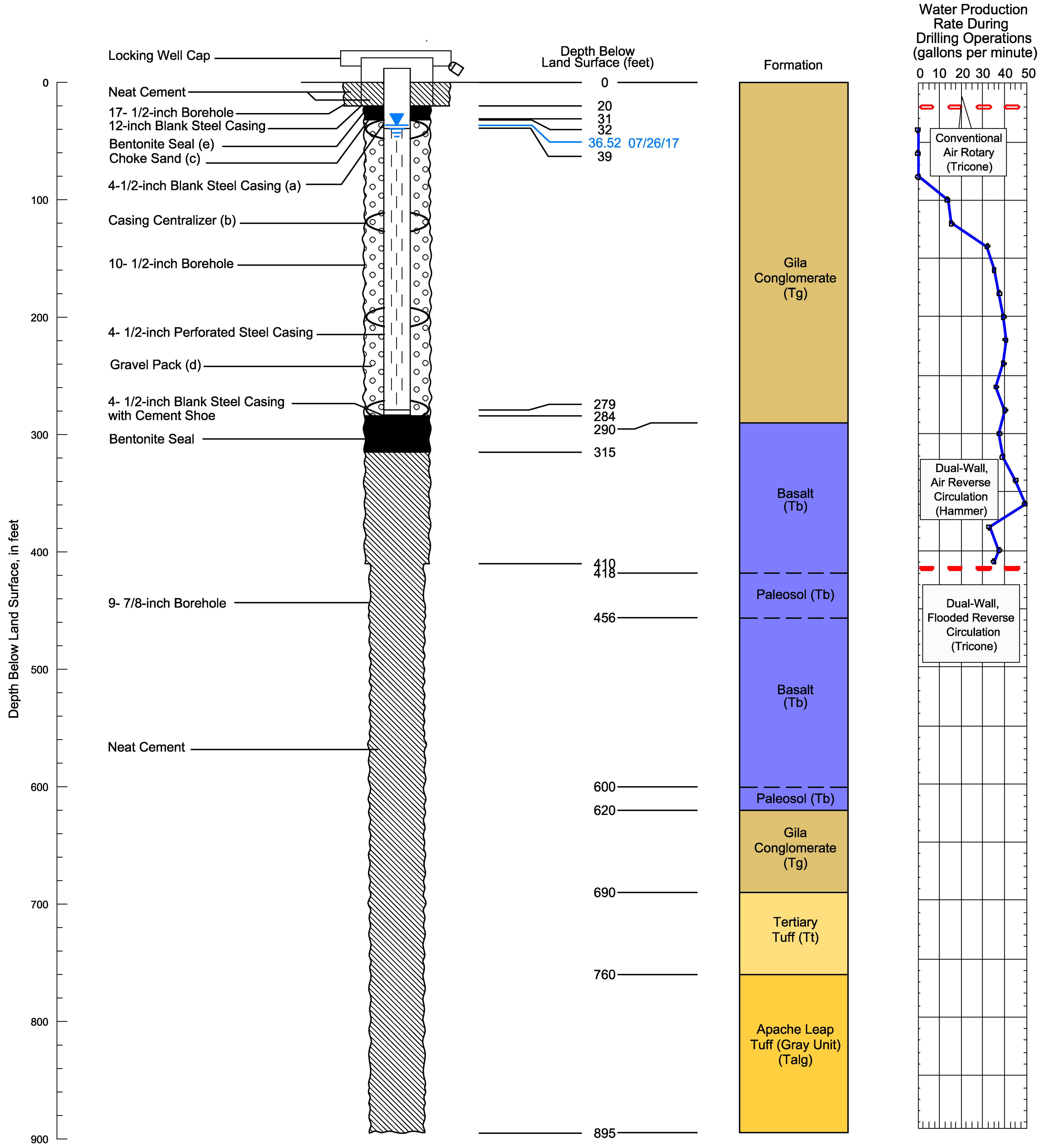
ADWR WELL NO: 55-920154	NORTHING: 842132.7
DATUM: AZSP83	EASTING: 937270.9
CLIENT: Resolution Copper	ELEVATION: 2,704 ft

DS16-13 [DS-B]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 14



59119
Megan M.
Zivic
10/13/2017
Megan Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 39, 119, 199 and 279 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips

ADWR WELL NO: 55-920155	NORTHING: 837284.7
DATUM: AZSP83	EASTING: 937527.1
CLIENT: Resolution Copper	ELEVATION: 2,639 ft

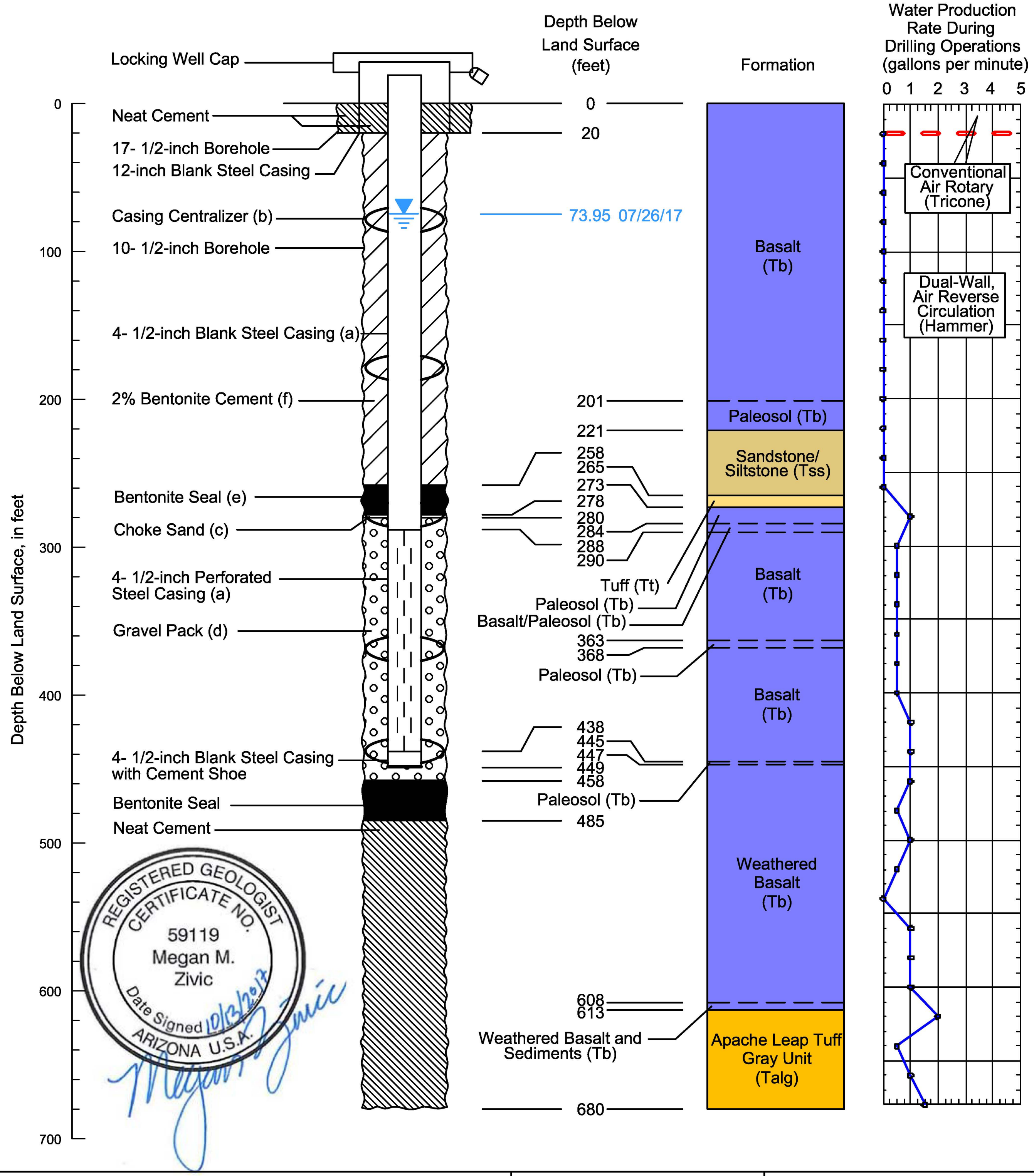
DS16-14 [DS-C]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 15

Drafting\605.78\DS16-014_WS\16Oct2017



59119
Megan M.
Zivic
Date Signed 10/13/2017
Megan M. Zivic

EXPLANATION

▽ Non-Pumping Water Level (ft.bls.)

(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered

(b) Centralizers installed at 78, 178, 278, 368, and 438 ft. bls

(c) 10-20 Sand (Fine)

(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded

(e) 3/8" Bentonite chips

(f) Mixture of cement (98%) and Bentonite (2%)

ADWR WELL NO: 55-920156	NORTHING: 834155.7
DATUM: AZSP83	EASTING: 933025.0
CLIENT: Resolution Copper	ELEVATION: 2,529 ft

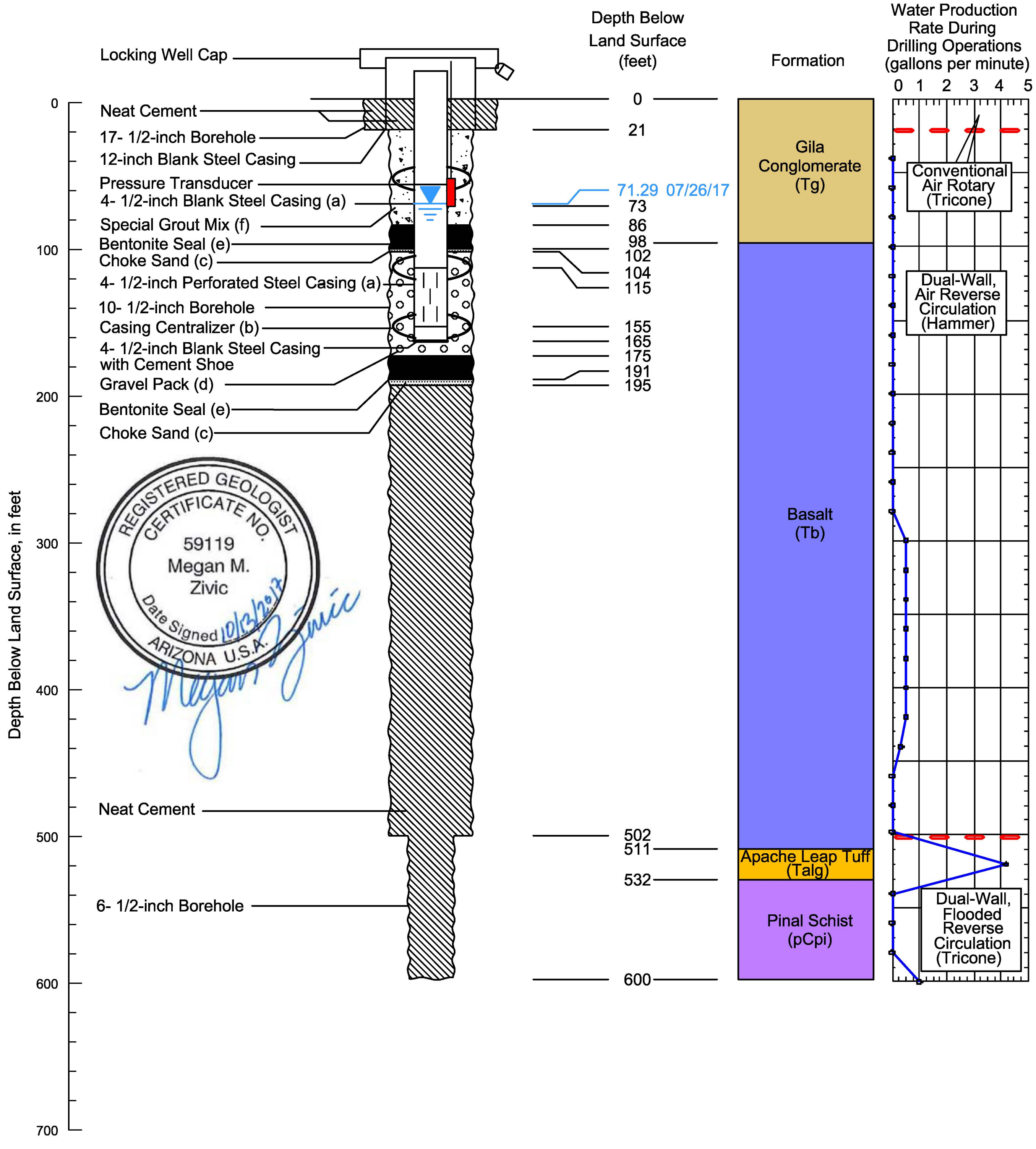
DS17-15 [DS-D]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 16

605.78\DS17-15_WS_LOGS\16Oct2017



59119
Megan M. Zivic
Date Signed 10/13/2017

EXPLANATION

Non-Pumping Water Level (ft.bls.)
(a) HWT casing (4" I.D., 4.5" O.D.) 2.5" x 1/8" slots, 2 slots per round, 4 rounds per foot, staggered
(b) Centralizers installed at 55, 115, and 155 ft. bls
(c) 10-20 Sand (Fine)
(d) 1/4" x 1/8" diameter, well-sorted, sub-rounded
(e) 3/8" Bentonite chips
(f) Mixture of cement (70%) and Bentonite (30%)

ADWR WELL NO: 55-920157	NORTHING: 833042.1
DATUM: AZSP83	EASTING: 929039.0
CLIENT: Resolution Copper	ELEVATION: 2,463 ft

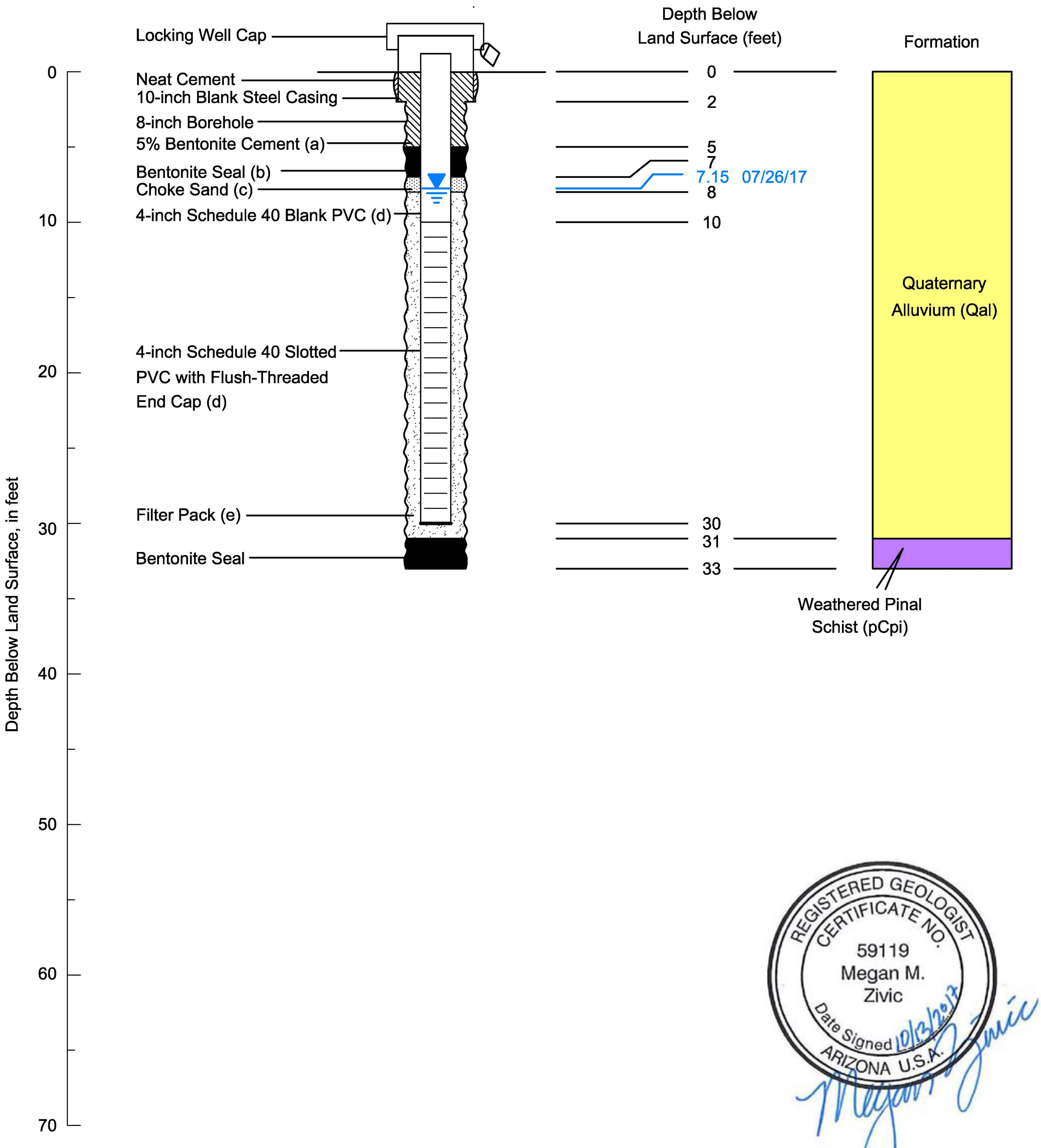
DS17-16 [DS-E]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 17

605.78\DS17-16_WS_LOGS\16Oct2017



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M.
Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) Mixture of cement (95%) and Bentonite (5%)
(b) 3/8" Bentonite chips
(c) Choke sand #60
(d) 4-inch Schedule 40 flush-threaded PVC, 0.020 inch slots
(e) Colorado silica sand (10-20)

ADWR WELL NO: 55-920368	NORTHING: 836969.0
DATUM: AZSP83	EASTING: 915160.9
CLIENT: Resolution Copper	ELEVATION: 2,222 ft

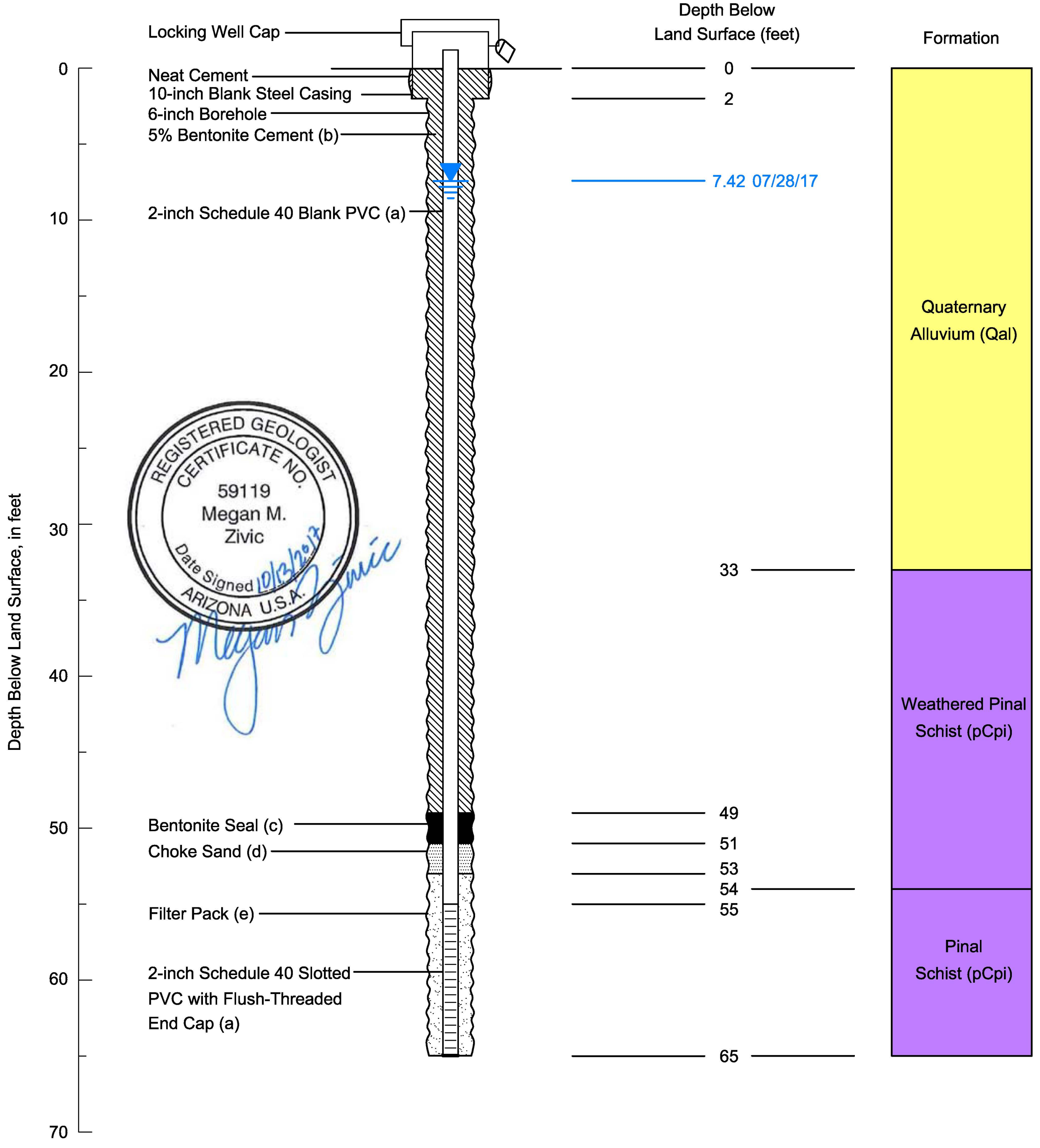
DS17-17 [DS-Q]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 18

Drafting\605.78\DS17-17.dwg\16Oct2017



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M. Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan M. Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) 2-inch schedule 40 flush-threaded PVC, 0.020-inch slots
(b) Mixture of cement (95%) and Bentonite (5%)
(c) 3/8" Bentonite chips
(d) Choke sand #60
(e) Colorado silica sand (10-20)

ADWR WELL NO: 55-920363	NORTHING: 836971.2
DATUM: AZSP83	EASTING: 915151.3
CLIENT: Resolution Copper	ELEVATION: 2,222 ft

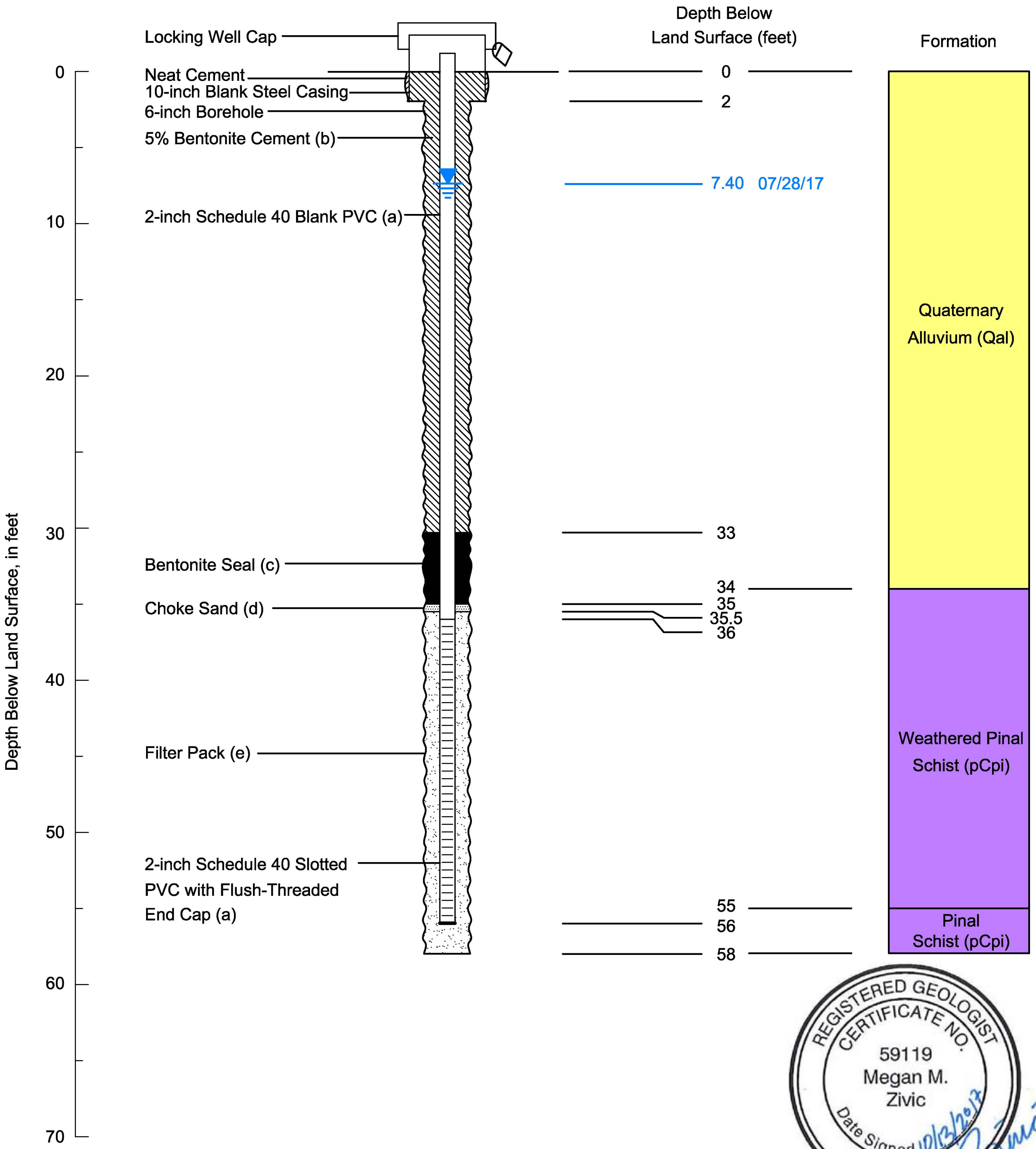
DS17-18 [GT-43]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY
& ASSOCIATES

FIGURE 19

Drafting\605.78\DS17-18_WS.dwg\16Oct2017



REGISTERED GEOLOGIST CERTIFICATE NO.
59119
Megan M. Zivic
Date Signed 10/13/2017
ARIZONA U.S.A.

Megan M. Zivic

EXPLANATION

▼ Non-Pumping Water Level (ft.bls.)

(a) 2-inch schedule 40 flush-threaded PVC, 0.020-inch slots
(b) Mixture of cement (95%) and Bentonite (5%)
(c) 3/8" Bentonite chips
(d) Choke sand #60
(e) Colorado silica sand (10-20)

ADWR WELL NO: 55-920364	NORTHING: 836973.7
DATUM: AZSP83	EASTING: 915141.8
CLIENT: Resolution Copper	ELEVATION: 2,222 ft

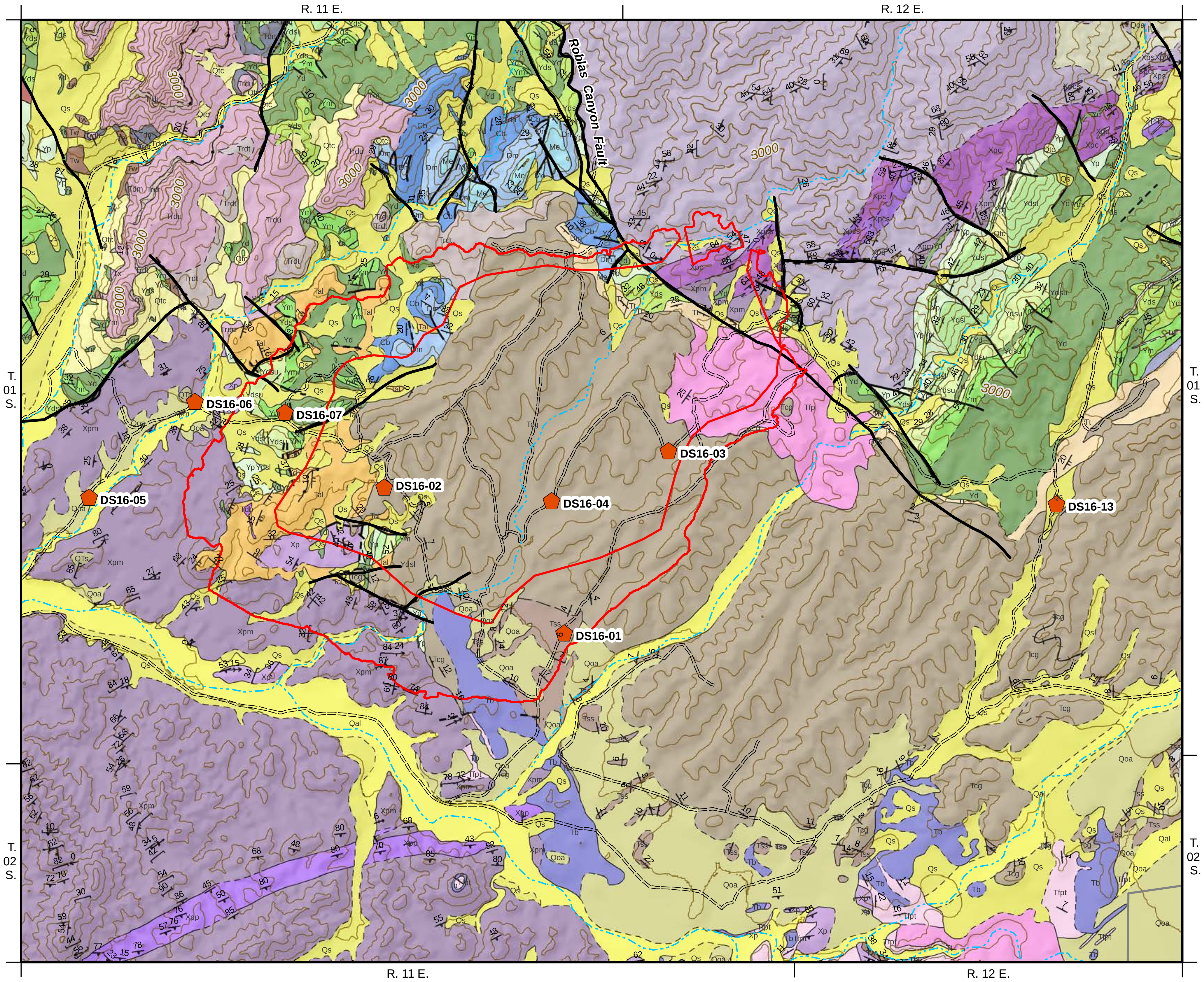
DS17-19 [GT-43-2]

DIAGRAM OF WELL CONSTRUCTION

MONTGOMERY & ASSOCIATES

FIGURE 20

Drafting\605.78\DS17-19_WS.dwg\16Oct2017



EXPLANATION

⬟	Constant-Rate Pump Test in Hydrologic Test Well
━	Fault
====	General Access Road
━	Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

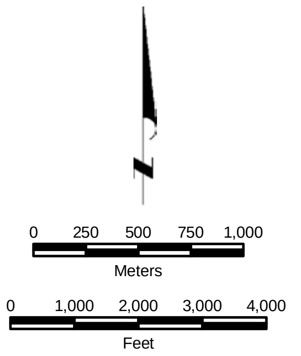
Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION COPPER

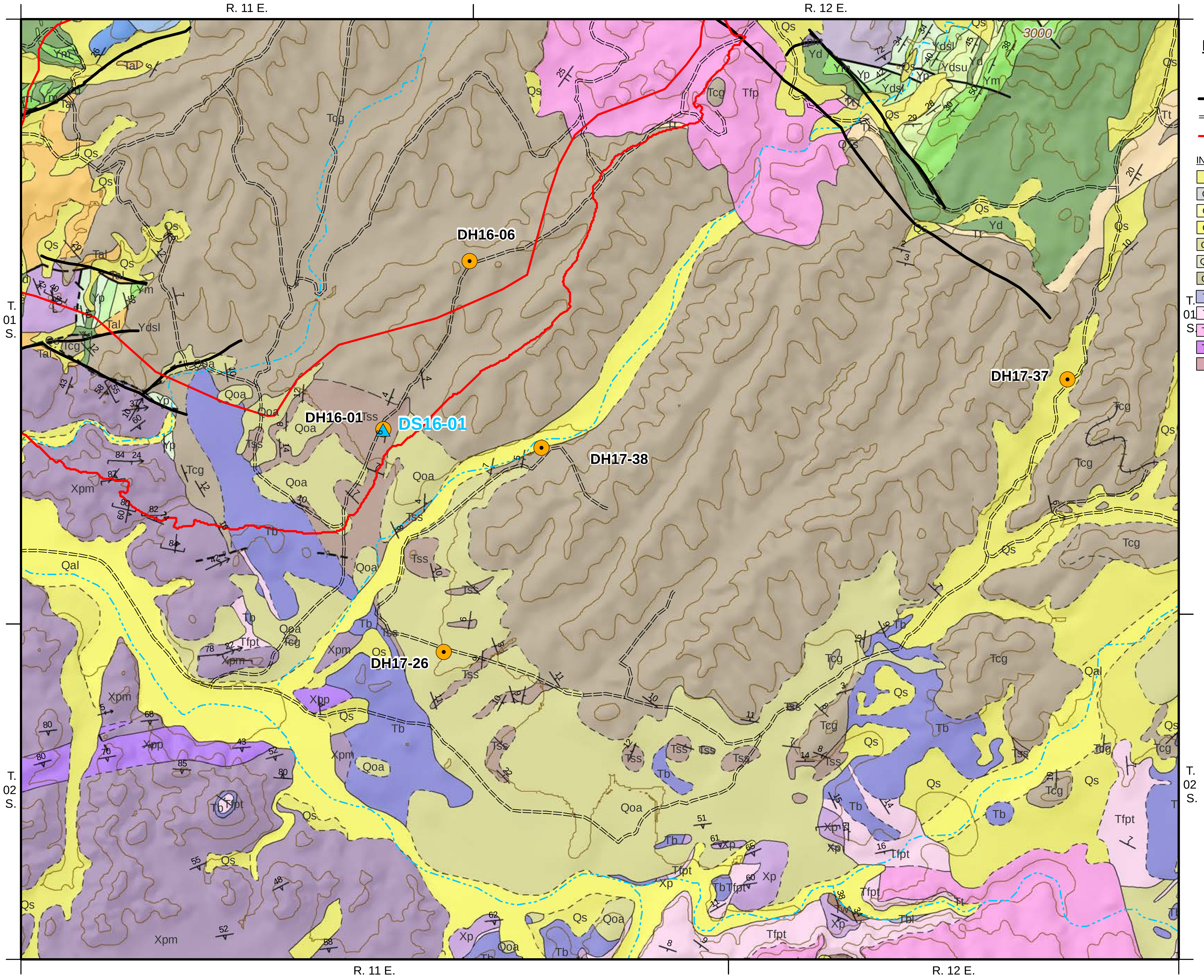
LOCATIONS OF CONSTANT-RATE PUMPING TESTS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 21

GIS-TUC\605\605.7808\ConstantRatePumpTestLocationMap_FINAL\16Oct2017



EXPLANATION

●	Observation Well / Piezometer
▲	Pumped Well
━━	Fault
═══	General Access Road
━━	Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)

0 250 500 750 1,000
Meters

0 1,000 2,000 3,000 4,000
Feet

RESOLUTION
COPPER

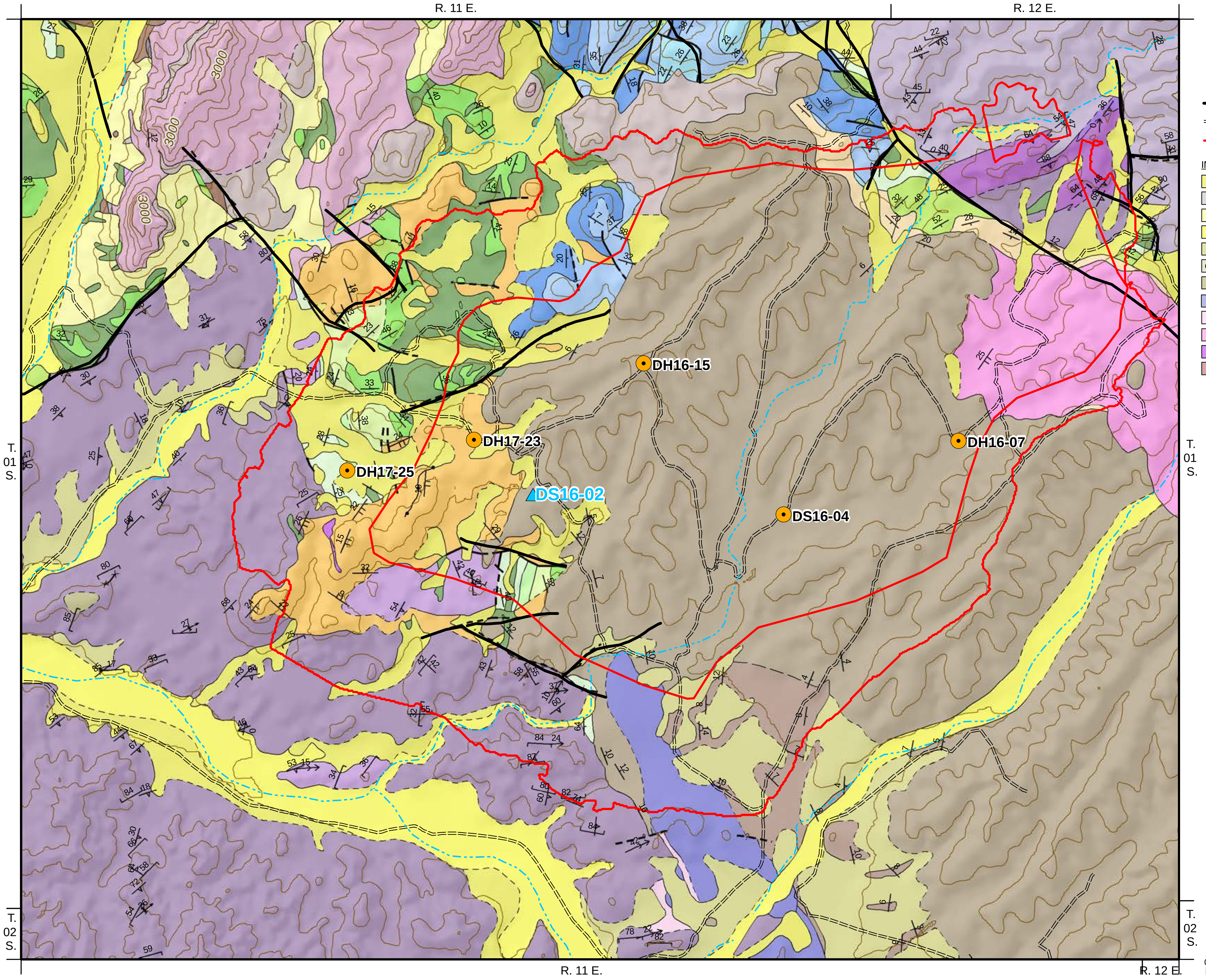
DS16-01 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 22

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-01_FINAL\16Oct2017



EXPLANATION

● Observation Well / Piezometer
▲ Pumped Well
Fault
==== General Access Road
Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)

RESOLUTION
COPPER

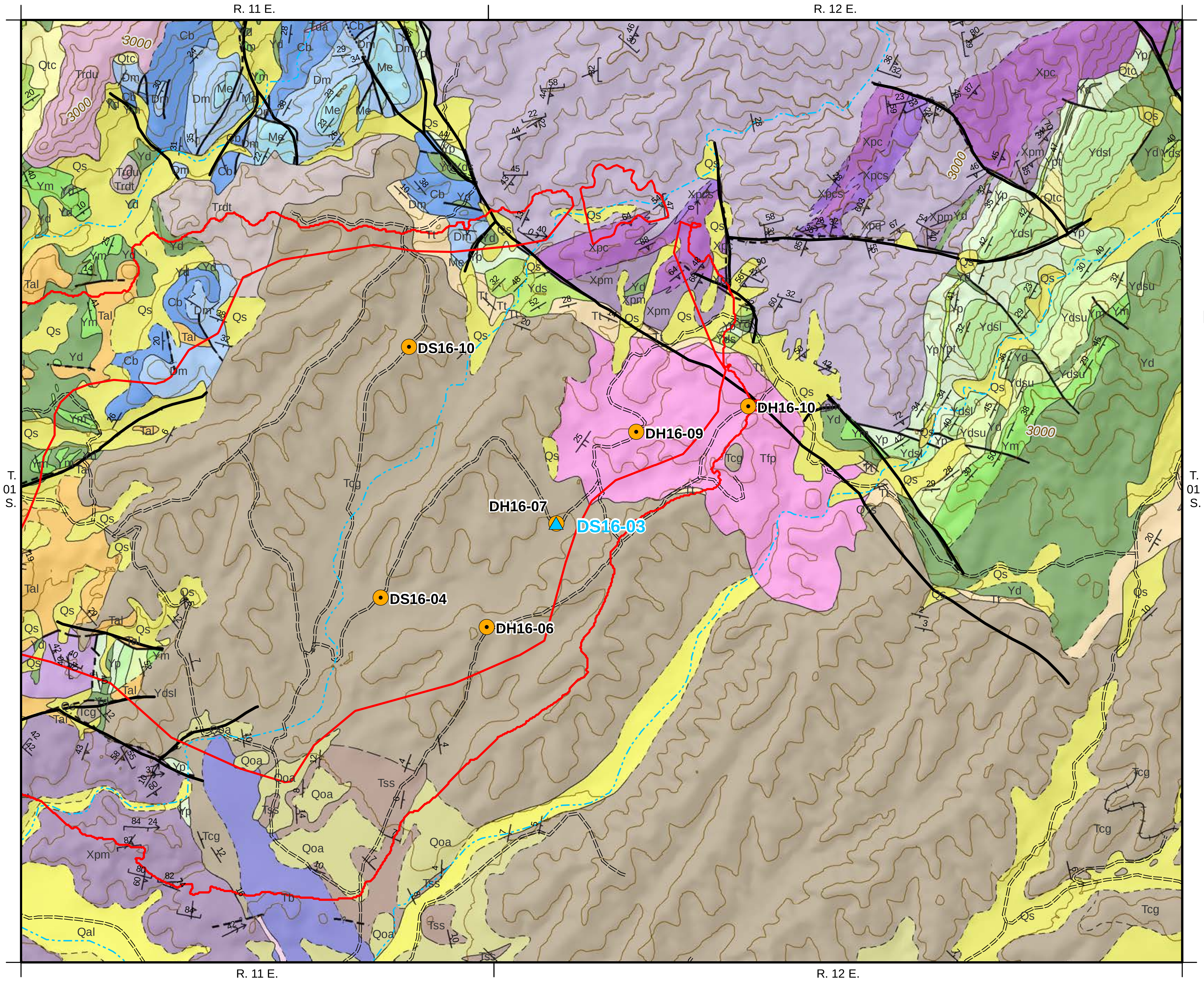
DS16-02 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

2017

FIGURE 23

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-02_FINAL\16Oct2017



EXPLANATION

- ● Observation Well / Piezometer
- ▲ Pumped Well
- — Fault
- ==== General Access Road
- — Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

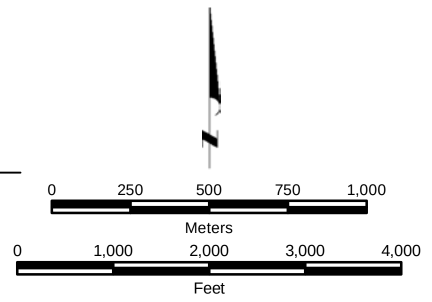
Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

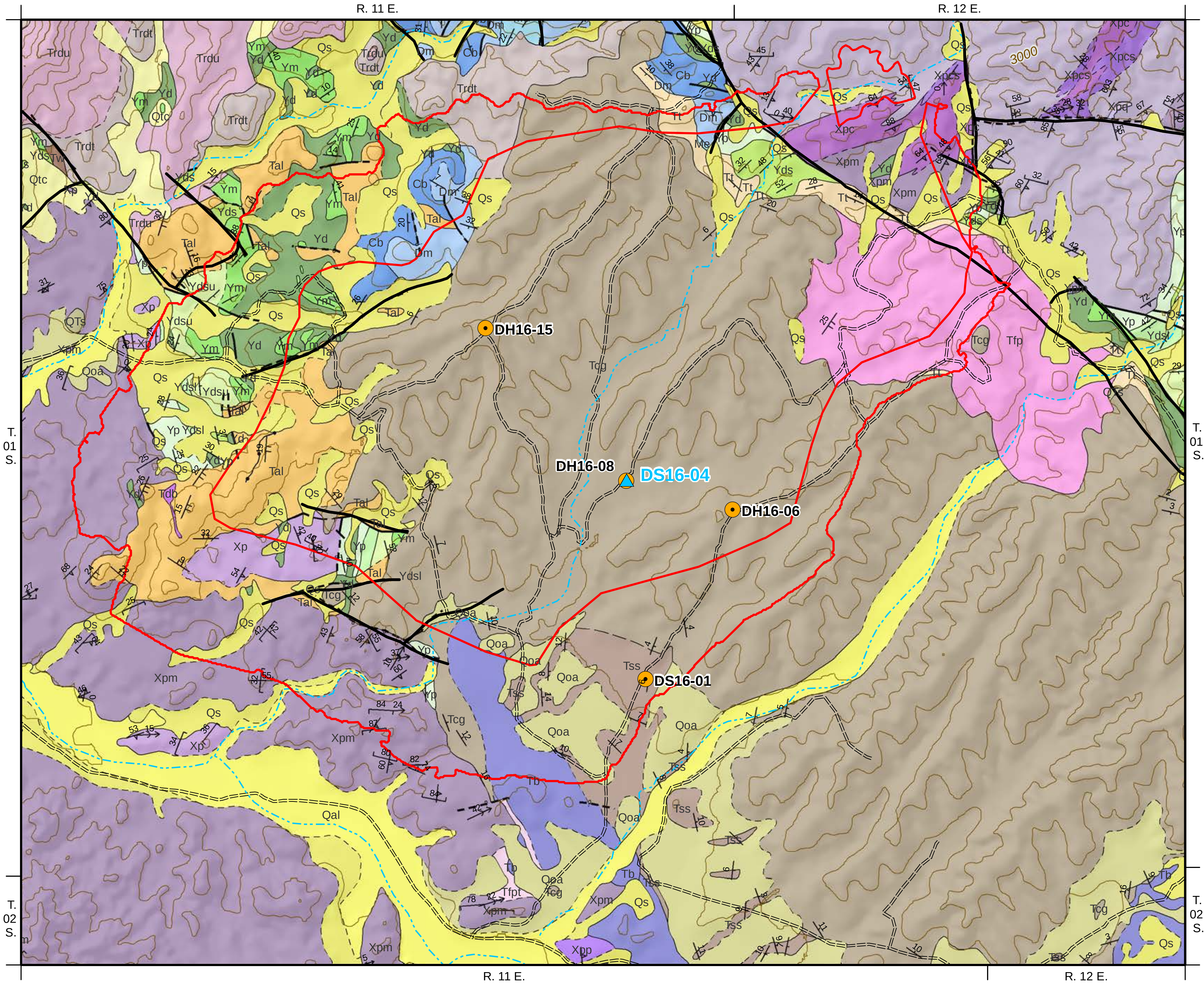
DS16-03 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 24

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-03_FINAL\16Oct2017



EXPLANATION

● Observation Well / Piezometer

▲ Pumped Well

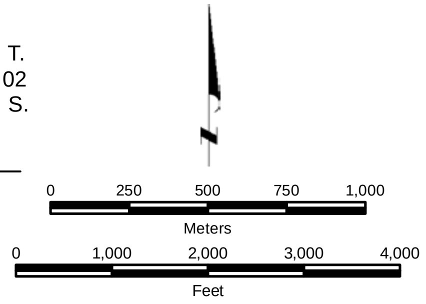
━━ Fault

==== General Access Road

━━ Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Unit	Description
Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)
Superstition Volcanic Complex	
Gila Group	
Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)
Picketpost Mountain Formation	
Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)
Apache Leap Tuff	
Tal	Apache Leap Tuff (early Miocene)
Superstition Group	
Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)
Whitetail Formation	
Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)
Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

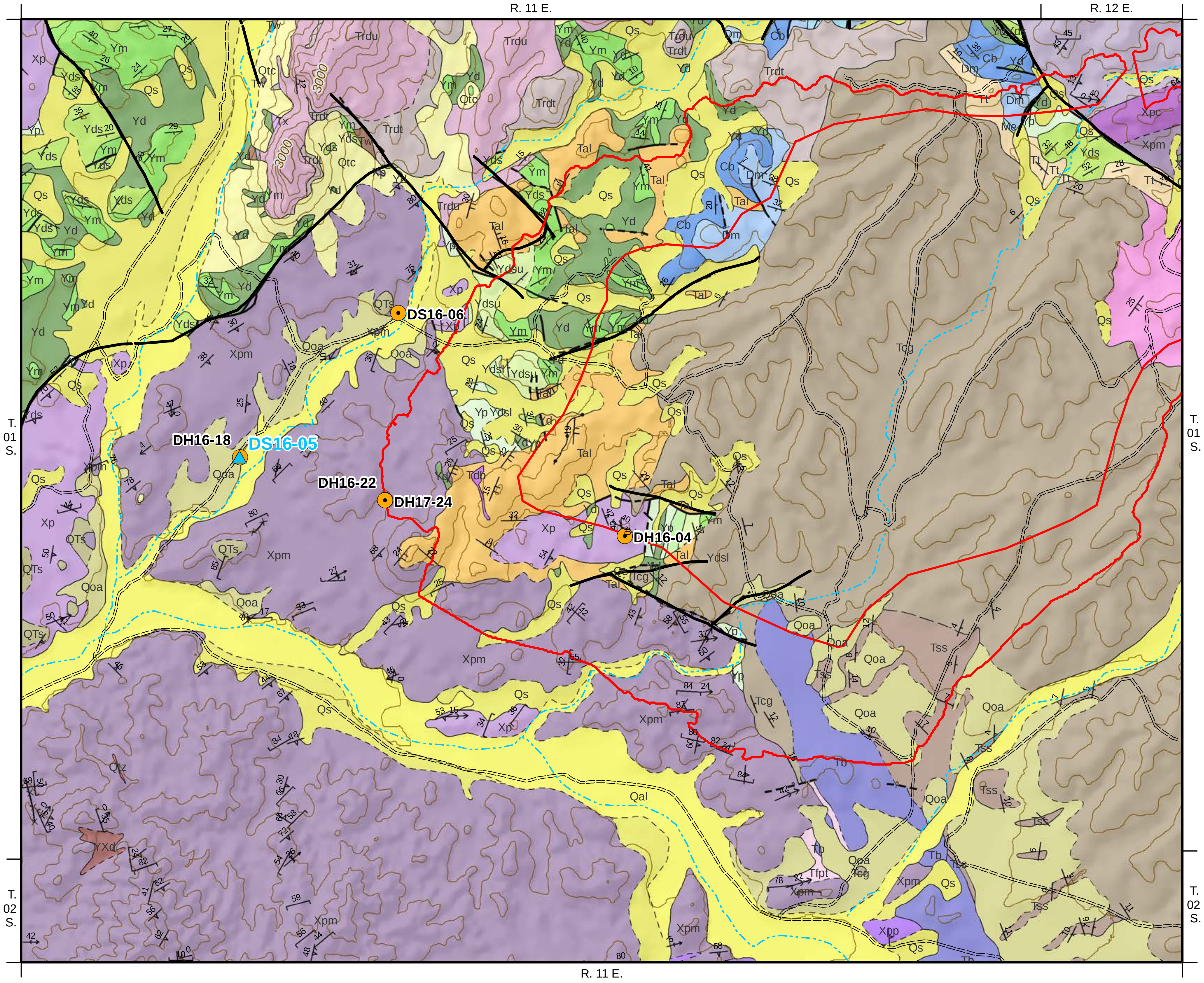
DS16-04 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

2017

FIGURE 25

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-04_FINAL\16Oct2017



EXPLANATION

● Observation Well / Piezometer

▲ Pumped Well

━ Fault

==== General Access Road

━ Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)

0 250 500 750 1,000
Meters

0 1,000 2,000 3,000 4,000
Feet

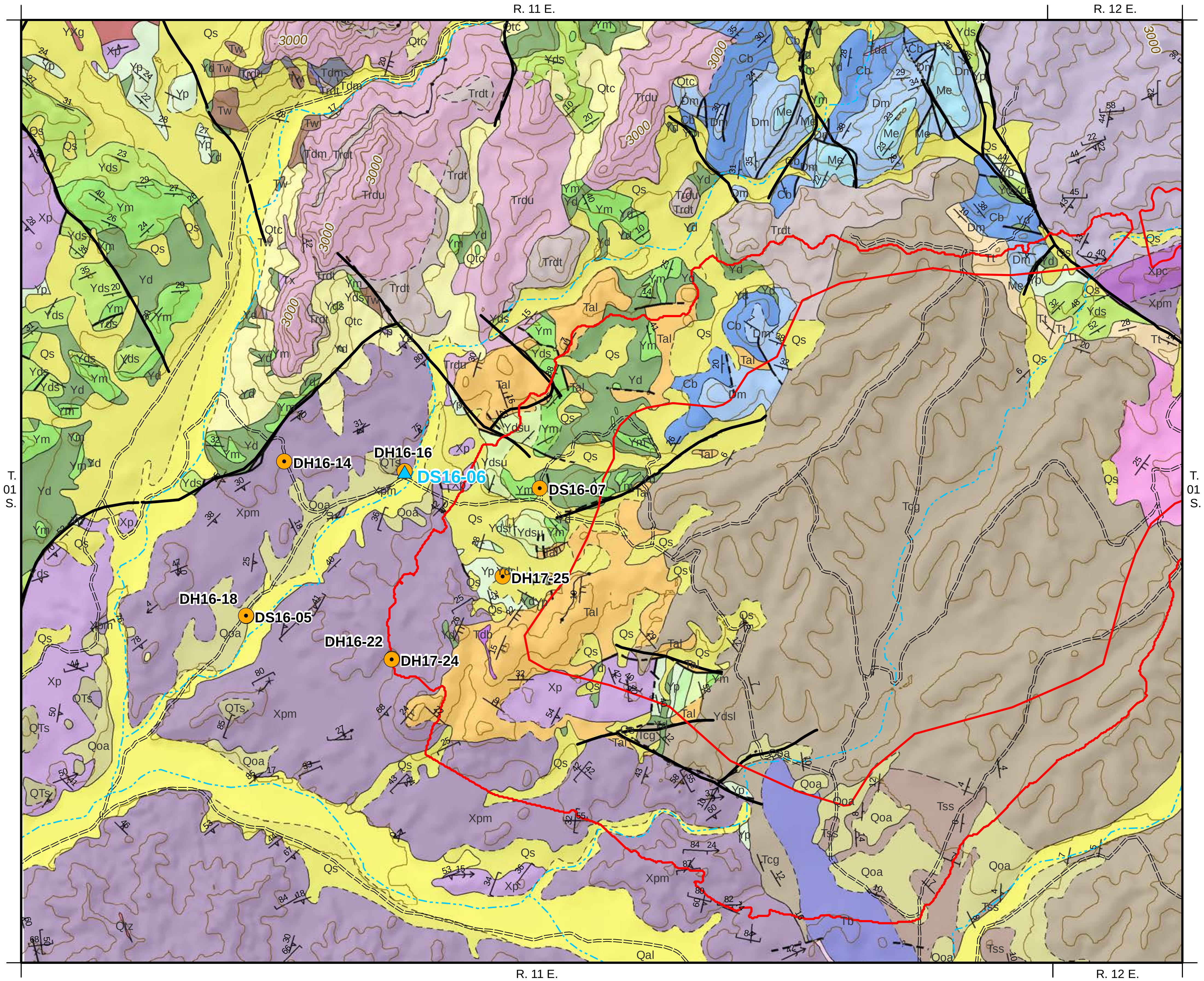
RESOLUTION
COPPER

DS16-05 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

2017

FIGURE 26



EXPLANATION

● Observation Well / Piezometer

▲ Pumped Well

━ Fault

==== General Access Road

━ Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

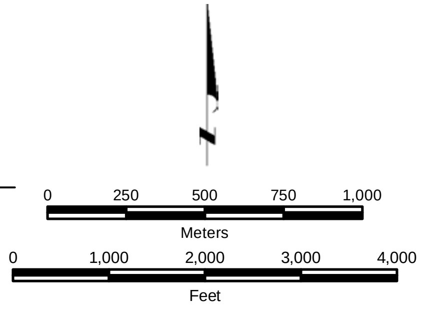
Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

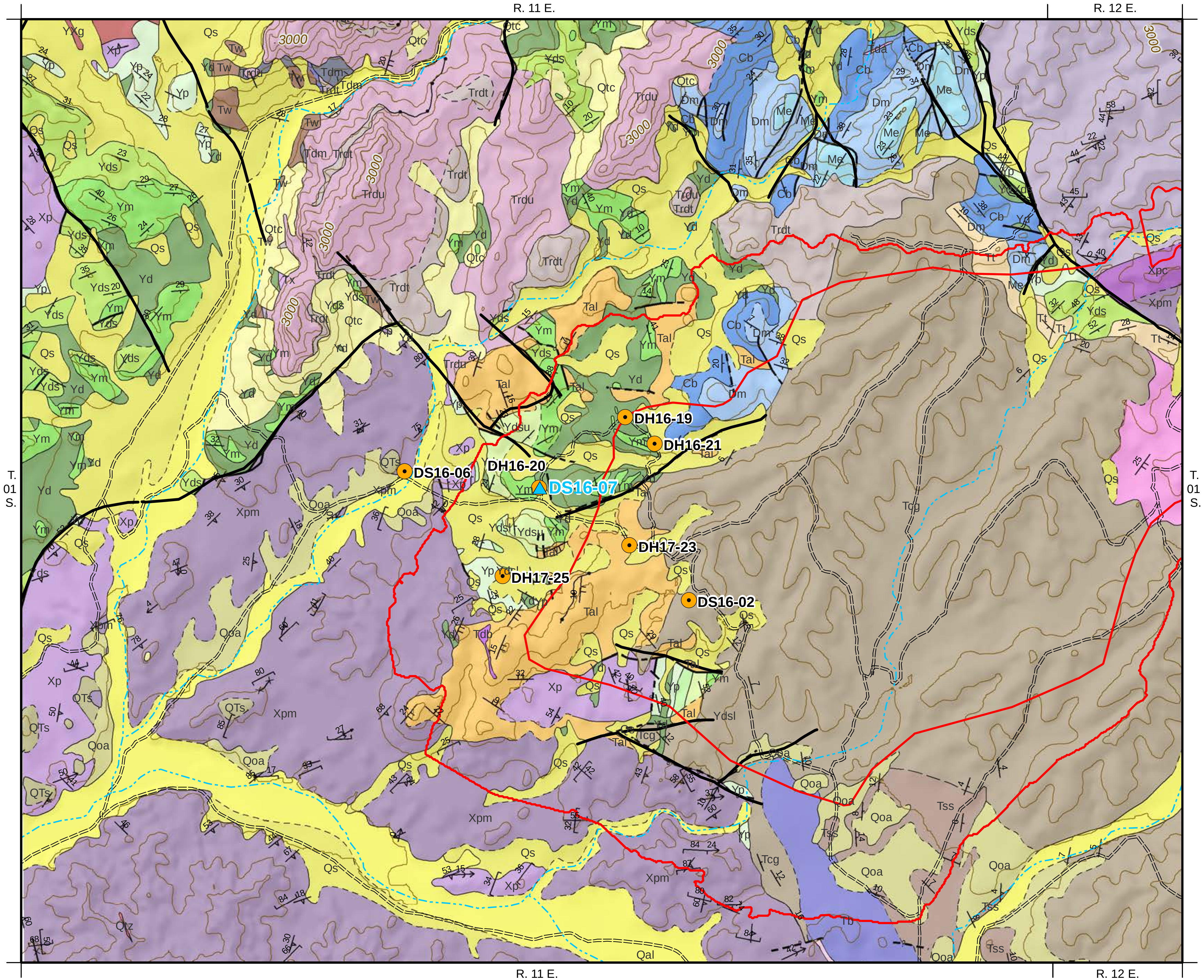
DS16-06 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 27

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-06_FINAL\16Oct2017

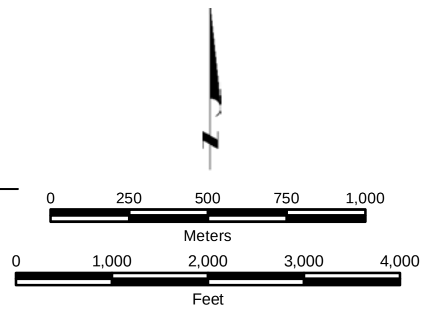


EXPLANATION

- ● Observation Well / Piezometer
- ▲ Pumped Well
- Fault
- General Access Road
- Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)
	Superstition Volcanic Complex
	Gila Group
Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)
	Picketpost Mountain Formation
Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)
	Apache Leap Tuff
Tal	Apache Leap Tuff (early Miocene)
	Superstition Group
Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)
	Whitetail Formation
Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)
Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

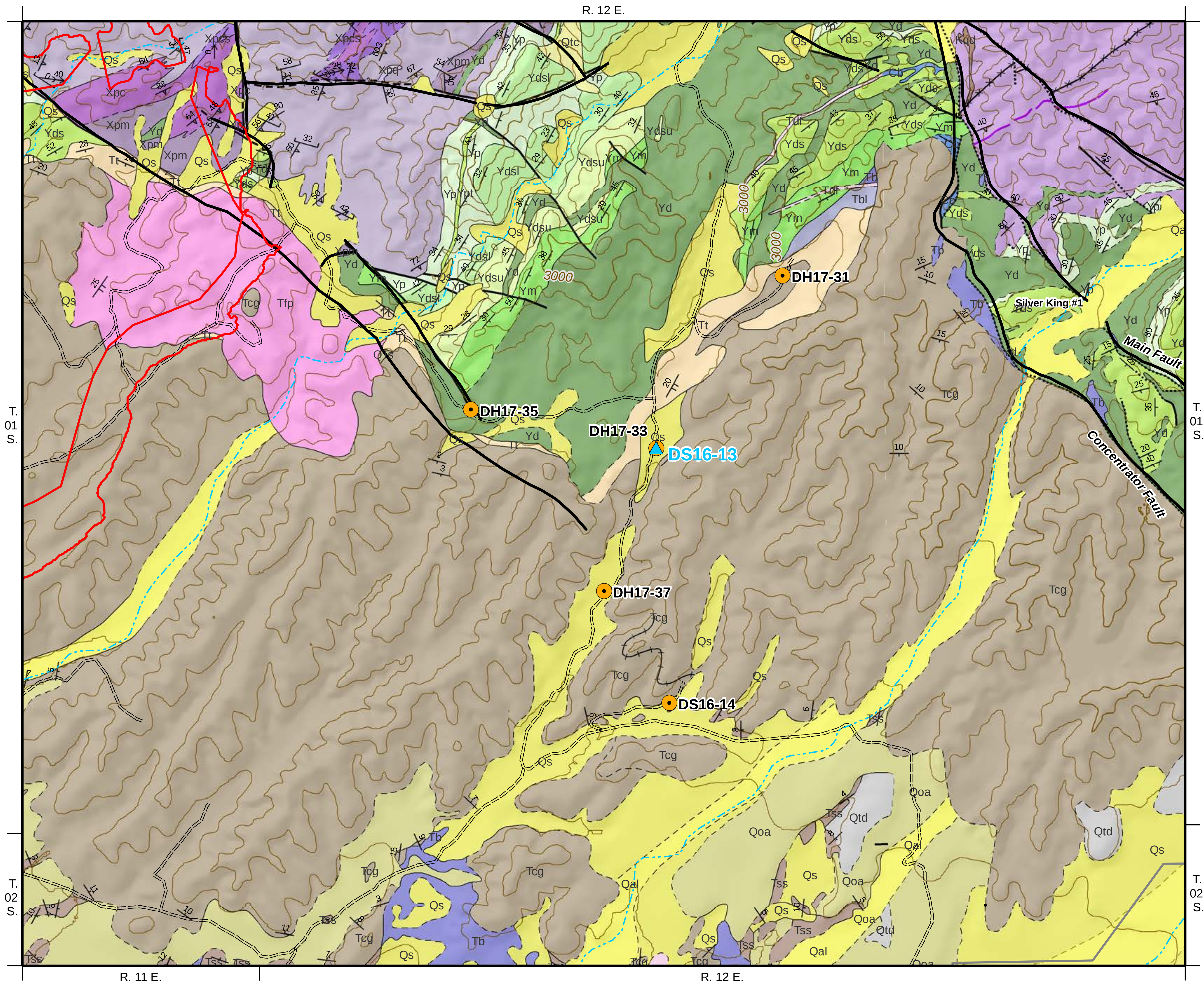
DS16-07 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 28

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-07_FINAL\16Oct2017



EXPLANATION

- ● Observation Well / Piezometer
- ▲ Pumped Well
- — Fault
- ==== General Access Road
- — Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

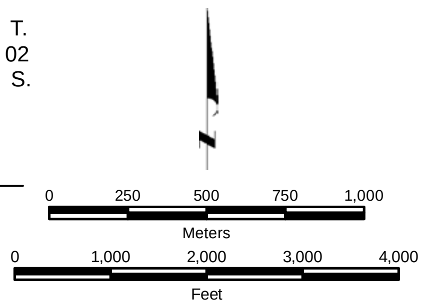
Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

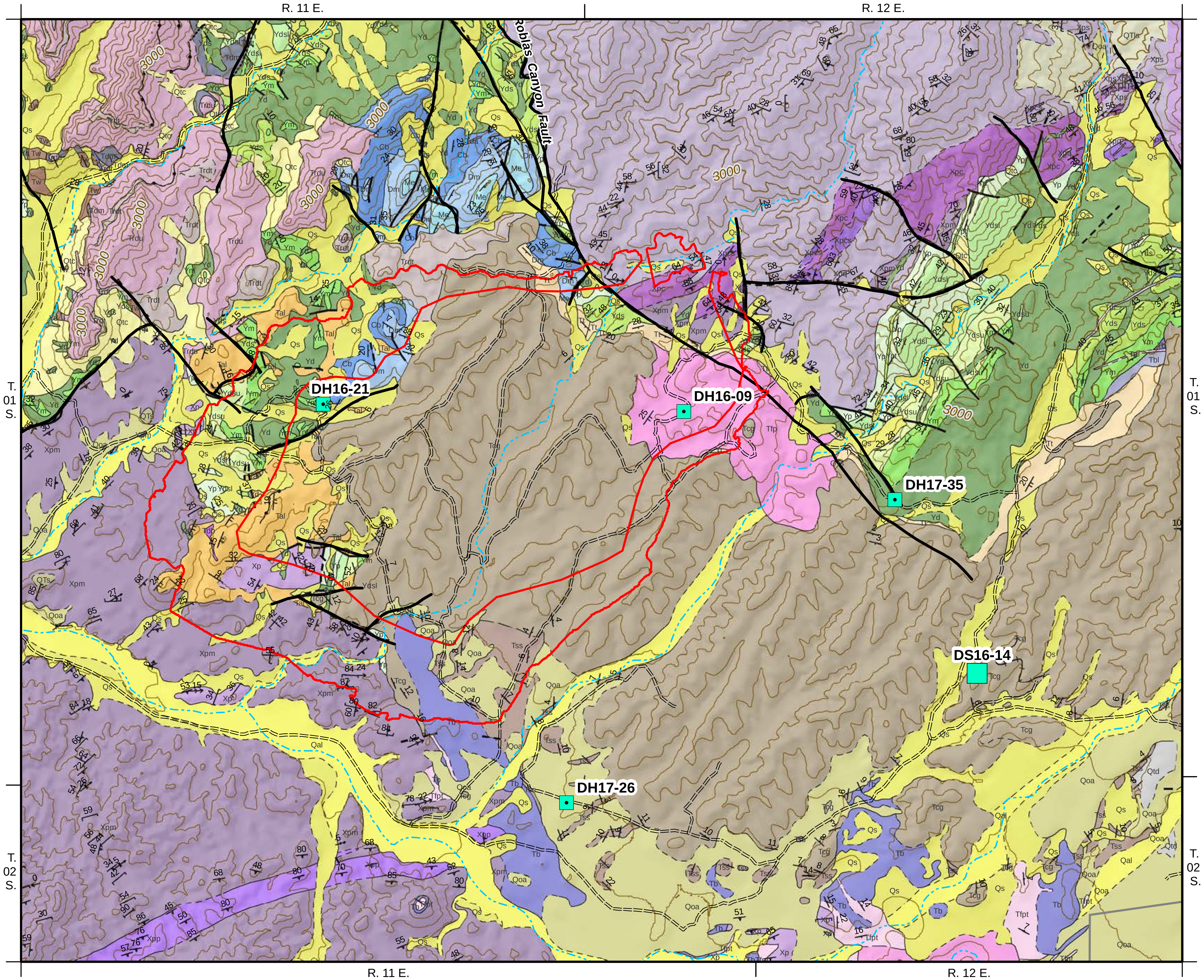
DS16-13 CONSTANT-RATE PUMPING TEST WELL LOCATIONS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 29

GIS-TUC\605\605.7808\ConstantRatePumpTest_DS16-13_FINAL\16Oct2017



EXPLANATION

▪	Pumping Test in Geotechnical Piezometer
■	Pumping Test in Hydrologic Test Well
━	Fault
====	General Access Road
━	Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)

0 250 500 750 1,000
Meters

0 1,000 2,000 3,000 4,000
Feet

RESOLUTION
COPPER

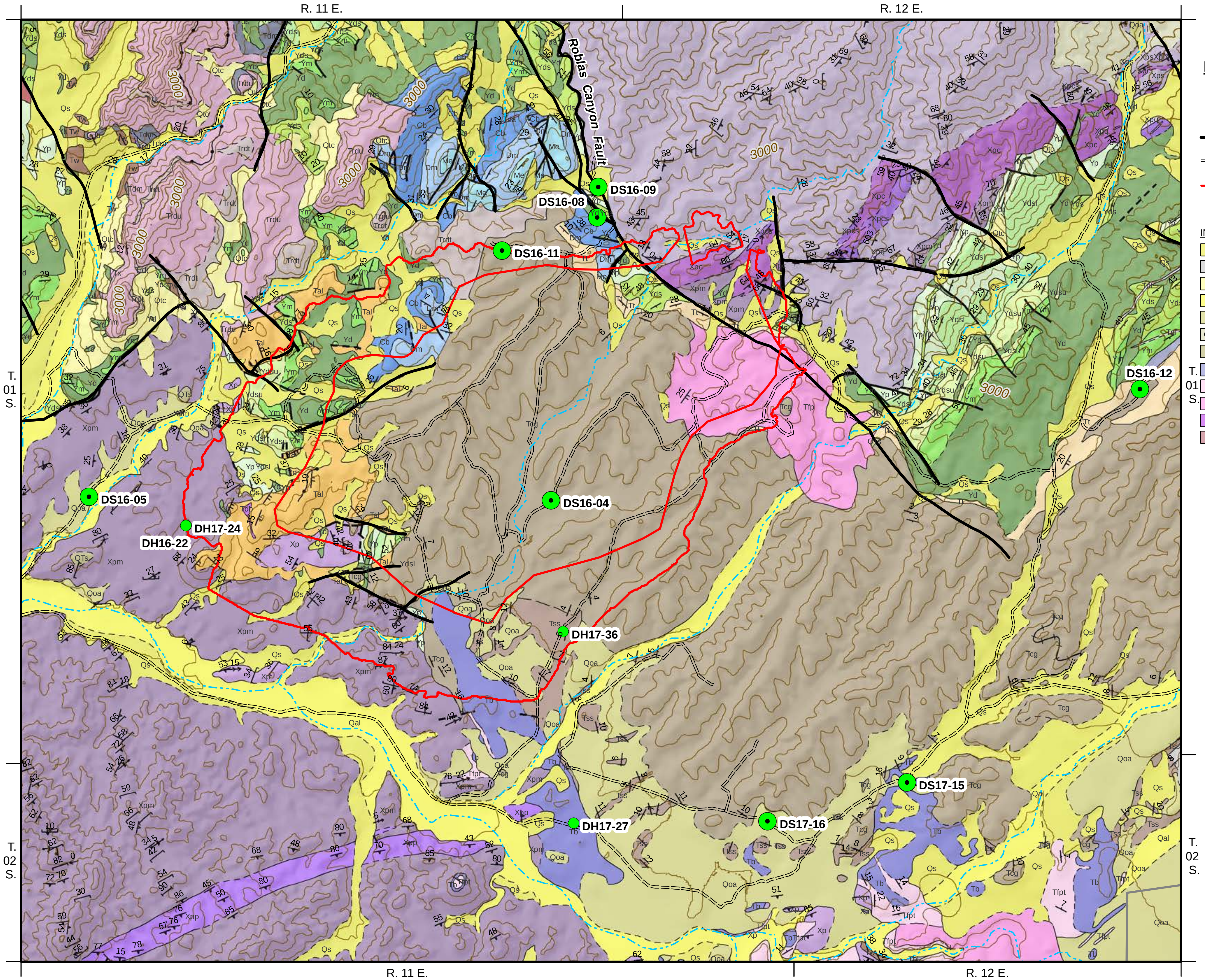
LOCATIONS OF SHORT-DURATION PUMPING TESTS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 30

GIS-TUC\605\605.7808\ShortDurationPumpTest_FINAL\16Oct2017



EXPLANATION

●	Slug Test in Geotechnical Piezometer
⊙	Slug Test in Hydrologic Test Well
━	Fault
====	General Access Road
━	Proposed TSF Footprint

INDEX MAP DETAILED GEOLOGIC UNITS

Qs	Undivided Surficial Deposits (Quaternary)
Qtd	Disturbed Surficial Deposits (Holocene)
Qtc	Talus and Colluvium (Quaternary)
Qal	Unconsolidated Alluvium (Holocene)
Qoa	Old Alluvium (late Pleistocene to early Pleistocene)
QTls	Older Landslide Deposits (early Quaternary to late Tertiary)
QTs	Older Alluvium (early Quaternary to late Tertiary)
Tbl	Lower Basalt (middle Tertiary)
Tdf	Felsic Dikes (middle or early Tertiary or Cretaceous)
Tda	Aphanitic Felsic to Intermediate Dikes (middle Tertiary)
Tdb	Basaltic Dikes (middle Tertiary)
Tg	Granite of Wood Camp Canyon (middle Tertiary)

Superstition Volcanic Complex

Gila Group

Tcg	Conglomerate (Miocene)
Tss	Sandstone (Miocene)
Tb	Basalt (middle to early Miocene)
Tt	Tuff (poorly welded) (Miocene)

Picketpost Mountain Formation

Tfp	Felsic Lava Flows (middle to early Miocene)
Tfpt	Felsic Tuffs (middle to early Miocene)
Tvx	Volcanogenic Breccia (middle to early Miocene)

Apache Leap Tuff

Tal	Apache Leap Tuff (early Miocene)

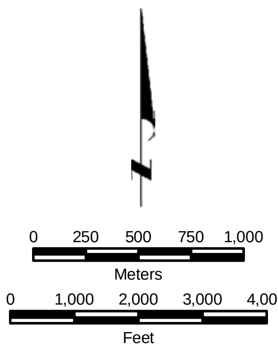
Superstition Group

Trdu	Undifferentiated Felsic Lavas (early Miocene)
Trdt	Tuffs associated with Trdu (early Miocene)
Tdm	Intermediate to mafic lavas (early Miocene)

Whitetail Formation

Tw	Conglomerate (Miocene to late Oligocene)
Tx	Rock Avalanche Breccia (Miocene or Oligocene)

Kqd	Quartz Diorite of Peachville Wash (late Cretaceous)
Kd	Quartz Diorite of Arnett Creek (late Cretaceous)
Pnaco	Naco Formation (Pennsylvanian)
Me	Escabrosa Limestone (Mississippian)
Dm	Martin Formation (Devonian)
Cb	Bolsa Quartzite (Cambrian)
Yd	Diabase (middle Proterozoic)
Yt	Troy Quartzite (middle Proterozoic)
Yb	Basalt (middle Proterozoic)
Ym	Mescal Limestone (middle Proterozoic)
Yds	Dripping Spring Quartzite, undivided (middle Proterozoic)
Ydsu	Dripping Spring Quartzite, Upper Unit (middle Proterozoic)
Ydsl	Dripping Spring Quartzite, Lower Unit (middle Proterozoic)
Yds+Yp	Dripping Spring Quartzite and Pioneer Formation (middle Proterozoic)
Yp	Pioneer Formation (middle Proterozoic)
Ypt	Pioneer Formation, Tuff Unit (middle Proterozoic)
YXd	Diorite (early or middle Proterozoic)
YXg	Granite (early or middle Proterozoic)
YXgd	Granodiorite (early or middle Proterozoic)
YXgm	Mixed Schist and Granite (early or middle Proterozoic)
Xp	Pinal Schist, undivided (early Proterozoic)
Xpc	Pinal Schist, Calc-silicate Facies (early Proterozoic)
Xpcs	Pinal Schist, Calc-silicate and Schist Facies (early Proterozoic)
Xpm	Pinal Schist, Psammite Facies (early Proterozoic)
Xpp	Pinal Schist, Phyllite Facies (early Proterozoic)
Xpq	Pinal Schist, Quartzite Layers (early Proterozoic)
Xps	Pinal Schist, Pelitic Schist (early Proterozoic)



RESOLUTION
COPPER

LOCATIONS OF SLUG TESTS

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2017

FIGURE 31

GIS-TUC\605\605.7808\SlugTestMap_FINAL\16Oct2017

MONTGOMERY
& ASSOCIATES

Appendix A

Daily Field Progress Reports (Montgomery & Associates)

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
9-Sep-16	DS16-01 [DS-N]	NEWP lead: Received site induction and discussed communication protocol between workers on site and around drilling operations	M. Shelley C. Gregory M. Zelazny	2.5	0	0	NEWP crew continued to set up rig and ancillary equipment. High energy equipment was insepected today by RC staff.	Final rig/site inspection is scheduled for tomorrow at 08:00. Following final inspection, crew will begin to drill, install and cement surface casing.	N/A	N/A	N/A	N/A
10-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Crew assigned "no go" areas to stay clear of during assembly of down-hole tooling.	M. Shelley M. Zelazny	2.5	0	0	NEWP crew continued to set up rig and ancillary equipment.	Drilling is scheduled to commence later this morning. Crew will hammer down BHA (43.47') conventionally. Once the BHA is down-hole, crew will switch to reverse circulation drilling.	N/A	N/A	N/A	N/A
10-Sep-16 [Night]	DS16-01 [DS-N]	NEWP lead: Crew assigned "no go" areas to stay clear of during assembly of down-hole tooling.	C. Gregory	4.5	20	20	NEWP crew continued to set up rig and ancillary equipment. Drilling of surface borehole commenced at 18:00. Crew determined that formation was competent at 20', so 12" surface casing was installed and cemented in place. Crew is currently setting up to begin assembling BHA.	Drilling is scheduled to commence later this morning. Crew will hammer down BHA (43.47') conventionally. Once the BHA is down-hole, crew will switch to reverse circulation drilling.	17-1/2" tricone; 12" surface casing	N/A	N/A	Tg [0' - current depth]
11-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Discussed the importance of wearing ear protection around the drill rig during operations.	M.Shelley M. Zelazny	12	180	160	NEWP crew continued setting up rig and preparing to begin drilling. BHA was measured and assembled and drilling commenced at 13:00	Penetration rate is averaging 20-25 mins per 20-foot drill rod.	11" hammer bit	N/A	0	Tg [0' - current depth]
11-Sep-16 [Night]	DS16-01 [DS-N]	M&A lead: Review hazards and identify risks for geologic logging activities; complete Take 5	C. Gregory	12	440	260	NEWP continues drilling from 180' with 11" hammer. A short recovery test conducted at 260' to determine the presence of water at the depth of the planned geotech corehole. No water detected down to 235' bgl during 55 minutes of recovery. Drilling advances to 440' by the end of night shift.	10-minute airlift tests are being conducted after each drilling rod (every 20'). After 10 minutes, only a very small amount of water is observed (<0.2 L/s) which is believed to be mostly residual drill water.	11" hammer bit	N/A	0	Tg [0' - 350'] Tt/Tss [350' - 360'] Tb [360' - 440']
12-Sep-16 [Day]	DS16-01 [DS-N]	M&A lead: Review the hazards of working on site around Jonovich vac trucks. Always maintain visual contact with truck driver when moving around work site.	M.Shelley M. Zelazny	11	460	20	Crew encountered fractured formation at 445' bls. Water production was measured at approximately 160-190 gpm. Decision was made to switch to flooded reverse drilling method.	Plan is to continue drilling to identify the current unit and decision for total depth will be determined by the lithology encountered below current depth.	9-7/8" tricone Flooded reverse circulation	44' bls	~190 gpm	Tg [0' - 340'] Tt [340' - 360'] Tb [360' - 440'] Tt [440' - 450']
12-Sep-16 [Night]	DS16-01 [DS-N]	NEWP lead: Review yellow alert and red alert protocols with NEWP following weather delay	C. Gregory	11	495	35	Red alert due to lightning from 18:30 to 20:00 hrs. Complete flooded reverse setup and trip in drilling rods. Advance borehole from 446' to 495' with 9.875" tricone.	Slower drilling through volcanics with 9-7/8" tricone	9-7/8" tricone Flooded reverse circulation	44' bls	~190 gpm (from confined aquifer located 445' bgl); water production monitoring will be unavailable with current drilling method	Tg [0' - 340'] Tt [340' - 360'] Tb [360' - 440'] Tt [440' - 450'] Tb [450 - 495]
13-Sep-16 [Day]	DS16-01 [DS-N]	RC lead: Leadership in the field on site. Reviewed CRM placement based on site layout.	M. Shelley	12	615	120	NEWP continued drilling flooded reverse. Penetration rate averaged 1.5-2 hours per rod from 495-535' bls. Rate increased to 30-60 mins per rod from 535-615' bls.	Shut down for lightning from 13:00 - 15:00 this afternoon.	9-7/8" tricone Flooded reverse circulation	Unavailable with current drilling method	Unavailable with current drilling method	Tg [0' - 340'] Tt [340' - 360'] Tb [360' - 440'] Tt [445-455'] Below 455' is under review
13-Sep-16 [Night]	DS16-01 [DS-N]	NEWP lead: Discussed the critical risks of working near backhoe. Backhoe activity has increased since drilling method changed. Awareness levels must be increased as well.	C. Gregory	12	735	120	NEWP continued drilling flooded reverse. Penetration rate averaged 40-70 mins per 20-foot drill rod	Shut down for lightning from 19:00 to 20:00 this afternoon.	9-7/8" tricone Flooded reverse circulation	Unavailable with current drilling method	Unavailable with current drilling method	Tg [0' - 340'] Tt [340' - 360'] Tb [360' - 440'] Tt [445-455'] Below 455' is under review

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
14-Sep-16 [Day]	DS16-01 [DS-N]	SWE lead: Designate "no go" areas around logging trailer. Avoid overhead hazards such as spool line for logging tools.	M. Shelley	13	875	140	NEWP continued drilling flooded reverse. Penetration rate averaged 55-70 minutes per rod. Upon entering diabase, the decision was made by RC Hydro to conclude drilling in this unit. Southwest Exploration, Inc. (SWE) arrived on site at 16:00 to commence borehole geophysical logging.	M&A will analyze geophysical logs during logging operations and prepare a well design.	9-7/8" tricone Flooded reverse circulation	Unavailable with current drilling method	Unavailable with current drilling method	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
14-Sep-16 [Night]	DS16-01 [DS-N]	NEWP lead: discuss hazards and safety procedures related to trip out of drill rod.	C. Gregory, M. Zelazny, W.R. Victor	8.5	875	0	NEWP trips equipment out of borehole and begins preparing materials for well construction. Southwest conducts geophysical logging.	M&A to prepare well design after review of geophysic logs and distribute.	N/A	50' (determined from geophysical logs)	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
15-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Discussed the process of mixing cement/grout and pumping slurry downhole. Avoid hoses and do not stand near mixer without dust mask.	M. Shelley	12	875	0	SWE finished logging borehole at 07:00. NEWP set up to pump bentonite cement to abandon the bottom of the borehole. Abandonment will continue until early evening.	M&A delivered a well diagram to RC and NEWP this morning. Well construction is scheduled to begin this evening.	N/A	Unavailable during abandonment operations	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
15-Sep-16 [Night]	DS16-01 [DS-N]	NEWP lead: Safely moving well casing materials and initial drive/mobe material to new site.	M. Zelazny B. Victor	12	875	N/A	NEWP finished the last batch of cement and pumped in neat cement (2% CaCl). Tremie in and the top of neat cement is at 627.5. Setup to pump another batch of neat cement.	Drove over to next site DS-M.	N/A	Unavailable during abandonment operations	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
16-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Safely mixing and installing cement and bentonite plug.	C. Gregory	12	875	0	Completion of neat cement placement at 10:30 hrs. NEWP works on installing and tagging bentonite plug during most of day; begin preparation for the installation of well casing (HWT pipe).	Coordinate the construction of pressure transducer housing to be installed on airline during development activities.	N/A	Unavailable during abandonment operations	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
16-Sep-16 [Night]	DS16-01 [DS-N]	M&A lead: Dangers of having more materials/pallets on pad and staying altert to trips slips and falls at night	M. Zelazny W.R. Victor	12	875	N/A	Installed all downhole casing with centralizers, taged the hole plug to 530 and adding gravel.	Weather is getting cooler at night, temps down to 63.	N/A	Unavailable during abandonment operations	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
17-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Safe operations when placing gravel and operating the mixer. Watch for fork lift that is being used to move pallets of material around pad.	C. Gregory	9	875	N/A	[CONSTRUCTION] Finished installing gravel and choke sand to 409', and bentonite seal to 400'. Prepare and inject grout (95% cement, 5% bentonite) for remainder of shift.	Transducer housing has been welded to tremie pipe and is ready for testing. T. White provided M&A with sampling bottles and instructions for collecting WQ samples at the end of development.	N/A	Not measured during construction activities	N/A	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
17-Sep-16 [Night]	DS16-01 [DS-N]	M&A Lead: Highlight dangers of sampling at the top of ladder.	M.Zelazny W.R. Victor	10.5	875	N/A	[DEVELOPMENT / TESTING] Tremie pipe (with transducer attached) lowered to 381' bls. Development activities begin at 03:20 hrs. Discharge from airlift approximately 50 - 60 gpm. Water sample collected after 3.5 hrs of continuous airlift. Air shut off at 07:20 hrs and water level recovery monitored for 2.5 hrs until 09:50 hrs.	Increased dust around pad from the movement of water vac trucks.	N/A	38.6 bls	50-60 gpm	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
18-Sep-16 [Day]	DS16-01 [DS-N]	NEWP lead: Review hazards during mobilization and movement of equipment on pad.	C. Gregory	5.5	875	N/A	[TESTING & MOBILIZATION] Complete monitoring of water level recovery at 09:50 hrs following development/airlift test. Begin mobilization activities from DS16-01 [DS-N] to DS16-02 [DS-M].	Developed well using airlift at a discharge of 50 - 60 gpm for 4 hours. Monitored water level recovery for 2.5 hours following development.	N/A	38.6	50 - 60 gpm	Tg [0 - 340'] Tt [340 - 360'] Tb [360 - 440'] Tt [440 - 450'] Ym [450 - 530'] Yds [530 - 685'] Yp [685 - 835'] Yd [835 - 875']
18-Sep-16 [Night]	N/A	N/A	N/A	0.0	N/A	N/A	[MOBILIZING] Continue mobilization activities from DS16-01 [DS-N] to DS16-02 [DS-M].	Surface drilling likely to begin in the morning.	N/A	N/A	N/A	N/A
19-Sep-16 [Day]	DS16-02 [DS-M]	NEWP lead: New site induction for DS16-02 pad. Identify muster area and locations where heavy equipment will be working.	C. Gregory, B. Jones	3.5	50	50	[START DRILLING] Complete surface drilling and install 12" surface casing to 20' bls in the morning. Begin drilling at 17:00 hrs from 20' to 50'.	Expect to see Gila conglomerate to 50' followed by Apache Leap tuff and Pinal schist.	11" hammer bit	N/A	0	Tg [0 - 50']
19-Sep-16 [Night]	DS16-02 [DS-M]	NEWP lead: New site induction for DS16-02 pad. Identify hazards in working area, DS16-02 pad smaller so no drilling rig deck.	M. Zelazny	12.0	300	250	[DRILLING] Continue drilling with airlift tests after each drill rod. No evidence of water 0 - 280' bls. Water appears at 292' bls, at a rate of approximately 20 - 30 gpm.	Continue drilling to see if we can locate the bottom of the Apache Leap tuff & top of Pinal schist. TD of hole will be coordinated with RC.	11" hammer bit	TBD	20 - 30 gpm	Tg [0 - 180'] Tal [180' - 300']
20-Sep-16 [Day]	DS16-02 [DS-M]	NEWP/M&A lead: Identify new hazard around site. Muddy area around borehole to be avoided when obtaining water levels. Placed a wooden pallet over mud for better foot placement.	C. Gregory, B. Jones, M. Shelley	12.0	460	160	[DRILLING] Continue drilling with airlift tests after each drill rod. Penetration rate averaged 30-50 minutes per 20-foot drill rod.	Pinal Schist encountered at 460 ft, bls. TD of borehole coordinated with RC to be 500 ft, bls.	11" hammer bit	272.8 ft, bls	11 - 17 gpm	Tg [0 - 180'] Tal [180' - 450'] pCpi [450' - 460']
20-Sep-16 [Night]	DS16-02 [DS-M]	NEWP lead: Review hazard tripping out rods: falling objects, moving objects, and pinch points. Maintain communication.	M. Zivic	12.0	500 (TD)	40	[DRILLING] Continue drilling with airlift tests after each drill rod. At 480 ft, bls Southwest Exploration conducted gyro survey. Reached TD of 500 ft, bls at 01:00 and began tripping out to conduct geophysical survey.	The rod 460 to 480 ft had slight circulation issues. Inclination at 400 ft, bls was 3.39º with an azimuth of 214.5.Southwest Exploration will run the full suite with an OBI and ABI.	11" hammer bit	272.8 ft, bls	11 - 16 gpm	Tg [0 - 180'] Tal [180' - 450'] pCpi [450' - 500']
21-Sep-16 [Day]	DS16-02 [DS-M]	RC lead: Drilling services placed caution tape behind geophysical logging trailer to prevent workers from walking below suspended tool cables. Reviewed the process of hazard recognition and placed hazard control in appropriate work area.	M. Shelley	12.0	500 (TD)	N/A	[GEOPHYSICAL SURVEY/WELL DESIGN] Geophysical logging began at 08:10 and included the suite: combo tool, elog, induction, sonic, OBI, and ABI. Logging completed at 12:40. Geophysical logs were reviewed by M&A for the well design. NEWP began tripping in tremie in preparation of abandoning the bottom portion of the borehole.	Well design prepared by M&A and approved by RC.	11" hammer bit	208.0 ft, bls	N/A	Tg [0 - 172'] Tal [172' - 447'] pCpi [447' - 500']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
21-Sep-16 [Night]	DS16-02 [DS-M]	NEWP lead: Review hazards of mobing equipment to the drill pad. Move vehicles as needed and use spotters.	M. Zivic	12.0	500 (TD)	N/A	[WELL CONSTRUCTION] Mobed casing and annular materials to drill pad. Pumped neat cement to abandon lower portion of the borehole in Pinal Schist and installed bottom bentonite seal. Preparing to trip in HWT casing.	Casing was mobed while the neat cement was allowed to cure for a minimum of 2 hours.	11" hammer bit	208.0 ft, bls	N/A	Tg [0 - 172'] Tal [172' - 447'] pCpi [447' - 500']
22-Sep-16 [Day]	DS16-02 [DS-M]	NEWP lead: NEWP filled out working at heights permit for installation of gravel. Work took place on ladder, roughly 4-5 feet above ground surface. The work area surrounding the ladder work was cleared of other obsticles before work commenced.	M. Shelley	12	500 (TD)	N/A	[WELL CONSTRUCTION] Crew installed all downhole casing with centralizers. Crew began installing gravel, but the well wasn't taking as much gravel as it needed. Tool pusher believes that the gravel should be swabbed in at the bottom due to the possibility of a dense layer of water/bentonite mixture at the bottom of the hole.	Currently setting up to trip in 4-inch swab to settle gravel.	10-3/4" hammer bit	208.0 ft, bls	N/A	Tg [0 - 172'] Tal [172' - 448'] pCpi [448' - 500']
22-Sep-16 [Night]	DS16-02 [DS-M]	M&A lead: Increased insect activity at night. Be mindful of spiders. Observe area before hand placement.	M. Zivic	12	500 (TD)	N/A	[WELL CONSTRUCTION] Lower gravel was swabbed but gravel tags remain the same. Continued gravel packing and installed bentonite seal between the perforated intervals.	Currently installing upper gravel interval.	10-3/4" hammer bit	208.0 ft, bls	N/A	Tg [0 - 172'] Tal [172' - 448'] pCpi [448' - 500']
23-Sep-16 [Day]	DS16-02 [DS-M]	NEWP lead: Discussed the hazards of mixing cement. Crew members wear respirators and goggles when mixing cement. Crew members practice proper lifting techniques when moving bags of cement.	M. Shelley	12	500 (TD)	N/A	[WELL CONSTRUCTION] Crew finished installation of gravel pack in the upper production zone. Crew tripped in and swabbed the perforated zone from 330-290' bls to settle gravel pack in. The a layer of transition sand was added, followed by a 10' bentonite seal. 2% bentonite cement was pumped from 268' to 30' bls in three lifts. From 30' to land surface, crew pumped in neat cement. While waiting for cement to cure, crew tripped in airline to begin airlift development and testing.	A 4-hour airlift test will be conducted. A LevelTROLL pressure transducer has been placed on the airline, 5 feet above bottom, to record water level changes.	10-3/4" hammer bit	Unable to measure static, water dropping slowly	N/A	Tg [0 - 172'] Tal [172' - 448'] pCpi [448' - 500']
23-Sep-16 [Night]	DS16-02 [DS-M]	NEWP/M&A lead: Discussed hazards of airlift development and high pressure lines. Use three points of contact when using stairs to the cyclone. Maintain housekeeping.	M. Zivic	12	500 (TD)	N/A	[AIRLIFT DEVELOPMENT] NEWP unloaded the hole for 30 minutes and then recovery was measured for 30 minutes. Airlift development conducted for 1 hour before the production rate decreased to ~ 6 gpm. The airline was then increased by 100 ft, bls and the airlift development was conducted for 3.5 hours followed by 3.5 hours of recovery measurements.	The discharge rate ranged from 7 - 12 gpm. A water quality sample was collected before the air was turned off.	10-3/4" hammer bit	177.18 ft, bls after 3.5 hours of recovery at 06:15 and still recovering	N/A	Tg [0 - 172'] Tal [172' - 448'] pCpi [448' - 500']
24-Sep-16 [Day]	DS16-02 [DS-M] to DS16-03 [DS-F]	NEWP lead: Crew filled out TRACK for mobilization of heavy equipment. Important to take it slow and leave enough space between vehicles.	M. Shelley	6	N/A	N/A	[EQUIPMENT MOBILIZATION] Airlift recovery was finished by 06:15 this morning. Crew tripped out tremie and began loading up pipe and other equipment for mobilization to DS16-03 [DS-F]. Mobilization operations began at 11:00.	Mobilization of large equipment has been limited to daylight hours only. RC has arranged for a Dalmolin dozer to assist National when driving down the steep hill near the DS-F drill pad.	N/A	N/A	N/A	N/A

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
24-Sep-16 [Night]	DS16-02 [DS-M] to DS16-03 [DS-F]	N/A	N/A	N/A	N/A	N/A	[EQUIPMENT MOBILIZATION] Mobilization from DS16-02 [DS-M] to DS16-03 [DS-F] will continue today. Crew anticipates having the site set up this afternoon and to commence drilling to set surface casing.	Mobilization of large equipment has been limited to daylight hours only. RC has arranged for a Dalmolin dozer to assist National when driving down the steep hill near the DS-F drill pad.	N/A	N/A	N/A	N/A
25-Sep-16 [Day]	DS16-02 [DS-M] to DS16-03 [DS-F]	N/A	N/A	N/A	N/A	N/A	[EQUIPMENT MOBILIZATION] Mobilization from DS16-02 [DS-M] to DS16-03 [DS-F] will continue today. Crew drilled surface casing and cemented.	Mobilization of large equipment has been limited to daylight hours only. RC has arranged for a Dalmolin dozer to assist National when driving down the steep hill near the DS-F drill pad.	17.5" tricone 12" steel surface casing	N/A	N/A	N/A
25-Sep-16 [Night]	DS16-03 [DS-F]	Review safe driving procedures on steep dirt roads and use of 4-wheel drive.	M. Zelazny	2.5	N/A	N/A	[ASSEMBLE BHA] Welded surface casing and began installing BHA	No cell phone reception at this site	17.5" tricone 12" steel surface casing	N/A	N/A	N/A
26-Sep-16 [Day]	DS16-03 [DS-F]	NEWP lead: Discussed the importance of staying focused on the last day of hitch. One crew was finishing their last day on site, before another crew took their place. Avoid becoming complacent and prepare like any other day.	M. Shelley	12	140	120	[DRILLING] Drilling at DS 16-03 commenced this morning at 07:45. Drilling averaged 30-45 minutes per 20-foot drill rod. At a depth of 120', we began drilling in a Tertiary Volcanic (perlite) unit. Water production was measured at 47 gpm and after approximately 30 minutes water level rose to 34' bls. Crew made the decision to switch to flooded reverse drilling method with a tricone bit due to the hammer dampening under the current head pressure. Crew began tripping out assembly at 18:00.	A mechanic was coming to site to fix the clutch of the rig compressor.	10.75" hammer bit	34.2 ft, bls	47 gpm	Tg [0 - 120'] Tv (perlite) [120 - 140']
26-Sep-16 [Night]	DS16-03 [DS-F]	N/A	N/A	0	140	0	[EQUIPMENT REPAIR] Crew was waiting for parts to fix the clutch on the rig compressor. Driller estimates that drilling should resume this afternoon.	Crew has switched to flooded reverse drilling method. Will resume drilling after compressor is fixed.	9.875" tricone bit	34.2 ft, bls	47 gpm	Tg [0 - 120'] Tv (perlite) [120 - 140']
27-Sep-16 [Day]	DS 16-03 [DS-F]	NEWP lead: Crew wearing fall protection when working on the rig compressor. All other obstacles have been removed from immediate work area before starting the repair.	M. Shelley	3.0	140	0	[EQUIPMENT REPAIR] Crew fixing the clutch on the rig compressor. Driller estimates that drilling should resume after 1900 hrs.	N/A	9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140']
27-Sep-16 [Night]	DS 16-03 [DS-F]	N/A	M. Zelazny	8.0	140	0	[EQUIPMENT REPAIR] Clutch on rig compressor is fixed but a sensor needed replacing. The sensor was replaced but air compressor still not working; crew is currently trouble shooting problem.	N/A	9.875" tricone bit	32.9 ft, bls	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140']
28-Sep-16 [Day]	DS16-03 [DS-F]	N/A	M. Shelley	5.0	140	0	[EQUIPMENT REPAIR] Mechanic continued to troubleshoot problems with the onboard compressor. Crew has ordered an auxiliary compressor to be delivered at 04:00 tomorrow morning.	Crew clean and organized site while troubleshooting compressor issues.	N/A	Unobtainable with current drilling method	Unobtainable with current drilling method	Tg [0 - 120'] Tv (perlite) [120 - 140']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
28-Sep-16 [Night]	DS16-03 [DS-F]	N/A	M. Zelazny	0.0	140	0	[EQUIPMENT REPAIR/STANDBY] Crew has ordered an auxiliary compressor was to be delivered at 04:00 tomorrow morning. Transportation complications have delayed the delivery. New ETA is ~14:30. Once compressor arrives, it will be inspected, then delivered to site.	Crew clean and organized site while troubleshooting compressor issues.	N/A	Unobtainable with current drilling method	Unobtainable with current drilling method	Tg [0 - 120'] Tv (perlite) [120 - 140']
29-Sep-16 [Day]	DS 16-03 [DS-F]	N/A	M. Shelley	3.0	140	0	[EQUIPMENT REPAIR/STANDBY] Auxiliary compressor arrived at US60 pulloff at 14:00 hours. RC and Peak's arrived to inspect compressor at 14:30. The compressor did not pass inspection and needed to be worked on before approval to mobe to site. Crew will transport compressor to NEWP shop in Chandler and mechanics will make the necessary repairs.	N/A	9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140']
29-Sep-16 [Night]	DS 16-03 [DS-F]	N/A	N/A	0.0	140	0	[EQUIPMENT REPAIR/STANDBY] Compressor is in Chandler at NEWP shop. Mechanics are currently working on the compressor before mobilizing back to site.	N/A	9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140']
30-Sep-16 [Day]	DS 16-03 [DS-F]	N/A	N/A	0.0	140	0	[EQUIPMENT REPAIR/STANDBY] Compressor is in Chandler at NEWP shop. Mechanics are currently working on the compressor before mobilizing back to site.	N/A	9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140']
30-Sep-16 [Night]	DS 16-03 [DS-F]	NEWP lead: safety protocols related to new auxiliary compressor on site - there is now an isolation zone/no go area between the green baker tank and compressor because of high pressure line.	M. Zelazny	10.50	295	155	[RESTART DRILLING] Arrival of inspected compressor to site, trip in and drilled to a depth of 295. Trip out to add 5 collars to BHA.	Needed to have BHA approximately 300ft bls for sufficient water head, submergence and turnaround with additional collars.	9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tv (perlite) [120 - 140'] Tv [140 - 295] geology under review
01-Oct-16 [Day]	DS 16-03 [DS-F]	NEWP lead: isolation areas/no go areas between green Baker tank and compressor; heighten awareness of backhoe activity due to close proximity to geologist's area.	B. Victor	12	445	150	[DRILLING] Drilling began after collars added at 295' with 9-7/8" tricone bit and flooded reverse rotary methods using only formation water. Drilled continuously through day shift.	Continued drilling to characterize volcanic sequence at this site.	9.875" tricone bit	Not measured during flooded reverse rotary drilling method	Unobtainable with current drilling method	Tg [0 - 120'] Tp(?) (perlite) [120 - 400'] Tf(?) (rhyolite) [400 - 445']
01-Oct-16 [Night]	DS 16-03 [DS-F]	M&A lead: be aware of backhoe since close proximity to our work station and frequent movement to move cuttings.	M. Zelazny	12.00	595	145	[DRILLING] drilling continued smoothly with a starting depth of 450 to 575/595 where we produced more than 105gpm and had to stop drilling at 0400. A plan is now in place to remove water from site.		9.875" tricone bit	N/A	N/A	Tg [0 - 120'] Tp(?) (perlite) [120 - 400'] Tf(?) (rhyolite) [400 - 445'] Tv [445 - 595] geology under review

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
02-Oct-16 [Day]	DS 16-03 [DS-F]	M&A lead: Rainy conditions today; take precautions on slippery surfaces and driving in muddy conditions.	B. Victor	12	715	120	[DRILLING] Drilling continued smoothly using flooded reverse with formation water only. At 700', call made to geophysical loggers, then continued drilling while waiting to total depth of 715' before shutdown due to blown discharge hose. Logger arrived at 15:00 to run deviation log. Remainder of shift tripping out drill pipe to complete suite of logs this evening.	Continued drilling to characterize volcanic sequence. After drilling to 700' (110 feet past base of water producing rhyoloite), contacted F. Deal to confirm end of drilling and call to logger. Used waiting time to drill further, but shift change and blown hose resulted in only 15' further progress to total depth (715'). NOTE: During previous shift, driller noted increasing water production from 550' to 590', corresponding to pink rhyolite unit.	9.875" tricone bit	Not measured during flooded reverse rotary drilling method	Driller estimated 105 gpm. Drilling crew able to keep up with formation water production by draining Baker tank with water truck.	Tg [0 - 120'] Tp(?) (perlite) [120 - 400'] Tf(?) (rhyolite) [400 - 590'] Tf(?) (ash flow tuff) [590 - 630'] [630 - 715'] under review
02-Oct-16 [Night]	DS 16-03 [DS-F]	NEWP lead:caution of slips when working on a site post rain.	M. Zelazny	9.00	N/A	N/A	[GEOPHYSICAL LOGGING] logging proceeded from 2200 to 0300 while running 4 logs: combo, e-log, sonic and ABI	Reviewing logs to determine well design.	9.875" tricone bit	32.8 ft bls	N/A	Tg [0 - 120'] Tp(?) (perlite) [120 - 400'] Tf(?) (rhyolite) [400 - 590'] Tf(?) (ash flow tuff) [590 - 630'] [630 - 715'] under review
3-Oct-16 [Day]	DS16-03 [DS-F]	NEWP lead: Discussed the importance of double checking that loads are secured before moving.	M.Shelley	12	715 (TD)	N/A	[BOREHOLE ABANDONMENT] Following the completion of borehole geophysics, logs were reviewed by M&A for the well design. NEWP abandoned the bottom portion of the borehole with 2% bentonite cement and a 40' neat cement cap. Crew was setting up to begin running in casing.	Well design prepared by M&A and approved by RC.	9-7/8" tricone bit	32.8' bls	N/A	Tg [0 - 120'] Tp (perlite) [120 - 400'] Tf (rhyolite) [400 -590'] Tf (ash flow tuff) [590 - 690'] Tt (welded tuff) [690 - 715']
3-Oct-16 [Night]	DS16-03 [DS-F]	NEWP lead: Reviewed safety with hot work for welding tabs to land casing.	M. Zivic	12	715 (TD)	N/A	[WELL CONSTRUCTION] Tagged the neat cement in the lower abandoned borehole after curing for 2 hours. The neat cement was well below the designed target so another batch of neat cement was pumped to the lower borehole and allowed to cure. NEWP installed casing after confirming the neat cement depth and then resumed installing annular materials. NEWP is currently installing gravel pack.	Top of neat cement for the borehole abandonment was 261.0 ft, bls. Top of the bottom bentonite seal was 251.5 ft, bls.	9-7/8" tricone bit	32.8' bls	N/A	Tg [0 - 120'] Tp (perlite) [120 - 400'] Tf (rhyolite) [400 -590'] Tf (ash flow tuff) [590 - 690'] Tt (welded tuff) [690 - 715']
4-Oct-16 [Day]	DS16-03 [DS-F]	NEWP lead: Discussed the importance of wearing a respirator while mixing cement. Keep other workers clear of mixing area.	M.Shelley	12	715	0	[WELL CONSTRUCTION / AIRLIFT DEVELOPMENT] Crew continued gravel packing the production zone of the well. A bentonite seal was placed above the gravel and neat cement was pumped up to surface. Airlift development began at 15:20. Development operations will continue into the night.	A LevelTROLL pressure transducer has been placed on the airline, 5 feet above bottom, to record water level changes.	9-7/8" tricone bit	32.98 ft, bls static	~8 gpm	Tg [0 - 120'] Tvy (perlite) [120 - 400'] Tvy (rhyolite) [400 -590'] Tvy (ash flow tuff) [590 - 690'] Tvy (welded tuff) [690 - 715']
4-Oct-16 [Night]	DS16-03 [DS-F]	NEWP lead: Discussed the hazards associated with demobing. Highlighted the importance of not putting oneself inbetween equipment and the winch truck until the air brake is engaged.	M. Zivic	8	715 (TD)	N/A	[AIRLIFT DEVELOPMENT] Airlifted for one hour and monitored high pH. Aired down to verify HWT is open at bottom. Airlifted for 45 minutes before tripping in airline from above perfs to the sump. Airlifted for 1:45 and collected sample.	pH was 9.6 - 9.0 during airlifts with the airline above perfs. Tagged bottom of HWT at 237.25' bls, indicating only ~3 feet of fill. When the airline was tripped into the sump, the water became gray and the pH rose again to 11.4 and quickly declined. Final pH was relatively stable 8.5.	9-7/8" tricone bit	Water level recovered to 33.5', bls	8 - 10 gpm	Tg [0 - 120'] Tvy (perlite) [120 - 400'] Tvy (rhyolite) [400 -590'] Tvy (ash flow tuff) [590 - 690'] Tvy (welded tuff) [690 - 715']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
5-Oct-16 [Day]	DS16-03 [DS-F] to DS16-04 [DS-G]	NEWP lead: Crew filled out TRACK for mobilization of heavy equipment. Important to take it slow and leave enough space between vehicles.	M. Shelley	4	N/A	N/A	[MOB TO SITE] Mob equipment from DS16-03 to DS16-04 [DS-G]. Set up to start surface drilling.	M&A measured water levels at previous wells.	N/A	N/A	N/A	Tg [0 - 20']
5-Oct-16 [Night]	DS16-04 [DS-G]	N/A	M. Zivic	1	20	20	[START DRILLING] Complete surface drilling and install 12" surface casing to 20' bls this evening. Setting up to begin R/C drilling.	Surface casing was set at 20' based on the competency of the rock unit at that depth. Anticipate R/C drilling to commence around 08:00.	17.5" tricone bit 12" steel casing	N/A	N/A	Tg [0 - 20']
6-Oct-16 [Day]	DS16-04 [DS-G]	NEWP lead: Site induction for new DS16-04 drill site. Auxiliary air compressor reduces available pad space. Logging station will be moved off pad.	C. Gregory	12	300	280	[DRILLING] Drilling at DS16-04 commenced this morning at 11:30 hrs.	Drilling averaged 15-20 minutes per 20-foot drill rod. Geology 0-300' has been Gila Conglomerate [Tg].	10.5" hammer	N/A	N/A	Tg [0 - 300']
6-Oct-16 [Night]	DS16-04 [DS-G]	NEWP lead: Site induction for new DS16-04 drill site.	M. ZIvic	12	560	260	[DRILLING] Drilling continued with no interruptions. Checked for water production at the end of each rod.	Penetration rate averaged 27 minutes per rod until 480' bls. Penetration rate decreased to 60 - 70 minutes rod starting at 480' bls due to lithology change.	10.5" hammer	N/A	4 gpm at 560' bls	Tg [0 - 421'] the following geology is under review: Tt [421 - 440'] Tg / Tt [440 - 485'] pCdiab [485 - 535'] pCdsu [535' - present]
7-Oct-16 [Day]	DS16-04 [DS-G]	NEWP lead: Make sure to use hand rails when on stairs.	C. Gregory	12	620	60	[DRILLING / GEOPHYSICS] TD borehole at 620' in diabase. Water level recovers to 290' bls after 3 hours of recovery. Southwest arrives in the morning and begins collecting geophysical logs in the afternoon.	Final well design to be prepared after reviewing geophysical logs on the morning of the 8th.	10.5" hammer	above 290' bls with open hole to 620' (WL still recovering)	4 - 7 gpm	Tg [0 - 421'] the following geology is under review: Tal [421' - 440'] Tg / Tt [440' - 485'] pCdiab [485' - 535'] Ym [535' - 570'] pCdiab [570' - 620']
7-Oct-16 [Night]	DS16-04 [DS-G]	M&A lead: being safety conscience even with low rig activity.	M. Zelazny	6.00	N/A	N/A	[GEOPHYSICS] Southwest perfomed 6 logs: combo, dual induction, e-log, sonic, OBI and ABI.	M&A will review logs at 06:00 and discuss with group at 07:30.	10.5" hammer	48' bls	N/A	Tg [0 - 421'] the following geology is under review: Tal [421' - 440'] Tg / Tt [440' - 485'] pCdiab [485' - 535'] Ym [535' - 570'] pCdiab [570' - 620']
8-Oct-16 [Day]	DS16-04 [DS-G]	NEWP lead: Stay off pad when possible while materials are being mobilized for construction.	C. Gregory	12	620	N/A	[WELL CONSTRUCTION] NEWP mobilizes well materials to platform in the morning. Well casing and some of the gravel installed in the afternoon. Top of gravel at shift end approximately 570' bls.	Slotted interval completed in water-producing zone in the younger Precambrian units (538.3' - 598.3' bls).	10.5" hammer	27 (measured at 8:45 hrs and still recovering)	N/A	~~ DRAFT ~~ Tg [0 - 415] Tt [415' - 440'] Tg [440' - 482'] pCdiab [482' - 550'] pCmls [550' - 570'] pCdiab [570' - 620']
8-Oct-16 [Night]	DS16-04 [DS-G]	M&A lead: Staying safe during severe weather over a few hours and new driving hazards after storm.	M.Zelazny	12.50	N/A	N/A	[WELL CONSTRUCTION] Top of gravel 517.68' bls with approx 1' choke sand. Tag top of hole plug (bentonite chips) to 495' bls. Top of cement at shift change is approximately 240'	Cement is being pumped in half batches, should be completed around 10:00am. Followed by development and sample collection.	10.5" hammer	N/A	N/A	~~ DRAFT ~~ Tg [0 - 415] Tt [415' - 440'] Tg [440' - 482'] pCdiab [482' - 550'] pCmls [550' - 570'] pCdiab [570' - 620']
9-Oct-16 [Day]	DS16-04 [DS-G]	NEWP lead: Watch out for hoses, wires and other tripping hazards on the pad during development and airlift testing activities.	C. Gregory	12	N/A	N/A	[WELL CONSTRUCTION / DEVELOPMENT / AIRLIFT TESTING] Grout and cement installation completed in the morning. Development/airlift testing activities from 12:00 - 16:00 hrs. Water level recovery measurements collected following airlift.	A water quality sample was collected at 15:30 hrs.	10.5" hammer	11.5 (measured at 11:00 hrs)	N/A	~~ DRAFT ~~ Tg [0 - 415] Tt [415' - 440'] Tg [440' - 482'] pCdiab [482' - 550'] pCmls [550' - 570'] pCdiab [570' - 620']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
9-Oct-16 [Night]	DS16-04 [DS-G]	M&A lead: the importance of doing a walk around before moving equipment or vehicles.	M. Zelazny	5.00	N/A	N/A	RECOVERY] Water level at end of recovery (4 hrs) is 28.02' bls and recovered over 383' during that time. Measured water level at completed wells.	Rig is going to NEWP shop for maintenance and expect to resume drilling Friday afternoon. M&A will not be on site or provide updates until drilling operations resume.	10.5" hammer	28.02' bls	6.8 gpm during development	~~ DRAFT ~~ Tg [0 - 415] Tt [415' - 440'] Tg [440' - 482'] pCdiab [482' - 550'] pCmls [550' - 570'] pCdiab [570' - 620']
15-Oct-16 [Day]	DS16-05 [DS-O]	NEWP lead: Tight pad area. Watch for heavy machinery during mobilization activities and at start of drilling.	C. Gregory	4	20	20	[MOBILIZATION / SURFACE DRILLING] Surface drilling starts at 15:00 hrs. Rock encountered over first 20' fairly competent. Decision made to complete surface casing to 20'. Borehole conditioned for installation of surface casing.	M&A logging station set-up off pad due to restricted available space.	17.5" tricone	N/A	N/A	~Under Review~ variably weathered schist, and quartz vein observed in first 20' of drilling
15-Oct-16 [Night]	DS16-05 [DS-O]	M&A lead: safe driving with busy season weekend recreational traffic on our new route to site; it also includes private residences and campers.	M. Zelazny	6.50	20	0	[DRILLING] A second batch of neat cement was needed. BHA assembled and drilling started at 0600.	New site has more lose dust and is a smaller pad with no parking.	10.5" hammer	N/A	N/A	~Under Review~ variably weathered schist, and quartz vein observed in first 20' of drilling
16-Oct-16 [Day]	DS16-05 [DS-O]	NEWP lead: watch out for encounters on the road with fast-driving ATVs and motorcycles.	C. Gregory	12	220	200	[DRILLING] Drill to 120' bls. Monitor WL in drill string for 4 hours without detecting water. Drill to 220' bls. Encounter fracture zone from 190' - 195' bls. Airlift test at 200' yields 3.7 L/s and airlift test at 220' yields 5.2 L/s.	No cellular signal near DS16-05 site. Nearest reliable cell signal is by ranch with windmill well 10 minutes-drive from DS16-05.	10.5" hammer	TBD	5.2 (at 220' bls)	Qal [0 - 15] pCpi [15 - 220]
16-Oct-16 [Night]	DS16-05 [DS-O]	NEWP lead: careful of slips, trips and falls when working near the rig to measure water level.	M. Zelazny	12.5	320	100	WATER LEVEL RECOVERY AND DRILLING] At 220' water level recovered 95' in 6 hrs (175 to 80). Drilled from 220' to 320' with airlifts after each rod produced 3.5gpm. The 1st hr of recovery at 320' measured an average of 1 ft/min.	The hole TD at 320' and Southwest Geophysics was in route. When logs are completed M&A with facilitate well design discussion.	10.5" hammer	77' bls and still recovering	3.5 gpm (at 320' bls)	Qal [0 - 15] pCpi [15 - 220]
17-Oct-16 [Day]	DS16-05 [DS-O]	NEWP lead: Tight pad area. Drillers will spot vehicles when driving in reverse onto pad.	C. Gregory	12	320	N/A	[MONITORING / GEOPHYSICS] Monitor water level recovery from 320' until 08:00 hrs. Southwest runs geophysical tooling during day shift. NMR equipment arrives at 17:00 hrs for final geophysical log.	Final well design will be decided with RC after review of the geophysical logs.	10.5" hammer	< 95' bls (still recovering)	3.5 gpm (at 320' bls)	Qal [0 - 15] pCpi [15 - 220]
17-Oct-16 [Night]	DS16-05 [DS-O]	Southwest Lead: safe procedures when running NMR tool.	M. Zelazny	12	N/A	N/A	[GEOPHYSICS/WATER LEVEL MEASUREMENTS] Southwest Geophysics completed NMR log and continue to monitor water level recovery.	A 06:00 call is scheduled to discuss all geophysical logs and determine a well design.	10.5" hammer	48.55' bls and still recovering	N/A	Qal [0 - 15] pCpi [15 - 220] under review [220-320]
18-Oct-16 [Day]	DS16-05 [DS-O]	NEWP lead: Importance of identifying different critical risks that exist within work environment.	C. Gregory	20	N/A	N/A	[WELL CONSTRUCTION] After receiving confirmation of well design, well construction activities begin at 11:00 hrs. Well casing installation completed to TD (319.3' bls) by 18:00 hrs. Construction included of a screened interval from 188.3' - 298.3' bls to target deeper fracture flow, and a pressure transducer installed at 150' bls.		10.5" hammer	< 48' bls (still recovering)	N/A	Qal [0 - 15] pCpi [15 - 220]

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
18-Oct-16 [Night]	DS16-05 [DS-O]	NEWP lead: aware of wire line for tagging annular material and safe use of wrenches in tremie trip in/out.	M. Zelazny	12	N/A	N/A	[WELL CONSTRUCTION] Install gravel, choke sand, bentonite seal and grout (30% bentonite cement) to surface. Monitor and record pressure transducer measurements during annular material install.	Annular material hit targeted depths and construction went smoothly. Will run airlift test/development when grout is set.	10.5" hammer	39,65' bls and still recovering	N/A	Qal [0 - 15] pCpi [15 - 320]
19-Oct-16 [Day]	DS16-05 [DS-O]	NEWP lead: Discussed the importance of practicing proper lifting techniques. Get help from another worker if the load is too big for one person to handle.	M.Shelley	9	N/A	N/A	[WELL CONSTRUCTION / AIRLIFT DEVELOPMENT] Crew allowed for a 12-hour cure for 30% bentonite grout. Crew tripped in tremie pipe down to 180' bls. Airlift development to began at 18:00. Development operations will continue into the night.	A LevelTROLL pressure transducer has been placed on the airline, 5 feet above bottom, to record water level changes.	10.5-inch hammer bit	32.40' bls before installing tremie	N/A	Qal [0 - 15] pCpi [15 - 320]
19-Oct-16 [Night]	DS16-05 [DS-O]	M&A lead: careful of working near the outtake over the baker tank to collect samples and measure parameters.	M. Zelazny	12	N/A	N/A	[AIRLIFT DEVELOPMENT AND SAMPLE COLLECTION] At 18:00 airlift for 6 hours and collected lab samples. Last parameter measured at 23:45 is Temp=22.3°C, pH=7.27std, EC=1972μS/cm, ORP=-84mV, and Turbidity=58.1NTU. Recovery measured for 6 hours until 06:00.	NEWP is preparing to mobe to next site DS-L and will set surface casing before M&A returns to site.	10.5-inch hammer bit	52.85' bls (still recovering)	2.5-3 gpm (on average)	Qal [0 - 15] pCpi [15 - 320]
20-Oct	DS16-06 [DS-L]						[MOBILIZATION] Moving equipment from site DS-O to site DS-L.					
21-Oct-16 [Day]	DS16-06 [DS-L]	RC lead: Discussed the importance of participating and sharing of safety interactions for all tasks that may occur on site and not only tasks that seem relative to only yourself.	M.Shelley	12	120	120	[DRILLING] Crew began drilling around 08:30 this morning. Drilling continued smoothly and penetration rate averaged 15-20 minutes per 20-foot drill rod. The borehole was advanced to 120 feet. Airlift production rate was about 19 gpm. Water level recovery was measured beginning at 13:40 when water level was 89 feet. After about an hour, water level was 35 feet. Rate of recovery has decreased to about 0.7 feet in 10 minutes. Decision was made by RC and M&A to call the hole at 120'. Southwest Exploration, Inc. will arrive this evening to run borehole geophysics	A preliminary well design is attached.	10.5-inch hammer bit	32.7' bls @ 17:42	18.8 gpm	pCpi [0 - 120]
21-Oct-16 [Night]	DS16-06 [DS-L]	NEWP lead: caution while opperating backhoe for casing installation. Care of fingers and hands with tooling and casing.	M. Zelazny	12	N/A	N/A	[GEOPHYSICS AND WELL CONSTRUCTION] Southwest Geophysics conduct a suite of logs including NMR. Set up for well construction and well casing install.	M&A will review logs to determine any adjustments to the preliminary well design.	10.5-inch hammer bit	32.21' bls (still recovering)	N/A	pCpi [0 - 120]

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
22-Oct-16 [Day]	DS16-06 [DS-L]	NEWP/M&A lead: Discussed the importance of driving the appropriate speed limit entering and exiting site. The weekend traffic near site has increased, so vehicle speed limit is very important.	M.Shelley	12	120	N/A	[WELL CONTSTUCTION / AIRLIFT TESTING] Crew hung casing at 05:30 this morning and began installation of annular materials. Gravel was installed from 120 - 13.1' bls. A bentonite seal was placed from 13.1 - 9.0'. A neat cement plug was placed from 9.0' to land surface. A 4-hour airlift test was conducted, starting at 13:30 this afternoon. Water production rate averaged 18.1 gpm and parameters stabilized ~2 hours into the test (see table below). A screening water sample was collected at 17:00. The test ended and water level recovery measurements are to be collected from 17:30 to 21:30 tonight.	A LevelTROLL transducer was attached to tremie pipe to record water level drawdown and recovery during the test.	10.5-inch hammer bit	34.8 (prior to start of airlift test / development)	18.1	pCpi [0 - 120]
22-Oct-16 [Night]	DS16-06 [DS-L]	NEWP lead: Always be on the lookout for snakes and other wildlife around the drilling pad and while driving on the roads.	C.Gregory	4.50	N/A	N/A	[AIRLIFT TESTING] Continue collecting water level recovery measurements until 21:30 hrs. Last water level at 21:30 hrs measured at 34.19 ft bls.	WQ samples are being stored on ice and will be delivered to RC on Monday.	N/A	34.19 (after 4 hrs of recovery)	N/A	pCpi [0 - 120]
23-Oct-16 [Day]	DS16-06 [DS-L] to DS16-07 [DS-K]	NEWP/M&A lead: Discussed clearing a path for M&A to obtain water from NEWP water truck. Before discussion there was not a safe path to water truck spout.	M.Shelley	2.5	60	60	[RIG MOBILIZATION / DRILLING] Crew mobilized rig and auxilliary equipment to site DS-K. Crew set up site by 08:00 and began drilling 17.5-inch borehole to 20' bls to set 12-inch steel surface at by 09:15. Surface casing was cemented in place by 12:00. Crew allowed cement to cure for ~4 hours and drilling R/C commenced at 16:40	M&A will conduct a recovery test at 120' bls.	10.5-inch hammer bit	N/A	N/A	pCdiab [0 - 50'] pCm [50 - 60']
23-Oct-16 [Night]	DS16-07 [DS-K]	NEWP lead: Crew moved the light plant after a safety discussion. Light plant was moved because hazards were recognized and working areas on site were not receiving proper lighting during night operations.	C. Gregory	12	220	160	[DRILLING] Drilling continued drilling smoothly through the night. Penetration rate averaged 20-50 minutes per 20-foot drill rod.	M&A conduct a 3-hour recovery tests at 120' and 220' bls. No water was measured during recovery testing.	10.5-inch hammer bit	N/A	N/A	pCdiab [0 - 50'] pCm [50 - 200'] pCdsqu [200-220']
24-Oct-16 [Day]	DS16-07 [DS-K]	NEWP lead: Discussed new procedure to conduct a ground resistivity test when grounding motorized equipment.	M.Shelley	12	320	100	[DRILLING / GEOPHYSICS] Drilling continued smoothly and penetration rate averaged 20-45 minutes per 20-foot drill rod. Total depth of 320' was reached at 11:00 this morning. At 14:15, Southwest Exploration, Inc arrived on site to begin geophysical logging of borehole. Logging operation will continue into the evening.	A recovery test was conducted after drilling to total depth. Water levels were recorded for ~2.5 hours while waiting for Southwest Exploration to arrive to begin logging.	10.5-inch hammer bit	70.8' bls	~70 gpm	pCdiab [0 - 60'] pCm [60 - 200'] pCdsqu [200 - 320']
24-Oct-16 [Night]	DS16-07 [DS-K]	NEWP lead: Remain in doghouse or vehicles while on red alert. Watch for incoming storms.	C. Gregory	12	320	N/A	[GEOPHYSICS / CONSTRUCTION] Geophysical logging completed at 21:00 hrs. NEWP transfers well construction materials from laydown yard to pad. Well casing landed at 4:40 hrs and begins preparing for addition of gravel.	Red alert from 20:15 to 20:45 hrs due to nearby lightning. On-and-off showers from 20:00 - 23:30 hrs.	10.5-inch hammer bit	70.8' bls	~70 gpm	pCdiab [0 - 60'] pCm [60 - 200'] pCdsqu [200 - 320']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
25-Oct-16 [Day]	DS16-07 [DS-K]	NEWP lead: Discussed how to properly engage air brakes on the pipe truck and water trucks.	M.Shelley	12	320	0	[WELL CONSTRUCTION / AIRLIFT] Crew gravel packed, placed a bentonite seal and cemented to surface. Cement was allowed to cure for ~5 hours. Airlift test began at 17:15, producing ~15 gpm. Plan to run 4 hours of airlift testing and 4 hours of recovery monitoring. NEWP will mobe to DS-I after testing and recovery is completed.	A LevelTROLL transducer was attached to tremie pipe to record water level drawdown and recovery during the test.	10.5-inch hammer bit	69.8' bls (water level recorded before test)	~15 gpm	pCdiab [0 - 60'] pCm [60 - 200'] pCdsqu [200 - 320']
25-Oct-16 [Night]	DS16-07 [DS-K]	NEWP lead: Discussed use of handrails when climbing and descending stairs.	C.Gregory	7	320	0	[AIRLIFT / MOBILIZATION] Airlift test completed at 21:15 hrs, followed by three hours of recovery. WL recovered quickly, rising to 71' bls within the first 15 minutes after turning off air. NEWP began mobilizing to DS-I at 01:00 hrs.	A water quality sample was collected at 20:50 hrs.	10.5-inch hammer bit	69.8' bls (water level recorded before test)	~15 gpm	pCdiab [0 - 60'] pCm [60 - 200'] pCdsqu [200 - 320']
26-Oct-16 [Day]	DS-I	NEWP lead: Discussed road hazards to watch for, as NEWP has had several flat tires from mobing between pads.	J.Bell, C.Gregory	1	N/A	N/A	[MOBILIZATION] NEWP mobilizing rig and accessories from DS-K to DS-I. J.Bell and C.Gregory visit DS-I pad in the afternoon and coordinate upcoming activities with NEWP.	DS16-07 WQ samples transferred to the hydro house refrigerator at 17:00 hrs.	N/A	N/A	N/A	N/A
26-Oct-16 [Night]	DS-I	N/A	N/A	0	N/A	N/A	[MOBILIZATION / SURFACE DRILLING] NEWP finishes mobilizing to DS-I, begins surface drilling in the A.M.	Drilling from 20' expected to start during day shift.	17.5" tricone	N/A	N/A	N/A
27-Oct-16 [Day]	DS16-08 [DS-I]	NEWP lead: Site safety induction; review Critical Risks to live by.	J.Bell	4	40	40	[DRILLING] Completed surface drilling and cemented in 12" casing to 20' bls. Started drilling from 20' bls with 10.5" hammer bit at 17:30 hrs.	M&A logging station set up outside of pad due to limited available space.	17.5" tricone; 10.5" hammer bit	N/A	N/A	pCdiab [0 - 40']
27-Oct-16 [Night]	DS16-08 [DS-I]	M&A lead: Discussed how diet and medications can affect one's energy levels on the job; pay attention to symptoms and get enough rest.	C.Gregory	12	240	200	[DRILLING] Drilling continued smoothly through the night. Penetration rate averaged 30-40 minutes per 20-foot drill rod. No evidence of water from airlift tests	A water level recover test was conducted at 140' bls. No water was detected during the recovery test.	10.5" hammer bit	N/A	N/A	pCdiab [0 - 240']
28-Oct-16 [Day]	DS16-08 [DS-I]	NEWP lead: Discussed importance of staying focused around the holiday season, when the number of accidents tends to increase.	J.Bell	12	340	100	[DRILLING] Continued drilling from 240' to 340' bls. Beginning at 280' bls, airlift tests yielded approximately 1 gpm. Drilling was paused at 340' bls in order to monitor water level recovery.	Water level detected during monitoring after drilling to 340' bls. After 5 hours of recovery, water level had risen to 208' bls.	10.5" hammer bit	208' bls (and rising)	1 gpm	~ UNDER REVIEW ~ pCdiab [0 - 300'] pCds [300' - 310'] pCpi [310' - 400']
28-Oct-16 [Night]	DS16-08 [DS-I]	NEWP lead: Discussed use of adequate lighting to prevent trips, slips and falls at night.	C.Gregory	12.5	400	60	[DRILLING / GEOPHYSICS] Drilling continued from 340' to 400' bls. Roblas fault observed from approximately 345' to 355', with fault system possibly extending below. Airlift tests show low yields around 1 - 3 gpm across fault zone. Upon reaching 400' bls, Southwest began running geophysical logs at	M&A will prepare preliminary well design after review of the geophysical logs, and in discussion with RC.	10.5" hammer bit	208' bls (and rising)	3.3 gpm	~ UNDER REVIEW ~ pCdiab [0 - 300'] pCds [300' - 310'] pCpi [310' - 400']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
29-Oct-16 [Day]	DS16-08 [DS-I]	NEWP lead: Discussed importance of staying focused around the holiday season, when the number of accidents tends to increase.	J.Bell	12	340	100	[DRILLING] Continued drilling from 240' to 340' bls. Beginning at 280' bls, airlift tests yielded approximately 1 gpm. Drilling was paused at 340' bls in order to monitor water level recovery.	Water level detected during monitoring after drilling to 340' bls. After 5 hours of recovery, water level had risen to 208' bls.	10.5" hammer bit	208' bls (and rising)	1 gpm	~ DRAFT ~ pCdiab [0 - 240'] pCp [240' - 250'] pCdiab [250' - 290'] pCdsu [300' - 310'] pCpi [310' - 400']
29-Oct-16 [Night]	DS16-08 [DS-I]	NEWP lead: Discussed road hazards that include low hanging branches on access roads that can damage vehicle antennas.	C.Gregory	12	400	N/A	[RE-DRILLING / CONDITIONING] Re-drilled from approximately 320' to 380' bls to remove fine sediment that had collected in the bottom of the borehole. Drilling with flooded reverse method did not work due to clogging of the tricone bit. Changed to conventional circulation, which proved more effective. Drilled with bentonite mud to increase borehole stability.	M&A has prepared a preliminary well design based that will be distributed. Final depths may be modified in the field based on the amount of sloughing in the bottom of the borehole.	9.875" tricone bit	N/A	Unobtainable with current drilling method	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCdsu [290' - 310'] pCpi [310' - 400']
30-Oct-16 [Day]	DS16-08 [DS-I]	NEWP lead: Filled out hot work permit for welding on landing tabs to HWT. One crew member conducted the welding and another was the designated fire watch.	M. Shelley	12	400	N/A	[BOREHOLE CONDITIONING / WELL CONSTRUCTION] Removed fine sediment fill from bottom of borehole. Conditioned borehole down to 400' bls. After tripping out tricone the bottom of the borehole was tagged at ~380' bls. Decision was made to adjust the well design for the current borehole depth. Crew tripped in tremie pipe and began tripping in HWT at 14:00. Landed casing at 15:35, welded on tabs and set up to begin installation of annular materials. Started gravel packing at 16:50.	Well design was modified in the field for the current depth of 380' bls. As-built well design showing final construction details is attached.	9.875" tricone bit	N/A	Unobtainable with current drilling method	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCdsu [290' - 310'] pCpi [310' - 400']
30-Oct-16 [Night]	DS16-08 [DS-I]	NEWP lead: Discussed the importance of using gloves when handling tag line and water level meter.	C.Gregory	9.5	400	N/A	[WELL CONSTRUCTION] Installed gravel in annular space from 378.9' to 280' bls, with 1' of choke sand from 280' to 279' bls. After swabbing the well, the top of the choke sand was unchanged at 279' bls. Above the choke sand, 11' of bentonite plug was installed from 279' to 268' bls. NEWP was preparing a cement grout (with 2% bentonite) and had begun to injecting the grout above 268' bls at shift change.	During grouting activities, C.Gregory drove to the hydro house and retrieved water quality sample bottles for the upcoming well development/airlift test.	N/A	N/A	N/A	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCdsu [290' - 310'] pCpi [310' - 400']
31-Oct-16 [Day]	DS16-08 [DS-I]	NEWP lead: Discussed the importance of good housekeeping. Less wasted time looking for tools if you maintain an orderly worksite.	M. Shelley	9.5	400	N/A	[WELL CONSTRUCTION / DEVELOPMENT] Crew finished pumping cement to surface at 07:30. Well development operations began ~10:30. Crew first tripped in tremie pipe to unload drilling mud by pumping water from the bottom of the well. Then, crew added Aquaclear dispersent and dry swabbed the well. Airlift operations began at 15:30. Airlifted for 1 hour until discharge rate fell to ~1 gpm. Crew will inject water and try to pump out as much mud as we can.	A water chemistry sample will be collected once they well water is free of drilling mud and water chemistry parameters are stabilized.	4-1/2" HWT	N/A	1-2 gpm	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCds (undifferentiated) [290' - 310'] pCpi [310' - 400']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
31-Oct-16 [Night]	DS16-08 [DS-I]	NEWP lead: Discussed the proper use of whip-checks on airline hoses during development and airlift testing.	C.Gregory	12	400	N/A	[DEVELOPMENT / AIRLIFT TESTING] Well development continued until 03:00 hrs to remove residual drilling mud. The well was given two doses of Aqua-Clear and flushed six times with fresh water. After 1 hour of recovery, an airlift test began at 04:00 hrs.	Extended well development required to purge the well of drilling mud used to stabilize the borehole during well construction.	N/A	N/A	1 - 2 gpm	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCdsl [290' - 310'] pCpi [310' - 400']
1-Nov-16 [Day]	DS16-08 [DS-K]	NEWP lead: Discussed road and pad conditions in preparation for mobilization to next site	M. Shelley	9.0	400	N/A	[AIRLIFT TESTING / MOBILIZATION] A 4-hour recovery test was conducted after air was shut off at 08:00. Water level was still slowly recovering to static after 4 hours, so water levels will be monitored over the next few days; NEWP began mobilizing to DS-P		4.5" HWT casing	304.9' bls @ 12:00	0.3 gpm	~ DRAFT ~ pCdiab [0 - 243'] pCdsu [243' - 256'] pCdiab [256' - 290'] pCds [290' - 310'] pCpi [310' - 400']
1-Nov-16 [Night]	DS16-09 [DS-P]	N/A	N/A	0.0	N/A	N/A	[MOBILIZATION] NEWP mobilizing to DS-P		N/A	N/A	N/A	N/A
2-Nov-16 [Day]	DS16-09 [DS-P]	N/A	N/A	0.0	20	20	[MOBILIZATION / SURFACE DRILLING] NEWP finished mobilizing to DS-P, and begin surface drilling	Drilling from 20' expected to start during night shift.	17.5" tricone	N/A	N/A	N/A
2-Nov-16 [Night]	DS16-09 [DS-P]	NEWP lead: Site safety induction; review Critical Risks to live by. Discussed monitoring for lightning during storm activity	J.Bell	7.5	140	140	[DRILLING] Completed surface drilling and cemented in 12" casing to 20' bls. Started drilling from 20' bls with 10.5" hammer bit at 22:50 hrs. A water level recovery test was conducted at 140' bls beginning at 03:00. No water level was detected.	M&A logging station set up outside of pad due to limited available space. On and off light showers throughout entire shift. Drilling operations were down for lightning beginning at 3:15 through end of shift at 06:00	17.5" tricone; 10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ QTg [0 - 20'] pCpi [20 - 140']
3-Nov-16 [Day]	DS16-09 [DS-P]	NEWP lead: Discussed working on a wet/muddy pad. Increased awareness for slips, trips and falls.	M. Shelley	12.0	340	200	[DRILLING] Drilling continued smoothly this morning. Penetration rate averaged ~15 minutes per 20-foot drill rods. Penetration slowed down from 280-340' to ~35 mins per rod. Southwest Exploration, Inc will arrive at 20:00 to begin borehole geophysics.	A 3-hour water level recovery test was conducted after drilling to 240' bls. No water recorded.	10.5-inch hammer bit	N/A	0	~UNDER REVIEW~ QTg [0 - 10'] pCpi [10 - 340']
3-Nov-16 [Night]	DS16-09 [DS-P]	M&A lead: discussed road conditions due to weather. Driving safely and using 4-wheel drive	J. Bell	12.0	400	60	[DRILLING / GEOPHYSICAL LOGGING] Due to delays for lightning, SW arrival time was pushed back to midnight and drilling was completed to a total depth of 400' bls at 22:30. Water level recovery was monitored until 23:55 with no water level detected above 360' bls. Southwest began conducting geophysical logs at midnight.	On and off showers throughput duration of shift. Drilling operations were down for lightning from 17:30 to 19:30 and 19:50 to 21:20 An obstruction was encountered at a depth of ~350' in the open borehole when running the combo tool. There is likely caved-in material from noticeably washed out zones preventing the tool from passing through	10.5" hammer bit	N/A	Possible evidence of very low production (<0.5 gpm) beginning at 340'	~UNDER REVIEW~ QTg [0 - 10'] pCpi [10 - 400']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
4-Nov-16 [Day]	DS16-09 [DS-P]	NEWP lead: Crew filled out a TRACK before fixing a flat tire on a water truck. Important to position vehicle on level ground before starting.	M. Shelley	12.0	400	0	[GEOPHYSICS / BOREHOLE CONDITIONING] Southwest Explorations continued running geophysical logs throughout the morning. The borehole continued to slough up to 250' by the end of geophysics. Decision was made to have crew condition the borehole down to 360', removing the sloughed material. At 15:00, material was encountered at a depth of 146' bls. Crew attempted to remove fill by circulating flooded reverse with only water. After getting plugged several times crew has decided to add some polymer to the water to try to keep the borehole open while attempting to remove fill material.	Red alert for lightning halted geophysical operations from 06:15 to 08:30.	10.25" tricone bit	N/A	Possible evidence of very low production (<0.1 gpm) beginning at 340'	Qal [0 - 10'] pCpi [10 - 400']
4-Nov-16 [Night]	DS16-09 [DS-P]	M&A lead: discussed road conditions due to weather. Driving safely and using 4-wheel drive	J. Bell	10.0	400	0	[BOREHOLE CONDITIONING] Crew added a mill tooth bit to try to better eat through the sloughed material, but continued to plug up. Crew switched to conventional drilling method to prevent plugging up. Mud pump needed maintenance and a very bad leak in the head shut down conditioning operations. Crew need to replace head seal before continuing to circulate because pad was starting to flood.	Crew waiting for mechanic to retrieve had seal. Currently moving casing to site.	10.25" tricone bit	N/A	Possible evidence of very low production (<0.1 gpm) beginning at 340'	Qal [0 - 10'] pCpi [10 - 400']
5-Nov-16 [Day]	DS16-09 [DS-P]	M&A lead: discussed daily vehicle inspections and encouraging the practice of Take 5's	M. Shelley	12.0	400	0	[BOREHOLE CONDITIONING / WELL CONSTRUCTION] Following the repair of the rig's head seal, NEWP resumed trying to clean out the borehole to target depth of 360' bls. With continued difficulties, the borehole was cleaned out to 180'. After discussion and consideration, the decision was made to call the hole and construct a well with a preliminary designed screened interval from 40 to 180' bls. Tooling was tripped out of the hole and tremie pipe was installed to 160' bls prior to running casing.	M&A prepared a preliminary well design. Final depths may be modified in the field based on the amount of additional sloughing encountered in the bottom of the borehole.	4-1/2" HWT	N/A	N/A	Qal [0 - 10'] pCpi [10 - 400']
5-Nov-16 [Night]	DS16-09 [DS-P]	NEWP lead: Filled out hot work permit for welding on landing tabs to HWT.	J. Bell	12.0	400	0	[WELL CONSTRUCTION] Casing was landed at 18:40 to a total depth of 177.5' bls, the maximum depth before encountering slough fill. The top of screen set at 36.5' bls. After welding tabs and cutting the casing at surface, gravel packing began at 23:30. Gravel was installed in the borehole annulus from 177.5 to 26.5' bls. NEWP crew was retrieving the rest of annular materials from laydown yard at end of shift.	The bottom, first 20 feet of borehole annulus from 177.5' bls took significantly less gravel volume than expected. There was likely additional sloughing following the installation of casing and there may not be continuous gravel pack in the very bottom of the screened interval.	4-1/2" HWT	N/A	N/A	Qal [0 - 10'] pCpi [10 - 400']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
6-Nov-16 [Day]	DS16-09 [DS-P]	NEWP lead: Slips, trips and falls. Many hoses layed out on worksite. Be aware of foot placement and pace yourself when moving from station to station.	M.Shelley	12.0	400	N/A	[WELL CONSTRUCTION / WELL DEVELOPMENT] Crew set bentonite seal from 26.4', up to 22' bls. Neat cement was pumped from 22' to surface. Cement was allowed ~5 hours to cure. Crew unloaded mud from well by flushing with clean water. Crew added ~250 gallons of water/Aquaclear mixture. After sitting for 2 hours, crew is currently swabbing screen interval. Development operations will continue through the night.	Due to very minimal water production, crew will continue to alternate between flushing with clean water, then airlifting, then adding Aquaclear mixture, swabbing, then airlifting.	4-1/2" HWT	N/A	N/A	Qal [0 - 10'] pCpi [10 - 400']
6-Nov-16 [Night]	DS16-09 [DS-P]	M&A lead: Discussed driving safely on roads out to site, using caution when pulling off to side of road for passing vehicles	J. Bell	12.0	400	N/A	[WELL DEVELOPMENT] Well development continued throughout the shift. After swabbing, 6 feet of sediment tagged inside the casing was removed via airlifting and flushing with fresh water. The well was given a second dose of Aqua-Clear and swabbed in after allowing to settle for 2 hours. More sediment was encountered in well casing and airlifting was continued to remove sediments and residual drilling fluid from inside the well and annular gravel pack.	Water produced during airlifting operations continued to contain significant fine sediment and residual drilling fluid	4-1/2" HWT	N/A	~0.2 gpm during airlift development	Qal [0 - 10'] pCpi [10 - 400']
7-Nov-16 [Day]	DS16-09 [DS-P]	NEWP lead: Discussed muddy conditions around drilling pad due to rainfall. Be careful walking on or around pad and when using stairs to collect water samples from cyclone.	C.Gregory	12.0	N/A	N/A	[WELL DEVELOPMENT] Continued development activities to remove drilling additive and fines. Injected Aqua-Clear for a third and final time followed by two hours of swabbing the screened interval of the well. Airlifted out the Aqua-Clear and rinsed the well twice with fresh water. At the end of the day, airlifted for 2.5 hours to observe any potential evidence of groundwater. Water parameters did not stabilize and discharge steadily fell to 0.13 gpm, therefore no WQ sample was collected. Finished development 16:50 hrs.	After development, a pressure transducer was installed in the well at 170.5 ft bls. The transducer will collect pressure readings every 30 mins and will be retrieved in 1 - 2 weeks.	4-1/2" HWT	143.5 (measured after development at 18:00 hrs; TBD if this is groundwater or residual development water injected from water truck)	~0.1 gpm (TBD if this is groundwater or residual development water injected from water truck)	Qal [0 - 10'] pCpi [10 - 400']
7-Nov-16 [Night]	DS16-09 [DS-P]	N/A	N/A	0.0	N/A	N/A	[MOBILIZATION] NEWP mobilizing to DS-H		N/A	N/A	N/A	N/A
8-Nov-16 [Day]	DS16-09 [DS-P]	N/A	N/A	0.0	20	20	[MOBILIZATION / SURFACE DRILLING] NEWP finished mobilizing to DS-H, and begin surface drilling	Drilling from 20' expected to start during night shift.	17.5" tricone	N/A	N/A	N/A
8-Nov-16 [Night]	DS16-09 [DS-P]	NEWP lead: Site safety induction and review of CRM	J. Bell	6.0	140	140	[DRILLING] Surface casing was drilled, cemented in, and allowed to cure. Drilling operations began at 01:00 and averaged a penertration rate of about 30 min per 20-foot joint. A water level recovery test was started at 5:15.	M&A logging station set up outside of pad due to limited available space. Yet to encounter any evidence of water production from quick airlift tests conducted at each 20-foot interval	17.5" tricone; 10.5" hammer bit	N/A	0	QTg [0 - 20'] Tg [20 - 140']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
9-Nov-16 [Day]	DS16-10 [DS-H]	NEWP lead: Discussed windy conditions of pad location. Important to keep loose items strapped down and be mindful of things that can be blown over.	C.Gregory	11.5	300	160	[DRILLING] Continued drilling from 140' to 300' bls at an average rate 20-30 minutes per drill rod. Drilling was paused at 140' bls and 240' in order to monitor water level recovery. No water level was detected at those depths.	A WQ sample was bailed from DS16-09 at the end of day shift and will be delivered to RC within the next couple of days.	10.5" hammer bit	N/A	N/A	Tg [0' - 300']
9-Nov-16 [Night]	DS16-10 [DS-H]	M&A Lead: Pay extra attention when working in lower light conditions.	M. Zelazny	15	440	140	Collected WQ sample using bailers at DS16-09. [DRILLING and WL RECOVERY] Drilled to depth of 340' with no water measured after 3 hrs of a WL recovery test. Drilled to 440' and water level was measured at 396' bmp after 2 hrs. Water production estimated to be less than 1 gpm after 420' and 440'.	Still windy and dusty on site. Will drill another 100', review lithology and discuss TD.	10.5" hammer bit	396' bmp (still rising)	Less than 1 gpm	~UNDER REVIEW~ Tg [0' - 305'] Tvy [305' - 415'] Tal [415' - 440']
10-Nov-16 [Day]	DS16-10 [DS-H]	NEWP lead: Discussed using spotters to back up vehicles around pad. Watch for equipment lying on the ground.	C.Gregory	11.5	520	80	[DRILLING] Continued drilling from 440' to 520' bls at an average rate 75 minutes per drill rod. Drilling was paused at 440' bls in order to monitor water level recovery over 4 hours. WL recovered slowly, at a rate of 1 ft per 3.5 mins over the period observed. Airlifts between 440' and 520' produced approximately 1.1 gpm.	Southwest has been notified that the borehole will likely TD at 540' and is on standby for geophysical logs.	10.5" hammer bit	363.4' bls [after 4 hrs recovery at 440' and rising]	1.1 gpm	~UNDER REVIEW~ Tg [0' - 305'] Tal [305' - 520']
10-Nov-16 [Night]	DS16-10 [DS-H]	SWEXP lead: safe procedures when working near suspended loads.	M. Zelazny	11.0	540 [Total Depth]	20	[WL RECOVERY AND GEOPHYSICS] Well TD at 540' and monitor water level recovery for 5 hrs with WL rising 97ft. Oversee geophysical logging of GYRO and OBI.	SWEXP will continue to run the suite of logs and upon completion a well design discussion call will occur.	10.5" hammer bit	443' bmp [after 5 hrs recovery at 540' and rising]	1.14 gpm	~UNDER REVIEW~ Tg [0' - 305'] Tal [305' - 540']
11-Nov-16 [Day]	DS16-10 [DS-H]	M&A lead: Discussed the use of caution tape around Southwest area when conducting geophysical logs to keep people and equipment safe.	C.Gregory	12.0	540 [TD]	0	[GEOPHYSICS] Southwest conducted geophysical logging during day shift. At 11:40 hrs the completed geophysical logs (all except NMR) were shared with management and a preliminary well design was prepared based on observations. At the end of day shift, the NMR log was being conducted and NEWP was transferring well construction materials to the pad.	Geology in lower section of borehole (477' - 540') still under review. The rock chips in this interval include weathered tuffaceous lithics, diabase, and in some instances basalt and minor quartzite.	10.5" hammer bit	372' bls [measured by Southwest combo tool at 8:50 a.m.; water level still rising]	N/A during geophysical logging	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']
11-Nov-16 [Night]	DS16-10 [DS-H]	NEWP Lead: the importance of PPE for each task at all times	M. Zelazny	12.0	N/A	N/A	[GEOPHYSICS AND WELL CONSTRUCTION] SWEXP finished NMR log. NEWP install neat cement to a tagged depth of 350'.	NEWP is adding a larger hot batch with an approximate lift of 35'	10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
12-Nov-16 [Day]	DS16-10 [DS-H]	NEWP lead: Discussed the construction activities planned and the use of the tank to collect residual cement and bentonite to avoid environmental impacts.	C.Gregory	12.0	540 [TD]	0	[CONSTRUCTION] NEWP continued with installation activities. The bottom of the borehole was abandoned with neat cement with a bentonite seal from 295.5' to 540' bls. The first 240 ft of well blank and slotted casing were installed before shift change. Remaining tasks include placement of gravel, upper bentonite seal, and grout in remaining annular space.	After construction, the well will be developed by filling with truck water, swabbing for 1 hour, then airlifting the water out. The process will be repeated 3 times. The hole is currently dry therefore no water quality sample will be collected.	10.5" hammer bit	N/A during construction	N/A during construction	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']
12-Nov-16 [Night]	DS16-10 [DS-H]	NEWP lead: safe driving in severe terrain	M. Zelazny	12.0	N/A	N/A	[WELL CONSTRUCTION] Land casing to 294' at 19:00 hrs. Installed gravel to 215.5', choke sand to 214', bentonite seal to 195', 2% bentonite cement to 33' and neat cement to surface.	Well will be developed and a transducer will be install installed to monitor WL.	10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']
13-Nov-16 [Day]	DS16-10 [DS-H]	NEWP lead: Discussed reporting substandard work conditions when observed. All substandard conditions of work environment or equipment need to be recorded.	C.Gregory	8.0	540 [TD]	0	[DEVELOPMENT / MOBILIZATION] Well development was carried out between 07:45 and 13:45 hrs. Due to the well being dry, water from NEWP's water truck was injected into well before swabbing and airlifting the water out. Water quality parameters were collected until the water discharged from the well began to resemble truck water. Development was finalized at 13:45 hrs and mobilization to DS16-11 (DS-J) began in the afternoon.	M&A will install a pressure transducer in the well tomorrow after the well monument has been constructed to monitor for groundwater recovery.	10.5" hammer bit, HWT casing	N/A during development	No groundwater apparent during well development.	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']
13-Nov-16 [Night]	DS16-10 [DS-H]	N/A	M.Zelazny	0.0	540 [TD]	0	[Mobing to DS-J]	NEWP thinks surface will start this afternoon.	10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ Tg [0' - 298'] Tal [298' - 477'] Tal (?) with diabase & basalt [477' - 540']
14-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Discussed maintaining equipment and vehicles stationed off of the road to prevent road blockages for public users.	C.Gregory	12.0	20	20	[MOBILIZATION / SURFACE DRILLING] NEWP spends most of day mobilizing from DS16-10 to DS16-11. Prior to shift change, surface drilling is completed to 20 ft bls.	A pressure transducer was installed in DS16-10 to monitor potential groundwater recovery. The pressure transducer will remain in the well for the coming weeks.	17.5" tricone bit	N/A	N/A	N/A
14-Nov-16 [Night]	DS16-11 [DS-J]	NEWP lead: safe rod arm procedures	M.Zelazny	8.5	140	120	[Drilling] Drilled from 20' to 140' with 5 min airlift water production test after each rod. After 140' a 3 hr recovery test was performed and finishing up at shift change.	After 2.5 hrs and with a sounder depth of 100' there was no WL measured.	10.5" hammer bit	N/A	0	[0-20] under review Tg [20' 140']
15-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Tight pad area. Drillers will spot vehicles when driving in reverse on and away from pad.	M.Shelley	12.0	280	140	[DRILLING] Drilling operations continued smoothly. Penetration rate averaged 40-60 minutes per 20-foot drill rod. A 5-10 minute airlift test was conducted after every rod to check for water production. A 3-hour recovery test was conducted after drilling to 240' bls.	After 3 hours, no water level was measured up to 200' bls.	10.5" hammer bit	N/A	0	~UNDER REVIEW~ Tg [0 - 150'] Tal [150 - 280']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
15-Nov-16 [Night]	DS16-11 [DS-J]	NEWP lead: frequency of greasing the water seal on the mass (red part) to extend the lifespan and prevent leaking.	M.Zelazny	12.0	340	60	[DRILLING] Drilling operations continued smoothly to 340' bls. Penetration rate averaged 76 minutes per 20-foot drill rod. A 5-10 minute airlift test was conducted after every rod to check for water production. A 3-hour recovery test was conducted after drilling to 340' bls. Lost air pressure due to two bad rod o rings and foot valve on bit; replaced hammer bit.	After 3 hours, no water level was measured up to 300' bls. After changing the hammer bit drilling resumed around cross shift.	10.5" hammer bit	N/A	0	~UNDER REVIEW~ Tg [0 - 150'] Tal [150 - 340']
16-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Discussed the importance of double checking that loads are secured before moving.	M.Shelley	12.0	500	160	[DRILLING] Drilling operations continued smoothly. Penetration rate averaged 40-60 minutes per 20-foot drill rod. A 10 minute airlift test was conducted after every rod to check for water production. A 3-hour recovery test was conducted after drilling to 440' bls.	After 3 hours, no water level was measured up to 400' bls.	10.5" hammer bit	N/A	0	~UNDER REVIEW~ Tg [0 - 150'] Tal [150 - 500']
16-Nov-16 [Night]	DS16-11 [DS-J]	NEWP Lead: Importance of properly inspecting equipment	M.Zelazny	12.0	580	80	[DRILLING] Drilling operations continued smoothly. Penetration rate averaged 58 minutes per 20-foot drill rod. At 500' and 520' 10 minute airlift test was conducted with no water production. At 560' and 580' 15/20 minute airlift test was conducted with 1/0.75 gpm water production.	At 540' a 4.5-hour recovery test was conducted and WL measured from 500 to 480 bmp.	10.5" hammer bit	480' [540' recovery test during drilling]	Less than 1 gpm	~UNDER REVIEW~ Tg [0 - 150'] Tal [150 - 580']
17-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Site safety induction; review Critical Risks to live by.	M.Shelley	12.0	640	40	[DRILLING / GEOPHYSICAL LOGGING] Drilling operations continued smoothly. Penetration rate averaged ~2-3 hours per 20-foot drill rod. A 10 minute airlift test was conducted after every rod to check for water production. A 3-hour recovery test was conducted after drilling to total depth of 640' bls. After 3 hours, water level recovered from ~640 to 582' bls, and was still recovering. Southwest Explorations, Inc. arrived on site at 15:30 to begin logging the borehole.	Southwest will continue logging borehole through the night. Discussion for well design will take place following geophysics.	10.5" hammer bit	582' bls; not static	~0.5 gpm	Tg [0 - 147'] Tal [147 - 640']
17-Nov-16 [Night]	DS16-11 [DS-J]	M&A Lead: Safe working procedures in high wind and cold weather conditions.	M.Zelazny	12.5	640' [TD]	N/A	[GEOPHYSICAL LOGGING] Southwest Exploration, Inc logged the full suite of geophysical logs including NMR.	Well design is being completed and well construction will start soon.	10.5" hammer bit	528.5' bls [still rising]	N/A	Tg [0 - 147'] Tal [147 - 640']
18-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Discussed double checking the strapping before moving loads.	M.Shelley	8.0	640	N/A	[WELL CONSTRUCTION] Following geophysical logging, M&A prepared a well design. Crew tripped in tremie pipe, then tripped in HWT casing to 640' bls. The installation of annular materials will occur this evening.	A 20-foot bentonite seal will be placed above gravel pack, followed by neat cement to surface.	10.5-inch hammer bit; 4.5-inch HWT steel casing	N/A	<0.75	Tg [0 - 147'] Tal [147 - 640']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
18-Nov-16 [Night]	DS16-11 [DS-J]	NEWP lead: Site safety induction; review Critical Risks to live by.	J. Bell	7.5	640	N/A	[WELL CONSTRUCTION] After landing casing, NEWP began transferring supplies for well construction from their laydown yard. A flat tire during the retrieval caused some delays. Gravel was installed in the annulus from TD to 438' bls. A foot of choke san will be installed before installing a bentonite seal.	A 20-foot bentonite seal will be placed above gravel pack, followed by neat cement to surface.	10.5-inch hammer bit; 4.5-inch HWT steel casing	N/A	N/A	Tg [0 - 147'] Tal [147 - 640']
19-Nov-16 [Day]	DS16-11 [DS-J]	NEWP lead: Discussed the importance of fit checking respirators before using during cement mixing operations.	M.Shelley	5.0	640	0	[WELL CONSTRUCTION] Crew placed bentonite seal from 437 to 418' bls. Cement was pumped from 418' to land surface. Crew tripped in tremie to begin well development operations after cement has cured.	Crew will develop well by injecting fresh water, swabbing and airlifting the water out. This process will be repeated until water comes out clean.	10.5-inch hammer bit; 4.5-inch HWT steel casing	N/A	<0.5	Tg [0 - 147'] Tal [147 - 640']
19-Nov-16 [Night]	DS16-11 [DS-J]	M&A Lead: Discussed staying hydrating and staying warm in cold windy weather. Some team members fighting common cold symptoms	J. Bell	14.0	640	N/A	[WELL DEVELOPMENT] Water added to the well during construction was air-lifted out. The well was then flooded with new fresh water and swabbed for over 1 hour. The well was evacuated via airlifting and repeated three more times with fresh water until producing relatively clear and stable parameters. Air-lifting was completed at 3:30. After tripping out, NEWP began mobilization to the next site.	Immediately following air-lift development at 03:45, water level recovery was monitored for 30 min. Water level was initially recorded at 579.05' bls and rising. A transducer was set in the well after the tremie air line was tripped out to continue monitoring recovery. Water quality samples of the makeup water (NEWP water truck) were collected.	10.5-inch hammer bit; 4.5-inch HWT steel casing	479.07' bls at 07:30 following development; and rising	<0.5 gpm after evacuating fresh water	Tg [0 - 147'] Tal [147 - 640']
20-Nov-16 [Day]							[MOBILIZATION] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A]					
20-Nov-16 [Night]							[MOBILIZATION] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A]					
21-Nov-16 [Day]							[MOBILIZATION] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A]					
21-Nov-16 [Night]							[MOBILIZATION] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A]					
22-Nov-16 [Day]							[MOBILIZATION] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A]					
22-Nov-16 [Night]							[MOBILIZATION / DRILLING] Mobing from DS16-11 [DS-J] to DS16-12 [DS-A] and surface drilling					
23-Nov-16 [Day]	DS16-12 [DS-A]	NEWP lead: Site safety induction. Discussed tractor route that will be used to dump drill cuttings and high risk areas to avoid.	C.Gregory	11.5	160	140	[DRILLING] Drilling with 10.5" hammer bit began at 07:00 hrs from 20 ft bls. At 13:00 hrs, drilling was paused for three hours for water level monitoring--no water level was detected. By the end of day shift drilling had advanced to 160 ft bls.	Happy Thanksgiving folks!	10.5" hammer bit	N/A	0	~UNDER REVIEW~ Qtg [0' - 10'] Tuff (Tt?) [10' - 140']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
23-Nov-16 [Night]	DS16-12 [DS-A]	M&A Lead: The importance of making sure your work area is secure for rapid changes in weather conditions.	M.Zelazny	12	280	120	[DRILLING] Drilling operations continued smoothly. Penetration rate averaged 57 minutes per 20-foot drill rod. At 180', 200', 220', and 240' 10 minute airlift test was conducted with trace to little water production. At 260 and 280 the water production was 1.73 and 1.75 gpm.	At 240' a 3-hour recovery test was conducted and WL was not measured due to an error with the sounder. Another recovery test is currently underway at 300'.	10.5" hammer bit	see comment	1.74 gpm	~UNDER REVIEW~ Qtg [0' - 10'] Tuff (Tt?) [10' - 140']
24-Nov-16 [Day]	DS16-12 [DS-A]	NEWP lead: discussed higher accident rates around the holidays and the importance of staying focused on work and safety.	C.Gregory	12	340	60	[DRILLING / GEOPHYSICS] Drilling advanced to 340' bls. At 300' bls, water level recovery was monitored for 1.5 hours and rose to 107.1' bls before stabilizing. Southwest arrived in the afternoon and began running the geophysical logs at 14:30 hrs.	A well design will be prepared tomorrow morning once the geophysical logs have been reviewed by M&A and RC.	10.5" hammer bit	107.1' bls	8.1 gpm	~UNDER REVIEW~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 225'] pCdiab [225' - 340']
24-Nov-16 [Night]	DS16-12 [DS-A]	Southwest Lead: safe procedures when running NMR tool.	M.Zelazny	12	340 [TD]	N/A	[GEOPHYISCS] Southwest Exploration Services ran the full open borehole suite of logs. Confirmed TD of 340' and WL 107' at 17:30. NMR is currently running.	M&A will review logs and consult with group to prepare a final well design at 8:30/9am.	10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 225'] pCdiab [225' - 340']
25-Nov-16 [Day]	DS16-12 [DS-A]	NEWP lead: discussed tripping hazards that exist around drilling pad and materials that will be used for VW piezometer installation.	C.Gregory	12.0	340 [TD]	N/A	[GEOPHYSICS / CONSTRUCTION] During the morning, the NMR survey was completed and sent to management for review. Based on the geophysical results, a preliminary well design was prepared and distributed. Construction of the well began at 13:45 hrs, with the well casing landing at 16:00 hrs. A vibrating wire (VW) pressure transduer was installed at 215.5 ft bls.	Installation of annular materials will begin on night shift.	10.5-inch hammer bit; 4.5-inch HWT steel casing	N/A during NMR survey and well construction	N/A during NMR survey and well construction	~DRAFT~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 238'] pCdiab [238' - 340']
25-Nov-16 [Night]	DS16-12 [DS-A]	M&A Lead: the importance of PPE when mixing cement.	M.Zelazny	8	340 [TD]	N/A	[WELL CONSTRUCTION] NEWP added annular material -gravel to 251.8'; sand to 250.4'; seal to 241.4; grout to 25' and neat cement to surface. Piezometer is still functioning and data was recorded during all phases of well construction.	Neat cement needs about 5 hrs to cure with no accelerant. M&A is off site until 06:30 to start well development.	10.5" hammer bit	N/A	N/A	~DRAFT~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 238'] pCdiab [238' - 340']
26-Nov-16 [Day]	DS16-12 [DS-A]	NEWP lead: discussed the use of gloves when using water level meters.	C.Gregory	13	340 [TD]	N/A	[DEVELOPMENT] DS16-12 was developed with airlift beginning at 09:00 hrs. Due to low discharge and very high turbidity, truck water was used to rinse and swab the well screen interval. At the end of development, discharge was clear but had decreased to less than 0.1 gpm.	Water level will be monitored manually over the next several weeks. If water level recovery is observed, a sample will be collected within the next 1-2 days with a bailer.	10.5-inch hammer bit; 4.5-inch HWT steel casing	Slowly recovering from 329' bls	~0.1 gpm	~DRAFT~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 238'] pCdiab [238' - 340']
26-Nov-16 [Night]	DS16-12 [DS-A]		M.Zelazny	1.5	340 [TD]	N/A	[DEVELOPMENT] Water level recovery and pack up site.	NEWP started to mobe to the next site DS16-13 (DS-B)	10.5" hammer bit	331.64 [still recovering]	N/A	~DRAFT~ Qtg [0' - 10'] Tal [10' - 170'] pCmls [170' - 238'] pCdiab [238' - 340']
27-Nov-16 [Day]	DS16-13 [DS-B]						NEWP mobe to the next site DS16-13 (DS-B)					

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
27-Nov-16 [Night]	DS16-13 [DS-B]	M&A Lead: Careful of recreational drivers speeding past site when working so close to the road with loud machinery and ear protection.	M.Zelazny	12.5	100	80	[DRILLING] Drilled to 100' with 5 min airlift after each rod. At 80' and 100' an 1 hr WL recovery test was performed with WL recovering up to 33.9 ft bls both times.	We will continue to drill this upper zone with WL monitoring test after each rod.	10.5" hammer bit	33.9' bls	1.5 to 1.7 gpm	Under review
28-Nov-16 [Day]	DS16-13 [DS-B]	M&A lead: pointed out broken glass from beer bottles around pad and parking areas, and disposed of large shards wearing proper PPE.	C.Gregory	12.5	160	60	[DRILLING] Drilling continued from 100' - 160' bls during day shift, averaging 75 mins per 20' rod through highly altered (argillic) tuff. Between drill rods, water level recovery was monitored for 1 to 1.5 hrs, with recovery indicating a static water level around 34' bls. Airlift discharge varied from 0.4 to 2.3 gpm.	Matt Shelley will be on day shift beginning tomorrow morning.	10.5" hammer bit	33.8	~2.3 gpm	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 160']
28-Nov-16 [Night]	DS16-13 [DS-B]	M&A Lead: Safe sounder measurements when collecting WL in wet conditions on a muddy pad.	M.Zelazny	12.5	220	60	[DRILLING] Drilling continued from 160' - 220' bls averaging 59 mins per rod. After each rod airlift produced 1.4 gpm and WL recovered to 36 bls after monitoring for 1.5 hrs.	We will continue to drill until change in lithology.	10.5" hammer bit	36' bls	1.4 gpm	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 160']
29-Nov-16 [Day]	DS16-13 [DS-B]	NEWP lead: Crew filled out a working at heights permit to work on leak on drill head. Discussed critical risks associated with working on drill head.	M.Shelley	12.0	280	60	[DRILLING] Drilling continued smoothly today. Penetration rate averaged 50-80 mins per 20-foot drill rod. Crew shut down ~13:00 to repair leak in head and replace cup in rod arm. Drilling resumed at 16:00.	A 1.5 hour recovery test was conducted after drilling to 220' bls. Water level recovered to approximately 38' bls.	10.5-inch hammer bit	~38' bls	2	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 160']
29-Nov-16 [Night]	DS16-13 [DS-B]	M&A Lead: safe working in very cold conditions.	M. Zelazny	12.5	400	120	[DRILLING] Drilling continued from 280' - 400' bls averaging 58 mins per rod. After each rod airlift rate was 2.3 gpm; however airlift rate was 25 and 34 gpm at 380' and 400', respectively. A WL recovery test performed at 340 recovered to 40' bls after monitoring for 1.5 hrs.	We will drill another 40' and discuss due to the large water production at lower depths.	10.5" hammer bit	39' bls	2.3 avg (260'-360') 30 avg (360-400)	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 400']
30-Nov-16 [Day]	DS16-13 [DS-B]	RC lead: Discussed fatigue management in the field. It is important to look after one another for signs of fatigue when working in the field.	M.Shelley	12.0	440	40	[DRILLING] Monitored recovery while waiting for Jonovich to pump water from tanks on site. Continued drilling at 09:45. Drilled to 410' and crew made decision to switch to tricone bit because hammer was beginning to water out. Penetration rate averaged 60 minutes per 20-foot drill rod after switching to tricone.	Plan to drill to 480' bls and monitor recovery for 2 hours. Southwest Exploration is scheduled to run geophysical logs later this evening.	10-1/2-inch hammer bit; 9-7/8-inch tricone	~41' bls	39 gpm	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440']
30-Nov-16 [Night]	DS16-13 [DS-B]	M&A Lead: safety checks on fire extinguishers needed for the start of a new month.	M. Zelazny	13.0	540 [TD]	100	[DRILLING] Drilling continued from 440 - 540' bls averaging 56 mins per rod. After each rod airlift rate was 25 gpm. A WL recovery test performed at 540 recovered to 87' bls after monitoring for 3.0 hrs.	Southwest Exploration Services is onsite and running Gyro, then open borehole logs and end with NMR.	10-1/2-inch hammer bit; 9-7/8-inch tricone	87' bls [still recovering]	25 gpm	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435 - 470] pCmls [470 - 510] pCdiab [510 - 540]

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
1-Dec-16 [Day]	DS16-13 [DS-B]	NEWP lead: Blocked off area behind SWE logging truck. Flagged area due to overhead loads and moving wireline while logging operations are ongoing.	M.Shelley	11.0	540	0	[GEOPHYSICAL LOGGING] Southwest Exploration, Inc arrived on site this morning ~06:00 to conduct borehole geophysical logging. SWE ran gyro, and NEWP crew tripped out drill rods. While running the first tool in, a bridge was encountered at 150' bls. NEWP switched over to flooded reverse and curculated down to bottom to clear borehole of sloughed material.	Geophysical loggers will return to run logging suite at 19:00 this evening.	10-1/2-inch hammer bit; 9-7/8-inch tricone	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
1-Dec-16 [Night]	DS16-13 [DS-B]	N/A	M. Zelazny	1.0	540 [TD]	N/A	While running the first tool in, a bridge was encountered at 155' bls. NEWP switched over to flooded reverse and curculated down with mud (viscosity 40) to bottom to clear borehole of sloughed material.	M&A will contact Southwest Exploration Inc. once NEWP calls to return to site for logging.	10-1/2-inch hammer bit; 9-7/8-inch tricone	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
2-Dec-16 [Day]	DS16-13 [DS-B]	NEWP lead: Crew filled out unloading permit to unload HWT casing from semi trailer. Discussed the hazards associated with unloading and ways to mitigate them.	M.Shelley	11.0	540	N/A	[GEOPHYSICAL LOGGING] Southwest Exploration, Inc arrived on site this morning ~06:15 to conduct borehole geophysical logging. SWE was able to run all tools to bottom with no problem. Crew finished running NMR at 18:00.	M&A prepared well design for NEWP after review of geophysical logs.	10-1/2-inch hammer bit; 9-7/8-inch tricone	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
2-Dec-16 [Night]	DS16-09 [DS-P]	NEWP lead: Site safety induction and review of CRM	J. Bell	8.0	540	N/A	[WELL CONSTRUCTION] Following the completion of geophysical logging, neat cement was installed in the bottom of the open borehole and allowed to cure. Tremie pipe was set at a depth of 460' bls. After cure time, the cement level was tagged at 474' bls. A bentonite seal will be installed via tremie from 474' to a depth of 436' bls after casing is installed to a total depth of 430' bls. NEWP is currently running in well casing.	The screened interval for the well will be from 420' to 250' bls. A vibrating wire pressure transducer will be attached to the outside of blank casing at a depth of about 130' bls.	10-1/2-inch hammer bit; 9-7/8-inch tricone	N/A	0	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
3-Dec-16 [Day]	DS16-13 [DS-B]	NEWP lead: Reviewed safety with hot work for welding tabs to land casing.	M.Shelley	12.0	540	N/A	[WELL CONSTRUCTION] A vibrating wire transducer was installed at 130' bls. Casing landed at 09:45 and transducer is reading fine. Crew began installation of bentonite seal above cement and tremie plugged. Tremie was removed and cleared of bentonite. Crew picked up a motorized pump to pump bentonite to bottom. Crew finished pumping bentonite to 438' bls. Crew setting up to run gravel pack.	M&A will continue to monitor vibrating wire transducer during installation of annular material.	4-1/2" HWT	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
3-Dec-16 [Night]	DS16-13 [DS-B]	NEWP lead: Discussed safe parking procedures and awarness of common local traffic on tight road through drill pad	J. Bell	12.5	540	N/A	[WELL CONSTRUCTION] Gravel pack operations began this evening. Plugging of tremie was common and new tremie pipe was tripped down hole. The gravel level was last tagged at 350' bls but it is taking significantly much less gravel than expected each lift, likely due to sloughing material in the annulus. 35 feet of sediment was also tagged inside well casing. After assessment with senior M&A and NEWP staff, a modification was made to the designed depth of gravel in anticipation of settling during subsequent development. A high-polymer water mix will be added to promote stability during continued gravel install	M&A will continue to monitor vibrating wire transducer during installation of annular material.	4-1/2" HWT	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
4-Dec-16 [Day]	DS16-13 [DS-B]	NEWP lead: Reviewed JSA for mixing cement/grout. Make sure goggles and respirator mask fit properly before beginning task.	M.Shelley	9.0	540	N/A	[WELL CONSTRUCTION] In order to deal with the formation sloughing, crew began to install gravel with polymer water mix rather than only water. Crew successfully completed gravel pack and bentonite seal. Crew pumped pressure transducer bentonite grout mixture up to surface. Currently waiting for grout to cure before airlift development operations can begin.	M&A continued to monitor vibrating wire transducer during installation of annular material.	4-1/2" HWT	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
4-Dec-16 [Night]	DS16-13 [DS-B]	NEWP lead: Discussed working at night JSA. Communication around worksite is most important due to lower visibility work conditions.	J. Bell	3.5	540	N/A	[WELL DEVELOPMENT] After grout mixture began to start setting up, crew tripped tremie inside well to begin flushing out formation fill with water. Pumped tremie down to 430', cleaning the well of sediment. After the well was free of sediment, 300 gallon mixture of Aquaclear dispersant was pumped inside the well and crew will wait for grout to completely set before airlifting operations will commence.	Airlift and swab development will occur until the well is free of bentonite drilling mud and sediment. Then, a 4-hour airlift test and recovery will be conducted.	4-1/2" HWT	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
5-Dec-16 [Day]	DS16-13 [DS-B]	NEWP lead: Discussed maintaining equipment and vehicles. Keep equipment and vehicles clean and free of caked on mud.	M.Shelley	9.5	540	0	[WELL DEVELOPMENT] Crew let pressure transducer grout mixture cure completely before beginning airlift development. Well was developed for ~ 1 hour, unloading mud until the water was free of sediment. Aquaclear mix was pumped downhole and swabbed for 2 hours. Crew airlifted on well, removing more mud and sediment until 17:45. Another round of Aquaclear dispersant and swabbing will occur before beginning airlift test.	M&A will conduct a 4-hour airlift test and 4-hour recovery test. Water chemistry parameters will be recorded throughout the duration of the test.	4-1/2" HWT	N/A	N/A	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
5-Dec-16 [Night]	DS16-13 [DS-B]	M&A lead: Discussed using PPE wearing gloves when handling equipment	J. Bell	10.5	540	0	[WELL DEVELOPMENT] Development operations continued after adding another batch of aquaclear and swabbing. A 4-hour airlift test was conducted beginning at 21:30 followed by recovery monitoring until 05:30. NEWP began mobing to next drill pad.	Water quality samples were collected at the end of the airlift test under stable parameters A transducer will be set in the well to continue monitoring water level recording upon leaving site	4-1/2" HWT	109' bls after 4 hours of recovery and rising	15.0 gpm (after 4 hrs)	~UNDER REVIEW~ Tg [0' - 72'] Tal [72' - 435'] Talv [435' - 440'] pCb [440' - 470'] pCdiab [470' - 480'] pCmls [480' - 510'] pCdiab [510' - 540']
6-Dec-16 [Day]	DS16-14 [DS-C]	[DRILLING / STAND-DOWN] Drilling began from 20 ft bls with 10.5" hammer bit at 08:45 hrs. Drilling continued until reaching 60 ft bls at 11:06 hrs. At 60 ft bls, the borehole was monitored for water level recovery until 13:00 hrs, with no water level detected. NEWP initiated a Safety Stand-down at 11:30 hrs that lasted through the remainder of day shift.	C. Gregory	2	N/A	N/A	[MOBILIZATION] NEWP mobilizing rig and accessories. A transducer was installed in the completed well to continue monitoring water level recovery. Monitoring data from other logging wells were retrieved.	DS16-13 WQ samples transferred to RCM Hydro House	4-1/2" HWT	N/A	N/A	N/A
6-Dec-16 [Night]	DS16-14 [DS-C]	N/A	N/A	N/A	N/A	N/A	[MOBILIZATION / SURFACE DRILLING] NEWP finishes mobilizing to DS16-14, and drilling and setting 12" surface casing to 20 feet bls	Drilling from 20' expected to start 07:00	17.5" tricone	N/A	N/A	N/A
7-Dec-16 [Day]	DS16-14 [DS-C]	NEWP lead: Site induction for new drilling site; discussed protected vegetation and restricted parking areas around pad.	C. Gregory	10	60	40	[DRILLING / STAND-DOWN] Drilling began from 20 ft bls with 10.5" hammer bit at 08:45 hrs. Drilling continued until reaching 60 ft bls at 11:06 hrs. At 60 ft bls, the borehole was monitored for water level recovery until 13:00 hrs, with no water level detected. NEWP initiated a Safety Stand-down at 11:30 hrs that lasted through the remainder of day shift.	M&A has been informed that the Stand-down is indefinite until further notice due to personnel changes.	10.5" hammer bit	N/A	N/A	Tg [0' - 60']
7-Dec-16 [Night]	DS16-14 [DS-C]	N/A	J. Bell	-	60	0	NEWP on Safety Stand-down.		10.5" hammer bit	N/A	N/A	Tg [0' - 60']
8-Dec-16 [Day]	DS16-14 [DS-C]	N/A	N/A	N/A	60	N/A	NEWP on Safety Stand-down.	A meeting between NEWP and RC is scheduled for tomorrow morning (Friday) to discuss how to proceed.	10.5" hammer bit	N/A	N/A	Tg [0' - 60']
8-Dec-16 [Night]	DS16-14 [DS-C]	N/A	N/A	N/A	60	N/A	NEWP on Safety Stand-down.	N/A	10.5" hammer bit	N/A	N/A	Tg [0' - 60']
9-Dec-16 [Day]	DS16-14 [DS-C]	N/A	N/A	N/A	60	N/A	NEWP on Safety Stand-down.	NEWP has informed that 24-hour drilling will resume tomorrow (Saturday) at 0600 hrs.	10.5" hammer bit	N/A	N/A	Tg [0' - 60']
9-Dec-16 [Night]	DS16-14 [DS-C]	N/A	N/A	N/A	60	N/A	NEWP on Safety Stand-down.	J.Bell demobilizing. M.Shelley will be on night shift beginning Saturday night.	10.5" hammer bit	N/A	N/A	Tg [0' - 60']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
10-Dec-16 [Day]	DS16-14 [DS-C]	RC lead: Review RC work practices checklist, verify that personnel have credentials for tortoise training course.	C. Gregory	12	140	80	[DRILLING] Drilling resumed from 60 ft bls at 07:05 hrs. Drilling continued smoothly throughout the day, averaging 30 - 45 minutes per 20 ft drill rod. Water level monitoring was conducted at the end of each rod to check for groundwater recovery. Beginning at 100 ft bls, groundwater consistently stabilized around 49 ft bls within 1.5 hrs following the end of airlift tests.	A water quality sample was collected at 100 ft bls--the first instance of groundwater encountered at DS16-14. The sample was collected after field parameters had stabilized, following 1.5 hours of continuous discharge at approximately 15 gpm. M&A will discuss the possibility of analyzing the sample with RC.	10.5" hammer bit	~ 49 ft bls	33 gpm	Tg [0' - 140']
10-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Discuss importance of flagging trip hazards on site. Hoses on pad during fluid management operations provide extra hazards in high foot traffic work space.	M. Shelley	12	240	100	[DRILLING] Drilling continued smoothly tonight. Penetration rate averaged 40-50 minutes per 20-foot drill rod. Water level monitoring continued to be conducted at the end of each rod to check for groundwater recovery until we reach a depth of 200' bls.	Recovery tests will now be conducted every 100'.	10.5" hammer bit	~55 ft bls	40 gpm	Tg [0' - 240']
11-Dec-16 [Day]	DS16-14 [DS-C]	NEWP lead: Discussed the use of absorbent clothes to collect and contain drilling oils.	C. Gregory	12	280	40	[DRILLING / MAINTENANCE] Drilling resumed from 240 ft bls averaging 50 mins per 20 ft rod. At 10:40 hrs, drilling activities were halted due oil leaking from the top drive head. After attempting to repair, the head continued to leak with the possibility of causing damage to the drive, therefore a mechanic was called. The mechanic arrived at approximately 14:40 hrs and the rest of the afternoon was spent disassembling the head assembly.	Drilling to resume after the drive head seal has been replaced and is no longer leaking.	10.5" hammer bit	~ 53 ft bls	40 gpm	Tg [0' - 280']
11-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Filled out working out heights permit for attaching spindle back on head. Discussed the importance of proper foot placement when working on rig.	M. Shelley	12	330	50	[MAINTENANCE / DRILLING] Crew continued working on rig head, replacing seals. Drilling resumed at midnight and has continued smoothly through the morning. Entered a new unit (Tb) and penetration rate has slowed from ~50 minutes to 140 minutes per 20-foot drill rod.	Continuing to drill reverse circulation method until hammer waters out. Then, crew will switch to flooded reverse drilling method.	10.5" hammer bit	52.2 ft bls	40 gpm	Under Review Tg [0' - 290'] Tb [290' - 330']
12-Dec-16 [Day]	DS16-14 [DS-C]	Westland lead: Went over plan to designate protected areas around pad; will add Westland personnel to daily email list to provide notice of upcoming mobilizations.	C. Gregory	12	390	50	[DRILLING / MAINTENANCE] Drilling continued from 330 to 390 ft bls during day shift. Drilling progress was slow through very competent basalt, averaging 2.2 hrs per 20 foot drilling rod. At 13:53 hrs, drilling was paused due to malfunctioning of the shaker tank's control board. A NEWP mechanic arrived on-site at 15:30 and began working to repair the control board until the end of day shift.	Drilling to resume after the control board on mud system is repaired.	10.5" hammer bit	~ 53 ft bls	33 gpm	Under Review Tg [0' - 295'] Tb [295' - 390']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
12-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Reviewed JSA for loading and unloading. Discussed the importance of double checking guards and straps before driving loaded vehicle.	M. Shelley	7	410	20	[MAINTENANCE / DRILLING] Crew continued working on mud system control board. Drilling resumed at 19:00. Penetration rate slowed to >2 hours to drill from 400-410' bls. Decision was made by NEWP to trip out and switch to flooded reverse drilling method with a tricone.	Crew anticipates resuming drilling activites by 08:00 this morning.	10.5" hammer bit	~ 53 ft bls	35 gpm	Under Review Tg [0' - 295'] Tb [295' - 410']
13-Dec-16 [Day]	DS16-14 [DS-C]	NEWP Lead: Site safety induction; review CRM	J. Bell	10	475	65	[DRILLING] Drilling resumed from 410 ft bls after NEWP completed switching to flooded-reverse drilling method and tripping back in with new BHA including a tricone bit. Penetration rate averaged slightly over 1 hour per 20 foot drilling rod.	Obstructions in the open borehole were encountered when tripping back in with new tooling before resumed drilling. Likely bridged slough material in the borehole that was conditioned on the trip back down to bottom.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tg? [420 - 460] Tb [460 - 475]
13-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Discussed using spotters to back up vehicles around pad. Watch for equipment lying on the ground.	M. Shelley	12	565	90	[DRILLING] Drilling continued smoothly tonight. Penetration rate averaged 60-90 minutes per 20-foot drill rod. Drilling operations were halted from 21:00 to midnight to replace damaged 6" discharge hose. Drilling resumed after new hose was attached.	Water parameters and discharge rates cannot be measured while drilling flooded reverse.	9-7/8" hammer bit	N/A	N/A	Tg [0' - 295'] Tb [295' - 420'] Tg? [420' -460'] Tb [460' - 565']
14-Dec-16 [Day]	DS16-14 [DS-C]	NEWP Lead: NEWP reviewed all safety procedures and documentation with safety supervisor on site; mitigate trip hazards on site	J. Bell	12	655	90	[DRILLING] Drilling operations resumed throughout the day with penetration rate ranging from 1 to 2 hours per 20-foot drill rod. Drilling operations were down from 12:40 to 16:20 for maintenance and repair on the drill rig and mud tank.	Water parameters and discharge rates cannot be measured while drilling flooded reverse.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 655']
14-Dec-16 [Night]	DS16-14 [DS-C]	M&A lead: be aware of backhoe since close proximity to our work station and frequent movement to move cuttings.	M. Shelley	12	835	180	[DRILLING] Crew continued drilling throughout the night. Penetration rate averaged 40-60 minutes per 20-foot drill rod. Entered unwelded tuff unit at 692' bls. The drill cuttings appear to be more competent Tal beginning around 760-780' bls. Discussion on whether to continue or TD will take place this morning between RC hydrology and geology group.	Water parameters and discharge rates cannot be measured while drilling flooded reverse.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 835']
15-Dec-16 [Day]	DS16-14 [DS-C]	NEWP lead: discuss parking and vehicle traffic on pad and road with increased mobile activity	J. Bell	12	895	0	[DRILLING / GEOPHYSICAL LOGGING] Drilling continued in the morning until the decision was made to T.D. the borehole at 895'. SWE was notified and arrived on site at 10:40. Drilling operations were completed at 11:00. After running the gyro tool, NEWP tripped out drill rods and BHA. SWE began running remaining geophysical logs beginning at 15:30	NEWP crew will begin well construction after provided with a well design.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
15-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Discuss the importance of proper hand signalling when spotting site vehicle operations. Make sure to know the correct hand signals when operating large equipment.	M. Shelley	6	895	0	[GEOPHYSICAL LOGGING] Southwest Exploration continued logging borehole until 22:15. Set up to run NMR and began logging at 23:30. Finished running NMR tool at 06:00. A conference call to discuss the well design will take place shortly.	NEWP crew will begin well construction after provided with a well design.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760']
16-Dec-16 [Day]	DS16-14 [DS-C]	Group lead: Discuss maintaining PPE; discuss parking/traffic boundaries and site sensitivity to cultural disturbance w/ Westland	J. Bell	12	895	0	[ABANDONMENT / CONSTRUCTION] After completion of the NMR log; data was reviewed by M&A and RCM staff and a well design was developed and provided to NEWP. Crew began mixing and pumping cement batches to abandon the bottom portion of the borehole from TD to 330' bls. Cement will be allowed to cure prior to commencing with well contruction.		9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']
16-Dec-16 [Night]	DS16-14 [DS-C]	NEWP lead: Raining, windy conditions require more attention to detail when moving around site. Try to keep site clear of extra obsticles.	M. Shelley	9	895	0	[ABANDONMENT / CONSTRUCTION] Crew pumped cement up to 315' bls. Crew began to install bentonite seal above cement at 00:30. Crew went on lightning standdown at 01:50. Red alert was lifted at 03:30, and crew continued to install bentonite up to 285' bls. Plugging issues were encountered and there may be some sloughing material bridging in the borehole. Tremie was pulled and the tag level inside the open hole was up to 245'. NEWP is currently preparing to trip back in with the tricone bit and clear any slough down to 297' the last tagged bentonite level.	Casing installation will begin after installation of bentonite seal.	9-7/8" tricone bit	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']
17-Dec-16 [Day]	DS16-14 [DS-C]	M&A Lead: Discuss staying focused as we near the break period; muddy conditions on site from rain	J. Bell	12	895	N/A	[WELL CONSTRUCTION] NEWP tripped back into the open hole with the tricone bit and cleared through bridged slough at 253' and down to bottom at 294' bls. The bentonite seal was then completed to 285' bls. At 14:00 crew began running in 4" HWT casing. Bottom of casing was landed at 284.35' bls with 0.65' of stick-up at surface. Screened interval is from 279 to 39' bls. Tabs were welded to the stick-up at surface. Crew is currently installing gravel pack in the borehole annulus.		4-1/2" HWT	N/A	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
17-Dec-16 [Night]	DS16-14 [DS-C]	NEWP Lead: Discuss windy conditions during yesterday's shift, potential for tent to be blown over if tarp is left on.	C. Gregory	12	895	N/A	[WELL CONSTRUCTION] Gravel pack was installed from 32' to 285' bls, followed by 1 ft of choke sand from 31' to 32' bls and 11 ft of bentonite plug from 20' to 31' bls. Neat cement was installed in the annular space between the well casing and surface casing from 0 to 20' bls. The neat cement was allowed to cure for 3 hours from approximately 02:45 hrs until 05:45.	Well development and airlift testing activities began at 06:00 hrs, and should be completed by the end of the day.	4-1/2" HWT	54.2 ft bls (measured after construction, prior to development)	N/A	Under Review Tg [0' - 295'] Tb [295' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']
18-Dec-16 [Day]	DS16-14 [DS-C]	NEWP Lead: Discussed working at heights during de-rigging; importance of wearing harness and fall protection	J. Bell	11	895	0	[WELL DEVELOPMENT / DEMOBILIZATION] Airlift development operations began at 06:00 and continued through 11:30 until discharge cleared up and parameters were stable. A water quality sample was collected at 11:05. A transducer attached to the bottom of the airline monitored recovery until 14:00. Manual measurements were also recorded. Following test, NEWP began demobilizing until 18:00. Both crews will be working day shift today to demobilize most equipment to laydown yard for the upcoming break. Montogmery and Associates will demobilize from site today and will return when drilling resumes after the holiday break.	Water quality samples collected both during drilling and after development will be dropped off at the hydro house today. Drawdown and recovery rate during development and testing was rapid	4-1/2" HWT	Pre-airlift static: 54.2' bls	Initially 37.5 gpm; stabilizing to ~3 gpm quickly into test	Under Review Tg [0' - 290'] Tb [290' - 420'] Tb (paleosol) [420' - 460'] Tb [460' - 590'] Tb (paleosol) [590' - 620'] Tg [620' - 690'] Tt [690' - 760'] Tal [760' - 895']
19-Dec-16 - 16-Jan-17	N/A	N/A	N/A	N/A	N/A	N/A	No activity on site. Break for holiday season	N/A	N/A	N/A	N/A	N/A
17-Jan-17 [Day]	DS16-15 [DS-D]	N/A	N/A	0.0	20	20	[MOBILIZATION / SURFACE DRILLING] NEWP completed mobilizing repaired rig and accessories to DS-D and began spudding in	Drilling from 20' expected to start during night shift	17.5" tricone bit	N/A	N/A	N/A
17-Jan-17 [Night]	DS16-15 [DS-D]	NEWP lead: Site safety induction and review of CRM	J. Bell	4	40	20	[SURFACE DRILLING / DRILLING] Surface casing was set to 20 feet bls and cement was allowed to cure. After assembling down hole tooling, drilling operations resumed at 05:00 at an initial penetration rate of 50 minutes per 20 foot joint.	Water level recovery tests will be conducted after each 20 foot joint in anticipation of shallow groundwater	10.5" hammer bit	N/A	N/A	~UNDER REVIEW~ Tb [0' - 40']
18-Jan-17 [Day]	DS17-01 [DS-D]	NEWP Lead: Discussed plan to use backhoe and trash pumps to mitigate pad issues for upcoming rainy weather.	M. Shelley	12	120	80	[DRILLING] Drilling operations resumed throughout the day with penetration rate averaging 80 minutes per 20-foot drill rod. ~10 minutes of airlifting is conducted after drilling 20 feet to monitor for water production.	1.5 hour recovery tests were conducted after drilling every 20' to determine if the shallow zones contain water that is undetected during airlifting.	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 120']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
18-Jan-17 [Night]	DS17-01 [DS-D]	M&A Lead: Discussed keeping up excellent housekeeping and staying hydrated in cold weather	J. Bell	12	180	60	[DRILLING] Drilling operations continued throughout the day with penetration rate decreasing to 120 minutes per 20-foot drill rod.	1.5 to 2 hour recovery tests were conducted after drilling every 20' to determine if the shallow zones contain water that is undetected during airlifting.	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 180']
19-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Crew filled out working at heights permit to fix leak in head. Discussed the critical risks associated with working above the deck.	M. Shelley	12	240	60	[DRILLING] Drilling operations resumed throughout the day with penetration rate averaging 2.5 hours per 20-foot drill rod down to 200'. From 200-240', penetration picked up to 40-60 minutes per 20-foot drill rod. Airlifted borehole for 10-15 minutes after drilling every 20 feet to monitor for water production.	1.5 hour recovery tests were conducted after drilling every 20' to determine if the shallow zones contain water that is undetected during airlifting. Recovery tests will now be conducted every 100'.	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 220'] Tss [220'-240']
19-Jan-17 [Night]	DS17-01 [DS-D]	NEWP Lead: Discussed working in rainy and muddy conditions on site	J. Bell	12	370	130	[DRILLING] Drilling penetration rate increased through tertiary sedimentary/tuffaceous units to less than 30 min per rod. Upon re-entering basalt, penetration rate reduced back to about 1.5 hours per 20-foot drill rod.	A 3-hour recovery test was conducted after drilling to 300' bls. With a sounder set at the max depth of 260', no water level was detected.	10.5" hammer bit	N/A	Possibly producing <1 gpm after 280' bls	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tss [270'-290'] Tb [290' - 360']
20-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Crew designated new "no-go" areas on the pad due to excessive water pooling.	M. Shelley	12	460	90	[DRILLING] Drilling operations resumed throughout the day with penetration rate averaging 50 minutes to 2 hours per 20-foot drill rod. Airlifted borehole for 10-15 minutes after drilling every 20 feet to monitor for water production. Collected water parameters from discharge water during airlift.	Recovery test was conducted at 400'. After 2.5 hours of monitoring, water level had recovered to 343' bls.	10.5" hammer bit	343.0' bls (still recovering)	<1 gpm	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tss [270'-290'] Tb [290' - 460']
20-Jan-17 [Night]	DS17-15 [DS-D]	NEWP Lead: Discussed awareness of elevated slips, trips, and fall hazards	J. Bell	12	540	80	[DRILLING] Penetration though competent basalt averaged 2 hours per 20-foot drill rod. Airlifted borehole for 10-15 minutes after drilling every 20 feet to monitor for water production. Collected water parameters from discharge water during airlift.	Another recovery test was conducted at 500'. After 3 hours of monitoring, water level had recovered to 441' bls.	10.5" hammer bit	441.0' bls (still recovering)	<1 gpm	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tss [270'-290'] Tb [290' - 540']
21-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Watch for trip hazards all over site. Pad covered in puddles of water with holes and rocks hidden.	M. Shelley	12	620	80	[DRILLING] Drilling operations resumed throughout the day with penetration rate averaging 1 to 2 hours per 20-foot drill rod. Airlifted borehole for 10-15 minutes after drilling every 20 feet to monitor for water production. Collected water parameters from discharge water during airlift. Plan to drill another 60' into Apache Leap Tuff before running geophysics.	An 8-hour recovery test was conducted at a depth of 620'. After 3.5 hours of monitoring, water level had recovered to 540.0' bls.	10.5" hammer bit	540.0' bls (still recovering)	1-2 gpm	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tb [270' - 610'] Tal [610' - 620']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
21-Jan-17 [Night]	DS17-15 [DS-D]	NEWP Lead: Discuss electrical hazards on site	J. Bell	11	680	60	Recovery was monitored until 23:00. The water level was last recorded at 449.20' and still rising at a relatively constant rate of about 18 ft/hr. Drilling then resumed to a total depth of 680' bls at a penetration rate of about 45 minutes per 20-foot rod. Parameters were recorded from airlift discharge after each rod. Water production remained the same throughout Tal unit	Southwest Exploration is scheduled to arrive on site to run geophysical logs at 06:00	10.5" hammer bit	449.20' bls (still recovering)	1-2 gpm	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tb [270' - 610'] Tal [610' - 680']
22-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Crew flagged off area behind SWE logging truck and designated the area as off limits during logging operations. The area was flagged due to the overhead winch cables leading from the truck to the rig.	M. Shelley	12.0	680	N/A	[GEOPHYSICAL LOGGING] SWE arrived on site ~06:30 to begin running borehole gyro. After gyro, NEWP crew airlifted water to evacuate borehole before tripping out drill rods and tooling. In the open hole, SWE ran OBI, DIL, and GCT combo tool.	M&A prepared a well diagram after review of geophysical logs and a discussion with members of KCB, NEWP, and RC. Well construction operation will commence this evening.	10.5" hammer bit	503' bls at 19:00 (~10 hours of recovery)	1-2 gpm	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tb [270' - 610'] Tal [610' - 680']
22-Jan-17 [Night]	DS17-15 [DS-D]	NEWP Lead: Review CRM in preparation for well construction	J. Bell	3.0	680	N/A	[WELL CONSTRUCTION] NEWP began abandoning the bottom of the borehole with neat cement to a targeted depth of 480' bls. Neat cement was tremied down hole and allowed to cure. At 05:00 the cement level was tagged at ~485 feet bls. A bentonite seal will be installed on top to a depth of 460' bls.		10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 220'] Tss [220'-260'] Tt [260'-270'] Tb [270' - 610'] Tal [610' - 680']
23-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Crew filled out a working at heights permit for using a ladder during gravel packing operations. Made sure ladder was securely strapped to table for better security.	M.Shelley	12.0	680	0	[WELL CONSTRUCTION] Crew tripped in HWT after placing bentonite seal up to 458' bls. Crew continued to install annular materials throughout the day. Gravel was installed from 458' up to 280' bls and choke sand from 280-278'	Cementing operations will continue into tonight/tomorrow morning.	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 221'] Tss [221' - 265'] Tt [265' - 273'] Tb [273' - 608'] Tb/Tal (weathered) [608' - 613] Tal [613' - 680']
23-Jan-17 [Night]	DS17-15 [DS-D]	NEWP Lead: Review CRM in preparation for well construction	J. Bell	9.0	690	N/A	[WELL CONSTRUCTION] Installation of annular materials continued with the bentonite seal above the gravel pack. NEWP experienced some issues with plugging during tremie of bentonite chips down hole. The top of bentonite was completed at 258' bls. A 2% bentonite grout was mixed and pumped in batches above the seal and was topped off with neat cement to surface.	Cement will need to cure before proceeding with well development	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 221'] Tss [221' - 265'] Tt [265' - 273'] Tb [273' - 608'] Tb/Tal (weathered) [608' - 613] Tal [613' - 680']
24-Jan-17 [Day]	DS17-15 [DS-D]	NEWP Lead: Be careful crossing washes during or after storms. Make sure that the water is not too deep or active to cross. Also, be aware of deep washouts on the roads as a result of the recent storms.	M. Shelley	11.0	680	0	[WELL DEVELOPMENT] Cement finished curing at 9:00 this morning. Airlifting operations consisting of swabbing, injecting clean water, and airlift pumping commenced at 10:00 this morning.	Airlift development will continue tonight while tracking water parameters until they stabilize.	4-1/2" HWT casing	N/A	~1 gpm	Under Review Tb [0' - 221'] Tss [221' - 265'] Tt [265' - 273'] Tb [273' - 608'] Tb/Tal (weathered) [608' - 613] Tal [613' - 680']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Depth to Water	Water Production	Geology
24-Jan-17 [Night]	DS17-15 [DS-D]	NEWP Lead: Discussed importance of wearing harness when working at heights for rig repair/maintenance	J. Bell	8.0	680	0	[WELL DEVELOPMENT] Well development continued in cycles of surging, airlifting, and injecting fresh water. Development continued until discharge was relatively clean and parameters stable. Following development, NEWP conducted rig maintenance and will begin mobing to the next site during daylight hours with the muddy and washed out road conditions.	Water quality samples were collected following the completion of development A transducer was set inside the well to monitor recovery and static water level	4-1/2" HWT casing	381.73' bls (and still recovering) at 00:45	~1 gpm	Under Review Tb [0' - 221'] Tss [221' - 265'] Tt [265' - 273'] Tb [273' - 608'] Tb/Tal (weathered) [608' - 613] Tal [613' - 680']
25-Jan-17 [Day]	DS17-15 [DS-D]	N/A	N/A	N/A	N/A	N/A	[MOBILIZATION] NEWP crew is mobilizing rig to site DS17-16 [DS-E]		N/A	N/A	N/A	N/A
26-Jan-17 [Day]	DS17-16 [DS-E]	NEWP lead: Slow mobilization in order to avoid accidents due to muddy conditions.	C. Gregory	0.5	Surface drilling	Surface drilling	[SURFACE DRILLING] NEWP begins surface drilling around 3 pm. Chris stops by the Hydro house in the afternoon to collect In-Situ transducers and cables. A Geokon transducer is removed from DS16-12 and replaced with a high-pressure LevelTroll. A Level Troll is also installed in DS16-14 to collect background water level data prior to the upcoming slug tests.	Drilling with hammer to begin during night shift after surface cement has been allowed to cure.	17.5" Conventional Air Rotary	N/A	N/A	TBD
26-Jan-17 [Night]	DS17-16 [DS-E]	NEWP Lead: Discussed hazards involved in BHA assembly to include load overhead, pinch points and slips, trips and falls.	M. Zelazny	6	80	60	[DRILLING] Drilling operations started at 02:00 with penetration rate averaging 33 - 38 mins per 20-foot drill rod. Airlifted borehole for 5-7 minutes after drilling every 20 feet to monitor for water production.	2 hour recovery test was conducted after drilling to 80' to determine if the shallow zones contain water that is undetected during airlifting.	10.5" hammer bit	N/A	N/A	Under Review Tb [0' - 80']
27-Jan-17 [Day]	DS17-16 [DS-E]	M&A lead: Windy conditions with strong gusts. Be mindful of objects and equipment that can potentially be blown down.	C. Gregory	12	150	70	[DRILLING] Drilling operations resumed throughout the day with penetration rate increasing from about 36 mins to about 75 mins per 20-foot drill rod, as lithology changed from Tg to Tb around 100 ft bls. Airlifted the borehole after drilling every 20 feet to monitor for water production, followed by 2 hours of water level recovery monitoring. No water level has been detected.	Will continue monitoring for 2 hours following each drill rod until a water level is detected.	10.5" hammer bit	N/A	N/A	Under Review Tg [0' - 100'] Tb [100' - 150']
27-Jan-17 [Night]	DS17-16 [DS-E]	NEWP Lead: protocols for safe compressor use	M. Zelazny	12	200	50	[DRILLING] Drilling operations continue with penetration rate averaging 1hr50mins to 2hr36mins per 20-foot drill rod. Airlifted borehole for 20-30 minutes after drilling every 20' to monitor for water production.	2 hour recovery tests conducted after drilling 20' rod to determine if the shallow zones contain water that is undetected during airlifting.	10.5" hammer bit	N/A	N/A	Under Review Tg [0' - 100'] Tb [100' - 200']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
28-Jan-17 [Day]	DS17-16 [DS-E]	M&A lead: Make sure to use handrails when ascending and descending stairs.	C. Gregory	12	220	20	[DRILLING] Monitored for potential water level recovery at 200' bls drilling depth (sounder at 157' bls) for a period of 4 hours; no water level detected but significant amount of water unloaded from borehole upon resumption of drilling. Drilled to 220' bls and tripped out drilling rods to be able to reach borehole bottom with sounder. Monitored water level recovery from 211' to 199.5' bls over 2 hours (steadily rising). By the end of day shift, rods were tripped in and drilling from 220' had resumed.	There appears to be groundwater entering the borehole. Monitoring of water level recovery at 220' drill depth and cascading water heard at the ground surface during monitoring suggest that there may be a perched water level above the Tg / Tb contact, with an inflow rate of approximately 0.4 gpm. Drilling will resume until an increase in discharge rate is observed from airlift tests.	10.5" hammer bit	Potential perched water level above Tg / Tb contact around 100' bls	~0.4 gpm	Under Review Tg [0' - 100'] Tb [100' - 220']
28-Jan-17 [Night]	DS17-16 [DS-E]	M&A Lead: precautions when working around a heater.	M. Zelazny	12	300	80	[DRILLING] Drilling operations continue with penetration rates averaging 1hr31mins to 2hr2mins per 20' drill rod. Airlifted borehole for 10-15 minutes after drilling every 20' to monitor for water production.	Drilled to 300' before conducting another 3 hr recovery test to determine if the shallow zones contain water that is undetected during airlifting.	10.5" hammer bit	N/A	N/A	Under Review Tg [0' - 100'] Tb [100' - 300']
29-Jan-17 [Day]	DS17-16 [DS-E]	NEWP lead: Discuss RC brief safety standdown scheduled for tomorrow at noon.	C. Gregory	12.0	370	70	[DRILLING] Continued drilling through Tb from 300' to 370' bls with average drilling rate of 2.5 hours per 20 ft drilling rod. No increase in discharge observed from airlifts and WQ parameters collected during airlifts were relatively consistent. In the afternoon, a transducer was installed in DS16-05 to begin monitoring water levels ahead of upcoming slug tests.	A brief safety standdown has been scheduled by RC for tomorrow at noon based on a recent increase in incidents reported at Rio Tinto properties.	10.5" hammer bit	Potential perched water level above Tg / Tb contact around 100' bls	~0.4 gpm	Under Review Tg [0' - 100'] Tb [100' - 370']
29-Jan-17 [Night]	DS17-16 [DS-E]	NEWP Lead: safe and proper use of hand tools	M. Zelazny	12	400	30	[DRILLING] Drilling operations continue with penetration rate of 5hr6mins and 1hr55mins for a 20' drill rod. Airlifted borehole for 15 minutes after drilling every 20' to monitor for water production and collect field parameters.	At 375' a 2 hr open borehole recovery tested yielded a 10' WL rise from 365' to 355'.	10.5" hammer bit	355' [during 375' open borehole 2hr recovery test]	~0.4 gpm	Under Review Tg [0' - 100'] Tb [100' - 400']
30-Jan-17 [Day]	DS17-16 [DS-E]	RC lead: RC rep conducted a safety standdown meeting at noon to discuss multiple incidents that have occurred this month at Rio Tinto operations (not at RC) and to go over how to avoid common accidents and injuries.	C. Gregory	12	450	50	[DRILLING] Continued drilling through Tb from 400' to 450' bls with an average penetration rate of 3.5 hours per 20 ft drilling rod. A safety standdown meeting was held by RC over NEWP cross-shift. A water quality sample was collected from NEWP's water truck and will be delivered to the Hydro house tomorrow (Tuesday) morning.	M. Shelley will cover day shift beginning tomorrow (Tuesday); C. Gregory will conduct slug tests in completed wells over the next several days.	10.5" hammer bit	Potential perched water level above Tg / Tb contact around 100' bls	~0.4 gpm	Under Review Tg [0' - 100'] Tb [100' - 450']
30-Jan-17 [Night]	DS17-16 [DS-E]	NEWP Lead: safe and proper use of the rod arm	M. Zelazny	12	490	40	[DRILLING] Drilling operations continue with penetration rate of 5hr7mins and 6hr22mins for a 20' drill rod. Airlifted borehole for 15 minutes after drilling every 20' to monitor for water production.	Will trip out to check the bha and do an open hole water level recovery test.	10.5" hammer bit	355' [during 375' open borehole 2hr recovery test]	~0.4 gpm	Under Review Tg [0' - 100'] Tb [100' - 490']

DAILY FIELD PROGRESS REPORTS

										Hydro Data		
Date	**Well/Hole #**	**Daily Safety Meeting/Lead**	**M&A Personnel on Site**	**Hours on Site**	**Shift Change Depth (ft)**	**Progress in last 12 Hrs (ft)**	**Activities**	**Comments**	**Hole Type/Size**	**Depth to Water**	**Water Production**	**Geology**
31-Jan-17 [Day]	DS17-16 [DS-E]	NEWP Lead: LIF on site. Crew review critical risk checklists with RC staff.	M. Shelley	11	503	13	[DRILLING] Crew drilled to ~500' bls before deciding to trip out due to very slow drilling rates (6.5 hours per 20-foot drill rod). Crew replaced foot valve in hammer bit and replaced a few o-rings before tripping back in. Penetration continued at a very slow rate, drilling 3 feet in 1 hour. Decision was made to change to a deep hole tricone (6-1/2"), reverse circulation in attempt to increase penetration rate.	Crew currently tripping out current tooling.	6.5" hammer bit	N/A	<0.1 gpm	Under Review Tcg [0' - 100'] Tb [100' - 503']
31-Jan-17 [Night]	DS17-16 [DS-E]	NEWP Lead: safe working procedures when working at night	M. Zelazny	11	[TD] 600	97	[DRILLING] Drilling operations continue with penetration rate of 31mins to 2hrs24mins for a 20' drill rod. Airlifted borehole for 10-20 minutes after drilling every 20' to monitor for water production. Conduct WL recovery test at 600' with sounder set to 580'	TD at 600' and Southwest Geophysics was notified and expected around 8am	6.5" tricone bit	[Still rising - WL recovery test] 552' bls	[not sustained] ~1-2 gpm	Under Review Tcg [0' - 100'] Tb [100' - 503']
01-Feb-17 [Day]	DS17-16 [DS-E]	NEWP Lead: Crew placed caution tape behind SWE logging truck to restrict access due to overhead hazards present with the suspended wireline. Avoid walking under suspended load at all times.	M. Shelley	12.0	600	0	[RECOVERY/GEOPHYSICAL LOGGING] Finished recovery water level monitoring at 08:00. SWE began logging borehole. Geophysical logs obtained include OBI, GCT, DIL and borehole video log. Logging concluded at 18:00 hours. A conference call between M&A, RC, and KCB has been set for 20:30 to discuss a well design.	Logs have been sent out for review before discussion of well design.	6.5" tricone bit	540' bls before geophysical logging commenced	~1 gpm	Lithologic contacts finalized after review of geophysical logs Tcg [0' - 98'] Tb [98' - 511'] Tal [511' - 532'] pCpi [532' - 600']
01-Feb-17 [Night]	DS17-16 [DS-E]	NEWP Lead: safe methods for lifting loads	M. Zelazny	4.5	[TD] 600	N/A	[WELL CONSTRUCTION] After conference call with committee a well design was drafted. NEWP poured 7 batches of neat cement and 1 hot batch.	Expected 4 hr cure time of cement to tag.	6.5" tricone bit	N/A	N/A	Lithologic contacts finalized after review of geophysical logs Tcg [0' - 98'] Tb [98' - 511'] Tal [511' - 532'] pCpi [532' - 600']
02-Feb-17 [Day]	DS17-16 [DS-E]	NEWP Lead: Crew filled out hot work permits for welding landing tabs on HWT and torch cutting stick up. One crew member was designated fire watch for welding operations.	M. Shelley	10.0	[TD] 600	0	[WELL CONSTRUCTION] After cement finished curing, crew set bentonite seal, then tripped in 4-1/2" HWT steel casing. A vibrating wire transducer was set at 73' bls. Gravel pack was installed up to 104', then a bentonite seal was set up to 88'. Crew finished pumping of 30% bentonite grout mixture at 17:00.	Crew will allow 10 hours for grout mixture to set up before commencing airlift development operations.	4-1/2" HWT	N/A	~1 gpm	Lithologic contacts finalized after review of geophysical logs Tcg [0' - 98'] Tb [98' - 511'] Tal [511' - 532'] pCpi [532' - 600']
02-Feb-17 [Night]	DS17-16 [DS-E]	M&A Lead: Safe procedures while collecting parameters near the baker tank	M. Zelazny	4.5	[TD] 600	0	[WELL DEVELOPEMENT] Conducted airlifting, surging and swabbing of well and collected parameters.	Development, airlifting and sample collection will finish up this morning.	4-1/2" HWT	N/A	~1 gpm	Lithologic contacts finalized after review of geophysical logs Tcg [0' - 98'] Tb [98' - 511'] Tal [511' - 532'] pCpi [532' - 600']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
03-Feb-17 [Day]	DS17-16 [DS-E]	NEWP lead: Discussed maintaining equipment and vehicles. Keep equipment and vehicles clean and free of caked on mud.	M. Shelley	7.0	[TD] 600	0	[WELL DEVELOPEMENT] Conducted airlifting, surging and swabbing of well and collected parameters. Screening water chemistry sample was collected after parameters stabilized.	Hung LevelTROLL transducer at 160' bls to monitor water level recovery post airlift.	4-1/2" HWT	97.70' bls @ 11:50 (still in recovery)	~1 gpm	Lithologic contacts finalized after review of geophysical logs Tcg [0' - 98'] Tb [98' - 511'] Tal [511' - 532'] pCpi [532' - 600']
END OF ROTARY HOLE DRILLING PROGRAM												
START OF SONIC HOLE DRILLING PROGRAM												
7-Feb-17 [Day]	GT-43-1	NEWP lead: Site induction and rig inspection for commencement of drilling at new site location. Discussed muster points, emergency response plan, site activity and critical risks.	M. Shelley	6.0	55	55	[SETUP/DRILLING] Crew finished setting up equipment on location at 12:00. RC drilling services conducted a rig inspection before commencement of drilling. Began drilling at 14:30.	Drilled from 0-33' in alluviam (Qal). Entered into weathered Pinal schist (pCpi) at 33' bls. At 53' bls, drilling began to slow down as schist became more competent. Plan to drill ~5-10 more feet in the morning and construct the well within the schist.	4" core; 6" casing advancemnt	~13' (observed in core)	N/A	Qal [0-33'] pCpi (weathered) [33'-53'] pCpi [53'-55']
8-Feb-17 [Day]	GT-43-1	NEWP lead: Discussed inspection of all gear before use. Today we discussed checking the lugnuts on vehicles and trailers daily before use.	M.Shelley	11.0	65	10	[DRILLING / WELL CONSTRUCTION] Crew cored from 55' to 65' bls, into competent bedrock, to reach total depth. There was a conference call to discuss well design at 13:00. Well was constructed with the screen interval from 55-65' bls. Crew completed grouting and began moving rig over to set up and drill alluvial well DS17-17 [DS-Q].	Drilling of DS17-17 will commence tomorrow morning. DS17-17 will be completed in the alluvium with 4" PVC.	2" schedule 40 PVC	~13' (observed in core)	N/A	Qal [0-33'] pCpi (weathered) [33'-53'] pCpi [53'-65']
9-Feb-17 [Day]	DS17-17 [DS-Q]	NEWP lead: Discussed inspection of all gear before use. Today we discussed checking the lugnuts on vehicles and trailers before use.	M.Shelley	10.0	32.5	32.5	[DRILLING] Crew finished moving rig to set up and start drilling DS17-17 [DS-Q]. Crew picked up well construction supplies from laydown yard this morning. Started coring down through the alluvium at 12:00. Drilled down into top of the weathered schist to 32.5' bls. Crew had to shut down before starting well construction due to mechanical issues with the rig compressor. A mechanic was called and worked on the compressor until the end of the shift.	Crew anticipates being up and running by ~10:00 tomorrow morning. Crew will then resume well construction.	6" core barrel; 8" casing advancement	~12-13', observed in core	N/A	Qal [0-31'] pCpi (weathered) [31'-32.5']
10-Feb-17 [Day]	DS17-17 [DS-Q]	N/A	M. Shelley	0.0	32.5	0	[STANDBY] Crew waiting for replacement part to fix compressor. Part will show up tonight.	Crew anticipates having the compressor fixed and running by 08:00 tomorrow morning.	6" core barrel; 8" casing advancement	~12-13', observed in core	N/A	Qal [0-31'] pCpi (weathered) [31'-32.5']
2/11/2017 [Day]	DS17-17 [DS-Q]	NEWP lead: Reviewed JSA for well construction. Discussed proper use of foot clamps while lowering in PVC.	M. Shelley	4.0	32.5	0	[WELL CONSTRUCTION] Crew repaired compressor and began well construction at 09:20 this morning. Screen interval of well runs from 10-30' bls. Finished construction at 11:00, lowered the mast and moved over 10' to begin drilling GT-43-2.	Well design has been prepared by M&A and apporved by RC staff	4" schedule 40 PVC	~12-13', observed in core	N/A	Qal [0-31'] pCpi (weathered) [31'-32.5']

DAILY FIELD PROGRESS REPORTS

Date	Well/Hole #	Daily Safety Meeting/Lead	M&A Personnel on Site	Hours on Site	Shift Change Depth (ft)	Progress in last 12 Hrs (ft)	Activities	Comments	Hole Type/Size	Hydro Data		Geology
										Depth to Water	Water Production	
	GT-43-2	RC lead: Discussed possibly engineering a way to prevent crew from holding 5-foot sample bags while clearing core barrel. Sometimes the sample is hot and it would be safer to keep hands off drill pipe and core sample.	M. Shelley	7.0	57.5	57.5	[DRILLING / WELL CONSTRUCTION] Crew began coring at 12:30 this afternoon. Cored down into the weathered schist to a total depth of 57.5' bls. Screen intercal of well runs from 36-56' bls. Finished construction at 18:00. Crew will cement 5' surface monuments in place tomorrow. They will be cemented 2' bls, 3 feet stick up, with a 24" x 4" cement pad finish.	Well design has been prepared by M&A and apporved by RC staff	4" core barrel, 6" casing, 2" schedule 40 PVC	~14' bls, observed in core	N/A	Qal [0-34'] pCpi (weathered) [34'-55'] pCpi (competent) [55'-57.5']
END OF 2016-17 DRILLING PROGRAM												

Appendix B

Drilling Technical Data Sheets (National EWP)

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 9-10-16
Client: Rio Tinto
Hole/Well No.: ~~BS N~~ DS 16-01
Location: Near West
Serial No.: No Serial #

Job #: 402-0214
Depth in: 20'
Depth out:
Total hrs:
Bit diam.: 17"/11"

	Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
9/10 AR	0	20	18:00	19:00							
9/11 AR	20	40	13:00	13:27	.27	.27		15-20	900		Gila Conglomerate
	40	60	13:37	13:59	.22	.49		15-20	900		Gila Conglomerate
	60	80	14:13	14:35	.22	1.01		15-20	900		Gila Conglomerate
	80	100	14:49	15:11	.22	1.23		15-20	900		Gila Conglomerate
	100	120	15:26	15:48	.22	1.45		15-20	900		Gila Conglomerate
	120	140	16:07	16:27	.20	2.05		15-20	900		Gila Conglomerate
	140	160	16:43	17:05	.22	2.27		15-20	900		Gila Conglomerate
	160	180	17:25	17:42	.22	2.49		15-20	900		Gila Conglomerate
	180	200	18:08	18:27	.19	3.08		15-20	900		Gila Conglomerate
	200	220	18:47	19:07	.20	3.28		15-20	900		Gila Conglomerate
	220	240	19:29	19:59	.30	3.58		15-20	900		Gila Conglomerate
	240	260	20:24	20:56	.32	4.30		15-20	800		Gila Conglomerate
	260	280	22:25	22:46	.21	4.51		15-20	900		Gila Conglomerate
	280	300	23:00	23:22	.22	5.13		15-20	900		Gila Conglomerate
	300	320	23:39	23:58	.19	5.32		15-20	900		Gila Conglomerate
JC	320	340	12:52	1:16	.24	5.56		10-15	900		Gila conglomerate
	340	360	1:34	2:04	.30	6.26		10-15	900		Clay Rock Mix
	360	380	2:22	2:58	.36	7.02		10-15	900		Multi Color Rock
	380	400	3:15	3:50	.35	7.37		10-15	1000		Torque increse/Dark Brown Trace of Quartz
	400	420	4:06	4:49	.43	8.20		10-15	900-1K		Multicolor
	420	440	5:15	5:54	.39	8.59		10-15	900-1K		Muti Color
	440	460	6:19					10-15	1000		445 hit water Stop @ 7:00

455-475
Stop Start
23:44 1:23
630
12:41 12 730
12:53
13:03
15:03

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 9-12-16
Client: Riotinto
Hole/Well No.: DS16-01
Location: West Point
Serial No.: No Serial #

Job #: 402-0224
Depth in: 20' / 447'
Depth out:
Total hrs:
Bit diam.: 11" / 9 7/8

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
AR 447	455	22:35	23:12	.37	:37					
455	460	23:29	23:44	.15	:52					
460	475	1:23	2:52	1:29	2:21	9-13.5K	25-35	800-1000		473' Frac Brown
475	495	3:25	5:28	2:03	4:24	9-10K	25-35	8-1100		Brown / Multi color
495	515	6:13	7:51	1:38	6:02	9-10K	25-35	8-1100		Multi color Change water seals
515	535	9:40	11:52	2:12	8:14	9-13.5K	25-35	10-1200		Red / Brown / Dark Brown
LIF [illegible] AR 535	555	12:31	15:29	1:13	9.27	13K	20-30	1100		Grey Brown Red
555	575	15:42	16:14	.32	9.59	13K	20-30	1100		Red
575	595	16:22	17:08	.46	10.45	13K	20-30	1100		Red some grey
595	615	17:15	18:06	.51	11.36	13K	20-30	1100		Red Grey
lightning delay 615	635	18:17	19:57	.40	12.16	13K	20-30	1100		Multi Color Red brown Grey
635	655	20:08	20:54	.46	13.02	13K	30-35	1000		Multi Color
655	675	21:03	22:19	1:16	14.18	11-13K	30-40	1100		Got hard fractured
675	680	22:34	2300	:26	14 44					Bit Plugged
680	695	1:15	157	:42	15:26	11K	25-35	10-1100		Multi Drain some head oil
695	715	2:40	3:43	1:03	16:29	11-13K	25-35	11-1200		Multi color Brown / Red / Grey
715	735	4:14	5:23	1:09	17:38	13-14.5K	25-35	10-1100		Brown & Grey
735	755	5:41	7:04	1:23	19:01	13-14.5K	25-35	10-1200		Multi color
755	775	7:40	8:49	1:09	20:10	13-14.5K	25-35	10-1100		Multi color
775	795	9:15	10:13	:58	21:08	13-14.5K	25-35	10-1200		Multi color
795	815	10:32	11:52	1:20	22:28	11-14.5K	25-35	10-1200		Brown / Dark Red
AR 815	835	12:26	13:27	1:01	23:29	13K	30-40	[illegible]		Brown
835	855	13:38	14:37	.59	24:28	13K	20-40	1000		Dark brown
855	875	15:00	16:03	1.03	25:31	13K	30-40	1000		going black

DS16-02

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 9-19-16
Client: Rio Tinto
Hole/Well No.: DS
Location: Resolution
Serial No.:

Job #: 402.0224
Depth in: 20
Depth out:
Total hrs:
Bit diam.: 10"

	Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
	20	40	17:05	17:32	.27			15-20	850		A little clay
	40	60	17:49	18:13	.24	.51		15-20	850		little clay
	60	80	18:27	18:59	.32	1.23		15-20	850		Gila
	80	100	19:16	19:43	.27	1.50		15-20	850		Gila
	100	120	19:58	20:21	.23	2.13		15-20	850		Gila
	120	140	20:35	21:03	.28	2.41		15-20	850		Gila
	140	160	21:22	21:50	.28	3.09		15-20	850		Gila
	160	180	22:13	22:41	28	3 37		15-20	900		Gila
	180	200	22:57	23:27	.30	4.07		15-30	850		Gila
	200	220	23:44	00:15	:31	4:38		30-35			Gila
MM	220	240	00:43	1:17	:34	5:12		15-25	800		" "
	240	260	1:42	2:12	30	5:42		15-20	8-900		" " Airlift/Recovery 1HR
	260	280	4:10	4:41	:31	6:13		15-20	900		
	280	300	5:08	5:42	:33	6:46		15-20	900-1000		297' water Airlift/Recovery
	300	320	6:21	6:55	:34	7:20		15-25	1000-1100	14	Airlift/Recover
	320	340	8:04	8:36	32	7:52		15-25	1000-1100	12	Airlift NoRecovery
	340	360	9:18	9:51	:33	8:25		15-25	1000-1100	11	" "
	360	380	10:31	11:20	.49	9.14		15-25	1000-1100	NA	Fracture 360-365 - Turned injection Back on
JC	380	400	1:19	2:08	.49	10.03		15-20	1000-1200	17	Sandy - multi Colors
	400	420	2:34	3:34	.40	10.43		15-20	9-1000	11	medium to Hard Sand
	420	440	3:59	4.36	.37	11.20		15-20	1000-1100	11	medium to Hard Sand - Gila
	440	460	5:08	5.39	.31	11.51		15-20	900-1000	19	Light Fracture. 450' Change to Gray Rock
	460	480	6:19	8.20	2.01	13.52		15-20	1000	11	Bad Circulation coming/going Trace of Sand
	480	500	11:42	12:21	39	14:01		15-20	900-1000		Light med [illegible]

BHA 38.66

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 9-25-16
Client: Rco tinto
Hole/Well No.: DS16-03
Location: Near West
Serial No.: No Number /06925

Job #: 402-0224
Depth in: 20'
Depth out: 140' /
Total hrs: 17.58/
Bit diam.: 17"Surface / 10.75" Hammer / 97/8"

DS16-02 - 14:01

	Depth		Time		Elasped	Total	Weight on				
	From	To	Start	Stop	Time	Hours	Bit	RPM	Torque	GPM	Comments
	0	20	6:45	10:00	3.25						Surface
	20	27	7:45	7:59	14	14:15					
	27	40	9:25	9:58	33	14:48		15-25	1000		Brown / Red
	40	60	10:10	10:50	40	15:28		15-25	1000-1200		Brown
	60	80	11:03	11:48	45	16 :13	4500	15-25	900-1100		Brown/Greyish
JC	80	100	12:48	1:35	.47	17.00	1115	15 - 20	800		Mix color Rock - Sand mix
	100	120	1:50	2:29	.39	17.39	1115-2230	15 - 20	1000		Mix Color Rock - Sand mix
	120	140	2:56	3:15	.19	17.58	50-100psi	15 - 20	1005	46	light gray whiteish volcanic Semisoft water
JC	140	155	9:49	10:16	.27	.27	13K	25 - 35	9-1000		light gray whiteish - Semisoft
	155	175	10:30	11:09	.39	1.06	13K	35-40	9-1000		" "
	175	195	11:20	11:57	.37	1.43	13K	35-40	900		
AR	195	215	00:17	1:18	1.01	2.44	13K	40	1000		Darker Grey Harder
	215	235	1:26	2:05	.39	3.23	13K	35-40	1000		Multi grey
	235	255	2:12	2:55	.43	4.06	13K	35-40	900		Multi grey
	255	275	3:03	3:43	.40	4.46	13K	35-40	900		Multi grey
	275	295	3:51	4:26	.37	5.23	13K	35-40	900		light gray to white
	295	315	7:49	9:08	1.19	6.42	11K	40	1000		Grey Volcanic
	315	335	9:16	10:24	1.08	7.50	13K	40	1000		Grey Volcanic Stuff
	335	355	10:33	11:21	:48	8.38	13K	~~40~~	1000		Grey Volcanic
JC	355	375	11:28	12:57	1.29	10.07	13K	30-35	9 - 1000		light grey material Medium Hard
	375	395	1:46	2:52	1.06	11.13	13.5K	25-30	1000-1150		" 392' Red Rock mix light grey
	395	415	3:09	4:01	.52	12.05	13.5K	25-30	1100		" ~~light Redish and white Rock mix~~
	415	435	4:17	5:10	.53	12.58	13.5K	25-30	1000-1100		light Redish and white Rock sandy mix

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

BHA= [redacted] 138.75

Date:	10-01-16	Job #:	402.0224
Client	Rio tinto	Depth in:	140'
Hole/Well No.:	DS16-03	Depth out:	
Location:	Near west	Total hrs:	
Serial No.:	06925	Bit diam.:	9 7/8"

Depth		Time		Elasped Time	12.58 Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
435	455	5:24	6:24	1.00	13.58	13-15K	25-30	1000-1100		light gray Rock light Sand mix Medium Har
455	475	6:37	7:39	1.02	15.00	13-15K	25-30	900-1000		light gray White Rock mix
475	495	7:52	8:54	1.02	16.02	13-15K	30-35	1000-1100		White Sandy Rock
495	515	9:12	10:07	.55	16.57	15K	35-40	11-1200		" "
515	535	10:20	11:24	1.04	18.01	14-15K	35-40	11-1200		" "
535	555	00:21	1:14	.53	18.54	15	40	1000		" "
555	575	1:21	2:12	.51	19.45	15	40	1100		" "
575	595	2:21	3:16	.55	20.40	15	40	1100		" "
595	615	3:30	6:31	1.01	21.41	15	40	1100		" "
615	635	6:39	7:28	.49	22.30	15	40	1100		" "
635	655	7:42	8:22	.40	23.10	15	40	1100		Geting into darker material
655	675	8:36	9:11	.35	23.45	15	40	1100		Multi Color white to grey
675	695	9:20	9:54	.34	24.19	15	40	1100		Multi greys and whites
695	715	10:15	11:31	.36	24.55	13-15	40	11-1200		
~~[illegible]~~	~~[illegible]~~									

AR

4-6

10-25-11:05

JC

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	10/5/16	Job #:	402.0224
Client	Resolution	Depth in:	20
Hole/Well No.:	DS16-04	Depth out:	
Location:	NearWest	Total hrs:	
Serial No.:	Hammer-201700	Bit diam.:	Starter 17" Hammer ~10.5"

Depth		Time		Elasped	Total	Weight on				
From	To	Start	Stop	Time	Hours	Bit	RPM	Torque	GPM	Comments
0	20	2350	1:45							
20	40	11:30	11:45	.15	.15		25-30	900		
40	60	11:55	12:14	19	:34					Harder @ 53'
60	80	12:19	12:35	16	:50		25-30	1100		
80	100	12:53	1:10	:17	1:07		25-30	1100		
100	120	1:18	1:35	:17	1:24		25-30	1100		
120	140	1:42	2:01	:19	1:43		25-30	1-1000		
140	160	2:09	2:30	:21	2:04		25-30	900-1100		
160	180	2:40	3:01	:21	2:25		25-30	900-1100		
180	200	3:10	3:29	:19	2:44		25-30	900-1100		
200	220	3:39	3:58	:19	3:03		25-30	900-1100		
220	240	4:08	4:26	:18	3:21		25-30	900-1100		
240	260	4:36	4:55	:19	3:40		25-30	1000-1100		
260	280	5:04	5:24	:20	4:00		25-30	1000-1100		
280	300	5:34	5:56	:22	4:22		20-30	1000-1200		
300	320	6:06	6:23	:17	4:39		25-30	1000-1200		Frac @ 313'
320	340	6:33	6:51	:18	4:57		25-30	900-1200		
340	360	7:01	7:20	:19	5:16		25-30	900-1200		Frac @ 348'
360	380	7:32	7:53	:21	5:37		25-30	1000-1200		
380	400	8:05	8:27	:22	5:59		25-30	1100-1200		
400	420	8:37	9:01	:24	6:23		25-35	900-1200		Frac @ 403'
420	440	9:20	9:43	:23	6:46		25-35	900-1100		Lighter color White/Tan 421'/Brown again 435'
440	460	10:05	10:31	:26	7:12		25-35	900-1100		

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 10/6/16
Client: Resolution
Hole/Well No.: DS16-04
Location: NearWest
Serial No.: 201100
Job #: 402.0224
Depth in: 20'
Depth out:
Total hrs:
Bit diam.: 10.5

Depth		Time		Elasped	Total	Weight on				
From	To	Start	Stop	Time	Hours	Bit	RPM	Torque	GPM	Comments
460	480	10:45	11:13	27	7:39		25-35	900-1200		Frac @480'
480	500	11:27	0:29	1.02	8:41		25-35	1100		Frac 495
500	520	0:47	2:01	1.14	9:55		25-35	1100		Dark Color Basalt
520	540	2:22	3:25	1.03	10:08		25-35	1100		Jumpy at 535 Black to
540	560	4:02	5:24	1.22	11:30		25-35	1100	4	545 Changed to Red to brown
560	580	6:20	6:57	.37	12.07		25-35	1100		White ish 550 Black
580	600	7:10	7:50	.40	12.47		25-35	1200		Black
600	620	8:07	8:42	.35	13:22		25	1200		Black

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 10/18/16
Client: Resolution
Hole/Well No.: DS-0 / DS16-05
Location: Superior, AZ
Serial No.: 201700

Job #: 4020224
Depth in: 20'
Depth out: 320'
Total hrs: 19.34
Bit diam.: 17" Surface / 10.5"

	Depth		Time		Elasped Time	~~[illegible]~~ 13.22 Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
Surface	~~[illegible]~~ 0	20	1445	1640							
JC	20	40	6:00	6:17	.17	13.39			1000-1100		Gray Rock Sand Mix
	40	60	6:30	6:49	.19	13.58			11-1200		Gray Rock Some Sand Mix
	60	80	7:03	7:20	.17	14.15			1000		Multi Color Rock Sand Mix
	80	100	7:38	8:01	.23	14.38			1000-1100		Gray Rock Sand Mix
	100	120	8:16	8:34	.18	14.56			1000-1100		Gray Rock Sand mix Trace of white Rock
UM	120	140	1:05	1:38	:33	15:29		25-30	1000-1200		Gray Rock
	140	160	1:50	2:12	:22	15:51		20-30	1000-1200		Gray Rock
	160	180	2:27	3:02	:35	16:26		20-30	1000-1200		Gray Rock
	180	200	3:18	4:03	:45	17:11		10-30	1000-1200	3.7 GPM Frac	Soft @ 190-195' Gray
	200	220	4:32	5:11	:39	17:50		10-25	900-1200	5.2 GPM	Gray Rock
JC	220	240	12:43	1:18	.35	18.25		15-25	1000-1250	3.4 gPM	Gray Rock ~~[illegible]~~ Sand mix
	240	260	1:50	2:06	.16	18.41		15-25	1100	3.5 gPM	Semi Soft Material Change @ 243' multi color Rock some sand
	260	280	2:31	2:48	.17	18.58		15-25	900-1000	3.45 gPM	Same material Semi soft Frac. 275'
	280	300	3:10	3:27	.17	19.15		15-25	1000	4.5 gPM	Same Material
	300	320	3:51	4:10	.19	19.34		15-25	1000	3.4	Same Material

G.L. 2.87
BHA 23.91

DS16-06
[DS-L]

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	10-21-16	Job #:	4102-0224
Client	Riotinto	Depth in:	20
Hole/Well No.:	DS16-06	Depth out:	120
Location:	Superior AZ	Total hrs:	20.59
Serial No.:	201700	Bit diam.:	10.5

Depth		Time		Elasped Time	Total Hours 19.34	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20									Surface
20	40	8:35	8:53	.18	19.52		15-25	1000-1100		Gray Silty Rock
40	60	9:12	9:30	.18	20.10		15-25	1000-1100	Trace 1 GPM	Gray Silty Sandy Rock 47-50 semi soft
60	80	10:07	10:36	.15	20.25		15-25	1100	6.9	67' got softer Small Frac 74 Small Frac 85
						Rock White Gray Sand mix				Stop 10:20 unplug cyclone Start 10:34
80	100	11:06	11:26	.20	20.45		15-25	1000-1100	7.9	Multicolor Rock + heavy Sand 85-90
100	120	12:56	13:10	.14	20.59		10-15	1100		

8.34 6.-.
22.00 BHA

DS 16-07

National
EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 10-23-16
Client: Rio tinto
Hole/Well No.: DS 16-07
Location: Superior AZ
Serial No.: Starter / 201700

Job #: 402-0224
Depth in: 20'
Depth out: 320
Total hrs: 28.15
Bit diam.: 17" / 10.5

20.59

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20	8:15	9:45	1.5						Starter 17"
20	40	16:40	17:02	.22	.22 21.21		10-15	1000		Dia Base
40	60	17:16	17:59	.43	1.05 22.04		15-20	800		50' got hard grey Cuttings Lime Stone
60	80	18:25	19:10	45	1.50 22.49		15-20	900		~~65~~ fractured softer at 75'
80	100	19:31	20:21	.50	2.40 23.39		15-20	900		Fractured Hard Volcanic Grey
100	120	20:37	20:59	.22	3.02 24.01		15-20	900		105 got brown & Softer 115 more yellowy
JC 120	140	12:36	1:02	.26	24.27		15-25	1000-1100		Brown - multi color Rock
140	160	1:20	1:36	.16	24.43		15-25	1000-1100		Frac. 153' [illegible] Multi color Rock Sand mix
160	180	1:57	2:12	.15	24.58		15-25	900		Brown Material
180	200	2:28	2:47	.19	25.17		15-25	900-1000		Multi color Rock Sand mix - Frac. 190
200	220	3:02	3:20	.18	25.35		15-25	1000-1100		Brown Material Rock Sand mix
220	240	7:05	7:36	.31	26.06		15-25	1000-1100		223' change in Material light gray Rock
										230' Frac.
240	260	7:54	8:27	.33	26.39		15-25	900-1000	Trace	Multi Color Rock Sand mix Brown Material
										increase in Penetration Rate
260	280	8:50	9:11	.21	27.00		15-25	900-1000	16	267 Frac. Multi color Rock
280	300	9:53	10:23	.30	27.30		15-25	1000	55	Multi color Rock Sand mix
300	320	10:45	11:30	.45	28.15		15-25	1000-1100	69	307 Frac.

DS16-08
[DS-I]

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	10/27/16	Job #:	402.0224
Client	Resolution	Depth in:	
Hole/Well No.:	DS-I (DS16-08)	Depth out:	
Location:	Near West Superior Az	Total hrs:	
Serial No.:	10.5"-201700	Bit diam.:	17½" Surface / 10.5" Hammer

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
rface 0	20	815	11:35							
20	40	17:30	18:06	.36	.36		10-15	900		
40	60	18:18	18:52	.34	1.10		10-15	900		
60	80	19:08	19:34	.26	1.36		10-15	1000		at 70' it got softer
80	100	19:46	20:17	.31	2.07		10-15	1000		
100	120	20:25	20:57	.32	2.39		10-15	1000		
120	140	21:14	21:47	.33	3.12		10-15	1000		135' Fractured
140	160	01:31	2:03	32	3:44		10-20	1000-1100		Brown / Redish
160	180	2:20	3:05	45	4:29		10-20	1000-1200		162' Frac (small) Brown
180	200	3:21	4:01	40	5:09		10-20	1000-1100		198' Frac Brown
200	220	4:15	4:47	32	5:41		15-25	1000		Brown
220	240	5:01	5:31	30	6:11		15-250	1000		Brown
240	260	8:52	9:48	57	7:08		15-25	900-1100		Brown / 247'-Redish / Hard again Brown
260	280	10:08	10:39	31	7:39		15-25	900-1100		Brown / 275'-280' Sandy Rock Brown
280	300	10[illegible]	11:30	34	8:13		15-25	900-1100		Redish Brown 297-298' Fractured
300	320	13:00	13:26	26	8:39		10-15	900		303-313' shist
320	340	14:01	14:20	19	8.58		10-15	900		3[illegible]' back into the shist
340	360	20:13	20:46	.33	9.31		10-15	[illegible]	345'	loose Gravel like, Soft
[illegible]	[illegible]	[illegible]							36PM 355'	Came in on me, Not nice zone
360	380	21:44	22:09	.25	9.56		10-15	1100	365'	turn redish 370' Grey 375' harder
380	400	22:36	23:06	.30	10.26		10-15	1100		352-[illegible] Red Grey [illegible]hard

BHA = 22.39
GL = 2.83

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	11-2-16	Job #:	402-0224
Client	Rio tinto	Depth in:	20
Hole/Well No.:	DS16-09	Depth out:	400
Location:	Superior AZ	Total hrs:	7.05
Serial No.:	201700	Bit diam.:	10.5

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20									17" Starter bit Surface
SC 20	40	10:51	11:24	.33	.33		15-25	1100		Semi Hard Dark Brown Rock / Gray Rock
40	60	11:41	12:07	26	:59		15-25	1000		Softer @44' Brown Rock Larger Size
										42' Light gray Hard @50'
MM 60	80	12:22	12:45	:23	1:22		15-30	1000		Soft @77'-80' Gray
80	100	12:56	1:13	:17	1:39		15-30	1000-1100		Gray Cyclone Plugged
100	120	1:52	2:08	:16	1:55		15-30	1000-1100		Soft 113'-115' Gray/Sandy
120	140	2:29	2:44	:15	2:10		15-30	1000-1100		Soft / 135' Brown / 137' Gray
140	160	7:35	7:50	:15	2:25		15-30	1000		Gray
160	180	8:06	8:21	:15	2:40		15-30	1100		Soft @170'-175' Gray
180	200	8:33	8:50	:17	2:57		15-30	1100		Gray
200	220	9:04	9:15	:11	3:08		15-30	1100		Gray Soft & Sandy Cuttings
220	240	9:34	9:46	:12	3:20		15-30	1100		Gray " "
SC 240	260	1:57	2:08	.11	3.31		15-25	1100		bigger Rock at 248' Gray Rock
							/			253' Small Frack
260	280	2:24	2:51	.27	3.58		15-25	900		268' Semi Hard Gray White Rock 270 Multi Color Rock
280	300	3:07	3:37	.30	4.28		15-25	900-1000		285' Hard Multi Color Rock
300	320	3:51	4:31	.40	5.08		15-25	1000-1100		Brown Material Hard Gray White Rock
320	340	4.44	5:10	.26	5.34		15-25	1000		Gray White Rock - mix color Rock
340	360	7:12	7:47	.35	6.09		15-25	1100		Light Gray whit Rock
360	380	9:19	9:48	.29	6.38		15-25	900		Light Gray whit Rock mix
380	400	10:01	10:28	.27	7.05		15-25	1000		Light Gray White Rock Mix

4°

BHA 22.39
G.L 3.27

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	11-8-16	Job #:	402-0224
Client	Riotinto	Depth in:	20'
Hole/Well No.:	Pad H Hole # DS16-10	Depth out:	
Location:	Superior AZ	Total hrs:	cased
Serial No.:	Starter / 201700	Bit diam.:	17"

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20	4:00	2:15		2.15					Surface
20	40	1:23	1:42	.19	.19		10-15	900		
40	60	1:53	2:19	.26	.45		10-15	900		
60	80	2:30	3:03	:33	1.18		10-15	900		
80	100	3:15	3:39	.24	1.42		10-15	900		98' went Grey Fractured Grippy
100	120	3:48	4.15	.27	2.09		10-15	1050		101' back brown
120	140	4:24	4:54	.30	2.39		10-15	1000	Recovery Test	
140	160	8:25	8:53	.28	3.07		10-15	1000		150' fractured to 160'
160	180	9:07	9:33	.26	3.33		10-15	1100		Still fractured
180	200	9:48	10:11	.33	4.06		10-15	1100		Got hard 185' drilling smoothed at 190'
200	220	10:26	10:51	.25	4.31		10-15	1000		
220	240	11:04	11:26	.22	4.53		10-15	1000		Small fractures at 225' & 238'
JC 240	260	2:59	3:25	.26	5.19		10-15	1000		MultiColor Rock sandy mix
260	280	3:39	4:12	.33	5.52		10-15	900		MultiColor Rock Sandy mix Lots of silt
280	300	4:27	4:56	.29	6.21		10-15	1000-1100		" "
300	320	5:08	7:01	.46	7.07		10-15	900		300-305 Multy color Rock Sandy mix 305' Sandy
[illegible]	[illegible]						[illegible]	[illegible]		Stop to change screens out
320	340	7:13	7:48	.35	7.42		10-15	1000		Moderate Hard Sand - Recovery 8:15
340	360	11:25	12:24	.59	8.41		10-15	1000		Sandy
360	380	12:44	1:56	1.12	9.53		10-15	1100		Sand and silt
380	400	2:14	3:04	.50	10.43		10-15	1100		Sand silt like
400	420	3:30	4:19	.49	11.32		10-15	1100-900	.5 to 1	415' Some clay Red cuttings
420	440	4:52	5:38	.44	12.16		10-15	1100		Red fine Sandyish

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 11-10-16
Client: Rio Tinto
Hole/Well No.: DS16-10
Location: Superior AZ
Serial No.: 201700

Job #: 402-0224
Depth in: 20'
Depth out: 540'
Total hrs: 18.26
Bit diam.: 10 ½"

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
440	460	10:49	11:40	.51	13.08		10-15	950	1.09	Brown Rock
JC 460	480	12:37	1:57	1.20	14.28		15-20	900-1000	1.10	Brown Material Sand 474' Some Rock
480	500	2:31	3:53	1.22	15.50		15-25	900-1000	1.11	Redish Rock sand mix mostly sand Hard
										494' [illegible] Change in Rock Multi color
										Rock Sandy
500	520	4:29	5:54	1.25	17.15		15-25	1000-1100	1.13	Redish Sand
520	540	6:25	7:36	1.11	18.26		15-25	1000-1100	1.14	527 Small Frac' Red material

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 11-15-16

Client: Rio Tinto

Hole/Well No.: DS16-11

Location: Resolution

Serial No.: 201700 / 201701

Job #: 402-0224

Depth in: 201700 in 20 out 340 total hours 87.32

Depth ~~out~~: 201701 in 340

Total hrs:

Bit diam.: 10 ½

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20				66.76					
20	40	11:33	23:54	.21	.21		10-15	900		Gila
40	60	0:05	0:31	.26	.47		10-15	900		
60	80	0:43	1:10	.27	1.14		10-15	900		
80	100	1:20	1:56	.36	1.50		10-15	1000		Kind of grippy
100	120	2:08	2:45	.43	2.33		10-15	1000		
120	140	2:58	3:28	.30	3.03		10-15	900		125' ~~[illegible]~~ smoothed out
140	160	6:50	7:19	.29	3.32		10-15	900		Apache Leap tuff
160	180	7:31	8:09	.38	4.10		10-15	1000		fine sand like
180	200	8:23	9:21	.58	5.08		10-15	900		
200	220	9:51	10:52	1.01	6.09		10-15	900		
220	240	11:06	12:12	1:06	7:15		10-15	900		Brown Sandy
240	260	4:08	4:56	:48	8:03		10-20	900-1050		" "
260	280	5:12	5:51	:39	8:42		10-20	900-1000		" "
280	300	6:07	6:58	:51	9:33		10-20	900-1000		" " Harder
300	320	7:16	8:38	1:22	10:55		10-20	900-1100		Alot Harder
320	340	8:52	10:27	1:35	12:30		10-20	1000-1200		Hard Last 1' was grabby but Faster
340	360	5:38	6:22	.44	.44	New Bit	10-15	1000		Apache leap tuff looking
360	380	6:38	7:35	.57	1.11		10-15	900		
380	400	7:55	8:50	.55	2.06		10-15	900		380' Redish mudstone stuff
400	420	9:13	9:50	.37	2.43		10-15	900		
420	440	10:10	10:52	.42	3.25		18	900		
440	460	2:42	3:21	39	4:04		10-20	900-1000		Brown Sandy

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 9/16/16
Client: Resolution
Hole/Well No.: DS16-11
Location:
Serial No.: 201701

Job #: 402.0224
Depth in: 340'
Depth out:
Total hrs:
Bit diam.: 10.5"

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
460	480	3:39	4:25	:46	4:50		10-20	900-1000		Brown Sandy
480	500	4:52	5:50	:58	5:48		10-20	900-1000		" "
500	520	6:09	6:54	:45	6:33		10-20	1000-1100		" "
520	540	7:16	8:01	:45	7:18		10-20	1000-1100		" "
540	560	1:05	2:10	1:05	8:23		10-20	900		" "
560	580	2:39	3:56	1:17	9.40		10-20	900		" "
580	600	4:37	6:47	2:10	11.40		10-20	900		" "
600	620	7:18	9:42	2:24	14.04		10-20	900		" "
620	640	10:14	11:50	1:36	15:40		10-20	900		" "

2.63 = G.L.
22.39 = BHA

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 11-23-16
Client: Riotinto
Hole/Well No.: Pad A - DS16-12
Location: Superior AZ
Serial No.: 201704

Job #: 402-0224
Depth in: 20'
Depth out:
Total hrs:
Bit diam.: 10.5'

15140

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
0	20									Surface
20	40	7:02	7:45	.43	.43		15-25	1100		Brown Material Mainly Sand
40	60	7:59	8:42	.48	1.31		15-25	1100		Brown Material Hard Sand Some Rock
60	80	9:00	10:02	1:02	2:33		15-25	1100		MultiColor Rock Sand Mix Pen. Rate increase
										Large Rock @ 75'
80	100	10:20	11:00	.40	3.13		15-25	900-1000		Brown Material Multi color Rock and Sand Mix
100	120	11:11	11:53	.42	3.55		15-25	1100		Frac: 115 Brown Material
120	140	12:10	12:49	:39	4:34		15-25	1000		Brown
140	160	4:36	5:24	:48	5:22/21:02		15-25	900-1000		Brown
160	180	5:38	6:22	44	21:46		15-25	1000-1100	Trace	Brown - Grey - Brown
180	200	6:46	7:36	.50	22:36		15-25	900-1100	Trace	Brown/Tan Last 1' very Soft
200	220	7:59	8:52	:53	23:29		15-25	900-1100	Trace	Brown 200-208' Fast, 208-220 very Slow
220	240	9:15	10:28	1:13	24:42		15-25	900-1100	Less Than 1	Frac @ 222' Redish & Hard 230' Alot softer
240	260	2:13	3:07	.54	25.36		15-25	1000	1.7	Dark Color Rock
260	280	3:37	4:43	1.06	26.42		15-25	900-1100	1.75	Hard Sandy Rock Dark Brown
280	300	5:17	6:28	1.11	27.53		15-25	1000-1100	1.79	Same Material / Hard Reddish Black Rock
300	320	9:05	9:59	.54	28.47		15-25	900-1100	4.5	Frac 301' Black Red Rock
320	340	12:38	1:56	1:18	30:05		15-25	900-1100		Black w/ Little Red Hard

L = 2.89 32

BHA = 22.39

1015

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 11/22/16
Client: Resolution
Hole/Well No.: DS16-13
Location: Superior AZ
Serial No.: 201701

Job #: 402.0224
Depth in: 21'
Depth out: 408
Total hrs: H 49.15
Bit diam.: 10.5"

30105 Total HRS

Comments

H/T	Depth		Time		~~Total~~	~~Weight on~~			Water	Unload	Drilling	~~Fracturing~~	~~Water~~
	From	To	Start	Stop	Hours	~~Bit~~	Torque	GPM	Temp	Pressure	Pressure	~~1-10~~	~~Level~~
T	0'	20	930	11:53	Surface								
H	20	40	21:00	21:23	:23	30:28	900-1000					Brown	
H	40	60	21:36	2200	:24	30:52	900					Brown	
H	60	80	22:12	2257	:45	31:37	900-1000	1.5				Tan Sandy	Harder
H	80	100	12:37	2:06	1.09	32.46	900-1000	1.7				Hard white	Sandy clay
H	100	120	8:27	9:53	1.26	34.12	1000	1.79				Firm white sandy clay	
H	120	140	12:15	13:26	1:11	34:23	900	2.3				white/Gray sandy clay	
H	140	160	15:18	16:37	1:19	35:42	900	0.3				white/Gray	clay
H	160	180	20:05	21:02	:57	36:39	900-1000	1.5				white/Gray	Redish Tint Clay
H	180	200	1:11	2:00	.49	37.28	1000	1.34		195 change	Redish Sandy Rock	white Sandy Clay	Redish tint
H	200	220	4:30	5:41	1.11	38.39	1000	1.34		Multi Color Rock		Sand mix	
H	220	240	8:04	9:19	1.15	39.54	1000-1100	1.36		Multicolor Rock		Sand mix	
H	240	260	9:55	11:17	1.22	41.16	1100	1.55		Multi Color Rock		Sand mix	Hard
H	260	280	16:18	17.10	.52	42.08	1100	1.99					
H	280	300	17:50	18:31	.41	42.49	1100	1.75					
H	300	320	19:02	19:39	.37	43.26	1100	1.835106	3829787	23			
H	320	340	20:07	20:45	.38	44.04	1100	3.0263157	89473681				
H	340	360	23:20	12:17	.57	45.01	1000	2.90			Heavy	sand	
H	360	380	12:57	2:30	1.33	46.34	1000 1100	25.39		Sand with white Rock chips			Water increase 365
H	380	400	2:57	4:25	1.28	48.02	1000	33.65		Multicolor Rock		Sand mix	
H	400	415	9:45 16:13	16:40	.27		1000	39.00		Stop [illegible]		H/T = Hammer/Tricone	
T	415	435	17:05	18:03	.58	1.25	1200					432 chip color change 435 [illegible]	

JC
MM
JC
355 JC
T 400-416

G.L. 2.87
BHA 19.11

1.22

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 11-30-16
Client: Rio Tinto
Hole/Well No.: PS16-13
Location: Resolution
Serial No.: 06926

Job #: 407-0724
Depth in: 408
Depth out: 540
Total hrs: 6.59
Bit diam.: 9 7/8

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
435	455	18:28	19:32	1:04	2.29		25-35	1200	26.20	[illegible] went brown 448' darker
455	475	20:04	21:26	1:22	3.51		35-40	1200	21.07	
475	495	21:43	22:27	.44	4.35		35-40	1100	21.56	480 conglomerate 481' little return
495	515	22:50	23:45	.55	5.30		35-40	1200	24.79	481 fractured 486 got soft
~~[illegible]~~	~~[illegible]~~									508' went white 511' going brown
515	535	12:17	1:30	1.13	6.43		35-40	1100	–	517 Black Rock / 529' Small Frac
535	540	1:41	1:57	.16	6.59		35-40	1100	28.16	Black Redish Rock Sand mix
										Some white Rock

72.25 = BHA
2-6 = GL

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 12/7/16
Client: Resolution
Hole/Well No.: DS16-14
Location: Superior
Serial No.: 201701 / 06926T 6.59T starting hrs 48:29

Job #: 402.0224
Depth in: 21' / 410'
Depth out:
Total hrs: 73.05 H /
Bit diam.: 10.5 / 9 7/8"

	Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
AR T	0	20	21:30	23:05	1:35		lots	fast	1200		
M H	20'	40	845/9:35	9:00/10:06	:36	49:05		15-20	900		Brown/Multicolor
	40	60	10:18	11:06	:48	49:53		15-20	900		Brown/Multicolor - Redish 55-60'
J	60	80	7:05	7:50	:45	50:38		15-20	900		Brown/multicolor - Br 63'-65'
	80	100	9:50	10:30	:40	51:18		15-20	900		Same broken up
A	100	120	13:34	14:07	:33	51:51		10-15	900		" "
	120	140	16:14	17:07	.53	52:44		10-15	800		" " but a little harder
	140	160	19:08	19:45	.37	53:11		15-20	900		
	160	180	21:40	22:20	.40	53:51		15-20	900		A little broken up
	180	200	00:20	01:00	:40	54:31		15-20	900		" " Air lift - 120
	200	220	02:53	03:43	:50	55:21		15-20	900		" " Air lift - 4:00
	220	240	04:10	04:55	:45	56:06		15-20	900		" " Air lift - 5:10
	240	260	08:22	9:10	:48	56:54		15-20	900		" " 9:30
	260	280	9:40 pm	10:25 pm	:52	57:44		15-20	900		" "
	280	300	08:20	9:45	1:25	59:09		15-20	850		Black Brown Rock 290-300' 2:00
	300	320	02:10	04:30	2:20	61:29		15-20	900		" " 4:40
	320	340	04:50	07:05	2:15	63:42		15-20	800		Black, Brown, White
	340	360	07:30	09:45	2:15	65:57		15-20	850		Black ass rock with white specks.
	360	380	10:15	12:25	2.10	68:07		15-20	900		
	380	388	12:53	1:53	1.00	69:07					
	388	400	19:28	21:15	1.47	70.54		15-20	900		" "
JC	400	415	21:34	23:45	2:11/1:49	73.05/8	17K	15-20	900		" " Tripout Button @ 410 Black Rock
	415	435	2:34	3:44	1.10	9.23	18K	10-20	800-1000		419 Red Rock softer 430 multicolor 433 hard

BHA=77.25
6L=2.6

National
EXPLORATION•WELLS•PUMPS

Bit Run Sheet

Date: 12-13-16
Client: Riotinto
Hole/Well No.: DSI6-1A
Location: Superior
Serial No.: 06926T

Job #: 402-0224
Depth in: 416'
Depth out: 895'
Total hrs: 35.18
Bit diam.: 9 7/8"

9.23

	Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
	435	455	3:54	4:55	1.01	10.29	15-18K	20-30	800-1000		Brown-Mix Color Rock Sand Mix
	455	475	5:04	6:09	1.05	11.29	16-18K	20-30	1000-1200		Black Rock Some Brown Sandy Mix 462 more Black
	475	495	6:23	7:46	1.23	12.52	18-20K	15-25	1000-1100		Black Rock Trace of Red
	495	515	8:00	8:58	.58	13.50	19K	20-30	1000		Black Sandy Rock mix
											Black Brownish Color Rock
JO	515	535	1:00	2:30	1:30	15:20	18K	30	1000-1100		Brown Red Sand
	535	555	2:53	4:06	1:13	16:33	18K	30	1000-1100		" "
	555	575	5:10	6:27	1:17	17:50	18K	30	1000-1100		" "
	575	595	6:39	8:25	1:44	19:34	19K	30	1100		Black & Red Rock
	595	615	8:43	9:38	:55	20:29	19K	30	1100		Redish brown
	615	615	10:09	10:19	:10	20:39	18K	30	1100		" "
	615	635	10:43	12:40	1:57	22:36	18K	30	1100		Multi Color
JC	635	655	4:23	5:14	.51	23.27	15-17K	25-30	1000-1100		Multi Color-Sand Mix & 49 Trace of clay
	655	675	5:31	6:30	.59	24.26	17K	15-30	1100		Brown Black Rock
	675	695	6:45	7:41	.54	25.20	15-17K	25-35	1100		Small Frac 685'-692' White Sandy clay
	695	715	7:55	8:48	.53	26.13	15-16K	30-40	1000-1200		White Sandy Clay
	715	735	9:02	10:00	.58	27.11	15-17K	25-35	1200		White Sandy clay
	735	755	10:15	10:55	.40	27.51	17-18K	25-30	1000-1100		White Sandy clay / Gray White Some Black Rock 754
	755	775	11:09	11:53	.44	28.37	17K	25-35	1100-1200		White Sandy clay / White Rock
JO	775	795	02:22	03:22	1.00	29.37	17-18	35-40	1000-1100		White Sandy Clay / White Rock
	795	815	03:37	04:47	.50	30.27	17-18K	25-35	1000		" " Clay & Sand
	815	835	05:05	06:15	1.10	31.37	19K	25-35	1100		Blackish green Rock
	835	855	06:30	07:40	1.10	32.47	15K	30-40	1200		Grey Clay & Sand
	855	875	07:57	9:14	1.17	34.04	15-17K	30-40	1100-1200		" " "
	875	895	09:40	10:54	1.14	35.18	17K	25-35	1000-1100		875'-880' Clay, Grey rock

48 Rods on track

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 1 18 17
Client: Resolution
Hole/Well No.: DS17-15
Location: Superior AZ
Serial No.: 25172-03-1

Job #: 402.0224
Depth in: 20'
Depth out:
Total hrs: 24.37
Bit diam.: 10 5/8

H/T	Depth		Time		~~Total~~ Hours	~~Weight on Bit~~	Torque	GPM	Water Temp	Unload Pressure	Drilling Pressure	Fracturing 1-10	Water Level
	From	To	Start	Stop									
T	0	20	15:12			Total Hours	900						
H	20	40	05:15	05:53	:38		1000			190	202	3	5:53 – 6:1
H	40	60	06:34	07:20	:46	1:14	900				202	3	
H	60	80	08:00	9:21	1.21	2:35	900				200	3	
H	80	100	12:12	13:38	1.26	4 01	900				200		
H	100	120	15:36	16:58	1.22	5.23	900				220		
H	120	140	19:12	20:44	1.32	6.55	950				220		
H	140	160	22:38	00:38	2.00	8.55	900				248		
H	160	180	2:50	05:28	2:48	11:43	1000				~~248~~ 276		
H	180	200	08:04	10:40	2:36	14:19	1000				270		
H	200	220	12:36	13:27	.51	15.10	1000				298		Red
H	220	240	15:56	16:33	.37	15.47	1100				310		
H	240	260	19:02	19:29	.27	16.14	1100				315		
H	260	280	19:41	20:10	.29	16.43	1100				312		270 white
H	280	300	20:36	21:30	.54	17.39	900				285		290 hard
	300	320	00:30	01:40	1:10	18:49	1000				286		TRC
	320	340	02:04	03:24	1:20	20:09	950				286		
	340	360	03:46	05:10	1:24	21:33	950				282		
	360	380	05:30	06:50	1:20	22:53	950				286		
	380	400	07:15	08:59	1:44	24:37	950				282		

H/T = Hammer/Tricone

2.57 to grd level

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date:	1-20-17	Job #:	402-0224
Client	Rio Tinto	Depth in:	20
Hole/Well No.:	DS17-15	Depth out:	
Location:	Resolution	Total hrs:	
Serial No.:	25172-03-1	Bit diam.:	10 5/8

Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
From	To	Start	Stop							
400	420	12:10	14:17	2.07	26.44		10-20	900		Hard
420	440	14:42	16:22	1.40	28.24		10-20	900		
440	460	16:46	17:32	.46	29.10		10-20	1000		445 got Soft
460	480	17:50	18:41	.51	30.01		10-20	1000		
480	500	19:00	19:57	.57	30.58		10-20	900		
500	520	23:58	01:56	1:58	33.56		10·20	1000		Oxidized 500-510 Fe
520	540	02:38	04:25	1:47	35:43		10·20	1050		
540	560	05:02	07:15	02:13	36:30		10·20	1050		
560	580	08:43	09:51	1.08	37:38		10·20	1000		
580	600	10:20	11:31	1.10	38:48		10·20	1000		
600	620	12:32	14:08	1.36	40.24		10-20	1100		615 tuff
620	640	23:19	24:00	41	41 05		10-20	1100		
640	660	00:38	01:22	.44	41.49		10·20	1000		
660	680	01:54	02:37	.43	42.30		10·20	1000		

BHA = 22.39
ground Level = 2.78

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 1-27-17
Client: Riotinto
Hole/Well No.: DS17-16
Location: Superior AZ
Serial No.: 25172-03-1

Job #: 402-0224
Depth in: 21'
Depth out:
Total hrs: 42.30
Bit diam.: 10 5/8"

	H/T	Depth		Time		Rod Time ~~Total Hours~~	Total hrs ~~Weight on Bit~~	Torque	GPM	Water Temp	Unload Pressure	Drilling Pressure	Comments ~~Fracturing 1-10~~	~~Water Level~~
		From	To	Start	Stop									
	T	0	21'	–	–									
	H	21	40'	2:01	02:34	:33	43:03	900				219	Soft	
	H	40	60	2:56	03:34	:38	43:41	900				222		
	H	60	80	3:50	4:27	37	44:18	900				223	Recover	
	H	80	100	6:57	7:33	:36	44:54	900				223		
	H	100	120	9:53	10:44	:51	45:43	1000				238	It got hard	
JC	H	120	140	1:20	2:41	1:21	47:04	1000				300	Trace of water after Rec Brownish Black Rock Sand	
	H	140	160	5:13	7:03	1:50	48:54	1000-1100				298	Black Rock Some white mix	
	H	160	180	9:38	11:54	2:16	51:10	1100				300	Black Hard Rock	
	H	180	200	2:39	5:15	2:36	53:46	1000-1100				298	Black & hard	
JC	H	200	220	10:42	12:48	2:06	55:52	1000				300	Black Hard Rock	
	H	220	240	5:45	7:42	1:57	57:49	1000-1100				300	Black	Same
	H	240	260	8:00	9:31	1:31	59:20	1000				300	242' Small	Frac. Some Red Same Rock
	H	260	280	9:56	23:58	2:02	61:22	1000-1100				305	* "	
	H	280	300	00:26	02:28	2:02	63:24	11000				305	" "	
	H	300	320	06:16	07:46	1:30	64:54	1100				307	" "	
	H	320	340	08:05	10:24	2:19	67:13	1100				308	" "	
JC	H	340	360	11:03	2:47	3:44	70:57	1000				300	Hard	Same Rock
	H	360	380	3:22/7:38	12:46/1:38	4:14/:53	76:04	1100				302	Reddish Rock	378'
JO	H	380	400	2:11	4:06	1:56	77:59	1000				308	Brownish black	

H/T = Hammer/

Bit st = 4.08

National

EXPLORATION • WELLS • PUMPS

Bit Run Sheet

Date: 1.30.17
Client: Resolution
Hole/Well No.: 05.17.16
Location: Superior AZ.
Serial No.: 25172-03-1 / 1267002

Job #: 402.0224
Depth in: 20' / 502'
Depth out: 10 5/8 502' / 600'
Total hrs: 104.33 / 4.20
Bit diam.: 10 5/8 / 6½"

77:59

	Depth		Time		Elasped Time	Total Hours	Weight on Bit	RPM	Torque	GPM	Comments
	From	To	Start	Stop							
	400	420	4:33	08:03	3.30	81:29		20	1000		Blackish brown
	420	440	08:30	1138 2:16	3.29	84.58		10-15	900	Trace	Same Material
JC	440	460	2:35	7:42	5.07	90.05	Just a Tad Bit	10-15	1000		447 multi color Rock Black Rock very hard
	460	480	8:00	2:22	6.22	96.27		10-15	1000-1100		Black white chips very hard
AR	480	500	2:44	9:05	6.22 1:39	103.28		10-15	1000		Black white chips very hard 7.01 Total Time
JC	500	520	8:00	9:19	2.24	1.19	10-14K	10-15	1000	4.19	508 Formation change - Brown Rock Sand mix
	520	540	9:55	10:58	1.03	2.22	8-10K	25-30	1000	NA	multi Color Rock 529 Gray Rock Multi co. Sand Mix
AR	540	560	0:25	1:05	.40	3.02	6.6 K	30-40	1000		Grey Rock
	560	580	1:25	1:56	.31	3.33	6.6K-8.8	20-25	1000		
	580	600	2:18	3:05	.47	4.20	6.6K	30	1000		595 getting more brown

Appendix C

Lithologic Descriptions for Drill Cuttings

(Photographs for DS17-17 through DS17-19 are included on DVD)

(Montgomery & Associates)

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer & Flooded Reverse tricone / National EWP	LOGGED BY: M. Shelley, M. Zelazny, B. Victor
DEPTH DRILLED / LAND SURFACE ELEVATION: 875.0 feet / 2406.80 feet msl	DATE DRILLED: Sept. 10 - 14, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)36aca / 838446 N / 923210 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; mixed lithology conglomerate with 65% silty sand matrix and 35% clasts of some schist, quartzite, quartz vein, rhyolite, trace chert; poorly sorted, non-plastic; gravel is very fine to very coarse, subangular to subrounded; reaction to acid: strong		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 1.9 cm
10 - 20	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; mixed lithology conglomerate with 60% silty sand matrix and 40% clasts of schist, quartzite, quartz vein; reaction to acid: weak to strong		angular to subrounded chips up to 1.9 cm
20 - 30	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; mixed lithology conglomerate with 60% silty sand matrix and 40% clasts of schist, quartzite, quartz vein, siltstone; reaction to acid: weak		10-3/4-inch hammer; Reverse Circulation; subangular to subrounded chips up to 2 cm
30 - 40	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 65% silty sand matrix and 35% clasts of schist, quartzite, quartz vein, siltstone; reaction to acid: moderate	trace iron oxide staining	subangular to subrounded chips up to 1 cm
40 - 50	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of schist, quartzite, quartz vein, siltstone, trace limestone, trace diabase; reaction to acid: moderate to strong		subangular to subrounded chips up to 1.2 cm
50 - 60	**Tg**	clast-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 65% clasts of schist, quartzite, quartz vein, siltstone, trace diabase and 35% silty sand matrix; reaction to acid: moderate to strong		subangular to subrounded chips up to 0.8 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of schist, quartzite, quartz vein, siltstone; reaction to acid: very weak		subangular to subrounded chips up to 2 cm
70 - 80	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of schist, quartzite, quartz vein, siltstone; reaction to acid: weak		subangular to subrounded chips up to 1 cm
80 - 90	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of schist, quartzite, quartz vein, siltstone, trace limestone, trace diabase; reaction to acid: weak		subangular to subrounded chips up to 1.2 cm
90 - 100	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of schist and quartz vein, quartzite, siltstone, trace limestone, trace diabase; reaction to acid: very weak		angular chips up to 1.4 cm
100 - 110	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of schist, quartzite, siltstone, quartz vein; reaction to acid: moderate		angular chips up to 2 cm
110 - 120	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of schist, quartzite, siltstone and quartz vein, trace limestone, trace tuff; reaction to acid: moderate	very trace iron oxide staining	angular to subangular chips up to 1.4 cm
120 - 130	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 80% silty sand matrix and 20% clasts of schist, quartzite, quartz vein clasts, trace tuff; reaction to acid: none		subangular to subrounded chips up to 1.3 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 80% silty sand matrix and 20% clasts of quartzite, quartz vein clasts, trace tuff, trace diabase, trace schist; reaction to acid: weak		angular chips up to 1.2 cm
140 - 150	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of quartzite, tuff, quartz vein clasts, trace diabase, trace schist; reaction to acid: weak		angular to subangular chips up to 1.4 cm
150 - 160	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, quartz vein, trace tuff, trace diabase, trace schist; reaction to acid: none		angular to subangular chips up to 1.2 cm
160 - 170	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, quartz vein, trace tuff, trace diabase, trace schist; reaction to acid: weak		angular to subangular chips up to 1.2 cm
170 - 180	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately to well lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, quartz vein, trace tuff, trace diabase, trace schist; reaction to acid: very weak		subangular to rounded chips up to 1.5 cm
180 - 190	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 65% silty sand matrix and 35% clasts of quartzite, schist, tuff, quartz vein, trace diabase; reaction to acid: very weak		subangular to subrounded chips up to 1 cm
190 - 200	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, tuff, quartz vein, trace diabase, trace siltstone; reaction to acid: very weak		subangular to subrounded chips up to 2 cm
200 - 210	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, tuff, quartz vein, trace basalt, trace siltstone; reaction to acid: very weak		subangular to rounded chips up to 1 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of quartzite, schist, tuff, rhyolite, quartz vein, trace basalt, trace siltstone; reaction to acid: weak to moderate		angular to subangular chips up to 1 cm
220 - 230	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of quartzite, diabase, tuff, trace schist; reaction to acid: moderate		angular to subangular chips up to 1.7 cm
230 - 240	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately to well lithified; mixed lithology conglomerate with 65% silty sand matrix and 35% clasts of quartzite, diabase, trace limestone, trace basalt, trace schist; reaction to acid: moderate to strong		angular to subangular chips up to 1.2 cm
240 - 250	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% clasts of quartzite, schist, quartz vein, trace diabase, trace basalt; reaction to acid: weak		subangular to subrounded chips up to 1.2 cm
250 - 260	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, quartz vein, trace basalt; reaction to acid: very weak		angular to rounded chips up to 1.2 cm
260 - 270	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, quartz vein, trace basalt, trace tuff; reaction to acid: weak		angular to rounded chips up to 1.2 cm
270 - 280	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 80% silty sand matrix and 20% clasts of quartzite, schist, quartz vein, trace basalt, trace tuff; reaction to acid: very weak		subrounded to rounded chips up to 2 cm
280 - 290	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subrounded to rounded chips up to 2 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
290 - 300	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subangular to subrounded chips up to 1.3 cm
300 - 310	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subangular to subrounded chips up to 1 cm
310 - 320	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 75% silty sand matrix and 25% clasts of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subangular to subrounded chips up to 1 cm
320 - 330	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 70% silty sand matrix, 30% clasts of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subangular to subrounded chips up to 1.5 cm
330 - 340	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; mixed lithology conglomerate with 70% silty sand matrix and 30% chips of quartzite, schist, quartz vein, trace tuff; reaction to acid: weak		subangular to subrounded chips up to 1 cm
Tertiary Sandstone (Gila Group) (Tss)				
340 - 350	**Tss**	sandstone; brown [7.5YR5/4]; very weakly lithified; tuffaceous sandstone; poorly to moderately sorted; muscovite and biotite throughout; reaction to acid: weak		subangular to subrounded chips up to 1.3 cm
350 - 360	**Tss**	sandstone; reddish brown [5YR4/3]; very weakly lithified; tuffaceous sandstone with quartz, biotite, and plagioclase, trace quartzite; poorly to moderately sorted; muscovite and biotite throughout; reaction to acid: very weak	some weathering; some iron oxide staining	subangular to rounded chips up to 0.9 cm
Tertiary Basalt (Gila Group) (Tb)				
360 - 370	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	subangular chips up to 1.2 cm
370 - 380	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	subangular chips up to 0.9 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
380 - 390	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	subangular to subrounded chips up to 1.3 cm
390 - 400	**Tb**	basalt; black [5YR2.5/1]; well lithified; black and dark brown basalt; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	subangular to subrounded chips up to 0.9 cm
400 - 410	**Tb**	basalt; black [5YR2.5/1]; well lithified; black and dark reddish-brown basalt with plagioclase amygdules; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	angular to subrounded chips up to 1 cm
410 - 420	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with plagioclase amygdules; reaction to acid: none	trace calcite on fracture faces; trace iron oxide staining; weathered	angular to subangular chips up to 1.4 cm
420 - 430	**Tb**	basalt; dark reddish brown [5YR3/4]; well lithified; black, brown, and red basalt; reaction to acid: weak	trace calcite on fracture faces; trace iron oxide staining; weathered	angular chips up to 1.5 cm
430 - 440	**Tb**	basalt; dark reddish brown [5YR3/4]; well lithified; black, brown, and red basalt; trace grayish-brown dolomite; reaction to acid: weak	trace calcite on fracture faces; trace iron oxide staining; weathered	angular to subangular chips up to 0.9 cm
MESCAL LIMESTONE (pCmls)				
440 - 450	**pCmls**	dolomite; gray [7.5YR5/1]; well lithified; fine to medium-grained sandy dolomite; reaction to acid: moderate to strong	abundant calcite crystals present on fracture surfaces; trace iron oxide staining	angular to subangular chips up to 1.3 cm; some basalt contamination
450 - 460	**pCmls**	dolomite; brown [7.5YR5/2]; well lithified; fine to medium-grained sandy dolomite; trace fine-grained quartzite; reaction to acid: moderate	trace calcite on fracture surfaces	9-7/8-inch tricone; Flooded Reverse Circulation; angular to subangular chips up to 1.6 cm
460 - 470	**pCmls**	dolomite; brown [7.5YR4/2]; well lithified; fine to medium-grained sandy dolomite; trace fine-grained quartzite; bedding; reaction to acid: weak to moderate	trace iron oxide staining present on grain boundaries; trace calcite on fracture surfaces	angular to subangular chips up to 2.6 cm
470 - 480	**pCmls**	dolomite; brown [7.5YR4/2]; well lithified; fine to medium-grained sandy dolomite; trace fine-grained quartzite; bedding; reaction to acid: moderate to strong	trace iron oxide staining present on grain boundaries; some calcite present on fracture surfaces	angular to subangular chips up to 1.8 cm
480 - 490	**pCmls**	dolomite; dark grayish brown [10YR4/2]; well lithified; Sandy, argillaceous dolomite; trace fine-grained sandstone; bedding; reaction to acid: moderate to strong	some iron oxide staining; some calcite on fracture surfaces	angular to subangular chips up to 2.2 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
490 - 500	**pCmls**	dolomite; brown [10YR5/3]; well lithified; 60% crystalline limestone/dolomite; 40% sandy, argillaceous dolomite; bedding; reaction to acid: moderate	common iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 1.6 cm
500 - 510	**pCmls**	dolomite; dark grayish brown [10YR4/2]; well lithified; 90% sandy, argillaceous dolomite; 10% crystalline limestone/dolomite; bedding; reaction to acid: moderate to strong	trace iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 2.6 cm
510 - 520	**pCmls**	dolomite; dark grayish brown [10YR4/2]; well lithified; sandy, argillaceous dolomite; trace crystalline limestone/dolomite; bedding; reaction to acid: moderate to strong	trace iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 3.0 cm
520 - 530	**pCmls**	dolomite; dark grayish brown [10YR4/2]; well lithified; 90% sandy, argillaceous dolomite; 10% crystalline limestone/dolomite; trace chert; bedding; reaction to acid: strong	common iron oxide staining; some calcite on fracture surfaces	angular to subangular chips up to 2.2 cm
UPPER DRIPPING SPRING QUARTZITE (pCdsu)				
530 - 540	**pCdsu**	quartzite; weak red [10R4/4], light yellowish brown [10YR6/4]; well lithified; red, yellow, and gray medium-grained quartzite; bedding; reaction to acid: weak to strong	abundant iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 1.6 cm
540 - 550	**pCdsu**	quartzite; gray [7.5YR6/1]; well lithified; 75% gray medium-grained quartzite; 25% fine-grained, oxidized quartzite; reaction to acid: weak to moderate	common iron oxide staining; some calcite on fracture surfaces	angular to subangular chips up to 1.3 cm
550 - 560	**pCdsu**	quartzite; weak red [10R4/3]; well lithified; dark gray, yellow, and red fine to coarse-grained quartzite; poorly sorted; common bedding; reaction to acid: none to very weak	abundant iron oxide staining	angular to subangular chips up to 1.6 cm
560 - 570	**pCdsu**	quartzite; weak red [10R4/3]; well lithified; 50% dark gray, yellow, and red fine to coarse-grained quartzite; 50% red, dark gray and some yellow thinly bedded, silty quartzite; common bedding; reaction to acid: none	abundant iron oxide staining	angular to subangular chips up to 1.8 cm
570 - 580	**pCdsu**	quartzite; red [2.5YR4/6]; well lithified; thinly bedded quartzite/siltstone; common bedding; reaction to acid: none	abundant iron oxide staining; some orangish-red clay	angular to subangular chips up to 1.2 cm
580 - 590	**pCdsu**	quartzite; pale red [5R6/2], gray [7.5YR6/1]; well lithified; 75% fine to medium-grained, massive quartzite; 25% thinly bedded quartzite/siltstone; common bedding; reaction to acid: none	abundant iron oxide staining; trace orangish-red clay; trace manganese oxide on fractures; trace white clay	angular to subangular chips up to 1.7 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
590 - 600	**pCdsu**	quartzite; pale red [5R6/2], gray [7.5YR6/1]; well lithified; 75% thinly bedded quartzite/siltstone; 25% fine to medium-grained, massive quartzite; common bedding; reaction to acid: none	abundant iron oxide staining; trace manganese oxide on fractures	angular to subangular chips up to 1.6 cm
600 - 610	**pCdsu**	quartzite; red [2.5YR4/6], gray [7.5YR6/1]; well lithified; 80% fine-grained quartzite; 20% fine to medium-grained, massive quartzite; common bedding; reaction to acid: none	trace orange clay; some iron oxide staining	angular to subangular chips up to 1.3 cm
610 - 620	**pCdsu**	quartzite; light reddish brown [2.5YR6/3]; well lithified; 90% fine-grained quartzite/siltstone; 10% medium-grained quartzite with sugary texture; common bedding; reaction to acid: none	trace orange clay; some iron oxide staining	angular to subangular chips up to 1.6 cm
620 - 630	**pCdsu**	quartzite; reddish brown [2.5YR4/3]; well lithified; 90% fine-grained quartzite/siltstone; 10% medium-grained quartzite with sugary texture; common bedding; reaction to acid: none	trace orange clay; some iron oxide staining	angular to subangular chips up to 1.4 cm
LOWER DRIPPING SPRING QUARTZITE (pCdsl)				
630 - 640	**pCdsl**	quartzite; light reddish brown [2.5YR6/3]; well lithified; 90% medium to coarse-grained quartzite with sugary texture; 10% fine-grained quartzite/siltstone; common bedding; reaction to acid: none	some iron oxide staining; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.7 cm
640 - 650	**pCdsl**	quartzite; light brown [7.5YR6/3]; well lithified; medium to coarse-grained quartzite with sugary texture; trace fine-grained quartzite/siltstone; some bedding; reaction to acid: none	some iron oxide staining on grain boundaries; trace manganese oxide on fracture surfaces	angular to subangular chips up to 2.3 cm
650 - 660	**pCdsl**	quartzite; light brown [7.5YR6/3]; well lithified; medium to coarse-grained, quartzite with sugary texture; trace fine-grained quartzite/siltstone; some bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.8 cm
660 - 670	**pCdsl**	quartzite; light brown [7.5YR6/3]; well lithified; medium to coarse-grained, quartzite with sugary texture; trace fine-grained quartzite/siltstone; trace chert; some bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.4 cm
670 - 680	**pCdsl**	quartzite; light gray [5YR7/1]; well lithified; medium to coarse-grained, quartzite with sugary texture; trace fine-grained quartzite/siltstone; trace chert; some bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide on fracture surfaces	angular to subangular chips up to 2.2 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]

NEAR WEST

PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
PIONEER SHALE (pCp)				
680 - 690	**pCp**	shale; light gray [5YR7/1]; well lithified; 50% medium to coarse-grained quartzite with sugary texture; 50% fine-grained thinly bedded shale; trace fine-grained siltstone/shale; some bedding; reaction to acid: none	some iron oxide staining; trace manganese oxide on fracture surfaces; trace white clay/gouge	angular to subangular chips up to 1.4 cm
690 - 700	**pCp**	shale; pale red [5R6/2]; well lithified; 90% fine-grained, thinly bedded shale; 10% fine to medium-grained, massive quartzite; common bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide on fracture surfaces; trace yellow clay/gouge	angular to subangular chips up to 1.5 cm
700 - 710	**pCp**	shale; pale red [5R6/2]; well lithified; 90% fine-grained, thinly bedded shale; 10% fine to medium-grained, massive quartzite; common bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide on fracture surfaces; common white clay/gouge	angular to subangular chips up to 1.8 cm
710 - 720	**pCp**	shale; pale red [5R6/2]; well lithified; 50% medium-grained quartzite; 50% thinly bedded shale; common bedding; reaction to acid: none	common iron oxide staining; common white clay/gouge	angular to subangular chips up to 2.0 cm
720 - 730	**pCp**	shale; light brown [7.5YR6/3]; well lithified; 50% medium-grained quartzite; 50% thinly bedded quartzite/siltstone; common bedding; reaction to acid: none	common iron oxide staining; some manganese oxide staining on fracture surfaces; some yellow clay	angular to subangular chips up to 1.4 cm
730 - 740	**pCp**	shale; brown [7.5YR5/2]; well lithified; 90% thinly bedded quartzite/siltstone; 10% fine to medium-grained quartzite; common bedding; reaction to acid: none	common iron oxide staining; common manganese oxide staining on fracture surfaces; some yellowish-white clay	angular to subangular chips up to 1.6 cm
740 - 750	**pCp**	shale; brown [7.5YR5/2]; well lithified; 70% thinly bedded shale; 30% fine to medium-grained quartzite; common bedding; reaction to acid: none	common iron oxide staining; some manganese oxide staining on fracture surfaces; trace white clay	angular to subangular chips up to 2.1 cm
750 - 760	**pCp**	shale; yellowish brown [10YR5/4]; well lithified; fine-grained, thinly bedded siltstone/shale; trace black quartzite; common bedding; reaction to acid: none	common iron oxide staining; some manganese oxide staining on fracture surfaces	angular to subangular chips up to 2.2 cm
760 - 770	**pCp**	shale; yellowish brown [10YR5/4]; well lithified; fine-grained, thinly bedded siltstone/shale; trace black quartzite; common bedding; reaction to acid: none	common iron oxide staining; some manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.8 cm
770 - 780	**pCp**	shale; dark grayish brown [10YR4/2]; well lithified; 90% sandy quartzite; 5% fine-grained, thinly bedded siltstone/shale; 5% coarse-grained quartzite; common bedding; reaction to acid: none to very weak	common iron oxide staining; some manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.5 cm

C-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-01 [*55-919892*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
780 - 790	**pCp**	shale; dark grayish brown [10YR4/2]; well lithified; 90% fine-grained, thinly bedded siltstone/shale; 10% fine to medium-grained quartzite; common bedding; reaction to acid: none to very weak	trace iron oxide staining; trace manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.4 cm
790 - 800	**pCp**	shale; dark grayish brown [10YR4/2]; well lithified; 80% fine-grained, thinly bedded siltstone/shale; 10% fine to medium-grained quartzite; 10% medium to coarse-grained, massive sandstone; common bedding; reaction to acid: none to moderate	trace iron oxide staining; trace manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.7 cm
800 - 810	**pCp**	shale; dark grayish brown [10YR4/2]; well lithified; 80% fine-grained, thinly bedded siltstone/shale; 20% medium-grained quartzite; common bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.8 cm
810 - 820	**pCp**	shale; dusky red [2.5YR3/2]; well lithified; 70% medium to coarse-grained quartzite; 30% fine-grained, thinly bedded siltstone/shale; common bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide staining on fracture surfaces	angular to subangular chips up to 1.5 cm
820 - 830	**pCp**	shale; dusky red [2.5YR3/2]; well lithified; 80% medium-grained quartzite; 20% fine-grained, thinly bedded siltstone/shale; common bedding; reaction to acid: none	trace iron oxide staining; trace manganese oxide staining on fracture surfaces; some sandy clay	angular to subangular chips up to 1.3 cm
PRECAMBRIAN DIABASE (pCdiab)				
830 - 840	**pCdiab**	diabase; dark reddish gray [2.5YR3/1]; well lithified; 70% medium-grained quartzite; 30% weathered diabase; some bedding; reaction to acid: none	common iron oxide staining; trace manganese oxide staining on fracture surfaces; trace sandy clay; trace calcite crystals	angular to subangular chips up to 1.7 cm
840 - 850	**pCdiab**	diabase; dark reddish gray [2.5YR3/1]; well lithified; weathered diabase; reaction to acid: none	common iron oxide staining; trace calcite crystals	angular to subangular chips up to 1.6 cm
850 - 860	**pCdiab**	diabase; dark reddish gray [2.5YR3/1]; well lithified; weathered diabase; reaction to acid: none	common iron oxide staining; trace calcite crystals	angular to subangular chips up to 1.8 cm
860 - 875	**pCdiab**	diabase; dark reddish gray [2.5YR3/1]; well lithified; weathered diabase; reaction to acid: none	common iron oxide staining; trace calcite crystals	angular to subangular chips up to 1.8 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP
LOGGED BY: C. Gregory, M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 500.0 feet / 2487.84 feet msl
DATE DRILLED: Sept. 19 - 21, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)26dba / 842613 N / 918066 E
NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, tuff, trace diabase; reaction to acid: very weak	light weathering	17-1/2-inch tricone; Conventional Air Rotary; subangular to subrounded chips up to 4.0 cm
10 - 20	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, less tuff, trace diabase, trace calcite; reaction to acid: weak		subangular to subrounded chips up to 3.2 cm
20 - 30	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 65% silty sand matrix and 35% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, trace calcite; reaction to acid: moderate		10-3/4-inch hammer; Reverse Circulation; angular to subrounded chips up to 2.7 cm
30 - 40	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, trace calcite; reaction to acid: moderate		subangular to subrounded chips up to 2.0 cm
40 - 50	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of more schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, trace calcite; reaction to acid: moderate		subangular to subrounded chips up to 1.8 cm
50 - 60	**Tg**	matrix-supported conglomerate; reddish brown [5YR5/4]; moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, very trace calcite; reaction to acid: moderate		angular to subrounded chips up to 1.8 cm
60 - 70	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, very trace calcite; reaction to acid: moderate		angular to subrounded chips up to 1.7 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
70 - 80	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, very trace calcite; reaction to acid: weak		subangular to subrounded chips up to 2.0 cm
80 - 90	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase, very trace calcite; reaction to acid: weak		angular to subrounded chips up to 1.6 cm
90 - 100	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately to well lithified; 75% silty sand matrix and 25% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase; minor iron oxide staining on quartzite; reaction to acid: weak	very trace calcite	subangular to subrounded chips up to 1.4 cm
100 - 110	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately to well lithified; 65% silty sand matrix and 35% clasts of schist, quartz vein, sandstone, siltstone, tuff, basalt, trace diabase; minor iron oxide staining on quartzite; reaction to acid: weak to moderate	very trace calcite	angular to subrounded chips up to 1.5 cm
110 - 120	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately to well lithified; 65% silty sand matrix and 35% clasts of schist, quartz vein, sandstone, more siltstone, tuff, basalt, trace diabase, trace fine-grained sandstone, very trace calcite; reaction to acid: moderate	minor iron oxide staining; very trace calcite	angular to subrounded chips up to 1.8 cm
120 - 130	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 65% silty sand matrix and 35% clasts of schist, quartzite, siltstone, tuff, basalt, diabase; minor iron oxide staining on quartzite; reaction to acid: very weak		subangular to subrounded chips up to 2.0 cm
130 - 140	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately to well lithified; 65% silty sand matrix and 35% clasts of schist, quartzite, siltstone, tuff, basalt, diabase; minor iron oxide staining on quartzite; reaction to acid: moderate		subangular to subrounded chips up to 1.8 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
140 - 150	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately to well lithified; 75% silty sand matrix and 25% clasts of schist, quartzite, siltstone, tuff, basalt, diabase; minor iron oxide staining on quartzite; reaction to acid: weak to moderate		angular to subrounded chips up to 2.0 cm
150 - 160	**Tg**	matrix-supported conglomerate; reddish brown [5YR5/4]; moderately lithified; 65% silty sand matrix and 35% clasts of schist, quartzite, siltstone, tuff, more basalt, diabase, trace milky quartzite; minor iron oxide staining on quartzite; reaction to acid: moderate to strong		subangular to subrounded chips up to 1.2 cm
160 - 170	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartzite, siltstone, tuff, more basalt, diabase, trace milky quartzite; minor iron oxide staining on quartzite; reaction to acid: moderate		angular to subrounded chips up to 2.0 cm
170 - 180	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 75% silty sand matrix and 25% clasts of schist, quartzite, siltstone, more tuff, more basalt, diabase, trace milky quartzite; minor iron oxide staining on quartzite; reaction to acid: moderate		angular to subrounded chips up to 2.0 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
180 - 190	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: very weak	trace iron oxide staining	angular to subangular chips up to 0.9 cm
190 - 200	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: very weak	trace iron oxide staining	angular to subangular chips up to 0.8 cm
200 - 210	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: very weak	trace iron oxide staining	angular to subangular chips up to 0.8 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: none	minor iron oxide staining	angular to subangular chips up to 1.5 cm
220 - 230	**Talg**	Gray Unit; pinkish gray [5YR7/2]; very weakly to weakly lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: none	minor iron oxide staining	angular to subangular chips up to 1.1 cm
230 - 240	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; weakly welded; reaction to acid: none	minor iron oxide staining	angular to subangular chips up to 1.2 cm
240 - 250	**Talg**	Gray Unit; pinkish gray [7.5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: none	trace calcite	angular to subangular chips up to 0.8 cm
250 - 260	**Talg**	Gray Unit; pinkish gray [7.5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak		angular to subangular chips up to 0.6 cm
260 - 270	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak	very trace calcite	angular to subangular chips up to 0.6 cm
270 - 280	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.0 cm
280 - 290	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak	very trace calcite	angular to subangular chips up to 1.4 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
290 - 300	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.1 cm
300 - 310	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: very weak		angular to subangular chips up to 0.9 cm
310 - 320	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 0.7 cm
320 - 330	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak		angular to subangular chips up to 0.5 cm
330 - 340	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak		angular to subangular chips up to 0.5 cm
340 - 350	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none		angular to subangular chips up to 1.2 cm
350 - 360	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	trace calcite	angular to subangular chips up to 0.7 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
360 - 370	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace calcite	angular to subangular chips up to 0.6 cm
370 - 380	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to weak	trace calcite	angular to subangular chips up to 1.3 cm
380 - 390	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to weak	trace calcite	angular to subangular chips up to 0.4 cm
390 - 400	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite, very trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	trace calcite	angular to subangular chips up to 0.4 cm
400 - 410	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite, very trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace calcite	angular to subangular chips up to 0.7 cm
410 - 420	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately lithified; dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite, very trace lithic fragments; weakly to moderately welded; reaction to acid: none	very trace calcite	angular to subangular chips up to 0.5 cm

C-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-02 [*55-919893*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
420 - 430	**Talg**	Gray Unit; red [2.5YR5/6]; moderately lithified; 50% dacite tuff with pink to whitish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite, very trace lithic fragments; 50% dacite tuff with orangish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; weakly to moderately welded; reaction to acid: none	trace quartz vein	angular to subangular chips up to 0.9 cm
430 - 440	**Talg**	Gray Unit; reddish brown [2.5YR5/4], red [2.5YR5/6]; moderately lithified; mostly tuff dacite tuff with whitish-pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; some orangish-brown and gray tuff; weakly to moderately welded; reaction to acid: none	trace quartz vein	angular to subangular chips up to 1.3 cm
PINAL SCHIST (pCpi)				
440 - 450	**pCpi**	schist; dark greenish gray [5BG4/1], reddish brown [2.5YR5/4]; moderately lithified; 60% dark greenish-gray and reddish-purple, phyllitic schist; 40% dacite tuff with whitish-pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; weakly to moderately welded; reaction to acid: none	trace quartz vein; some whitish-gray clay gouge	angular to subangular chips up to 0.8 cm
450 - 460	**pCpi**	schist; dark greenish gray [5BG4/1]; moderately lithified; dark greenish-gray and reddish-purple, phyllitic schist; reaction to acid: none	trace quartz vein; trace whitish-gray clay gouge	angular to subangular chips up to 2.1 cm
460 - 470	**pCpi**	schist; dark greenish gray [5BG4/1]; moderately lithified; mostly dark greenish-gray, phyllitic schist; trace purple schist; reaction to acid: none	some quartz veins	angular to subangular chips up to 1.3 cm
470 - 480	**pCpi**	schist; dark greenish gray [5BG4/1]; moderately lithified; mostly dark greenish-gray, phyllitic schist; trace purple schist; reaction to acid: none	some quartz vein; trace whitish-gray clay gouge	angular to subangular chips up to 1.2 cm
480 - 490	**pCpi**	schist; dark greenish gray [5BG4/1]; moderately lithified; mostly dark greenish-gray, phyllitic schist; trace purple schist; reaction to acid: none	some quartz veins	angular to subangular chips up to 1.7 cm
490 - 500	**pCpi**	schist; dark greenish gray [5BG4/1]; moderately lithified; mostly dark greenish-gray, phyllitic schist; trace purple schist; reaction to acid: none	some quartz veins	angular to subangular chips up to 1.7 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer & Flooded Reverse tricone / National EWP	LOGGED BY: M. Shelley, B. Victor
DEPTH DRILLED / LAND SURFACE ELEVATION: 715.0 feet / 2496.45 feet msl	DATE DRILLED: Sept. 26 - Oct. 4, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-12)30bca / 843649 N / 926185 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 60% sandy, silty matrix and 40% clasts of quartzite, diabase, schist, tuff, trace quartz vein; reaction to acid: weak		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 0.9 cm
10 - 20	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 60% sandy, silty matrix and 40% clasts of quartzite, diabase, schist, tuff, trace quartz vein; reaction to acid: weak		angular to subrounded chips up to 1.3 cm
20 - 30	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/3]; moderately lithified; 55% silty, sandy matrix and 45% clasts of quartzite, diabase, schist, trace tuff, trace quartz vein; reaction to acid: very weak		10-3/4-inch hammer; Reverse Circulation; angular to rounded chips up to 2.1 cm
30 - 40	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/3]; moderately lithified; 65% silty, sandy matrix and 35% clasts of quartzite, diabase, schist, trace limestone, trace quartz vein; reaction to acid: moderate		angular to subrounded chips up to 1.4 cm
40 - 50	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/3]; moderately lithified; 60% silty, sandy matrix and 40% clasts of quartzite, diabase, schist, trace basalt, chert, trace quartz vein; reaction to acid: weak to moderate		angular to subrounded chips up to 1.6 cm
50 - 60	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately lithified; 60% silty, sandy matrix and 40% clasts of quartzite, diabase, schist, trace basalt, trace chert, trace quartz vein; reaction to acid: weak		angular to subrounded chips up to 1.7 cm
60 - 70	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately lithified; 70% silty, sandy matrix and 30% clasts of quartzite, diabase, schist, trace basalt, trace limestone, trace chert, trace quartz vein; reaction to acid: moderate		angular to subrounded chips up to 1.5 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
70 - 80	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately lithified; 70% silty, sandy matrix and 30% clasts of quartzite, diabase, schist, trace basalt, trace limestone, trace chert, trace quartz vein; reaction to acid: weak to moderate		angular to subrounded chips up to 0.8 cm
80 - 90	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately to well lithified; 75% silty, sandy matrix and 25% clasts of schist, quartzite, diabase, trace basalt, trace limestone, trace chert, trace quartz vein; cementation coating on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.7 cm
90 - 100	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately to well lithified; 75% silty, sandy matrix and 25% clasts of schist, quartzite, diabase, trace basalt, trace limestone, trace chert, trace quartz vein; cementation coating on clasts; reaction to acid: weak		angular to subrounded chips up to 2.2 cm
100 - 110	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately to well lithified; 80% silty, sandy matrix and 20% clasts of quartzite, schist, diabase, tuff, trace limestone, trace quartz vein; cementation coating on clasts; reaction to acid: weak to moderate		angular to subangular chips up to 2.6 cm
110 - 120	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/3]; moderately to well lithified; 80% silty, sandy matrix and 20% clasts of quartzite, schist, diabase, tuff, trace limestone, trace quartz vein; cementation coating on clasts; reaction to acid: weak		angular to subangular chips up to 1.8 cm
PICKETPOST MOUNTAIN FELSIC LAVA FLOWS PERLITE (Tfp)				
120 - 130	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; felsic, amorphous perlite; striations; reaction to acid: none to weak	trace calcite	9-7/8-inch tricone; Flooded Reverse Circulation; angular to subangular chips up to 2.5 cm
130 - 140	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; felsic, amorphous perlite; striations; reaction to acid: none to weak	trace calcite	angular to subangular chips up to 2.4 cm
140 - 150	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; striations; reaction to acid: none		angular to subangular chips up to 0.6 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
150 - 160	**Tfp**	perlite; pinkish gray [5YR7/2]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; striations; reaction to acid: none to weak		angular to subangular chips up to 1.2 cm
160 - 170	**Tfp**	perlite; pinkish gray [5YR7/2]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; striations; reaction to acid: none		angular to subangular chips up to 1.5 cm
170 - 180	**Tfp**	perlite; pinkish gray [5YR7/2]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; striations; reaction to acid: none		angular to subangular chips up to 0.9 cm
180 - 190	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; striations; reaction to acid: none		angular to subangular chips up to 1.8 cm
190 - 200	**Tfp**	perlite; white [5Y8/1], reddish gray [5YR5/2]; moderately lithified; felsic volcanic, glassy, crystalline perlite; trace rhyolite; trace white chalky clay; color has more light/dark contrast; striations/banding; some dense silica; reaction to acid: none	some white clay alterations	angular to subangular chips up to 1.9 cm
200 - 210	**Tfp**	perlite; white [5Y8/1], reddish gray [5YR5/2]; weakly to moderately lithified; felsic volcanic, perlite; some microcrystalline rhyolite; trace quartz veins; some glassy texture; some striations; concoidal fracturing of lithic fragments; reaction to acid: none to weak	some white alterations; weathered; quartz fracture filling	angular to subangular chips up to 2.0 cm
210 - 220	**Tfp**	perlite; white [5Y8/1], reddish gray [5YR5/2]; weakly to moderately lithified; felsic volcanic, pinkish-gray and white quartz-rich perlite; more lithic fragments (rhyolite); some glassy texture; concoidal fracturing of lithic fragments; some banding; reaction to acid: none to weak	quartz veins	angular to subangular chips up to 1.5 cm
220 - 230	**Tfp**	perlite; white [5Y8/1], reddish gray [5YR5/2]; moderately lithified; felsic volcanic, pinkish-gray and white quartz-rich perlite; more lithic fragments (rhyolite); some glassy texture; concoidal fracturing of lithic fragments; some banding; reaction to acid: none	quartz veins	angular to subangular chips up to 1.5 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
230 - 240	**Tfp**	perlite; white [5Y8/1], reddish gray [5YR5/2]; moderately lithified; felsic volcanic, mostly pinkish-gray and some white quartz-rich perlite; more lithic fragments (rhyolite); some glassy texture; concoidal fracturing of lithic fragments; some banding; reaction to acid: none	quartz veins	angular to subangular chips up to 1.5 cm
240 - 250	**Tfp**	perlite; reddish gray [5YR5/2], white [5Y8/1]; moderately lithified; felsic volcanic, mostly pinkish-gray and some white crystalline to amorphous quartz-rich perlite; microcrystalline volcanic lithics; some glassy perlitic texture; some banding of lithics; concoidal fracturing of lithics; reaction to acid: none	quartz veins	angular to subangular chips up to 2.2 cm
250 - 260	**Tfp**	perlite; reddish gray [5YR5/2], white [5Y8/1]; moderately lithified; 70% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 30% reddish-gray, microcrystalline volcanic lithic; some glassy perlitic textures; some banding of lithics; striations; concoidal fracturing of lithics; reaction to acid: none	quartz veins; trace greenish-white alteration with dendritic pattern	angular to subangular chips up to 1.5 cm
260 - 270	**Tfp**	perlite; reddish brown [5YR5/3], reddish gray [5YR5/2], light gray [5Y7/1]; moderately lithified; 70% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 30% reddish-gray, microcrystalline volcanic lithics; some glassy perlitic texture; some banding of lithics; striations; concoidal fracturing of lithics; reaction to acid: none	quartz veins; trace greenish-white alteration with dendritic pattern; trace chalky white alteration	angular to subangular chips up to 1.2 cm
270 - 280	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; 70% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 30% reddish-gray, microcrystalline volcanic lithics; predominately glassy perlitic texture; some banding of lithics; striations; concoidal fracturing on lithics; reaction to acid: none		angular to subangular chips up to 1.7 cm
280 - 290	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; 70% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 30% reddish-gray, microcrystalline volcanic lithics; predominately glassy perlitic textures; some banding of lithics; striations; concoidal fracturing on lithics; reaction to acid: none to weak	trace calcite; weathered vitrics	angular to subangular chips up to 1.7 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
290 - 300	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; 70% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 30% reddish-gray, microcrystalline volcanic lithics; predominately glassy perlitic textures; some banding of lithics; striations; concoidal fracturing on lithics; reaction to acid: none to weak	trace calcite; weathered vitrics	angular to subangular chips up to 0.5 cm
300 - 310	**Tfp**	perlite; light gray [5YR7/1]; moderately lithified; 80% felsic volcanic, white crystalline to amorphous quartz-rich perlite; 20% reddish-brown, microcrystalline volcanic lithics; predominately glassy perlitic textures; some dark gray vitric fragments; some banding of lithics; some glassy texture; striations; concoidal fracturing on lithics; reaction to acid: none to weak	trace calcite; weathered vitrics	angular to subangular chips up to 1.2 cm
310 - 320	**Tfp**	perlite; light gray [5YR7/1], reddish brown [5YR5/3]; moderately lithified; 70% felsic volcanic, light gray to white crystalline to amorphous quartz-rich perlite; 30% reddish-brown, microcrystalline rhyolite tuff; predominately glassy perlitic textures; some dark gray vitric fragments; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	trace calcite	angular to subangular chips up to 1.4 cm
320 - 330	**Tfp**	perlite; light gray [5YR7/1], reddish brown [5YR5/3]; moderately lithified; 70% felsic volcanic, light gray to white crystalline to amorphous quartz-rich perlite; 30% reddish-brown, microcrystalline rhyolite tuff; predominately glassy perlitic textures; some dark gray vitric fragments; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	trace calcite	angular to subangular chips up to 0.5 cm
330 - 340	**Tfp**	perlite; light gray [5YR7/1], reddish brown [5YR5/3]; moderately lithified; 70% felsic volcanic, light gray to white crystalline to amorphous quartz-rich perlite; 20% reddish-brown, microcrystalline rhyolite tuff; 10% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering; trace calcite	angular to subangular chips up to 1.3 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]

NEAR WEST

PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
340 - 350	**Tfp**	perlite; light gray [5YR7/1], reddish brown [5YR5/3]; moderately lithified; 70% felsic volcanic, light gray to white crystalline to amorphous quartz-rich perlite; 20% reddish-gray and brown, microcrystalline rhyolite tuff; 10% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering; trace calcite	angular to subangular chips up to 1.2 cm
350 - 360	**Tfp**	perlite; light gray [5YR7/1], reddish brown [5YR5/3]; moderately lithified; 70% felsic volcanic, gray to white crystalline to amorphous quartz-rich perlite; 20% reddish-gray and brown, microcrystalline rhyolite tuff; 10% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering to chalky texture; trace calcite	angular to subangular chips up to 1.6 cm
360 - 370	**Tfp**	perlite; gray [5YR5/1], reddish brown [5YR4/4]; moderately lithified; 70% felsic volcanic, gray to white crystalline to amorphous quartz-rich perlite; 15% reddish-gray and brown, microcrystalline volcanic rhyolite tuff; 15% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering to chalky texture; trace calcite	angular to subangular chips up to 1.5 cm
370 - 380	**Tfp**	perlite; gray [5YR5/1], reddish brown [5YR4/4]; moderately lithified; 70% felsic volcanic, gray to white crystalline to amorphous quartz-rich perlite; 15% reddish-gray and brown, microcrystalline rhyolite tuff; 15% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering to chalky texture; trace calcite	angular to subangular chips up to 1.4 cm
380 - 390	**Tfp**	perlite; gray [5YR5/1], reddish brown [5YR4/4]; moderately lithified; 50% felsic volcanic, gray to white crystalline to amorphous quartz-rich perlite; 30% reddish-gray and brown, microcrystalline rhyolite tuff; 20% dark gray vitric fragments; predominately glassy perlitic textures; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering to chalky texture; trace calcite	angular to subangular chips up to 1.7 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
390 - 400	**Tfp**	perlite; gray [5YR5/1], reddish brown [5YR4/4]; moderately lithified; 50% felsic volcanic, gray to white crystalline to amorphous quartz-rich perlite; 30% reddish-gray and brown, microcrystalline volcanic rhyolite tuff; predominately glassy perlitic textures; 20% dark gray vitric fragments; striations on glass; some banding on lithics; concoidal fracturing on lithics; reaction to acid: none to weak	weathering to chalky texture; trace calcite	angular to subangular chips up to 2.3 cm
PICKETPOST MOUNTAIN FELSIC LAVA FLOWS RHYOLITE (Tfp)				
400 - 410	**Tfp**	rhyolite; light reddish brown [2.5YR6/3]; moderately to very well lithified; aphanitic, felsic rhyolite; some volcanic breccia; reaction to acid: none		angular chips up to 1.4 cm
410 - 420	**Tfp**	rhyolite; reddish brown [2.5YR5/4]; moderately to very well lithified; aphanitic, felsic rhyolite; some volcanic breccia; reaction to acid: none		angular chips up to 2.0 cm
420 - 430	**Tfp**	rhyolite; reddish brown [2.5YR5/4]; moderately to very well lithified; rhyolite with aphanitic to crystalline groundmass and phenocrysts of quartz, biotite, hornblende; reaction to acid: none		angular chips up to 1.9 cm
430 - 440	**Tfp**	rhyolite; pale red [10R7/3]; moderately lithified; rhyolite with aphanitic to crystalline groundmass and phenocrysts of quartz, biotite, hornblende; striations on some phenocrysts; reaction to acid: none		angular to subangular chips up to 1.5 cm
440 - 450	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, biotite, hornblende; minor mafic volcanic clasts; reaction to acid: none		angular to subangular chips up to 1.6 cm
450 - 460	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, biotite, hornblende; minor mafic volcanic clasts; reaction to acid: none		angular to subangular chips up to 2.0 cm
460 - 470	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.0 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
470 - 480	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.0 cm
480 - 490	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.0 cm
490 - 500	**Tfp**	rhyolite; light gray [5Y7/1], pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, feldspar, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.8 cm
500 - 510	**Tfp**	rhyolite; light gray [5Y7/1]; moderately lithified; tuffaceous/pumiceous rhyolite with fewer phenocrysts of quartz, feldspar, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 1.6 cm
510 - 520	**Tfp**	rhyolite; light gray [5Y7/1]; moderately lithified; tuffaceous/pumiceous rhyolite with phenocrysts of quartz, feldspar, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.1 cm
520 - 530	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with fine phenocrysts of quartz, feldspar, biotite, hornblende; reaction to acid: none		angular to subangular chips up to 2.2 cm
530 - 540	**Tfp**	rhyolite; pinkish gray [5YR7/2]; moderately lithified; tuffaceous/pumiceous rhyolite with fine phenocrysts of quartz, feldspar, biotite, hornblende; reaction to acid: none to weak	siliceous fracture void filling matrix; some with dark inclusions; rare basaltic xenolith	angular to subangular chips up to 1.6 cm
540 - 550	**Tfp**	rhyolite; pink [5YR8/3]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; reaction to acid: none	less fracture void filling material; rare basaltic xenolith	angular to subangular chips up to 1.6 cm
550 - 560	**Tfp**	rhyolite; pink [5YR8/3]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; reaction to acid: none	some siliceous fracture fill	angular to subangular chips up to 2.0 cm
560 - 570	**Tfp**	rhyolite; pink [5YR8/3]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; reaction to acid: none	more abundant siliceous fracture fill	angular to subangular chips up to 1.8 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
570 - 580	**Tfp**	rhyolite; pink [5YR8/3]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; reaction to acid: none	some siliceous fracture fill	angular to subangular chips up to 2.5 cm
580 - 590	**Tfp**	rhyolite; pinkish white [5YR8/2]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; some ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; reaction to acid: none	some siliceous fracture fill	angular to subangular chips up to 2.3 cm
590 - 600	**Tfp**	rhyolite; light gray [5Y7/2]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; some ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; some lithic fragments; reaction to acid: none	sandy, siliceous fracture fill	angular to subangular chips up to 2.5 cm
600 - 610	**Tfp**	rhyolite; pale yellow [5Y7/3]; moderately lithified; massive alkali feldspar rhyolite with crystalline groundmass and trace phenocrysts of biotite, hornblende; some ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; some lithic fragments; reaction to acid: none	sandy, siliceous fracture fill	angular to subangular chips up to 1.5 cm
PICKETPOST MOUNTAIN FELSIC TUFFS ASHFLOW TUFF (Tfpt)				
610 - 620	**Tfpt**	ashflow tuff; pale yellow [5Y7/3]; moderately lithified; ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; some lithic fragments; reaction to acid: none	sandy, siliceous fracture fill	angular to subangular chips up to 2.5 cm
620 - 630	**Tfpt**	ashflow tuff; pale yellow [5Y7/3]; moderately lithified; ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; some lithic fragments; reaction to acid: none	sandy, siliceous fracture fill	angular to subangular chips up to 2.0 cm
630 - 640	**Tfpt**	ashflow tuff; pinkish white [5YR8/2]; moderately to well lithified; ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; some lithic fragments; reaction to acid: none to weak	weathering of biotite phenocrysts; very trace calcite veins	subangular chips up to 1.7 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
640 - 650	**Tfpt**	ashflow tuff; very pale brown [10YR8/2]; moderately to well lithified; ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 10% lithic fragments; trace pink, aphanitic tuff; reaction to acid: none	weathering of biotite phenocrysts	subangular chips up to 1.6 cm
650 - 660	**Tfpt**	ashflow tuff; very pale brown [10YR8/2]; moderately to well lithified; ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 20% lithic fragments; trace pink, aphanitic tuff; reaction to acid: none	weathering of biotite phenocrysts	subangular chips up to 2.0 cm
660 - 670	**Tfpt**	ashflow tuff; light reddish brown [2.5YR7/3]; moderately to well lithified; 60% ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 40% pink, porphyritic tuff with aphanitic groundmass and phenocrysts of plagioclase, quartz and biotite; lithic fragments; reaction to acid: none	weathering of biotite phenocrysts	angular to subangular chips up to 2.4 cm
PICKETPOST MOUNTAIN FELSIC TUFFS (Tfpt)				
670 - 680	**Tfpt**	tuff; very pale brown [10YR8/2], very dark gray [5YR3/1]; moderately to well lithified; 50% ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 50% lithic fragments of schist, diabase, quartzite; reaction to acid: none to weak	weathering of biotite phenocrysts; very trace calcite veins	angular to subangular chips up to 2.5 cm
680 - 690	**Tfpt**	tuff; pinkish gray [5YR7/2]; moderately to well lithified; 90% porphyritic tuff with pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; 5% ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 5% lithic fragments; reaction to acid: none		angular to subangular chips up to 1.8 cm
690 - 700	**Tfpt**	tuff; pinkish gray [5YR7/2], very pale brown [10YR8/2]; moderately to well lithified; 50% porphyritic tuff with pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; 45% ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 5% lithic fragments; reaction to acid: none	weathering of biotite phenocrysts	angular to subangular chips up to 2.2 cm

C-3. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-03 [*55-919894*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
700 - 710	**Tfpt**	tuff; light reddish brown [5YR6/3]; moderately to well lithified; 70% porphyritic tuff with pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; 20% ashflow tuff with crystalline groundmass and phenocrysts of yellow quartz, biotite, plagioclase; 10% lithic fragments; reaction to acid: none to weak	weathering of biotite phenocrysts; very trace calcite veins	angular to subangular chips up to 1.9 cm
710 - 715	**Tfpt**	tuff; light reddish brown [5YR6/3]; moderately to well lithified; porphyritic tuff with pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; some lithic fragments; reaction to acid: none		angular to subangular chips up to 2.3 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 620.0 feet / 2442.44 feet msl	DATE DRILLED: Oct. 6 - 7, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)25dbb / 842227 N / 922849 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; reddish brown [5YR5/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: weak to moderate		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 3.0 cm; average chip size 0.04 cm
10 - 20	**Tg**	matrix-supported conglomerate; reddish brown [5YR5/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average chip size 0.04 cm
20 - 30	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, diabase, quartzite, quartz vein, sandstone; minor iron oxide staining on clasts; reaction to acid: weak		10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 1.5 cm; average chip size 0.2 - 0.3 cm
30 - 40	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, diabase, quartzite, quartz vein, sandstone; minor iron oxide staining on clasts; reaction to acid: weak		angular to subangular chips up to 1.5 cm; average chip size 0.2 - 0.3 cm
40 - 50	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, diabase, quartzite, quartz vein, sandstone, increase in large (1 cm) clasts of schist and diabase; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.8 cm; average chip size 0.5 cm
50 - 60	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.7 cm; average chip size 0.4 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein, less schist, slightly more red quartzite and sandstone; some iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 0.9 cm; average chip size 0.3 cm
70 - 80	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein, less schist, slightly more red quartzite and sandstone; some iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average chip size 0.3 cm
80 - 90	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein, less red quartzite; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.7 cm; average chip size 0.4 cm
90 - 100	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subangular chips up to 1.4 cm; average chip size 0.4 cm
100 - 110	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subangular chips up to 1.2 cm; average chip size 0.3 cm
110 - 120	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, sandstone, quartz vein; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.1 cm; average chip size 0.3 cm
120 - 130	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, quartz vein, sandstone; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average chip size 0.4 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to well lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, quartz vein, sandstone; some iron oxide staining on clasts; reaction to acid: very weak		angular to subangular chips up to 1.1 cm; average chip size 0.3 cm
140 - 150	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, quartz vein, sandstone; schist clasts increase in size to 1 cm; minor iron oxide staining on clasts; reaction to acid: very weak	dark stain on fracture surfaces of some sandstone	angular to subangular chips up to 1.4 cm; average chip size 0.3 cm
150 - 160	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, diabase, quartzite, quartz vein, sandstone; schist clasts increase in size to 1 cm; minor iron oxide staining on clasts; reaction to acid: very weak	dark stain on fracture surfaces of some sandstone	angular to subangular chips up to 1.3 cm; average chip size 0.3 cm
160 - 170	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 60% sandy, silty matrix and 40% clasts of schist, diabase, quartzite, quartz vein, sandstone; some iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average chip size 0.4 cm
170 - 180	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, diabase, quartzite, quartz vein, sandstone; some iron oxide staining on clasts; reaction to acid: very weak		angular to subangular chips up to 0.9 cm; average chip size 0.2 - 0.3 cm
180 - 190	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 65% sandy, silty matrix and 35% clasts of schist, diabase, quartzite, sandstone, more quartz vein; some iron oxide staining on clasts; trace green mineralization; reaction to acid: very weak		angular to subrounded chips up to 1.0 cm; average chip size 0.3 cm
190 - 200	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartz vein, quartzite, diabase, trace sandstone; some iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.3 cm; average chip size 0.3 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
200 - 210	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, quartz vein, quartzite, diabase, trace sandstone; some iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.3 cm; average chip size 0.3 cm
210 - 220	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, quartz vein, quartzite, some basalt, trace tuff; some iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average chip size 0.3 cm
220 - 230	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartz vein, quartzite, minor basalt, minor tuff; some iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average chip size 0.3 cm
230 - 240	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, quartzite, quartz vein, trace basalt; some iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.3 cm; average chip size 0.3 cm
240 - 250	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 60% sandy, silty matrix and 40% clasts of schist, quartzite, quartz vein, trace sandstone; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average chip size 0.3 cm
250 - 260	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, quartz vein, minor diabase, minor sandstone; trace iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.6 cm; average chip size 0.4 - 0.5 cm
260 - 270	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, more quartz vein with minor diabase, minor sandstone; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.1 cm; average chip size 0.3 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
270 - 280	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, quartz vein; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subangular chips up to 1.5 cm; average chip size 0.2 - 0.3 cm
280 - 290	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, quartz vein; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subrounded chips up to 1.1 cm; average chip size 0.3 cm
290 - 300	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, quartz vein; schist clasts increase in size to 1 cm; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: weak		angular to subrounded chips up to 1.8 cm; average chip size 0.2 - 0.3 cm
300 - 310	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of schist, quartzite, quartz vein; schist clasts increase in size to 1 cm; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: weak		angular to subrounded chips up to 1.7 cm; average chip size 0.3 cm
310 - 320	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 65% sandy, silty matrix and 35% clasts of schist, quartzite, quartz vein, minor sandstone; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subrounded chips up to 1.6 cm; average chip size 0.2 - 0.3 cm
320 - 330	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 65% sandy, silty matrix and 35% clasts of schist, quartzite, quartz vein, minor sandstone; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subangular chips up to 1.3 cm; average chip size 0.2 - 0.3 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
330 - 340	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 65% sandy, silty matrix and 35% clasts of more schist, quartzite, quartz vein, minor sandstone, trace tuff; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subrounded chips up to 1.2 cm; average chip size 0.3 - 0.4 cm
340 - 350	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, and quartz vein, trace sandstone, trace tuff; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subangular chips up to 1.6 cm; average chip size 0.2 - 0.3 cm
350 - 360	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, trace sandstone, trace tuff; minor iron oxide staining on clasts; minor green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subrounded chips up to 1.2 cm; average chip size 0.3 cm
360 - 370	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, trace basalt, trace tuff; minor iron oxide staining on clasts; trace green mineralization on quartz vein clasts; reaction to acid: weak		angular to subrounded chips up to 1.6 cm; average chip size 0.3 cm
370 - 380	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, diabase, trace basalt; minor iron oxide staining on clasts; trace green mineralization on quartz vein clasts; reaction to acid: very weak		angular to subrounded chips up to 1.6 cm; average chip size 0.3 cm
380 - 390	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, diabase, trace basalt; minor iron oxide staining on clasts; trace green mineralization on quartz vein clasts; reaction to acid: weak		angular to subangular chips up to 1.2 cm; average chip size 0.3 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
390 - 400	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, diabase, trace basalt; minor iron oxide staining on clasts; trace green mineralization on quartz vein clasts; reaction to acid: weak		angular to subrounded chips up to 1.8 cm; average chip size 0.3 cm
400 - 410	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 70% sandy, silty matrix and 30% clasts of quartzite, schist, quartz vein, diabase, trace basalt; reaction to acid: very weak	minor iron oxide staining	angular to subrounded chips up to 1.8 cm; average chip size 0.2 - 0.3 cm
410 - 420	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; moderately lithified; 50% mixed lithology conglomerate with clasts of schist, quartzite, quartz vein, diabase; 50% tuff with phenocrysts of plagioclase, quartz, biotite, trace muscovite; tuff moderately welded; reaction to acid: none to very weak	minor iron oxide staining	subangular to subrounded chips up to 1.1 cm; average chip size 0.4 cm
TERTIARY YOUNGER VOLCANICS - TUFF (Tt)				
420 - 430	**Tt**	tuff; very pale brown [10YR8/4]; moderately to very well lithified; tuff with very pale brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz , trace biotite; trace lithic fragments; moderately to strongly welded; reaction to acid: none	minor iron oxide stain spots	angular to subangular chips up to 1.2 cm; average chip size 0.4 - 0.5 cm
430 - 440	**Tt**	tuff; pinkish white [7.5YR8/2]; moderately lithified; tuff with pinkish-white aphanitic groundmass and phenocrysts of plagioclase, quartz, trace mica; trace lithic fragments; moderately to strongly welded; reaction to acid: none	minor iron oxide stain spots	angular to subangular chips up to 1.2 cm; average chip size 0.4 cm
GILA CONGLOMERATE (Tg)				
440 - 450	**Tg**	matrix-supported conglomerate; brown [7.5YR4/3]; moderately to very well lithified; 75% sandy, silty matrix and 25% clasts of schist, quartzite, basalt, minor quartz vein; reaction to acid: very weak to moderate	moderate presence of iron oxide stain spots on conglomerate chips	angular to subrounded chips up to 1.2 cm; average chip size 0.3 cm
450 - 460	**Tg**	matrix-supported conglomerate; brown [7.5YR4/3]; moderately lithified; 75% sandy, silty matrix and 25% clasts of schist, quartzite, basalt, minor quartz vein; reaction to acid: very weak to moderate	minor iron oxide staining on conglomerate chips	angular to subrounded chips up to 1.0 cm; average chip size 0.3 cm
460 - 470	**Tg**	matrix-supported conglomerate; brown [7.5YR4/3]; moderately lithified; 70% sandy, silty matrix and 30% clasts of more schist, quartzite, quartz vein; reaction to acid: very weak to moderate	minor iron oxide staining on conglomerate chips	angular to subangular chips up to 1.5 cm; average chip size 0.2 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
470 - 480	**Tg**	matrix-supported conglomerate; brown [7.5YR4/3]; moderately to very well lithified; 75% sandy, silty matrix and 25% clasts of schist, quartzite, quartz vein, minor diabase; reaction to acid: very weak to moderate	minor iron oxide staining on conglomerate chips	angular to subrounded chips up to 1.4 cm; average chip size 0.5 cm
PRECAMBRIAN DIABASE (pCdiab)				
480 - 490	**pCdiab**	diabase; dark reddish brown [5YR3/3]; subophitic diabase with light yellowish-green to reddish-brown plagioclase laths; reaction to acid: very weak to weak	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.0 cm; average chip size 0.3 cm
490 - 500	**pCdiab**	diabase; dark reddish brown [5YR3/3]; subophitic diabase with light yellowish-green to reddish-brown plagioclase laths; reaction to acid: very weak to weak	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.2 cm; average chip size 0.3 cm
500 - 510	**pCdiab**	diabase; dark reddish brown [5YR3/3]; subophitic diabase with light yellowish-green to reddish-brown plagioclase laths; trace white to clear pyroxene; reaction to acid: very weak to weak	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.4 cm; average chip size 0.3 cm
510 - 520	**pCdiab**	diabase; dark reddish brown [5YR3/3]; subophitic diabase with light yellowish-green to reddish-brown plagioclase laths; trace white to clear pyroxene; reaction to acid: very weak to weak	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.6 cm; average chip size 0.3 cm
520 - 530	**pCdiab**	diabase; dark reddish brown [5YR3/3]; subophitic diabase with light yellow green to reddish-brown plagioclase laths; trace white to clear pyroxene; reaction to acid: very weak to weak	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.4 cm; average chip size 0.3 cm
530 - 540	**pCdiab**	diabase; dark reddish gray [2YR3/1]; subophitic diabase with light yellowish-green to reddish-brown plagioclase laths; trace white to clear pyroxene crystals; reaction to acid: weak to moderate	moderate iron oxide staining, minor weathering	angular to subangular chips up to 1.5 cm; average chip size 0.3 cm
540 - 550	**pCdiab**	diabase; dark reddish gray [2YR3/1]; diabase with 75% black pyroxene groundmass and 25% dark reddish-brown, 0.5 to 2 mm sized phenocrysts of plagioclase laths; minor basalt, minor Mescal Limestone; reaction to acid: strong	minor iron oxide staining with trace weathering	angular to subangular chips up to 1.8 cm; average chip size 0.4 cm
MESCAL LIMESTONE (pCmls)				
550 - 560	**pCmls**	limestone; red [5R5/6]; moderately to very well lithified; multi-colored massive limestone and dolomite fragments; trace well-developed calcite crystals; reaction to acid: strong	trace calcite coatings on fracture surfaces	angular to subangular chips up to 1.5 cm; average chip size 0.4 - 0.5 cm

C-4. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-04 [*55-919895*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
560 - 570	**pCmls**	limestone; red [5R5/6], reddish black [2.5YR2.5/1]; very well lithified; 80% multi-colored massive limestone and dolomite; minor light gray dolomite; 20% diabase; trace well-developed calcite crystals; reaction to acid: strong	trace calcite coatings on fracture surfaces	angular to subangular chips up to 1.3 cm; average chip size 0.4 - 0.5 cm
PRECAMBRIAN DIABASE (pCdiab)				
570 - 580	**pCdiab**	diabase; reddish black [2.5YR2.5/1]; ophitic diabase with 80% black pyroxene groundmass and 20% white to red, 1 to 3 mm sized plagioclase laths; reaction to acid: weak	trace iron oxide staining	angular to subangular chips up to 1.1 cm; average chip size 0.4 cm
580 - 590	**pCdiab**	interbedded diabase and limestone; reddish black [2.5YR2.5/1]; 90% ophitic diabase with 75% black pyroxene groundmass and 25% white to red, 1 to 3 mm sized plagioclase laths, 10% Mescal Limestone interbedded; reaction to acid: weak	trace iron oxide staining	angular to subangular chips up to 1.4 cm; average chip size 0.4 - 0.5 cm
590 - 600	**pCdiab**	diabase; reddish black [2.5YR2.5/1]; ophitic diabase with 70% black pyroxene groundmass and 30% 1 to 4 mm sized plagioclase laths; trace Precambrian Mescal Limestone; reaction to acid: very weak	trace iron oxide staining	angular to subangular chips up to 2.2 cm; average chip size 0.5 cm
600 - 610	**pCdiab**	diabase; reddish black [2.5YR2.5/1]; ophitic diabase with 65% black pyroxene groundmass and 35% 1 to 4 mm sized plagioclase laths; reaction to acid: none to very weak	minor iron oxide staining	angular to subangular chips up to 1.2 cm; average chip size 0.5 cm
610 - 620	**pCdiab**	diabase; reddish black [2.5YR2.5/1]; ophitic diabase with 65% black pyroxene groundmass and 35% 1 to 4 mm sized plagioclase laths; reaction to acid: none to very weak	minor iron oxide staining	angular to subangular chips up to 1.2 cm; average chip size 0.5 cm

C-5. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-05 [*55-920012*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP

LOGGED BY: C. Gregory

DEPTH DRILLED / LAND SURFACE ELEVATION: 320.0 feet / 2222.35 feet msl

DATE DRILLED: Oct. 16 - 17, 2016

CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)27cbb / 842326 N / 909634 E

NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
QUATERNARY ALLUVIUM (Qal)				
0 - 10	**Qal**	alluvium; brown [7.5YR5/4]; non-lithified; alluvium with 40% quartz vein, 35% schist, 15% quartzite and 10% igneous and volcanics; reaction to acid: none to very weak	iron oxide staining on some quartz vein	17-1/2-inch tricone; Conventional Air Rotary; angular to rounded chips and gravel to pebble up to 5.3 cm; average size 1 cm
PINAL SCHIST (pCpi)				
10 - 20	**pCpi**	alluvium; brown [7.5YR5/4]; non-lithified; 75% schist; 25% alluvium with 20% milky quartz, minor quartzite and volcanics; reaction to acid: none to very weak	schist shows low degree of weathering; iron oxide stains on some quartz vein	angular to rounded chips and gravel to pebble up to 2.2 cm; average size 0.8 cm
20 - 30	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; weak to moderate foliation; quartz-rich protolith; low grade metamorphism; 5% clear to milky quartz vein; minor visible bedding 1-5 mm; reaction to acid: none to very weak	moderate iron oxide staining of chloritic mineralization	10-1/2-inch hammer; Reverse Circulation; angular to subrounded chips up to 1.1 cm; average chip size 0.4 cm
30 - 40	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; weak to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring, 2% milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: very weak		angular to subangular chips up to 1.4 cm; average chip size 0.6 cm
40 - 50	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; weak to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 2% milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: very weak		angular to subangular chips up to 1.8 cm; average chip size 0.5 cm
50 - 60	**pCpi**	schist; dusky red [10R3/3], very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith with low grade metamorphism; moderate chloritic coloring; 5% quartz; trace calcite; reaction to acid: very weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 2.1 cm; average chip size 0.5 cm

C-5. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-05 [*55-920012*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; weak to moderate foliation; quartz-rich protolith with low grade metamorphism; moderate chloritic coloring; 5% quartz; minor visible bedding 1-5 mm; reaction to acid: weak		angular to subangular chips up to 1.8 cm; average chip size 0.4 cm
70 - 80	**pCpi**	schist; dusky red [10R3/3], very dark greenish gray [5G13/1]; well lithified; psammitic schist; weak foliated; quartz-rich protolith with low grade metamorphism; moderate chloritic coloring; 5% milky quartz vein; trace visible bedding 1-3 mm; reaction to acid: weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.5 cm; average chip size 0.3 cm
80 - 90	**pCpi**	schist; dusky red [10R3/3], very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; trace quartz vein; reaction to acid: weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.5 cm; average chip size 0.4 cm
90 - 100	**pCpi**	schist; greenish gray [10GY5/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; moderately visible bedding 1-5 mm; reaction to acid: very weak		angular to subangular chips up to 1.4 cm; average chip size 0.4 cm
100 - 110	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; reaction to acid: none to very weak		angular to subangular chips up to 1.3 cm; average chip size 0.4 cm
110 - 120	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: none to very weak		angular to subangular chips up to 1.3 cm; average chip size 0.4 cm
120 - 130	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; trace visible bedding 2-4 mm scale; reaction to acid: weak		angular to subangular chips up to 1.6 cm; average chip size 0.5 cm

C-5. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-05 [*55-920012*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; reaction to acid: weak		angular to subangular chips up to 1.4 cm; average chip size 0.6 cm
140 - 150	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 15% milky quartz vein; reaction to acid: weak		angular to subangular chips up to 1.8 cm; average chip size 0.5 cm
150 - 160	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 15% milky quartz vein; reaction to acid: weak		angular to subangular chips up to 1.3 cm; average chip size 0.6 cm
160 - 170	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; minor visible bedding 2-5 mm; reaction to acid: weak		angular to subangular chips up to 1.7 cm; average chip size 0.6 cm
170 - 180	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 3% milky quartz vein; reaction to acid: none to very weak		angular to subangular chips up to 1.8 cm; average chip size 0.6 to 0.7 cm
180 - 190	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 5% milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: weak		angular to subangular chips up to 1.5 cm; average chip size 0.6 cm
190 - 200	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 10% milky quartz vein; moderately visible bedding 1-4 mm; reaction to acid: none to very weak	minor brown to black staining on some quartz vein	angular to subangular chips up to 1.7 cm; average chip size 0.6 to 0.7 cm

C-5. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-05 [*55-920012*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
200 - 210	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 5% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: very weak	chloritic alteration/staining on 25% of quartz vein	angular to subangular chips up to 1.5 cm; average chip size 0.6 cm
210 - 220	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; low to moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 10 to 15% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: weak	chloritic alteration/staining on 25% of quartz vein	angular to subangular chips up to 1.9 cm; average chip size 0.6 cm
220 - 230	**pCpi**	schist; very dark greenish gray [5G13/1], dusky red [10R3/3]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 10% milky quartz vein; minor visible bedding 2-5 mm; reaction to acid: very weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.3 cm; average chip size 0.4 cm
230 - 240	**pCpi**	schist; very dark greenish gray [5G13/1], dusky red [10R3/3]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 10% milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.5 cm; average chip size 0.5 cm
240 - 250	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith; low grade metamorphism; chloritic coloring; 20% clear to milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.6 cm; average chip size 0.8 cm
250 - 260	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; poor to moderate foliation; quartz-rich protolith; low grade metamorphism; 5% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: weak	abundant iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.2 cm; average chip size 0.4 cm
260 - 270	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith low grade metamorphis; minor chloritic coloring; 5% clear to milky quartz vein; minor visible bedding 1-5 mm; reaction to acid: very weak	moderate to abundant iron oxide staining of chloritic mineralization	angular to subangular chips up to 2.6 cm; average chip size 1.0 cm

C-5. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-05 [*55-920012*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
270 - 280	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; moderate foliation; quartz-rich protolith, low grade metamorphism; minor chloritic coloring; 3% clear to milky quartz vein; minor visible bedding 1-4 mm; reaction to acid: weak to moderate	moderate to abundant iron oxide staining of chloritic mineralization	angular to subangular chips up to 2.1 cm; average chip size 0.8 cm
280 - 290	**pCpi**	schist; dusky red [10R3/3]; well lithified; psammitic schist; moderate foliated; quartz-rich protolith; low grade metamorphism; minor chloritic coloring; 3% milky quartz vein; reaction to acid: weak	moderate iron oxide staining of chloritic mineralization	angular to subangular chips up to 2.5 cm; average chip size 0.6 cm
290 - 300	**pCpi**	schist; dusky red [10R3/3], very dark greenish gray [5G13/1]; well lithified; psammitic schist; moderate foliated; quartz-rich protolith; low grade metamorphism; moderate chloritic coloring; 2% milky quartz vein; reaction to acid: very weak	minor iron oxide staining of chloritic mineralization	angular to subangular chips up to 1.5 cm; average chip size 0.6 cm
300 - 310	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; poorly to moderate foliated; quartz-rich protolith; low grade metamorphism; chloritic coloring; 5% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: weak		angular to subangular chips up to 1.6 cm; average chip size 0.6 cm
310 - 320	**pCpi**	schist; very dark greenish gray [5G13/1]; well lithified; psammitic schist; poorly to moderate foliated; quartz-rich protolith; low grade metamorphism; chloritic coloring; 2% milky quartz vein; minor visible bedding 1-3 mm; reaction to acid: weak		angular to subangular chips up to 2.0 cm; average chip size 0.6 cm

C-6. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-06 [*55-920013*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 120.0 feet / 2284.63 feet msl	DATE DRILLED: Oct. 20 - 21, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)27aba / 845067 N / 912658 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
PINAL SCHIST (pCpi)				
0 - 10	**pCpi**	schist; brown [7.5YR5/4]; moderately lithified; green and reddish-brown psammitic schist; foliated; reaction to acid: none	weathered schist; some iron oxide staining; some milky quartz vein	17-1/2-inch tricone; Conventional Air Rotary; angular to subangular chips up to 1.3 cm
10 - 20	**pCpi**	schist; brown [7.5YR5/4]; moderately lithified; green and reddish-brown psammitic schist; foliated; reaction to acid: none to weak	weathered schist; some iron oxide staining; some milky quartz vein	angular to subangular chips up to 1.1 cm
20 - 30	**pCpi**	schist; light greenish gray [10GY7/1], brown [7.5YR5/4]; moderately to well lithified; dark greenish-gray psammitic schist; some bluish-green and gray phyllitic schist; foliated; reaction to acid: none to weak	some milky quartz vein	10-1/2-inch hammer; Reverse Circulation; sample mostly pulverized to silt; angular to subangular chips up to 1.4 cm
30 - 40	**pCpi**	schist; light greenish gray [10GY7/1]; moderately to well lithified; dark greenish-gray psammitic schist; some bluish-green and gray phyllitic schist; foliated; reaction to acid: none	some milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 1.7 cm
40 - 50	**pCpi**	schist; light greenish gray [10GY7/1]; moderately to well lithified; dark greenish-gray psammitic schist; some bluish-green and gray phyllitic schist; foliated; reaction to acid: none	some milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 2.0 cm
50 - 60	**pCpi**	schist; light greenish gray [10GY7/1]; moderately to well lithified; dark greenish-gray psammitic schist and bluish-green and gray phyllitic schist; foliated; reaction to acid: none	5% milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 2.3 cm
60 - 70	**pCpi**	schist; light greenish gray [10GY7/1]; moderately to well lithified; dark greenish-gray psammitic schist and bluish-green and gray phyllitic schist; foliated; reaction to acid: none	5% milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 2.5 cm
70 - 80	**pCpi**	schist; greenish gray [10Y6/1]; moderately to well lithified; bluish-green and gray phyllitic schist; trace dark green to gray psammitic schist; foliated; reaction to acid: none	some milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 1.8 cm

C-6. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-06 [*55-920013*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
80 - 90	**pCpi**	schist; greenish gray [10Y6/1]; moderately to well lithified; bluish-green and gray phyllitic schist; trace dark green to gray psammitic schist; foliated; reaction to acid: none	some milky quartz vein	sample mostly pulverized to silt; angular to subangular chips up to 1.9 cm
90 - 100	**pCpi**	schist; dark greenish gray [5GY4/1]; well lithified; bluish-green and gray phyllitic schist; trace dark green to gray psammitic schist; foliated; reaction to acid: none	some milky quartz vein	angular to subangular chips up to 2.8 cm
100 - 110	**pCpi**	schist; dark greenish gray [5GY4/1]; well lithified; greenish-gray and pink phyllitic schist; trace dark green to gray psammitic schist; foliated; reaction to acid: none	some milky quartz vein; very trace iron oxide staining	sample mostly pulverized to silt; angular to subangular chips up to 1.5 cm
110 - 120	**pCpi**	schist; dark greenish gray [5GY4/1]; well lithified; greenish-gray and pink phyllitic schist; trace dark green to gray psammitic schist; foliated; reaction to acid: none	some milky quartz vein; very trace iron oxide staining	sample mostly pulverized to silt; angular to subangular chips up to 1.5 cm

C-7. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-07 [*55-920014*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 320.0 feet / 2370.02 feet msl	DATE DRILLED: Oct. 23 - 24, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)26bba / 844754 N / 915230 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
PRECAMBRIAN DIABASE (pCdiab)				
0 - 10	**pCdiab**	diabase; brown [10YR5/3]; moderately to well lithified; diabase with pyroxene matrix and 1-2 mm sized plagioclase laths; common accessory magnetite; some Mescal limestone; reaction to acid: moderate to strong	abundant weathering of diabase; common iron oxide staining	17-1/2-inch tricone; Conventional Air Rotary; angular to subangular chips up to 1.1 cm
10 - 20	**pCdiab**	diabase; brown [10YR5/3]; moderately to well lithified; diabase with pyroxene matrix and 1-2 mm sized plagioclase laths; common accessory magnetite; some Mescal limestone; reaction to acid: moderate to strong	abundant weathering of diabase; common iron oxide staining	angular to subangular chips up to 1.0 cm
20 - 30	**pCdiab**	diabase; brown [10YR5/3]; moderately to well lithified; diabase with pyroxene matrix and 1-2 mm sized plagioclase laths; common accessory magnetite; trace Mescal limestone; reaction to acid: moderate to strong	common weathering of diabase; common iron oxide staining	10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 2.1 cm
30 - 40	**pCdiab**	diabase; black [5YR2.5/1]; moderately to well lithified; diabase with pyroxene matrix and 1-2 mm sized plagioclase laths; common accessory magnetite; reaction to acid: moderate	moderately weathered; some iron oxide staining	angular to subangular chips up to 1.8 cm
40 - 50	**pCdiab**	diabase; black [5YR2.5/1]; moderately to well lithified; diabase with pyroxene matrix and 1-2 mm sized plagioclase laths; common accessory magnetite; reaction to acid: weak to moderate	moderately weathered; some iron oxide staining	angular to subangular chips up to 2.1 cm
MESCAL LIMESTONE (pCmls)				
50 - 60	**pCmls**	limestone; light reddish brown [2.5YR6/4]; well lithified; pink and grayish-white crystalline limestone; trace diabase; reaction to acid: very strong	very trace manganese oxide; trace calcite veins	angular to subangular chips up to 1.6 cm
60 - 70	**pCmls**	limestone; gray [5YR6/1]; well lithified; 95% pink and gray silty-sandy limestone/dolostone; 5% white, crystalline limestone; reaction to acid: moderate to strong	some calcite veinlets	angular to subangular chips up to 2.2 cm

C-7. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-07 [*55-920014*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
70 - 80	**pCmls**	limestone; pinkish gray [5YR7/2]; well lithified; 95% pink and gray silty-sandy limestone/dolostone; 5% white, crystalline limestone; trace grayish-pink chert; reaction to acid: moderate	trace calcite veinlets	angular to subangular chips up to 2.4 cm
80 - 90	**pCmls**	limestone; white [5YR8/1]; well lithified; 80% white, crystalline limestone; 20% grayish-pink, silty limestone; trace grayish-red chert; reaction to acid: strong to very strong	very trace calcite veins	angular to subangular chips up to 2.1 cm
90 - 100	**pCmls**	limestone; pale red [2.5YR7/2]; well lithified; 60% grayish-tan, silty limestone/dolostone; 35% grayish-pink sandy limestone; 5% white, crystalline limestone; reaction to acid: very strong	very trace calcite veins	angular to subangular chips up to 1.9 cm
100 - 110	**pCmls**	limestone; pale red [2.5YR7/2]; well lithified; 80% grayish-pink, sandy limestone; 10% gray to tan, silty limestone/dolostone; 10% dark gray to black chert; reaction to acid: strong to very strong	very trace calcite veins	angular to subangular chips up to 1.7 cm
110 - 120	**pCmls**	limestone; light yellowish brown [10YR6/4]; well lithified; 90% yellowish-tan, calcareous siltstone; 10% dark gray to black chert; trace grayish-pink, sandy limestone; reaction to acid: very strong	trace iron oxide staining; very trace calcite veins	angular to subangular chips up to 1.6 cm
120 - 130	**pCmls**	limestone; light brown [7.5YR6/3]; well lithified; 90% yellowish-tan, calcareous siltstone; 10% dark gray to black chert; trace grayish-pink, sandy limestone; trace light gray, medium plasticity clay; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 1.4 cm
130 - 140	**pCmls**	limestone; light brown [7.5YR6/3]; well lithified; yellowish-tan, calcareous siltstone; trace dark gray to black chert; trace grayish-pink, sandy limestone; bedding; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 2.5 cm
140 - 150	**pCmls**	limestone; brown [7.5YR5/2]; well lithified; 60% gray, fine-grained limestone; 30% yellowish-tan, calcareous siltstone; 5% dark gray to black chert; 5% gray to pink, sandy limestone; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 2.0 cm
150 - 160	**pCmls**	limestone; brown [7.5YR5/2]; well lithified; 70% yellowish-tan, calcareous siltstone; 15% dark gray to black chert; 15% gray to pink, sandy limestone; trace gray, fine-grained limestone; reaction to acid: very strong	some iron oxide staining	angular to subangular chips up to 2.2 cm

C-7. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-07 [*55-920014*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
160 - 170	**pCmls**	limestone; light brown [7.5YR6/3]; well lithified; 85% yellowish-tan, calcareous siltstone; 10% dark gray to black chert; 5% gray to pink, sandy limestone; reaction to acid: very strong	trace iron oxide staining	angular to subangular chips up to 1.8 cm
170 - 180	**pCmls**	limestone; yellowish brown [10YR5/6]; well lithified; 95% yellowish-tan, calcareous siltstone; 5% gray to pink, sandy limestone; trace dark gray to black chert; reaction to acid: strong	trace iron oxide staining	angular to subangular chips up to 2.1 cm
180 - 190	**pCmls**	limestone; brown [7.5YR4/2]; well lithified; 50% yellowish-tan, calcareous siltstone; 50% dark gray to brown, argillaceous limestone/dolostone; trace dark gray to black chert; reaction to acid: strong		angular to subangular chips up to 2.0 cm
190 - 200	**pCmls**	limestone; brown [7.5YR4/2]; well lithified; 95% dark gray to brown, argillaceous limestone/dolostone; 5% yellowish-tan, calcareous siltstone; reaction to acid: very strong	some iron oxide staining	angular to subangular chips up to 1.8 cm
UPPER DRIPPING SPRING QUARTZITE (pCdsu)				
200 - 210	**pCdsu**	quartzite; yellowish red [5YR4/6]; well lithified; fine to medium-grained quartzite; trace fine-grained siltstone; reaction to acid: very weak	abundant weathering; common iron oxide staining; trace calcite veins	angular to subangular chips up to 2.0 cm
210 - 220	**pCdsu**	quartzite; strong brown [7.5YR5/6]; well lithified; fine to medium-grained quartzite; trace fine-grained siltstone; trace arenitic quartzite; reaction to acid: very weak	common weathering; common iron oxide staining	angular to subangular chips up to 1.8 cm
220 - 230	**pCdsu**	quartzite; brown [7.5YR5/4]; well lithified; fine to medium-grained, massive quartzite; trace fine-grained quartzite and siltstone; common bedding; reaction to acid: very weak	common weathering; common iron oxide staining on grain boundaries	angular to subangular chips up to 2.0 cm
230 - 240	**pCdsu**	quartzite; strong brown [7.5YR5/6]; well lithified; 75% fine-grained, thinly bedded quartzite and siltstone; 25% fine to medium-grained, massive quartzite; common bedding; reaction to acid: none	abundant weathering; common iron oxide staining on grain boundaries	angular to subangular chips up to 1.7 cm
240 - 250	**pCdsu**	quartzite; strong brown [7.5YR5/6]; well lithified; 90% fine-grained, thinly bedded quartzite and siltstone; 10% fine-grained, massive quartzite; common bedding; reaction to acid: none	common weathering; common iron oxide staining throughout	angular to subangular chips up to 2.3 cm

C-7. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-07 [*55-920014*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
250 - 260	**pCdsu**	quartzite; strong brown [7.5YR5/6]; well lithified; fine-grained, thinly bedded quartzite and siltstone; trace bedding; reaction to acid: none	some weathering; some iron oxide staining throughout	angular to subangular chips up to 1.8 cm
260 - 270	**pCdsu**	quartzite; strong brown [7.5YR5/6]; well lithified; fine-grained, thinly bedded quartzite and siltstone; trace bedding; reaction to acid: none	some weathering; some iron oxide staining throughout	angular to subangular chips up to 2.0 cm
270 - 280	**pCdsu**	quartzite; brown [7.5YR4/4]; well lithified; multicolored, fine-grained, thinly bedded quartzite and siltstone; trace medium-grained, massive quartzite; common bedding; reaction to acid: none	some weathering; some iron oxide staining of beds; trace manganese oxide on fracture surfaces	angular to subangular chips up to 2.3 cm
280 - 290	**pCdsu**	quartzite; brown [7.5YR4/4]; well lithified; multicolored, fine-grained, thinly bedded quartzite and siltstone; trace medium-grained, massive quartzite; common bedding; reaction to acid: none	some weathering; some iron oxide staining of beds; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.7 cm
290 - 300	**pCdsu**	quartzite; brown [7.5YR4/4]; well lithified; 95% multicolored, fine-grained, thinly bedded quartzite and siltstone; 5% medium-grained, massive quartzite; common bedding; reaction to acid: none	some weathering; some iron oxide staining of beds; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.6 cm
300 - 310	**pCdsu**	quartzite; brown [7.5YR5/4]; well lithified; 95% multicolored, fine-grained, thinly bedded quartzite and siltstone; 5% medium-grained, massive quartzite; common bedding; reaction to acid: none	some weathering; some iron oxide staining of beds; trace manganese oxide on fracture surfaces	angular to subangular chips up to 1.9 cm
310 - 320	**pCdsu**	quartzite; brown [7.5YR5/4]; well lithified; 90% multicolored, fine-grained, thinly bedded quartzite and siltstone; 10% medium-grained, massive quartzite; common bedding; reaction to acid: none	some weathering; some iron oxide staining of beds; trace manganese oxide on fracture surfaces	angular to subangular chips up to 2.0 cm

C-8. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-08 [*55-920079*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: J.Bell
DEPTH DRILLED / LAND SURFACE ELEVATION: 400.0 feet / 2704.44 feet msl	DATE DRILLED: Oct. 27 - 28, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)24aab / 850317 N / 924164 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
PRECAMBRIAN DIABASE (pCdiab)				
0 - 10	**pCdiab**	diabase; dark yellowish brown [10YR3/4]; well lithified; 75% black diabase with pyroxene groundmass and plagioclase laths; 25% yellowish-brown sandy silt; magnetite; reaction to acid: strong	abundant weathering; common iron oxide staining; common calcium carbonate; trace calcite	17-1/2-inch tricone; Conventional Air Rotary; angular to subangular chips up to 1.2 cm
10 - 20	**pCdiab**	diabase; dark yellowish brown [10YR3/4]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: strong	abundant weathering; common iron oxide staining; common calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm, mostly pulverized sand size
20 - 30	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate to strong	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 2.0 cm, mostly pulverized sand size
30 - 40	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
40 - 50	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 2.1 cm
50 - 60	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 1.6 cm
60 - 70	**pCdiab**	diabase; dark reddish brown [5YR3/3]; moderately to well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
70 - 80	**pCdiab**	diabase; dark reddish brown [5YR3/3]; moderately to well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak	abundant weathering and iron oxide staining; trace calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm

C-8. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-08 [*55-920079*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
80 - 90	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering and iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
90 - 100	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: strong	abundant weathering; common iron oxide staining; common calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
100 - 110	**pCdiab**	diabase; dark reddish brown [5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate	abundant weathering; common iron oxide staining; some calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
110 - 120	**pCdiab**	diabase; black [5YR2.5/1]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate	abundant weathering; common iron oxide staining; some calcium carbonate; some calcite	angular to subangular chips up to 1.5 cm
120 - 130	**pCdiab**	diabase; dark brown [7.5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: strong	abundant weathering; common iron oxide staining; common calcium carbonate; common calcite	angular to subangular chips up to 1.5 cm
130 - 140	**pCdiab**	diabase; dark brown [7.5YR3/3]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak	abundant weathering; common iron oxide staining; trace calcium carbonate; trace calcite	angular to subangular chips up to 1.5 cm
140 - 150	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: moderate	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 1.5 cm
150 - 160	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak	abundant weathering and very abundant iron oxide staining; trace calcite	angular to subangular chips up to 1.0 cm
160 - 170	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 2.5 cm
170 - 180	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; very well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: very weak	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 2.0 cm

C-8. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-08 [*55-920079*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
180 - 190	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; very well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: very weak	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 1.5 cm
190 - 200	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: very weak	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 1.5 cm
200 - 210	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 1.5 cm
210 - 220	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 2.0 cm
220 - 230	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: weak to moderate	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 2.0 cm
230 - 240	**pCdiab**	diabase; dark reddish brown [5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; accessory magnetite; reaction to acid: very weak	abundant weathering with common iron oxide staining; trace calcite	angular to subangular chips up to 2.5 cm
UPPER DRIPPING SPRING QUARTZITE (pCdsu)				
240 - 250	**pCdsu**	quartzite; brown [7.5YR4/4]; very well lithified; olive gray to reddish-brown, arkosic, fine-grained sandstone/siltstone; reaction to acid: none	abundant weathering and iron oxide staining	angular to subangular chips up to 1.0 cm, mostly sand-sized
PRECAMBRIAN DIABASE (pCdiab)				
250 - 260	**pCdiab**	diabase; black [7.5YR2.5/2]; well lithified; 75% black diabase with pyroxene groundmass and plagioclase laths; 25% arkosic fine-grained sandstone/siltstone; some accessory magnetite; reaction to acid: weak	abundant iron oxide staining	angular to subangular chips up to 1.0 cm
260 - 270	**pCdiab**	diabase; black [7.5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; some accessory magnetite; reaction to acid: very weak	abundant iron oxide staining	angular to subangular chips up to 1.0 cm
270 - 280	**pCdiab**	diabase; black [7.5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; some accessory magnetite; reaction to acid: very weak	abundant iron oxide staining	angular to subangular chips up to 1.0 cm

C-8. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-08 [*55-920079*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
280 - 290	**pCdiab**	diabase; black [7.5YR2.5/2]; well lithified; black diabase with pyroxene groundmass and plagioclase laths; some accessory magnetite; reaction to acid: weak to moderate	abundant iron oxide staining	angular to subangular chips up to 1.0 cm
UPPER DRIPPING SPRING QUARTZITE (pCdsu)				
290 - 300	**pCdsu**	quartzite; black [7.5YR2.5/2]; well lithified; 95% brownish-red to dark gray siltstone and fine-grained sandstone; 5% tan to pink quartz-arenite and massive quartzite; thinly bedded/laminated; reaction to acid: weak to moderate	abundant weathering and iron oxide staining; some calcium carbonate	angular to subangular chips up to 2.0 cm; fracture zone
300 - 310	**pCdsu**	quartzite; black [7.5YR2.5/2]; well lithified; 85% tan to pink feldspathic, fine to medium-grained, massive quartzite; 15% siltstone; reaction to acid: none	some weathering and iron oxide staining	angular to subangular chips up to 2.0 cm; fracture zone
PINAL SCHIST (pCpi)				
310 - 320	**pCpi**	schist; very dark greenish gray [5GY3/2], pinkish gray [7.5YR6/2]; moderately to well lithified; 65% bluish-green to gray phyllitic schist; 5% reddish-brown siltstone; foliated; reaction to acid: none	some weathering and iron oxide staining; common purple staining on quartz	angular to subangular chips up to 2.0 cm
320 - 330	**pCpi**	schist; very dark greenish gray [5GY3/2], pinkish gray [7.5YR6/2]; moderately to well lithified; 70% bluish-green to gray phyllitic schist; trace siltstone; foliated; reaction to acid: none	some weathering and iron oxide staining; common purple staining on quartz	angular to subangular chips up to 2.0 cm
330 - 340	**pCpi**	schist; very dark greenish gray [5GY3/2], pinkish gray [7.5YR6/2]; moderately to well lithified; 70% bluish-green to gray phyllitic schist; trace siltstone; foliated; reaction to acid: none	some weathering and iron oxide staining; common purple staining on quartz	angular to subangular chips up to 2.0 cm; potential fracture zone
340 - 350	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; 60% bluish-gray phyllitic schist; trace siltstone; foliated; reaction to acid: none	40% milky quartz vein; common weathering; iron oxide staining	angular to subangular chips up to 4.5 cm; fracture zone
350 - 360	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; 70% bluish gray phyllitic schist; trace siltstone; foliated; reaction to acid: none	30% milky quartz vein; common weathering; iron oxide staining	angular to subangular chips up to 2.0 cm; fracture zone
360 - 370	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; 65% blueish-green to gray phyllitic schist; foliated; reaction to acid: none	45% quartz vein; common weathering; iron oxide staining	angular to subangular chips up to 2.5 cm; potential fracture zone

C-8. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-08 [*55-920079*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
370 - 380	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; 65% blueish-green to gray phyllitic schist; foliated; reaction to acid: none	35% quartz vein; abundant iron oxide staining	angular to subangular chips up to 1.5 cm; potential fracture zone
380 - 390	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; 65% blueish-green to gray phyllitic schist; foliated; reaction to acid: none	35% quartz vein; abundant iron oxide staining	angular to subangular chips up to 1.5 cm
390 - 400	**pCpi**	schist; very dark greenish gray [5GY3/2]; well lithified; blueish-green to gray phyllitic schist; foliated; reaction to acid: none	15% quartz vein; some iron oxide staining	angular to subangular chips up to 2.0 cm

C-9. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-09 [*55-920076*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP
LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 400.0 feet / 2672.17 feet msl
DATE DRILLED: Nov. 2 - 3, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)13ddc / 851184 N / 924196 E
NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	**FORMATION**	**GENERAL DESCRIPTION**	**SECONDARY FEATURES**	**COMMENTS**
QUATERNARY ALLUVIUM (Qal)				
0 - 10	**Qal**	schist; weak red [2.5YR4/2]; weakly to moderately lithified; 80% weathered schist; 20% dark bluish-green and gray, phyllitic schist; trace weathered diabase; foliated; reaction to acid: none to very weak	abundant weathering; abundant iron oxide staining; trace milky quartz vein	17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 1.8 cm
PINAL SCHIST (pCpi)				
10 - 20	**pCpi**	schist; weak red [2.5YR4/2]; moderately lithified; 95% bluish-gray, phyllitic schist; trace weathered diabase; foliated; reaction to acid: none to very weak	5% milky quartz vein; abundant weathering; some iron oxide staining; very trace epidote	angular to subrounded chips up to 1.9 cm
20 - 30	**pCpi**	schist; reddish brown [2.5YR4/4]; moderately lithified; Bluish-gray, phyllitic schist; some purple, psammitic schist; foliated; reaction to acid: very weak to weak	common weathering; some milky quartz vein; some iron oxide staining	10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 2.2 cm
30 - 40	**pCpi**	schist; dark brown [10YR3/3], very dark greenish gray [10GY3/1]; moderately to well lithified; Dark bluish-gray, phyllitic schist; some purple, psammitic schist; foliated; reaction to acid: none to weak	common weathering; some milky quartz vein; some iron oxide staining	angular to subangular chips up to 1.6 cm
40 - 50	**pCpi**	schist; dark brown [10YR3/3], very dark greenish gray [10GY3/1]; moderately to well lithified; Dark bluish-gray, phyllitic schist; some purple, psammitic schist; foliated; reaction to acid: moderate	common weathering; some milky quartz vein; some iron oxide staining; trace calcite veinlets	angular to subangular chips up to 1.5 cm
50 - 60	**pCpi**	schist; dark brown [10YR3/3], very dark greenish gray [10GY3/1]; moderately to well lithified; Dark bluish-gray, phyllitic schist; some purple, psammitic schist; foliated; reaction to acid: moderate to strong	some weathering; some milky quartz vein; trace iron oxide staining; trace calcite veinlets	angular to subangular chips up to 2.0 cm
60 - 70	**pCpi**	schist; dark brown [10YR3/3], very dark greenish gray [10GY3/1]; moderately to well lithified; Dark bluish-gray, phyllitic schist; some purple, psammitic schist; foliated; reaction to acid: moderate to strong	some weathering; some milky quartz vein; trace calcite veinlets	angular to subangular chips up to 1.7 cm

C-9. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-09 [*55-920076*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
70 - 80	**pCpi**	schist; dark brown [10YR3/3], very dark greenish gray [10GY3/1]; moderately to well lithified; 50% bluish-gray, phyllitic schist; 50% very dark gray-blue, fine-grained schist; foliated; reaction to acid: moderate to strong	some weathering; some milky quartz vein; trace calcite veinlets	angular to subangular chips up to 1.5 cm
80 - 90	**pCpi**	schist; very dark bluish gray [10B3/1]; moderately to well lithified; 50% bluish-gray, phyllitic schist; 50% very dark gray-blue, fine-grained schist; foliated; reaction to acid: weak	some milky quartz vein; trace weathering	angular to subangular chips up to 2.4 cm
90 - 100	**pCpi**	schist; very dark bluish gray [10B3/1]; moderately to well lithified; 50% bluish-gray, phyllitic schist; 50% very dark gray-blue, fine-grained schist; foliated; reaction to acid: very weak	some milky quartz vein; trace weathering; very trace iron oxide staining	angular to subangular chips up to 1.7 cm
100 - 110	**pCpi**	schist; very dark bluish gray [10B3/1]; moderately to well lithified; 80% bluish-gray, phyllitic schist; 15% blackish-blue, fine-grained schist; foliated; reaction to acid: very weak	5% milky quartz vein; very trace iron oxide staining	angular to subangular chips up to 2.3 cm
110 - 120	**pCpi**	schist; very dark bluish gray [10B3/1]; moderately to well lithified; 80% bluish-gray, phyllitic schist; 15% blackish-blue, fine-grained schist; foliated; reaction to acid: none to very weak	5% milky quartz vein	angular to subangular chips up to 1.9 cm
120 - 130	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 85% dark bluish-gray, phyllitic schist; trace blackish-blue, fine-grained schist; foliated; reaction to acid: none to very weak	15% milky quartz vein	angular to subangular chips up to 1.9 cm
130 - 140	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 85% dark bluish-gray, phyllitic schist; trace blackish-blue, fine-grained schist; foliated; reaction to acid: none to very weak	15% milky quartz vein	angular to subangular chips up to 2.4 cm
140 - 150	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; trace blackish-blue, fine-grained schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 2.3 cm

C-9. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-09 [*55-920076*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
150 - 160	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; trace blackish-blue, fine-grained schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 2.6 cm
160 - 170	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; trace blackish-blue, fine-grained schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 2.1 cm
170 - 180	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; 5% blackish-blue, fine-grained schist; foliated; reaction to acid: none	15% milky quartz vein	angular to subangular chips up to 2.0 cm
180 - 190	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; 5% blackish-blue, fine-grained schist; foliated; reaction to acid: none	15% milky quartz vein	angular to subangular chips up to 2.1 cm
190 - 200	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 65% dark bluish-gray, phyllitic schist; 5% blackish-blue, fine-grained schist; foliated; reaction to acid: none	30% milky quartz vein	angular to subangular chips up to 3.0 cm
200 - 210	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 65% dark bluish-gray, phyllitic schist; 5% blackish-blue, fine-grained schist; foliated; reaction to acid: none	30% milky quartz vein	angular to subangular chips up to 2.2 cm
210 - 220	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 75% dark bluish-gray, phyllitic schist; 5% blackish-blue, fine-grained schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 2.4 cm
220 - 230	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 60% dark bluish-gray, phyllitic schist; 30% dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	10% milky quartz vein; some iron oxide staining	angular to subangular chips up to 2.7 cm

C-9. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-09 [*55-920076*]

NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
230 - 240	**pCpi**	schist; very dark bluish gray [10B3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; 5% dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	15% milky quartz vein;very trace iron oxide staining	angular to subangular chips up to 3.0 cm
240 - 250	**pCpi**	schist; very dark bluish gray [5PB3/1], bluish gray [5B6/1]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; 15% dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	15% milky quartz vein; trace talc	angular to subangular chips up to 3.3 cm
250 - 260	**pCpi**	schist; very dark bluish gray [5PB3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; trace dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 2.6 cm
260 - 270	**pCpi**	schist; very dark bluish gray [5PB3/1], bluish gray [5B6/1]; moderately to well lithified; 80% dark bluish-gray, phyllitic schist; trace dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	20% milky quartz vein	angular to subangular chips up to 3.4 cm
270 - 280	**pCpi**	schist; very dark bluish gray [5PB3/1], weak red [10R4/4]; moderately to well lithified; 80% dark bluish-gray and reddish brown, phyllitic schist; trace dark greenish-brown, fine-grained, psammitic schist; foliated; reaction to acid: none	20% milky quartz vein; common iron oxidation of schist	angular to subangular chips up to 2.8 cm
280 - 290	**pCpi**	schist; very dark bluish gray [5PB3/1], weak red [10R4/4]; moderately to well lithified; 70% dark bluish-gray and reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; abundant iron oxidation of schist	angular to subangular chips up to 2.5 cm
290 - 300	**pCpi**	schist; very dark bluish gray [5PB3/1], weak red [10R4/4]; moderately to well lithified; 70% dark bluish-gray and reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; abundant iron oxidation of schist	angular to subangular chips up to 2.4 cm
300 - 310	**pCpi**	schist; very dark bluish gray [5PB3/1], weak red [10R4/4]; moderately to well lithified; 70% dark bluish-gray and reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; abundant iron oxidation of schist	angular to subangular chips up to 2.5 cm
310 - 320	**pCpi**	schist; very dark bluish gray [5PB3/1], weak red [10R4/4]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; trace reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; trace iron oxidation of schist	angular to subangular chips up to 2.3 cm

C-9. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-09 [*55-920076*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
320 - 330	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; very trace reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; very trace iron oxidation of schist	angular to subangular chips up to 2.0 cm
330 - 340	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; very trace reddish brown, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein; very trace iron oxidation of schist	angular to subangular chips up to 2.1 cm
340 - 350	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein	angular to subangular chips up to 1.8 cm
350 - 360	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 70% dark bluish-gray, phyllitic schist; foliated; reaction to acid: none	30% milky quartz vein	angular to subangular chips up to 1.9 cm
360 - 370	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 75% dark bluish-gray, phyllitic schist; foliated; reaction to acid: none	25% milky quartz vein	angular to subangular chips up to 2.2 cm
370 - 380	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 75% dark bluish-gray, phyllitic schist; foliated; reaction to acid: none	25% milky quartz vein	angular to subangular chips up to 1.7 cm
380 - 390	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 75% dark bluish-gray, phyllitic schist; trace oxidized, phyllitic schist; foliated; reaction to acid: none	25% milky quartz vein; trace iron oxidation of schist	angular to subangular chips up to 1.9 cm
390 - 400	**pCpi**	schist; very dark bluish gray [5PB3/1]; moderately to well lithified; 75% dark bluish-gray, phyllitic schist; trace oxidized, phyllitic schist; foliated; reaction to acid: none	25% milky quartz vein; trace iron oxidation of schist	angular to subangular chips up to 1.9 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 540.0 feet / 2669.05 feet msl	DATE DRILLED: Nov. 8 - 10, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)24dbd / 847008 N / 923383 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; 60% sandy silt matrix and 40% clasts of schist, quartz vein, quartzite; minor iron oxide staining on clasts; reaction to acid: strong		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 2.1 cm; average size 0.3 cm
10 - 20	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; 60% sandy silt matrix and 40% clasts of schist, quartz vein, quartzite; minor iron oxide staining on clasts; reaction to acid: strong	trace calcite	angular to subrounded chips up to 1.7 cm; average size 0.3-0.4 cm
20 - 30	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, trace diabase; minor iron oxide staining on clasts; reaction to acid: weak to moderate		10-1/2-inch hammer; Reverse Circulation; angular to subrounded chips up to 1.9 cm; average size 0.4-0.5 cm
30 - 40	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite; minor iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.5 cm; average size 0.2 cm
40 - 50	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase, trace siltstone; minor iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.5 cm; average size 0.4-0.5 cm
50 - 60	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase, trace siltstone; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average size 0.4 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, more diabase, trace siltstone, trace weakly welded tuff; minor iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.3 cm; average size 0.3 cm
70 - 80	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, diabase, quartz vein; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.7 cm; average size 0.3 cm
80 - 90	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of quartzite, quartz vein, schist, minor diabase; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.6 cm; average size 0.3 cm
90 - 100	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of quartzite, quartz vein,schist; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.3 cm; average size 0.1-0.2 cm
100 - 110	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein, minor diabase, very minor siltstone; minor iron oxide staining; reaction to acid: very weak to weak		angular to subrounded chips up to 1.6 cm; average size 0.2-0.3 cm
110 - 120	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein with more diabase, very minor siltstone, trace tuff; minor iron oxide staining; reaction to acid: weak		angular to subrounded chips up to 1.8 cm; average size 0.3 cm
120 - 130	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly lithified; 60% sandy silt matrix and 40% clasts of schist, quartzite, quartz vein, diabase, minor siltstone; minor to moderate iron oxide staining; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average size 0.2-0.3 cm
130 - 140	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 60% sandy silt matrix and 40% clasts of schist, quartzite, quartz vein, diabase, minor siltstone; moderate iron oxide staining; reaction to acid: weak		angular to subrounded chips up to 1.5 cm; average size 0.2 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
140 - 150	**Tg**	matrix-supported conglomerate; reddish brown [2.5YR4/4]; weakly to moderately lithified; 60% sandy silt matrix and 40% clasts of diabase, quartzite, siltstone, minor schist, minor quartz vein; moderate iron oxide staining; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average size 0.4-0.5 cm
150 - 160	**Tg**	matrix-supported conglomerate; light reddish brown [2.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of quartzite, schist, quartz vein, minor diabase; minor iron oxide staining; reaction to acid: weak	possible fracture zone	subangular to subrounded chips up to 2.5 cm; average size 0.6-0.7 cm
160 - 170	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; moderately to well lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite,quartz vein, minor diabase, minor siltstone; minor iron oxide staining on clasts; reaction to acid: very weak	possible fracture zone	subangular to subrounded chips up to 2.2 cm; average size 0.7 cm
170 - 180	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; moderately lithified; 60% sandy silt matrix and 40% clasts of schist, quartz vein, quartzite, diabase, minor siltstone; minor iron oxide staining; reaction to acid: very weak to weak	possible fracture zone	angular to subrounded chips up to 1.9 cm; average size 0.6-0.7 cm
180 - 190	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; moderately lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase, trace siltstone; moderate iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.8 cm; average size 0.3-0.4 cm
190 - 200	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase, trace siltstone; moderate iron oxide staining on clasts; reaction to acid: very weak	possible fracturing	subangular to subrounded chips up to 2.0 cm; average size 0.5 cm
200 - 210	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase; minor iron oxide staining; reaction to acid: very weak	possible fracturing	subangular to subrounded chips up to 1.8 cm; average size 0.7 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of quartz vein, schist, quartzite, minor diabase; minor iron oxide staining; reaction to acid: weak	possible fracturing	subangular to subrounded chips up to 1.7 cm; average size 0.6 cm
220 - 230	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase; moderate iron oxide staining; reaction to acid: very weak	possible fracturing	subangular to subrounded chips up to 1.7 cm; average size 0.8 cm
230 - 240	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartz vein, quartzite, minor diabase; minor iron oxide staining on clasts; reaction to acid: weak	possible fracturing	subangular to subrounded chips up to 1.8 cm; average size 0.7 cm
240 - 250	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly to moderately lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein, diabase; minor iron oxide staining on clasts; reaction to acid: very weak to weak	possible fracturing	subangular to subrounded chips up to 1.8 cm; average size 0.6 cm
250 - 260	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite,quartz vein, diabase, trace siltstone; moderate iron oxide staining on clasts; reaction to acid: weak		angular to subangular chips up to 0.6 cm; average size 0.1-0.2 cm
260 - 270	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein, diabase; moderate iron oxide staining on clasts; reaction to acid: very weak to weak	possible fracturing	subangular to subrounded chips up to 2.0 cm; average size 0.6 cm
270 - 280	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite and quartz vein, diabase; moderate iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.7 cm; average size 0.6 cm
280 - 290	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein, minor diabase; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.8 cm; average size 0.6 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
290 - 300	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/4]; weakly lithified; 95% matrix-supported conglomerate with 65% sandy silt matrix and 35% clasts of schist, quartzite, quartz vein, minor diabase; minor iron oxide staining on clasts; 5% Apache Leap tuff; reaction to acid: very weak		subangular to subrounded chips up to 1.6 cm; average size 0.5 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
300 - 310	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately to well lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; approximately 15% Gila Conglomerate clasts; moderately welded; reaction to acid: weak	minor calcite	subangular to subrounded chips up to 1.4 cm; average size 0.2-0.3 cm
310 - 320	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately to well lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; moderately welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.7 cm; average size 0.4 cm; approximately 35% Gila Conglomerate clasts (contamination)
320 - 330	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately to well lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; moderately welded; trace flow banding; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.0 cm; average size 0.2 cm; minor Gila Conglomerate (contamination)
330 - 340	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately to well lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; moderately welded; trace flow banding; reaction to acid: weak	trace calcite	angular to subangular chips up to 0.9 cm; average size 0.2 cm; minor Gila Conglomerate (contamination)
340 - 350	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak		angular to subangular chips up to 0.8 cm; average size 0.2 cm; minor Gila Conglomerate (contamination)
350 - 360	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak	very trace calcite	angular to subangular chips up to 0.7 cm; average size 0.1-0.2 cm; minor Gila Conglomerate (contamination)

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
360 - 370	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: none to very weak		angular to subangular chips up to 1.0 cm; average size 0.2 cm
370 - 380	**Talg**	Gray Unit; pinkish gray [5YR7/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: none to very weak		angular to subangular chips up to 1.0 cm; average size 0.2 cm
380 - 390	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: none to very weak		angular to subangular chips up to 1.1 cm; average size 0.2 cm
390 - 400	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.0 cm; average size 0.2 cm
400 - 410	**Talg**	Gray Unit; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 1.0 cm; average size 0.2 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
410 - 420	**Talb**	Brown Unit; reddish yellow [5YR6/4]; weakly lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; approximately 50% Gray Unit; weakly welded; reaction to acid: very weak	trace calcite	angular to subangular chips up to 0.9 cm; average size 0.3 cm
420 - 430	**Talb**	Brown Unit; reddish yellow [5YR6/4]; weakly to moderately lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; approximately 20% Gray Unit; weakly welded; reaction to acid: weak	trace calcite	angular to subangular chips up to 0.9 cm; average size 0.3 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
430 - 440	**Talb**	Brown Unit; reddish yellow [5YR6/6]; weakly lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; approximately 20% Gray Unit; weakly welded; reaction to acid: very weak		angular to subangular chips up to 1.0 cm; average size 0.3 cm
440 - 450	**Talb**	Brown Unit; reddish yellow [5YR6/4]; moderately lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak to weak	trace calcite	subangular chips up to 1.3 cm; average size 0.4 cm; approximately 10% Gila Conglomerate (contamination?)
450 - 460	**Talb**	Brown Unit; reddish yellow [5YR6/4]; moderately lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak to weak		subangular chips up to 1.1 cm; average size 0.4 cm; approximately 5% Gila Conglomerate (contamination?)
460 - 470	**Talb**	Brown Unit; reddish yellow [5YR6/4]; moderately lithified; dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; weak to moderately welded; reaction to acid: very weak to weak		subangular chips up to 1.1 cm; average size 0.4 cm
APACHE LEAP TUFF (Tal)				
470 - 480	**Tal**	tuff; reddish brown [2.5YR4/4]; very weakly to weakly lithified; 75% reddish-brown tuff with phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; accessory magnetite; 25% dacite tuff with reddish-yellow aphanitic groundmass and phenocrysts of quartz, plagioclase, biotite; trace lithic fragments; very weakly welded; reaction to acid: moderate	minor calcite	subangular chips up to 1.6 cm; average size 0.5 cm
480 - 490	**Tal**	tuff; reddish brown [2.5YR4/4]; very weakly to weakly lithified; reddish-brown tuff with phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; accessory magnetite; very weakly welded; reaction to acid: moderate	minor calcite	subangular chips up to 1.2 cm; average size 0.4 cm

C-10. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-10 [*55-920080*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WHITETAIL CONGLOMERATE (Tw)				
490 - 500	**Tw**	clast-supported conglomerate; dark reddish brown [2.5YR3/4]; very weakly to well lithified; 50% clast-supported conglomerate with 70% clasts of diabase, basalt and 30% silty sand matrix; 50% reddish brown tuff with phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; accessory magnetite; reaction to acid: moderate	minor calcite	angular to subangular chips up to 1.2 cm; average size 0.5 cm
500 - 510	**Tw**	clast-supported conglomerate; dark reddish brown [2.5YR3/4]; weakly lithified; 70% clasts consisting of 60% diabase with pyroxene groundmass and plagioclase phenocrysts, 30% reddish-brown tuff, 10% quartzite and quartzose sandstone and 30% silty sand matrix; reaction to acid: weak	trace calcite	subangular to subrounded chips up to 1.0 cm; average size 0.2-0.3 cm
510 - 520	**Tw**	clast-supported conglomerate; dark reddish brown [2.5YR3/4]; weakly lithified; 70% clasts consisting of 50% diabase with pyroxene groundmass and plagioclase phenocrysts, 40% reddish brown tuff, 10% quartzite and quartzose sandstone and 30% silty sand matrix; reaction to acid: weak	trace calcite	subangular to subrounded chips up to 1.0 cm; average size 0.2-0.3 cm
520 - 530	**Tw**	clast-supported conglomerate; dark reddish brown [2.5YR3/4]; weakly lithified; 65% clasts consisting of 50% tuffaceous volcanics, 25% basalt, 15% diabase and 10% quartzite, quartose sandstone and quartz vein and 35% silty sand matrix; reaction to acid: weak to moderate	trace calcite	subangular to subrounded chips up to 1.1 cm; average size 0.2-0.3 cm
530 - 540	**Tw**	clast-supported conglomerate; dark reddish brown [2.5YR3/4]; weakly lithified; 65% clasts consisting of 50% tuffaceous volcanics, 25% basalt, 15% diabase and 10% quartzite, quartose sandstone and quartz vein and 35% silty sand matrix; reaction to acid: weak to moderate	trace calcite	subangular to subrounded chips up to 1.0 cm; average size 0.3 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 640.0 feet / 2733.98 feet msl	DATE DRILLED: Nov. 14 - 17, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)24bac / 849366 N / 921450 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/3]; weakly lithified; 70% silty sand matrix and 30% clasts of quartzite, schist, quartz vein, shale; minor iron oxide staining on clasts; reaction to acid: weak to moderate		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded clasts up to 1.3 cm
10 - 20	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/3]; weakly to moderately lithified; 60% silty sand matrix and 40% clasts of quartzite, schist, quartz vein, shale; minor iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded clasts up to 0.8 cm
20 - 30	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/3]; moderately lithified; 55% silty sand matrix and 45% clasts of quartzite, schist, quartz vein, shale, trace diabase; some iron oxide staining on clasts; reaction to acid: weak		10-1/2-inch hammer; Reverse Circulation; angular to subrounded clasts up to 1.4 cm
30 - 40	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/3]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, trace diabase; trace iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 1.8 cm
40 - 50	**Tg**	matrix-supported conglomerate; light brown [7.5YR6/3]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace diabase, trace tuff; trace iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 1.4 cm
50 - 60	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace diabase, trace pegmatite, trace tuff; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded clasts up to 1.0 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 60% silty sand matrix and 40% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace diabase, trace pegmatite, trace tuff; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded clasts up to 0.9 cm
70 - 80	**Tg**	matrix-supported conglomerate; yellowish brown [10YR5/4]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace tuff; common iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 0.8 cm
80 - 90	**Tg**	matrix-supported conglomerate; yellowish brown [10YR5/4]; moderately to well lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace tuff; minor iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 1.1 cm
90 - 100	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, quartz vein, basalt, shale, rhyolite, trace tuff; trace iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 0.8 cm
100 - 110	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 60% silty sand matrix and 40% clasts of quartzite, basalt, tuff, trace schist, trace quartz vein; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded clasts up to 0.8 cm
110 - 120	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 60% silty sand matrix and 40% clasts of quartzite, basalt, tuff, trace schist, trace quartz vein, trace diabase; some iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded clasts up to 1.0 cm
120 - 130	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 65% sandy matrix and 35% clasts of quartzite, basalt, tuff, schist, quartz vein, trace diabase; trace iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded clasts up to 1.3 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 65% sandy matrix and 35% clasts of quartzite, basalt, tuff, schist, quartz vein, trace diabase; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded clasts up to 0.6 cm
140 - 150	**Tg**	matrix-supported conglomerate; brown [10YR5/3]; moderately to well lithified; 65% sandy matrix and 35% clasts of quartzite, basalt, tuff, schist, quartz vein, trace diabase; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded clasts up to 0.5 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
150 - 160	**Talg**	Gray Unit; light brown [7.5YR6/3]; moderately to well lithified; dacite tuff with tan to light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace siltstone; reaction to acid: weak	very trace iron oxide staining	subangular to subrounded cut chips up to 0.4 cm
160 - 170	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately to well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace siltstone; reaction to acid: very weak		subangular to subrounded cut chips up to 0.3 cm
170 - 180	**Talg**	Gray Unit; pale red [2.5YR6/2]; moderately to well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of black basalt; reaction to acid: very weak		subangular to subrounded cut chips up to 0.3 cm
180 - 190	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of black basalt; reaction to acid: very weak		subangular to subrounded cut chips up to 0.4 cm
190 - 200	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of black basalt; reaction to acid: very weak		subangular to subrounded cut chips up to 0.5 cm
200 - 210	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of black basalt; reaction to acid: very weak		subangular to subrounded cut chips up to 0.5 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of black basalt; reaction to acid: weak		subangular to subrounded cut chips up to 0.6 cm
220 - 230	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace lithic fragments of black basalt; reaction to acid: weak		subangular to subrounded cut chips up to 0.5 cm
230 - 240	**Talg**	Gray Unit; pale red [2.5YR6/2]; well lithified; dacite tuff with pink, gray and light brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace lithic fragments of black basalt; reaction to acid: weak to moderate	trace calcite vein	subangular to subrounded cut chips up to 0.6 cm
240 - 250	**Talg**	Gray Unit; weak red [2.5YR5/2]; well lithified; dacite tuff with light grayish-brown, pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace lithic fragments of siltstone; reaction to acid: none to very weak		subangular to subrounded cut chips up to 0.5 cm
250 - 260	**Talg**	Gray Unit; weak red [2.5YR5/2]; well lithified; dacite tuff with light grayish-brown, pink aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; increase in lithic fragments; reaction to acid: none to very weak		subangular to subrounded cut chips up to 0.5 cm
260 - 270	**Talg**	Gray Unit; reddish gray [7.5R6/1]; well lithified; dacite tuff with mostly gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; increase in lithic fragments; reaction to acid: none to very weak		subangular to subrounded cut chips up to 0.6 cm
270 - 280	**Talg**	Gray Unit; reddish gray [7.5R6/1]; well lithified; dacite tuff with mostly gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; increase in lithic fragments; reaction to acid: none to very weak		subangular to subrounded cut chips up to 0.5 cm
280 - 290	**Talg**	Gray Unit; reddish gray [7.5R6/1]; well lithified; dacite tuff with mostly gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; increase in lithic fragments; reaction to acid: weak	very trace calcite veinlets	subangular to subrounded cut chips up to 0.7 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
290 - 300	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; reaction to acid: weak	very trace calcite veinlets	subangular to subrounded cut chips up to 0.7 cm
300 - 310	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
310 - 320	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
320 - 330	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; reaction to acid: weak	very trace iron oxide staining	subangular to subrounded cut chips up to 0.5 cm
330 - 340	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; some pumiceous groundmass; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
340 - 350	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; some pumiceous groundmass; reaction to acid: very weak		subangular to subrounded cut chips up to 0.5 cm
350 - 360	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pinkish-gray groundmass and phenocrysts of plagioclase, quartz, biotite; some pumiceous groundmass; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
360 - 370	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments; moderately welded; reaction to acid: none to very weak	very trace calcite veinlets	subangular to subrounded cut chips up to 0.7 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
370 - 380	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments; moderately welded; reaction to acid: very weak	very trace iron oxide staining; very trace calcite vein	subangular to subrounded cut chips up to 0.5 cm
380 - 390	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; 90% dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; 10% lithic fragments of red siltstone; moderately welded; reaction to acid: none to very weak	common iron oxide staining of siltstone clasts	subangular to subrounded cut chips up to 0.8 cm
390 - 400	**Talg**	Gray Unit; weak red [7.5R5/3]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone; moderately welded; reaction to acid: none to very weak	trace iron oxide staining of siltstone clasts	subangular to subrounded cut chips up to 0.6 cm
400 - 410	**Talg**	Gray Unit; weak red [10R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone; moderately welded; reaction to acid: none	trace iron oxide staining of siltstone clasts	subangular to subrounded cut chips up to 0.7 cm
410 - 420	**Talg**	Gray Unit; weak red [10R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone; moderately welded; reaction to acid: none	very trace iron oxide staining of siltstone clasts	subangular to subrounded cut chips up to 0.5 cm
420 - 430	**Talg**	Gray Unit; weak red [10R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and basalt; moderately welded; reaction to acid: none	very trace iron oxide staining of siltstone clasts	subangular to subrounded cut chips up to 0.6 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
430 - 440	**Talg**	Gray Unit; weak red [10R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and basalt; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
440 - 450	**Talg**	Gray Unit; weak red [7.5R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and basalt; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 1.0 cm
450 - 460	**Talg**	Gray Unit; weak red [7.5R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite, trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and larger basalt; moderately welded; reaction to acid: very weak	some iron staining of lithic fragments	subangular to subrounded cut chips up to 0.6 cm
460 - 470	**Talg**	Gray Unit; weak red [7.5R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite, trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and larger basalt; moderately welded; reaction to acid: very weak	some iron staining of lithic fragments	subangular to subrounded cut chips up to 0.5 cm
470 - 480	**Talg**	Gray Unit; weak red [7.5R5/2]; well lithified; dacite tuff with light brown, pink, and gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite, trace light gray pumiceous groundmass; trace lithic fragments of brown siltstone and larger basalt; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm
480 - 490	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: very weak	very trace iron oxide staining	subangular to subrounded cut chips up to 0.5 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
490 - 500	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 0.4 cm
500 - 510	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: weak	very trace calcite	subangular to subrounded cut chips up to 0.4 cm
510 - 520	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: weak	very trace calcite; very trace iron oxide staining	subangular to subrounded cut chips up to 0.7 cm
520 - 530	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: weak	very trace calcite; very trace iron oxide staining	subangular to subrounded cut chips up to 0.5 cm
530 - 540	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of basalt and siltstone; moderately welded; reaction to acid: weak	very trace calcite; very trace iron oxide staining	subangular to subrounded cut chips up to 0.5 cm
540 - 550	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of yellowish-brown siltstone; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 0.3 cm
550 - 560	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of yellowish-brown siltstone; moderately welded; reaction to acid: very weak	very trace iron oxide staining	subangular to subrounded cut chips up to 0.4 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]

NEAR WEST

PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
560 - 570	**Talg**	Gray Unit; weak red [7.5R4/2]; well lithified; dacite tuff with brownish-gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace grayish-white pumiceous groundmass; trace lithic fragments of yellowish-brown siltstone; moderately welded; reaction to acid: very weak	very trace iron oxide staining	subangular to subrounded cut chips up to 0.7 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
570 - 580	**Talb**	Brown Unit; dusky red [2.5YR3/2]; well lithified; dacite tuff with reddish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone and fine-grained quartzite; increased degree of welding; reaction to acid: very weak		angular to subrounded cut chips up to 0.7 cm
580 - 590	**Talb**	Brown Unit; dusky red [2.5YR3/2]; well lithified; dacite tuff with reddish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone and fine-grained quartzite; increased degree of welding; reaction to acid: very weak		angular to subrounded cut chips up to 0.6 cm
590 - 600	**Talb**	Brown Unit; dusky red [2.5YR3/2]; well lithified; dacite tuff with reddish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone and fine-grained quartzite; increased degree of welding; reaction to acid: weak	very trace calcite	angular to subrounded cut chips up to 0.6 cm
600 - 610	**Talb**	Brown Unit; dusky red [2.5YR3/2]; well lithified; dacite tuff with reddish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone; increased degree of welding; reaction to acid: none to very weak		angular to subrounded cut chips up to 0.5 cm
610 - 620	**Talb**	Brown Unit; reddish brown [2.5YR4/3]; well lithified; dacite tuff with 75% gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite, 20% reddish-brown tuff; 5% orange, unwelded tuff; trace lithic fragments of brown siltstone and schist; welded; reaction to acid: none to very weak	trace iron oxide staining	subangular to subrounded cut chips up to 0.7 cm
620 - 630	**Talb**	Brown Unit; weak red [7.5R5/3]; well lithified; dacite tuff with brown-light gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone; moderately welded; reaction to acid: very weak		subangular to subrounded cut chips up to 0.6 cm

C-11. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-11 [*55-920077*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
630 - 640	**Talb**	Brown Unit; weak red [7.5R5/3]; well lithified; dacite tuff with brown-light gray aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments of brown siltstone; moderately welded; reaction to acid: weak to moderate	trace calcite vein	subangular to subrounded cut chips up to 0.5 cm

C-12. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-12 [*55-920153*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 340.0 feet / 2877.53 feet msl	DATE DRILLED: Nov. 22 - 24, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-12)28aab / 845404 N / 939691 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
WEATHERED GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	basin fill; strong brown [7.5YR5/6]; non-lithified; mixed unconsolidated surficial deposit of gravel, sand and silts; gravel composition includes quartzite, quartz vein, diabase and tuff.; reaction to acid: strong		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 4.9 cm; average chip size 0.5 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
10 - 20	**Talb**	tuff; light brown [7.5YR6/3]; very weakly lithified; dacite tuff with light brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; weakly welded; reaction to acid: strong	moderate weathering	angular to subangular chips up to 0.8 cm; average chip size 0.2 cm
20 - 30	**Talb**	tuff; reddish brown [5YR5/3]; weakly lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly welded; reaction to acid: weak	minor weathering	10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 1.7 cm; average chip size 0.3 - 0.4 cm
30 - 40	**Talb**	tuff; reddish brown [5YR5/3]; weakly to moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly welded; reaction to acid: very weak		angular to subangular chips up to 1.7 cm; average chip size 0.5 cm
40 - 50	**Talb**	tuff; reddish brown [5YR5/3]; weakly to moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly welded; reaction to acid: none		angular to subangular chips up to 1.5 cm; average chip size 0.5 cm
50 - 60	**Talb**	tuff; reddish brown [5YR5/3]; moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	trace iron oxide staining; trace yellowish-green alteration	angular to subangular chips up to 1.8 cm; average chip size 0.4 cm

C-12. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-12 [*55-920153*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Talb**	tuff; reddish brown [5YR5/3]; moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none		angular to subangular chips up to 1.2 cm; average chip size 0.5 cm
70 - 80	**Talb**	tuff; reddish brown [5YR5/3]; moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none		angular to subangular chips up to 2.0 cm; average chip size 0.6 cm
80 - 90	**Talb**	tuff; reddish brown [5YR5/3]; weakly to moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly welded; reaction to acid: none		angular to subangular chips up to 1.9 cm; average chip size 0.4 cm
90 - 100	**Talb**	tuff; reddish brown [5YR5/3]; moderately to well lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; trace flow banding; reaction to acid: none		angular to subangular chips up to 2.2 cm; average chip size 0.6 cm
100 - 110	**Talb**	tuff; reddish brown [5YR5/3]; weakly to moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly welded; trace flow banding; reaction to acid: none	moderate iron oxide staining on lithic fragments; trace quartz vein	angular to subangular chips up to 1.2 cm; average chip size 0.5 cm
110 - 120	**Talb**	tuff; reddish brown [5YR5/3]; moderately to well lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; trace flow banding; reaction to acid: none	moderate iron oxide staining on lithic fragments; trace quartz vein	angular to subangular chips up to 1.9 cm; average chip size 0.6 - 0.7 cm
120 - 130	**Talb**	tuff; reddish brown [5YR5/3]; moderately to well lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments, trace very light brown pumice; moderately welded; reaction to acid: none	trace black spot stains	angular to subangular chips up to 1.8 cm; average chip size 0.6 cm

C-12. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-12 [*55-920153*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**Talb**	tuff; reddish brown [5YR5/3]; moderately lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; minor light brown pumice; moderately welded; reaction to acid: none	trace black spot stains	angular to subangular chips up to 2.4 cm; average chip size 0.6 cm
140 - 150	**Talb**	tuff; reddish brown [5YR5/3]; moderately to well lithified; dacite tuff with light pinkish-brown to white aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; trace pumice; moderately welded; reaction to acid: none		angular to subangular chips up to 2.2 cm; average chip size 0.5 cm
150 - 160	**Talb**	tuff; pinkish gray [5YR6/2]; weakly to moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase and biotite; weakly welded; reaction to acid: none	moderate iron oxide staining	angular to subangular chips up to 1.1 cm; average chip size 0.2 cm
160 - 170	**Talb**	tuff; pinkish gray [5YR7/2]; moderately lithified; dacite tuff with pinkish-gray aphanitic groundmass and phenocrysts of quartz, plagioclase and biotite; moderately welded; reaction to acid: none to weak	moderate iron oxide staining	angular to subangular chips up to 1.4 cm; average chip size 0.7 cm
MESCAL LIMESTONE (pCmls)				
170 - 180	**pCmls**	limestone; reddish gray [7.5R5/1], white [10R8/1], dark red [10R3/6]; weakly to moderately lithified; multi-colored limestone; trace tuff; minor visible bedding; reaction to acid: very strong	minor calcite veinlets	angular to subangular chips up to 1.1 cm; average chip size 0.4 cm
180 - 190	**pCmls**	limestone; red [10R4/6], pale red [2.5YR6/2], reddish black [2.5YR2.5/1]; moderately lithified; multi-colored limestone and dolostone; minor visible bedding; reaction to acid: weak to strong	moderate calcite veinlets; moderate weathering and iron oxide staining	angular to subangular chips up to 1.4 cm; average chip size 0.6 cm; trace contamination of tuff
190 - 200	**pCmls**	limestone; brown [7.5YR5/4], gray [7.5YR6/1], reddish black [2.5YR2.5/1]; moderately to well lithified; multi-colored limestone and dolostone; reaction to acid: weak to strong	moderate calcite veinlets; moderate weathering and iron oxide staining	angular to subangular chips up to 1.7 cm; average chip size 0.8 cm
200 - 210	**pCmls**	limestone; pale red [2.5YR6/2], dark red [2.5YR3/6], white [10YR8/1]; moderately lithified; multi-colored fine-grained to crystalline limestone; reaction to acid: moderate to very strong	minor calcite veinlets; moderate weathering and iron oxide staining; trace presence of well developed 3 mm sized calcite crystals on chip faces	angular to subangular chips up to 1.9 cm; average chip size 0.7 cm

C-12. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-12 [*55-920153*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**pCmls**	limestone; reddish brown [2.5YR4/4], reddish black [2.5YR2.5/1]; moderately lithified; multi-colored limestone and dolostone; reaction to acid: weak to very strong	abundant weathering and iron oxide staining; trace calcite veinlets	angular to subangular chips up to 1.8 cm; average chip size 0.7 cm
220 - 230	**pCmls**	diabase; dusky red [7.5R3/3]; moderately to well lithified; dark gray and rusty red sandy limestone; reaction to acid: weak	abundant weathering and iron oxide staining	angular to subangular chips up to 1.8 cm; average chip size 0.4 cm
PRECAMBRIAN DIABASE (pCdiab)				
230 - 240	**pCdiab**	diabase; dusky red [7.5R3/3]; moderately to very well lithified; diabase with pyroxene groundmass and minor 1 mm sized white plagioclase laths; minor accessory magnetite; reaction to acid: none to weak	abundant weathering and iron oxide staining	angular to subangular chips up to 1.8 cm; average chip size 0.8 - 0.9 cm
240 - 250	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; minor accessory magnetite; reaction to acid: none to very weak	abundant iron oxide staining; moderate weathering	angular to subangular chips up to 2.2 cm; average chip size 0.9 cm
250 - 260	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; minor accessory magnetite; reaction to acid: none to very weak	abundant iron oxide staining; moderate weathering; trace calcite	angular to subangular chips up to 2.4 cm; average chip size 0.8 cm
260 - 270	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; common accessory magnetite; reaction to acid: none to very weak	abundant iron oxide staining; moderate weathering; trace calcite	angular to subangular chips up to 1.9 cm; average chip size 0.7 cm
270 - 280	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; abundant accessory magnetite; reaction to acid: none to very weak	abundant iron oxide staining; moderate weathering	angular to subangular chips up to 2.2 cm; average chip size 0.7 cm
280 - 290	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; common accessory magnetite; reaction to acid: none to very weak	common iron oxide staining; moderate weathering; trace calcite	angular to subangular chips up to 2.9 cm; average chip size 0.8 cm
290 - 300	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 2 to 5 mm sized white plagioclase laths; common accessory magnetite; reaction to acid: none to weak	common iron oxide staining; moderate weathering; minor calcite	angular to subangular chips up to 1.7 cm; average chip size 0.8 cm

C-12. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-12 [*55-920153*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
300 - 310	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; trace accessory magnetite; reaction to acid: none to weak	common iron oxide staining; moderate weathering; minor calcite	angular to subangular chips up to 1.8 cm; average chip size 0.8 cm
310 - 320	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; trace accessory magnetite; reaction to acid: none to very weak	common iron oxide staining; moderate weathering; trace calcite	angular to subangular chips up to 1.8 cm; average chip size 0.7 cm
320 - 330	**pCdiab**	diabase; very dusky red [7.5R2.5/2]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; trace accessory magnetite; reaction to acid: none to very weak	common iron oxide staining; moderate weathering; trace calcite	angular to subangular chips up to 1.6 cm; average chip size 0.9 cm
330 - 340	**pCdiab**	diabase; very dusky red [7.5R2.5/2], dark gray [7.5YR4/1]; well to very well lithified; dark dusky red diabase with pyroxene groundmass and 1 to 4 mm sized white plagioclase laths; trace accessory magnetite; reaction to acid: none to very weak	common iron oxide staining; moderate weathering; minor green alteration; minor quartz vein; trace calcite	angular to subangular chips up to 2.2 cm; average chip size 0.9 - 1.0 cm

C-13. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*] NEAR WEST PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP	LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 540.0 feet / 2704.11 feet msl	DATE DRILLED: Nov. 27 - Dec. 4, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-12)28cab / 842133 N / 937271 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; brown [7.5YR4/4]; weakly lithified; 65% silty sand matrix and 35% clasts of basalt, tuff, diabase, minor quartzite; minor quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 2.9 cm; average chip size 0.3 cm
10 - 20	**Tg**	matrix-supported conglomerate; brown [7.5YR4/4]; weakly lithified; 65% silty sand matrix and 35% clasts of basalt, tuff, diabase; minor quartzite, minor quartz vein; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.0 cm; average chip size 0.2 cm
20 - 30	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; very weakly to weakly lithified; 65% silty sand matrix and 35% clasts of diabase, tuff, basalt; minor quartz vein, minor quartzite; trace pegmatite; minor iron oxide staining on clasts; reaction to acid: moderate		10-1/2-inh hammer; Reverse Circulation; angular to subrounded chips up to 2.3 cm; average chip size 0.2 cm
30 - 40	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; very weakly to weakly lithified; 65% silty sand matrix and 35% clasts of diabase, tuff, basalt; minor quartz vein, minor quartzite; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average chip size 0.3 cm
40 - 50	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly lithified; 55% silty sand matrix and 45% clasts of tuff, minor diabase, trace quartzite, trace quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.0 cm; average chip size 0.2 cm
50 - 60	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 60% silty sand matrix and 40% clasts of tuff, diabase, trace quartzite; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.3 cm; average chip size 0.2 cm

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; moderately lithified; 60% silty sand matrix and 40% clasts of tuff, diabase, trace quartzite; minor iron oxide staining on clasts; reaction to acid: none		angular to subrounded chips up to 1.0 cm; average chip size 0.2 cm
UNWELDED LIGHT GRAY TUFF (Tt)				
70 - 80	**Tt**	weathered tuff; pinkish gray [7.5YR7/2]; very weakly lithified; 85% pinkish-gray tuff with very light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; 15% Gila Conglomerate; reaction to acid: very weak	weathered; abundant clay	angular chips up to 0.1 cm; clumpy, some original rock texture
80 - 90	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly to moderately lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; minor lithic fragments of basalt and sandstone; reaction to acid: moderate	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
90 - 100	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace to minor lithic fragments of basalt and sandstone; reaction to acid: very weak	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
100 - 110	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; minor lithic fragments of basalt and sandstone; reaction to acid: very weak	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
110 - 120	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; minor lithic fragments of basalt and sandstone; reaction to acid: very weak	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
120 - 130	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
130 - 140	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly to weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; minor lithic fragments; reaction to acid: none	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
140 - 150	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
150 - 160	**Tt**	weathered tuff; light gray [7.5YR7/1]; very weakly lithified; tuff with light gray aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	weathered; abundant clay	angular chips up to 0.2 cm; clumpy, deformed chips, some original texture
UNWELDED PINK TUFF (Tt)				
160 - 170	**Tt**	unwelded tuff; light reddish gray [2.5YR7/1]; very weakly to moderately lithified; 80% tuff with pinkish-gray crystalline groundmass and <1mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none	trace oxidation of biotite phenocrysts	subrounded chips up to 2.0 cm; 20% contamination of weathered light gray tuff
170 - 180	**Tt**	unwelded tuff; light reddish gray [2.5YR7/1]; very weakly to moderately lithified; 60% pinkish-gray crystalline groundmass and <1 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none	trace oxidation of biotite phenocrysts	subangular chips up to 1.8 cm; 40% contamination of weathered light gray tuff
180 - 190	**Tt**	unwelded tuff; light reddish gray [2.5YR7/1]; weakly to moderately lithified; 75% pinkish-gray crystalline groundmass and <1 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none	trace oxidation of biotite phenocrysts	subangular chips up to 2.1 cm; 25% contamination of weathered light gray tuff
190 - 200	**Tt**	unwelded tuff; light reddish gray [2.5YR7/1]; weakly to moderately lithified; 60% pinkish-gray crystalline groundmass and <1 mm sized phenocrysts of plagioclase, quartz, and biotite; trace lithic fragments; moderately welded; reaction to acid: none to weak	trace oxidation of biotite phenocrysts; very trace calcite	subangular to subrounded chips up to 1.8 cm; 40% contamination of weathered light gray tuff
APACHE LEAP TUFF - Gray Unit (Talg)				
200 - 210	**Talg**	Gray Unit; brown [7.5YR5/2]; moderately lithified; 95% dacite tuff with brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; reaction to acid: none to weak	trace calcite	subangular to subrounded chips up to 1.9 cm; 5% contamination of unwelded gray tuff; trace moderately welded, pink tuff

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Talg**	Gray Unit; dark grayish brown [10YR4/2]; moderately lithified; dacite tuff with brown to yellowish-brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; some lithic fragments; reaction to acid: very weak to weak	trace calcite	subangular to subrounded chips up to 1.6 cm; trace contamination of unwelded gray tuff
220 - 230	**Talg**	Gray Unit; dark grayish brown [10YR4/2]; weakly to moderately lithified; 90% dacite tuff with brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; reaction to acid: very weak to weak	trace calcite	subangular to subrounded chips up to 2.0 cm; 10% contamination of unwelded gray tuff; very trace moderately welded, pink tuff
230 - 240	**Talg**	Gray Unit; gray [5YR5/1]; weakly to moderately lithified; 60% dacite tuff with brown aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; reaction to acid: very weak to weak	trace calcite	subangular to subrounded chips up to 2.0 cm; 40% contamination of unwelded gray tuff
240 - 250	**Talg**	Gray Unit; gray [5YR5/1]; weakly to moderately lithified; 70% yellowish-brown tuff, aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace lithic fragments; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.6 cm; 30% contamination of unwelded gray tuff
250 - 260	**Talg**	Gray Unit; weak red [2.5YR5/2]; moderately lithified; 95% yellowish-brown tuff, aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; very trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.8 cm; 5% contamination of grayish-pink unwelded tuff
260 - 270	**Talg**	Gray Unit; reddish gray [5YR5/2]; moderately lithified; tan to brown tuff with aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.4 cm
270 - 280	**Talg**	Gray Unit; reddish gray [5YR5/2]; moderately lithified; tan to brown tuff with aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.5 cm
280 - 290	**Talg**	Gray Unit; reddish gray [5YR5/2]; moderately lithified; tan to brown tuff with aphanitic groundmass and phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak		subangular to subrounded chips up to 1.2 cm

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	**FORMATION**	**GENERAL DESCRIPTION**	**SECONDARY FEATURES**	**COMMENTS**
290 - 300	**Talg**	Gray Unit; gray [5YR6/1]; weakly to moderately lithified; light grayish-brown crystalline groundmass and <2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak		subangular to subrounded chips up to 1.6 cm
300 - 310	**Talg**	Gray Unit; gray [5YR6/1]; weakly to moderately lithified; light grayish-brown crystalline groundmass and <2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; weakly to moderately welded; reaction to acid: none to very weak	very trace iron oxide staining; very trace calcite	subangular to subrounded chips up to 1.4 cm
APACHE LEAP TUFF - Brown Unit (Talb)				
310 - 320	**Talb**	Brown Unit; pale red [2.5YR6/2]; moderately lithified; tan to brown tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none to very weak	very trace iron oxide staining; very trace calcite	subangular to subrounded chips up to 1.0 cm
320 - 330	**Talb**	Brown Unit; pale red [2.5YR6/2]; moderately lithified; tan to brown tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; some lithic fragments; moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.8 cm
330 - 340	**Talb**	Brown Unit; pale red [2.5YR6/2]; moderately to very well lithified; tan to brown tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; some lithic fragments; moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.7 cm; trace contamination of unwelded white tuff
340 - 350	**Talb**	Brown Unit; pale red [2.5YR6/2]; moderately to very well lithified; tan to brown tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; some lithic fragments; moderately welded; reaction to acid: none to very weak	trace calcite; very trace iron oxide staining	subangular to subrounded chips up to 1.5 cm; 5% contamination of unwelded white tuff
350 - 360	**Talb**	Brown Unit; reddish gray [2.5YR5/1]; moderately to well lithified; tan to brownish-red tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 0.9 cm; trace contamination of unwelded white tuff

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
360 - 370	**Talb**	Brown Unit; reddish gray [2.5YR5/1]; moderately to well lithified; tan to brownish-red tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none to very weak	trace calcite; very trace iron oxide staining	subangular to subrounded chips up to 1.3 cm; 5% contamination of unwelded white tuff
370 - 380	**Talb**	Brown Unit; reddish gray [2.5YR5/1]; moderately to well lithified; tan to brownish-red tuff with aphanitic groundmass and 1-2 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; moderately welded; reaction to acid: none to very weak	very trace calcite	subangular to subrounded chips up to 1.2 cm; trace contamination of unwelded white tuff
380 - 390	**Talb**	Brown Unit; weak red [2.5YR4/2]; well lithified; brownish-red densely welded tuff, aphanitic groundmass and 1 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; welded; reaction to acid: none to very weak		angular to subrounded chips up to 0.8 cm
390 - 400	**Talb**	Brown Unit; weak red [2.5YR4/2]; well lithified; brownish-red densely welded tuff, aphanitic groundmass and 1 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; welded; reaction to acid: none to very weak		angular to subrounded chips up to 0.9 cm
400 - 410	**Talb**	Brown Unit; weak red [2.5YR4/2]; well lithified; brownish-red densely welded tuff, aphanitic groundmass and 1 mm sized phenocrysts of plagioclase, quartz, biotite; trace lithic fragments; welded; reaction to acid: none to very weak		angular to subrounded chips up to 0.5 cm
410 - 420	**Talb**	Brown Unit; weak red [2.5YR4/2]; well lithified; 50% light brown, welded tuff, aphanitic groundmass and 1 mm sized phenocrysts of plagioclase, quartz, biotite; welded; reaction to acid: none		subangular to subrounded chips up to 2.0 cm; 45% contamination of unwelded pink tuff; 5% unwelded light gray tuff
420 - 430	**Talb**	no sample		
430 - 440	**Talb**	Brown Unit and Vitrophyre; strong brown [7.5YR5/8], black [10YR2/1]; well lithified; 50% brownish-orange, welded tuff with microcrystalline groundmass and 1 mm sized phenocrysts of quartz, plagioclase, biotite; 50% glassy vitrophyre; reaction to acid: none	trace quartz vein	angular to subangular chips up to 1.4 cm; some contamination of unwelded tuff

C-13. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-13 [*55-920154*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
PRECAMBRIAN BASALT (pCbas)				
440 - 450	**pCbas**	basalt; dark reddish gray [2.5YR3/1], light brownish gray [10YR6/2]; well lithified; 70% blackish-red basalt; 30% tan, welded tuff with microcrystalline to glassy groundmass and 1 mm sized phenocrysts of quartz, biotite; reaction to acid: none to weak	common iron oxidation on basalt fracture surfaces; weathered; trace calcite vein	angular to subangular chips up to 1.7 cm; trace contamination of unwelded tuff
450 - 460	**pCbas**	basalt; reddish black [2.5YR2.5/1]; well lithified; 80% blackish-red basalt with some plagioclase amygdules; reaction to acid: none to weak	common iron oxidation on basalt fracture surfaces; weathered; trace calcite vein	angular to subangular chips up to 1.4 cm; 20% contamination of unwelded tuff
460 - 470	**pCbas**	basalt; reddish black [2.5YR2.5/1]; well lithified; blackish-red basalt with some plagioclase amygdules; reaction to acid: none to weak	common iron oxidation on basalt fracture surfaces; weathered; trace calcite vein	angular to subangular chips up to 2.2 cm; 5% contamination of unwelded tuff
PRECAMBRIAN DIABASE (pCdiab)				
470 - 480	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; 50% black diabase with 2-3 mm sized plagioclase laths; reaction to acid: none to weak	some iron oxidation on basalt fracture surfaces; slightly weathered; trace calcite vein	angular to subangular chips up to 1.7 cm; 50% contamination of unwelded tuff
MESCAL LIMESTONE (pCmls)				
480 - 490	**pCmls**	limestone; reddish brown [5YR5/3]; moderately to well lithified; 50% reddish-tan sandy limestone; 40% greenish-gray crystalline limestone; 10% gray massive limestone; reaction to acid: strong	trace calcite vein; trace iron oxidation	angular to subangular chips up to 1.3 cm; some contamination of unwelded tuff
490 - 500	**pCmls**	limestone; light reddish brown [5YR6/3]; moderately to well lithified; 80% greenish-tan crystalline limestone; 20% brownish-red calcareous siltstone; reaction to acid: strong	trace calcite vein; some iron oxidation	angular to subangular chips up to 1.2 cm; some contamination of unwelded tuff
500 - 510	**pCmls**	limestone; light reddish brown [5YR6/3]; moderately to well lithified; 80% greenish-tan crystalline limestone; 15% brownish-red calcareous siltstone; 5% white crystalline limestone; reaction to acid: strong	some calcite veins; trace iron oxidation	angular to subangular chips up to 1.5 cm; some contamination of unwelded tuff
PRECAMBRIAN DIABASE (pCdiab)				
510 - 520	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; black diabase with 1 mm sized plagioclase laths; trace greenish-tan crystalline limestone; reaction to acid: none to moderate	some iron oxide staining; moderately weathered; trace calcite veins	angular to subangular chips up to 0.8 cm
520 - 530	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; black diabase with 1 mm sized plagioclase laths; reaction to acid: none to weak	some iron oxide staining; moderately weathered; trace calcite veins	angular to subangular chips up to 0.7 cm
530 - 540	**pCdiab**	diabase; black [7.5YR2.5/1]; well lithified; black diabase with 1 mm sized plagioclase laths; reaction to acid: none to weak	some iron oxide staining; moderately weathered; trace calcite veins	angular to subangular chips up to 0.7 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer & Flooded Reverse tricone / National EWP	LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 895.0 feet / 2638.99 feet msl	DATE DRILLED: Dec. 7 - 14, 2016
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-12)33caa / 837285 N / 937527 E	NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; yellowish brown [10YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of diabase, quartzite, minor quartz vein, minor schist, minor tuff; reaction to acid: none to very weak		17-1/2-inch tricone; Conventional Air Rotary; angular to subrounded chips up to 2.3 cm; average chip size 0.4 cm
10 - 20	**Tg**	matrix-supported conglomerate; light yellowish brown [10YR6/4]; moderately lithified; 65% silty sand matrix and 35% clasts of diabase, quartzite, tuff, minor quartz vein, minor schist; reaction to acid: none to very weak		angular to subrounded chips up to 1.8 cm; average chip size 0.3 cm
20 - 30	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 60% silty sand matrix and 40% clasts of quartzite, diabase, minor quartz vein, minor tuff, minor schist; trace iron oxide staining on clasts; reaction to acid: none to very weak		10-1/2-inch hammer; Reverse Circulation; angular to subrounded chips up to 2.4 cm; average chip size 0.4-0.5 cm
30 - 40	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 60% silty sand matrix and 40% clasts of quartzite, diabase, minor quartz vein, minor tuff, minor schist; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.1 cm; average chip size 0.4 cm
40 - 50	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of diabase, quartzite, tuff, trace quartz vein; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 2.0 cm; average chip size 0.6 cm
50 - 60	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of tuff, diabase, quartzite, minor schist, trace to minor quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.2 cm; average chip size 0.5 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
60 - 70	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 70% silty sand matrix and 30% clasts of quartzite, tuff, diabase, minor quartz vein, trace quartzose siltstone; minor iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.4 cm; average chip size 0.4 cm
70 - 80	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of schist, diabase, quartzite, basalt, minor quartz vein, minor siltstone, trace tuff; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 3.2 cm; average chip size 0.6 cm
80 - 90	**Tg**	matrix-supported conglomerate; brown [7.5YR5/3]; weakly lithified; 70% silty sand matrix and 30% clasts of diabase, quartzite, minor schist, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.2 cm; average chip size 0.5 cm
90 - 100	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; 60% silty sand matrix and 40% clasts of quartzite, schist, diabase, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: moderate		angular to subrounded chips up to 1.7 cm; average chip size 0.6 cm
100 - 110	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; very weakly to weakly lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, diabase, more quartz vein, trace calcium carbonate and some green alteration on quartz vein clasts; trace iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 2.1 cm; average chip size 0.6 cm
110 - 120	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, diabase, more quartz vein, trace calcium carbonate and some green alteration on quartz vein clasts; trace iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 2.7 cm; average chip size 0.6-0.7 cm
120 - 130	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of tuff (approximately 40%), diabase, quartzite, schist, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.6 cm; average chip size 0.7 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
130 - 140	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of diabase, tuff, basalt, quartzite, trace quartz vein; minor iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.4 cm; average chip size 0.7 cm
140 - 150	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 70% silty sand matrix and 30% clasts of quartzite, tuff, diabase, minor schist, minor quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.4 cm; average chip size 0.6 cm
150 - 160	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, tuff, diabase, minor quartz vein, trace schist; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.3 cm; average chip size 0.5 cm
160 - 170	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 70% silty sand matrix and 30% clasts of diabase, quartzite, tuff, minor schis, trace quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.8 cm; average chip size 0.6 cm
170 - 180	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 70% silty sand matrix and 30% clasts of diabase, quartzite, tuff, trace schist, trace quartz vein, trace limestone; trace iron oxide staining on clasts; reaction to acid: weak to moderate		angular to subrounded chips up to 1.4 cm; average chip size 0.6 cm
180 - 190	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 70% silty sand matrix and 30% clasts of schist, quartzite, diabase, minor tuff, minor quartz vein, trace limestone; trace iron oxide staining on clasts; reaction to acid: very weak to moderate		angular to subrounded chips up to 1.5 cm; average chip size 0.5 cm
190 - 200	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 70% silty sand matrix and 30% clasts of quartzite, schist, diabase, minor quartz vein, trace limestone; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.3 cm; average chip size 0.4 cm
200 - 210	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, tuff, minor diabase, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 2.1 cm; average chip size 0.5 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
210 - 220	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately to well lithified; 65% silty sand matrix and 35% clasts of diabase, quartzite, schist, tuff, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: weak		angular to subrounded chips up to 1.3 cm; average chip size 0.3-0.4 cm
220 - 230	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; very weakly to weakly lithified; 70% silty sand matrix and 30% clasts of diabase, schist, quartzite, tuff, minor quartz vein; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.4 cm; average chip size 0.5 cm
230 - 240	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 70% silty sand matrix and 30% clasts of diabase, schist, quartzite, tuff, more quartz vein; trace iron oxide staining on clasts; reaction to acid: very weak to weak		angular to subrounded chips up to 1.8 cm; average chip size 0.3-0.4 cm
240 - 250	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; 65% silty sand matrix and 35% clasts of quartzite, diabase, schist, tuff, minor quartz vein; trace to minor iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded chips up to 1.3 cm; average chip size 0.5-0.6 cm
250 - 260	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly lithified; 65% silty sand matrix and 35% clasts of quartzite, diabase, schist, tuff, minor quartz vein; trace to minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.4 cm; average chip size 0.4 cm
260 - 270	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of quartzite, schist, tuff, minor diabase, minor quartz vein; minor iron oxide staining on clasts; reaction to acid: very weak		angular to subrounded chips up to 1.8 cm; average chip size 0.4 cm
270 - 280	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; moderately lithified; 60% silty sand matrix and 40% clasts of diabase, quartzite, minor tuff, minor schist, minor quartz vein; minor iron oxide staining on clasts; reaction to acid: none to very weak		angular to subrounded chips up to 2.0 cm; average chip size 0.5 cm
280 - 290	**Tg**	matrix-supported conglomerate; brown [7.5YR5/4]; weakly to moderately lithified; 65% silty sand matrix and 35% clasts of tuff, quartzite, minor diabase, minor schist, minor quartz vein; moderate iron oxide staining on clasts; reaction to acid: none to very weak	trace calcite coatings	angular to subrounded chips up to 1.5 cm; average chip size 0.6 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
BASALT (Tb)				
290 - 300	**Tb**	basalt; black [5Y2.5/1], brown [7.5YR5/4]; weakly to well lithified; 65% basalt; 35% matrix-supported conglomerate with clasts of quartzite and quartz vein; reaction to acid: none to weak	trace weathering, trace calcite on fracture surfaces	angular to subrounded chips up to 1.6 cm; average chip size 0.6 cm
300 - 310	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	trace calcite on fracture surfaces	angular to subangular chips up to 1.6 cm; average chip size 0.8 cm
310 - 320	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	trace calcite on fracture surfaces; trace quartz vein	angular to subangular chips up to 1.8 cm; average chip size 0.8 cm
320 - 330	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	trace calcite on fracture surfaces	angular to subangular chips up to 1.7 cm; average chip size 0.8 cm
330 - 340	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	minor calcite on fracture surfaces	angular to subangular chips up to 1.6 cm; average chip size 0.8 cm
340 - 350	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	minor calcite on fracture surfaces; trace quartz vein	angular to subangular chips up to 2.5 cm; average chip size 0.7 cm
350 - 360	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	minor iron oxide staining; trace calcite on fracture surfaces; trace quartz vein	angular to subangular chips up to 1.7 cm; average chip size 0.8 cm
360 - 370	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt with minor plagioclase amygdules; reaction to acid: none to weak	minor iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 1.9 cm; average chip size 0.7 cm
370 - 380	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt with minor plagioclase amygdules; reaction to acid: none to weak	minor iron oxide staining; trace calcite on fracture surfaces	angular to subangular chips up to 1.7 cm; average chip size 0.7 cm
380 - 390	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt with trace plagioclase amygdules; trace scoria; reaction to acid: none to strong	common iron oxide staining; chloritic alteration; some calcite vein; trace quartz vein	angular to subangular chips up to 2.0 cm
390 - 400	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt with trace plagioclase amygdules; trace scoria; reaction to acid: none to strong	trace quartz vein	angular to subangular chips up to 2.0 cm
400 - 410	**Tb**	basalt; black [5Y2.5/1]; well to very well lithified; basalt; reaction to acid: none to weak	common iron oxide staining; chloritic alteration; some calcite vein; trace quartz vein	angular to subangular chips up to 2.0 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
410 - 420	**Tb**	basalt; black [5Y2.5/1]; well lithified; 90% basalt; 10% sandstone and conglomerate; reaction to acid: very weak	some iron oxide staining; trace quartz vein	9-7/8-inch tricone; Flooded Reverse Circulation; angular to subangular chips up to 1.5 cm
BASALT (PALEOSOL) (Tb)				
420 - 430	**Tb**	paleosol; dark red [2.5YR3/6]; weakly to moderately lithified; 90% reddish-brown siltstone and sandstone with clayey matrix; 10% basalt; trace pale quartzite; trace schist; reaction to acid: none to weak	abundant iron oxide staining; weathering	angular to subangular chips up to 1 cm
430 - 440	**Tb**	paleosol; dark red [2.5YR3/6]; weakly to well lithified; 65% reddish-brown siltstone/sandstone with clayey matrix; 35% gray basalt flow breccia with angular feldspar clasts; flow banding; reaction to acid: none to weak	abundant iron oxide staining; weathering	angular to subangular chips up to 1.5 cm
440 - 450	**Tb**	paleosol; dark red [2.5YR3/6]; weakly to moderately lithified; reddish-brown paleosol with clayey sand matrix and clasts of basalt, siltstone, trace quartzite, trace schist, trace tuff, trace quartz vein; reaction to acid: none to weak	abundant iron oxide staining	angular to subangular chips up to 2.0 cm
450 - 460	**Tb**	paleosol; dark red [2.5YR3/6], black [5Y2.5/1]; moderately to well lithified; 85% reddish-brown paleosol with clayey sand matrix and clasts of basalt, siltstone, trace quartzite, trace schist, trace tuff, trace quartz vein; 15% black basalt; reaction to acid: none to weak	abundant iron oxide staining	angular to subangular chips up to 2.0 cm
BASALT (Tb)				
460 - 470	**Tb**	basalt; black [10YR2/1]; well lithified; basalt with up to 3 mm sized plagioclase amygdules; 5% tan siltstone; trace schist; reaction to acid: weak	common iron oxide staining	angular to subangular chips up to 2.0 cm
470 - 480	**Tb**	basalt; black [10YR2/1]; well lithified; basalt; trace brown tuff; reaction to acid: none to weak	common iron oxide staining	angular to subangular chips up to 2.0 cm
480 - 490	**Tb**	basalt; black [10YR2/1]; well lithified; basalt; trace brown tuff; reaction to acid: none	common iron oxide staining; trace quartz vein	angular to subangular chips up to 2.0 cm
490 - 500	**Tb**	basalt; very dark brown [5YR2.5/2]; well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; reaction to acid: weak	abundant iron oxide staining; commonly weathered	angular to subangular chips up to 2.0 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
500 - 510	**Tb**	basalt; very dark brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm; mostly pulverized drill cuttings
510 - 520	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
520 - 530	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
530 - 540	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; trace orange tuff; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
540 - 550	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; trace orange tuff; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
550 - 560	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; trace orange tuff; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
560 - 570	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; trace orange tuff; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.0 cm
570 - 580	**Tb**	basalt; dark reddish brown [5YR2.5/2]; moderately to well lithified; weathered basalt with common up to 3 mm sized plagioclase amygdules; trace orange tuff; reaction to acid: weak to moderate	abundant iron oxide staining; abundantly weathered; trace calcite	angular to subangular chips up to 2.5 cm
580 - 590	**Tb**	basalt; very dark brown [5YR2.5/2]; well lithified; weathered basalt; reaction to acid: none to weak	common iron oxide staining; chloritic alteration; trace talc	angular to subangular chips up to 2.5 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
590 - 600	**Tb**	basalt; very dark brown [5YR2.5/2], reddish brown [2.5YR4/4]; well lithified; 80% weathered basalt; 20% reddish-brown siltstone; reaction to acid: none to weak	abundant iron oxide staining	angular to subangular chips up to 2.5 cm
600 - 610	**Tb**	basalt; very dark brown [5YR2.5/2], reddish brown [2.5YR4/4]; moderately to well lithified; 60% reddish-brown siltstone; 40% weathered basalt; trace schist	abundant iron oxide staining; trace talc	angular to subangular chips up to 1.5 cm
BASALT (PALEOSOL) (Tb)				
610 - 620	**Tb**	paleosol; very dusky red [5YR2.5/2]; moderately lithified; 70% purple siltstone; 30% black basalt; trace altered olivine, schist, and quartz	common iron oxide staining	angular to subangular chips up to 1.5 cm
GILA CONGLOMERATE (Tg)				
620 - 630	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately to well lithified; 60% sandy matrix with 40% clasts of tuff, schist, basalt, red siltstone, quartz, trace olivine, trace quartzite; reaction to acid: none to weak	some iron oxide staining	angular to subangular chips up to 1.5 cm
630 - 640	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately to well lithified; 60% sandy matrix with 40% clasts of tuff, schist, basalt, red siltstone, quartz, trace olivine, trace quartzite, trace limestone; reaction to acid: none to weak	some iron oxide staining; trace chloritic alteration	angular to subangular chips up to 2.0 cm
640 - 650	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly to moderately lithified; 70% clayey sand matrix with 30% clasts of mostly schist and quartzite with tuff, basalt, red siltstone, quartz, trace olivine; reaction to acid: weak to moderate	some iron oxide stainig	angular to subangular chips up to 1.5 cm
650 - 660	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 65% clayey sand matrix with 35% clasts of mostly weathered diabase, orange siltstone, olive mudstone, basalt, trace quartzite, trace quartz; reaction to acid: weak to moderate	common iron oxide staining; trace chloritic alteration	angular to subangular chips up to 1.5 cm
660 - 670	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 60% clayey sand matrix with 40% clasts of mostly weathered diabase, basalt, brown siltstone, trace tuff, trace orange siltstone; reaction to acid: weak to moderate	abundant iron oxide staining	angular to subangular chips up to 2.0 cm

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
670 - 680	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 55% clayey, sandy matrix with 45% clasts of mostly weathered diabase, pink tuff, basalt, red siltstone, trace tuff, trace orange siltstone; reaction to acid: none to weak	abundant iron oxide staining; trace calcite	angular to subangular chips up to 2.0 cm
680 - 690	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 55% clayey sand matrix with 45% clasts of mostly weathered diabase, pink tuff, basalt, trace red siltstone; reaction to acid: none to weak	common iron oxide staining	angular to subangular chips up to 2.0 cm
TERTIARY TUFF (Tt)				
690 - 700	**Tt**	tuff; light brown [7.5YR6/3]; weakly lithified; pinkish-gray to light brown unwelded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments of basalt and red siltstone; reaction to acid: very weak	some iron oxide staining; weathered	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
700 - 710	**Tt**	tuff; light brown [7.5YR6/3]; weakly lithified; pinkish-gray to light brown unwelded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments of basalt and red siltstone; reaction to acid: none	groundmass weathered to clay; trace iron oxide staining	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
710 - 720	**Tt**	tuff; light brown [7.5YR6/3]; weakly lithified; pinkish-gray to light brown unwelded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; common lithic fragments (up to 8mm) of basalt and red siltstone; reaction to acid: none	groundmass weathered to clay; trace iron oxide staining	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
720 - 730	**Tt**	tuff; light brown [7.5YR6/3]; weakly lithified; pinkish-gray to light brown unwelded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	groundmass weathered to clay	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
730 - 740	**Tt**	tuff; pinkish gray [7.5YR7/2]; weakly lithified; white to pinkish-gray unwelded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	groundmass weathered to clay; trace chloritic alteration	angular to subrounded chips up to 1.0 cm; mostly pulverized sample

C-14. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
740 - 750	**Tt**	tuff; pinkish gray [7.5YR7/2]; weakly lithified; white to pinkish-gray un- to moderately welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	groundmass weathered to clay	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
750 - 760	**Tt**	tuff; light reddish brown [5YR6/3]; weakly to moderately lithified; 55% white unwelded tuff; 45% white to pink moderately welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	groundmass weathered to clay	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
APACHE LEAP TUFF - Gray Unit (Talb)				
760 - 770	**Talb**	Brown Unit; light reddish brown [5YR6/3]; moderately lithified; whitish-gray to pink tuff with microcyrstalline groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments (up to 1 cm); reaction to acid: none		angular to subrounded chips up to 1.0 cm; mostly pulverized sample
770 - 780	**Talb**	Brown Unit; light reddish brown [5YR6/3]; weakly to moderately lithified; 55% white unwelded tuff; 45% white to pink moderately welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none	groundmass weathered to clay	angular to subrounded chips up to 1.0 cm; mostly pulverized sample
780 - 790	**Talb**	Brown Unit; gray [7.5YR5/1]; weakly lithified; whitish-gray to pink poorly welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 1.0 cm; mostly pulverized sample
790 - 800	**Talb**	Brown Unit; dark gray [7.5YR4/1]; moderately lithified; white and dark grayish-pink, moderately welded tuff with microcrystalline groundmass; some lithic fragments; reaction to acid: none		angular to subrounded chips up to 1.5 cm; mostly pulverized sample
800 - 810	**Talb**	Brown Unit; dark gray [7.5YR4/1]; moderately to well lithified; dark gray, welded tuff with microcrystalline groundmass; some lithic fragments; reaction to acid: none	trace chloritic alteration	angular to subrounded chips up to 1.5 cm; mostly pulverized sample; some white unwelded tuff (contamination)
810 - 820	**Talb**	Brown Unit; brown [7.5YR4/2]; moderately to well lithified; dark gray, welded tuff with microcrystalline groundmass; some lithic fragments; reaction to acid: none	trace chloritic alteration	angular to subrounded chips up to 1.5 cm; mostly pulverized sample; some white unwelded tuff (contamination)

C-14. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS16-14 [*55-920155*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
820 - 830	**Talb**	Brown Unit; dark gray [7.5YR4/1]; moderately to well lithified; dark gray, welded tuff with microcrystalline groundmass; some lithic fragments; reaction to acid: none	some chloritic alteration	angular to subrounded chips up to 1.5 cm; mostly pulverized sample; abundant whitish-pink unwelded tuff (contamination)
830 - 840	**Talb**	Brown Unit; dark gray [7.5YR4/1]; moderately to well lithified; dark gray, welded tuff with microcrystalline groundmass; some lithic fragments; reaction to acid: none		angular to subrounded chips up to 2.5 cm; mostly pulverized sample; abundant whitish-pink unwelded tuff (contamination)
840 - 850	**Talb**	Brown Unit; brown [7.5YR4/2]; moderately lithified; white to pinkish-gray, moderately welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 1.0 cm; mostly pulverized sample
850 - 860	**Talb**	Brown Unit; brown [7.5YR4/2]; moderately to well lithified; white to pinkish-gray, moderately welded tuff with aphanitic groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 1.0 cm; mostly pulverized sample
860 - 870	**Talb**	Brown Unit; light reddish brown [2.5YR6/3]; moderately lithified; pinkish-gray to brown, moderately welded tuff with microcrystalline groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 1.0 cm; mostly pulverized sample
870 - 880	**Talb**	Brown Unit; light reddish brown [2.5YR6/3]; moderately lithified; pinkish-gray to brown, moderately welded tuff with microcrystalline groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 2.5 cm; mostly pulverized sample
880 - 890	**Talb**	Brown Unit; light reddish brown [2.5YR6/3]; moderately lithified; pinkish-gray, welded tuff with microcrystalline groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 2.5 cm; mostly pulverized sample
890 - 895	**Talb**	Brown Unit; light reddish brown [2.5YR6/3]; well lithified; pinkish-gray, welded tuff with microcrystalline groundmass and phenocrysts of plagioclase, biotite, quartz; trace lithic fragments; reaction to acid: none		angular to subrounded chips up to 2.5 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer / National EWP

LOGGED BY: M. Shelley

DEPTH DRILLED / LAND SURFACE ELEVATION: 680.0 feet / 2529.43 feet msl

DATE DRILLED: Dec. 18 - 22, 2016

CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-12)06ACD / 834156 N / 933025 E

NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
BASALT (Tb)				
0 - 10	**Tb**	andesitic basalt; brown [7.5YR4/4]; weakly lithified; weathered, slightly porphyritic basalt; common silt and clay; reaction to acid: very weak	common iron oxide staining	17-1/2-inch tricone; Conventional Air Rotary; angular to subangular chips up to 2.5 cm
10 - 20	**Tb**	andesitic basalt; brown [7.5YR4/4]; weakly to moderately lithified; weathered, slightly porphyritic basalt; some low plasticity clay; reaction to acid: very weak	common iron oxide staining	angular to subrounded chips up to 2.8 cm
20 - 30	**Tb**	andesitic basalt; dark gray [10YR4/1], dark reddish brown [2.5YR3/3]; moderately lithified; weathered, slightly porphyritic basalt; trace silt; reaction to acid: none	common iron oxide staining; very trace calcite vein	10-1/2-inch hammer; Reverse Circulation; angular to subangular chips up to 1.8 cm
30 - 40	**Tb**	andesitic basalt; dark gray [10YR4/1], dark reddish brown [2.5YR3/3]; moderately lithified; andesitic, porphyritic basalt; reaction to acid: none	some iron oxide staining	angular to subangular chips up to 1.0 cm
40 - 50	**Tb**	andesitic basalt; dark gray [10YR4/1], dark reddish brown [2.5YR3/3]; moderately lithified; andesitic, porphyritic basalt; reaction to acid: none	trace iron oxide staining	angular to subangular chips up to 1.5 cm
50 - 60	**Tb**	andesitic basalt; dark gray [10YR4/1], dark reddish brown [2.5YR3/3]; moderately to well lithified; andesitic, porphyritic basalt; reaction to acid: none	some iron oxide staining	angular to subangular chips up to 1.7 cm
60 - 70	**Tb**	andesitic basalt; dark gray [10YR4/1]; moderately to well lithified; andesitic, porphyritic basalt; reaction to acid: none	trace iron oxide staining; very trace calcite vein	angular to subangular chips up to 1.1 cm
70 - 80	**Tb**	andesitic basalt; dark gray [10YR4/1]; moderately to well lithified; andesitic, slightly porphyritic basalt, trace saponite on fracture surfaces; reaction to acid: none	trace iron oxide staining; trace calcite vein on fracture surfaces	angular to subangular chips up to 0.7 cm
80 - 90	**Tb**	andesitic basalt; dusky red [2.5YR3/2]; well lithified; andesitic, slightly porphyritic basalt, trace saponite on fracture surfaces; reaction to acid: none to weak	some iron oxide staining; trace calcite vein on fracture surfaces	angular to subangular chips up to 0.7 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
90 - 100	**Tb**	andesitic basalt; dusky red [2.5YR3/2]; well lithified; andesitic, slightly porphyritic basalt, trace saponite on fracture surfaces; reaction to acid: none to weak	some iron oxide staining; trace calcite vein on fracture surfaces	angular to subangular chips up to 0.7 cm
100 - 110	**Tb**	andesitic basalt; black [5YR2.5/1]; well lithified; andesitic, fine-grained, slightly porphyritic basalt; reaction to acid: none to weak	some iron oxide staining; trace calcite vein; trace saponite on fracture surfaces	angular to subangular chips up to 0.7 cm
110 - 120	**Tb**	andesitic basalt; black [5YR2.5/1]; well lithified; andesitic, fine-grained, slightly porphyritic basalt; reaction to acid: very weak to weak	some iron oxide staining; trace calcite vein; trace saponite on fracture surfaces	angular to subangular chips up to 0.7 cm
120 - 130	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; dark gray to reddish-black, slightly porphyritic basalt; reaction to acid: very weak	trace iron oxide staining	angular to subangular chips up to 1.3 cm
130 - 140	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; dark gray to reddish-black, slightly porphyritic basalt; reaction to acid: none	trace iron oxide staining	angular to subangular chips up to 1.7 cm
140 - 150	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; dark gray to reddish-black, slightly porphyritic basalt; reaction to acid: none	some iron oxide staining	angular to subangular chips up to 1.1 cm
150 - 160	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; dark gray to reddish-black, slightly porphyritic basalt; reaction to acid: none	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 0.8 cm
160 - 170	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; black to dark red basalt; reaction to acid: none to very weak	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 1.4 cm
170 - 180	**Tb**	andesitic basalt; black [5YR2.5/1], dusky red [10R3/2]; well lithified; black to dark red basalt; reaction to acid: very weak	trace iron oxide staining; some calcite vein	angular to subangular chips up to 0.8 cm
180 - 190	**Tb**	andesitic basalt; black [7.5YR2.5/1]; well lithified; black to dark red basalt; reaction to acid: very weak	trace iron oxide staining; some calcite vein	angular to subangular chips up to 1.5 cm
190 - 200	**Tb**	andesitic basalt; black [7.5YR2.5/1]; well lithified; black to dark red basalt; reaction to acid: very weak	trace iron oxide staining; some calcite on fracture surfaces	angular to subangular chips up to 1.9 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
BASALT (PALEOSOL) (Tb)				
200 - 210	**Tb**	paleosol; weak red [10R4/3]; moderately to well lithified; dusky red paleosol; some black basalt; reaction to acid: none	oxidized zone	angular to subangular chips up to 0.7 cm
210 - 220	**Tb**	paleosol; dusky red [10R3/4]; moderately to well lithified; red paleosol/siltstone; some scoria; reaction to acid: none	oxidized zone	angular to subangular chips up to 0.6 cm
TERTIARY EARLY SEDIMENTS (Tss)				
220 - 230	**Tss**	sandstone and siltstone; reddish brown [5YR4/4]; moderately to well lithified; brown fine-grained sandstone and siltstone; bedding; reaction to acid: none to very weak		angular to subangular chips up to 0.8 cm
230 - 240	**Tss**	sandstone and siltstone; reddish brown [5YR4/4]; moderately to well lithified; brown fine-grained sandstone and siltstone; bedding; reaction to acid: none to very weak		angular to subangular chips up to 0.8 cm
240 - 250	**Tss**	sandstone and siltstone; reddish brown [5YR4/4]; moderately to well lithified; brown fine-grained sandstone and siltstone; bedding; reaction to acid: none		angular to subangular chips up to 0.7 cm
250 - 260	**Tss**	sandstone and siltstone; reddish brown [2.5YR4/4]; moderately to well lithified; brown fine-grained sandstone and siltstone; bedding; reaction to acid: none		angular to subangular chips up to 0.9 cm
TERTIARY TUFFACEOUS VOLCANICS (Tt)				
260 - 270	**Tt**	tuff; pinkish gray [7.5YR7/2]; well lithified; whitish-tan tuff with crystalline groundmass and phenocrysts of quartz, biotite and plagioclase; reaction to acid: none		angular to subangular chips up to 0.6 cm
BASALT (PALEOSOL) (Tb)				
270 - 280	**Tb**	paleosol; dusky red [10R3/4]; moderately to well lithified; weathered basalt/paleosol with trace plagioclase amygdules; reaction to acid: very weak	abundant iron oxide; trace calcite vein; trace quartz vein	angular to subangular chips up to 0.6 cm
BASALT WITH PALEOSOL (Tb)				
280 - 290	**Tb**	basalt; reddish black [10R2.5/1]; well lithified; black to purple basalt/paleosol with trace plagioclase amygdules; reaction to acid: very weak	some iron oxide; trace calcite vein; trace quartz vein	angular to subangular chips up to 1.0 cm
BASALT (Tb)				
290 - 300	**Tb**	basalt; reddish black [10R2.5/1]; well lithified; black to purple basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; trace quartz vein	angular to subangular chips up to 0.9 cm; paleosol contamination
300 - 310	**Tb**	basalt; reddish black [10R2.5/1]; well lithified; black to purple basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; trace quartz vein	angular to subangular chips up to 1.0 cm; paleosol contamination

C-15. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
310 - 320	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; common quartz vein	angular to subangular chips up to 1.3 cm; paleosol contamination
320 - 330	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; common quartz vein; trace saponite on fractures	angular to subangular chips up to 1.6 cm; paleosol contamination
330 - 340	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; common quartz vein	angular to subangular chips up to 0.8 cm; paleosol contamination
340 - 350	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; common quartz vein	angular to subangular chips up to 0.7 cm; paleosol contamination
350 - 360	**Tb**	basalt; black [5YR2.5/1]; well lithified; black basalt with trace plagioclase amygdules; reaction to acid: none to very weak	trace calcite vein; some quartz vein	angular to subangular chips up to 0.7 cm; paleosol contamination
BASALT (PALEOSOL) (Tb)				
360 - 370	**Tb**	paleosol; dusky red [10R3/4]; moderately lithified; dark red weathered basalt; reaction to acid: very weak	abundant iron oxide; trace quartz vein	angular to subangular chips up to 1.3 cm; paleosol contamination
BASALT (Tb)				
370 - 380	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace quartz vein	angular to subangular chips up to 0.7 cm
380 - 390	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace quartz vein	angular to subangular chips up to 0.9 cm
390 - 400	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace calcite on fracture surfaces; very trace quartz vein	angular to subangular chips up to 0.9 cm
400 - 410	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace calcite on fracture surfaces; very trace quartz vein	angular to subangular chips up to 0.9 cm
410 - 420	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace calcite on fracture surfaces; very trace quartz vein	angular to subangular chips up to 0.9 cm
420 - 430	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace calcite on fracture surfaces; very quartz vein; very trace iron oxide on fractures	angular to subangular chips up to 1.2 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
430 - 440	**Tb**	basalt; black [5YR2.5/1]; well lithified; dark purple to black basalt with some plagioclase amygdules; reaction to acid: none	trace calcite on fracture surfaces; very quartz vein; very trace iron oxide on fractures	angular to subangular chips up to 1.3 cm
BASALT (PALEOSOL) (Tb)				
440 - 450	**Tb**	basalt and paleosol; black [5YR2.5/1], dusky red [10R3/4]; moderately to well lithified; 50% dark purple to black basalt with some plagioclase amygdules; 50% paleosol; reaction to acid: none to very weak	abundant iron oxide on fractures; trace calcite on fracture surfaces; very quartz vein	angular to subangular chips up to 1.4 cm
WEATHERED BASALT (Tb)				
450 - 460	**Tb**	basalt and paleosol; black [5YR2.5/1], dusky red [10R3/4]; moderately to well lithified; 80% dark purple to black basalt with some plagioclase amygdules; 20% paleosol; reaction to acid: none to very weak	abundant iron oxide on fractures; trace calcite on fracture surfaces; very trace quartz vein	angular to subangular chips up to 1.3 cm
460 - 470	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none to very weak	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 0.9 cm
470 - 480	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none to very weak	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 0.7 cm
480 - 490	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none to very weak	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 1.0 cm
490 - 500	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none to very weak	trace iron oxide staining; trace calcite vein	angular to subangular chips up to 1.1 cm
500 - 510	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none		angular to subangular chips up to 0.6 cm
510 - 520	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none	some iron oxide staining	angular to subangular chips up to 0.8 cm
520 - 530	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none	some iron oxide staining	angular to subangular chips up to 1.0 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
530 - 540	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none	trace iron oxide staining; very trace calcite vein	angular to subangular chips up to 0.8 cm
540 - 550	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none	very trace calcite vein	angular to subangular chips up to 1.8 cm
550 - 560	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; reddish-black basalt with common plagioclase amygdules; reaction to acid: none		angular to subangular chips up to 1.0 cm
560 - 570	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none	trace iron oxide staining	angular to subangular chips up to 0.7 cm
570 - 580	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none	trace iron oxide staining	angular to subangular chips up to 1.3 cm
580 - 590	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none		angular to subangular chips up to 1.0 cm
590 - 600	**Tb**	basalt; reddish black [5R2.5/1]; well lithified; slightly weathered, reddish-black basalt with common plagioclase amygdules; reaction to acid: none		angular to subangular chips up to 2.0 cm
WEATHERED BASALT AND SEDIMENTS (Tb)				
600 - 610	**Tb**	basalt and weathered tuff; reddish black [5R2.5/1], dark reddish brown [2.5YR3/4]; moderately to well lithified; 90% slightly weathered, reddish-black basalt with common plagioclase amygdules; 10% weathered tuff; reaction to acid: none	common iron oxide staining	angular to subrounded chips up to 1.3 cm
APACHE LEAP TUFF - Gray Unit (Talg)				
610 - 620	**Talg**	dacite tuff; dark reddish brown [2.5YR3/4], reddish gray [2.5YR6/1]; moderately to well lithified; 50% weathered tuff; 50% dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; reaction to acid: none to weak	abundant iron oxide staining; trace calcite vein	angular to subrounded chips up to 0.7 cm

C-15. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-15 [*55-920156*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
620 - 630	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; reaction to acid: none		angular to subrounded chips up to 0.6 cm
630 - 640	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; reaction to acid: none		angular to subrounded chips up to 0.5 cm
640 - 650	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; trace lithic fragments of siltstone; reaction to acid: none	trace iron oxide staining	angular to subrounded chips up to 0.7 cm
650 - 660	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; trace lithic fragments of siltstone; reaction to acid: none to weak	very trace calcite veinlet	angular to subrounded chips up to 0.7 cm
660 - 670	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; trace lithic fragments of siltstone; reaction to acid: none to weak	very trace calcite veinlet	angular to subrounded chips up to 0.9 cm
670 - 680	**Talg**	dacite tuff; reddish gray [2.5YR6/1]; well lithified; dacite tuff with aphanitic groundmass and phenocrysts of biotite, plagioclase, quartz; trace lithic fragments of siltstone; reaction to acid: none		angular to subrounded chips up to 0.8 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Reverse Circulation hammer & Flooded Reverse tricone / National EWP
LOGGED BY: C. Gregory
DEPTH DRILLED / LAND SURFACE ELEVATION: 600.0 feet / 2463.18 feet msl
DATE DRILLED: Jan. 26 - Feb. 1, 2017
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (D-1-11)01adb / 833042 N / 929039 E
NOMINAL BOREHOLE DIAMETER: 10 inches

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
GILA CONGLOMERATE (Tg)				
0 - 10	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; very weakly lithified; 65% silty sandy matrix and 35% clasts of tuff, schist, quartzite,minor quartz vein, trace quartzose sandstone; reaction to acid: none to very weak	minor iron oxide staining	17-1/2-inch tricone; Conventional Air Rotary; subangular to subrounded chips up to 1.2 cm
10 - 20	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; very weakly lithified; 65% silty sandy matrix and 35% clasts of tuff, schist, quartzite, minor quartz vein, trace quartzose sandstone; reaction to acid: none to very weak	minor iron oxide staining	subangular to subrounded chips up to 0.5 cm
20 - 30	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; very weakly to weakly lithified; 65% silty sandy matrix and 35% clasts of schist, quartz vein and quartzite, minor tuff; reaction to acid: very weak	minor iron oxide staining; trace calcite	10-1/2-inch hammer; Reverse Circulation; subangular to subrounded chips up to 1.4 cm
30 - 40	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly lithified; 65% silty sandy matrix and 35% clasts of schist, quartz vein and quartzite, minor tuff; reaction to acid: none to very weak	trace to minor iron oxide staining	subangular to subrounded chips up to 1.3 cm
40 - 50	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly to moderately lithified; 60% silty sandy matrix and 40% clasts of schist, quartzite, tuff, quartz vein, basalt, minor diabase; reaction to acid: none to very weak	trace to minor iron oxide staining	subangular to subrounded chips up to 1.3 cm
50 - 60	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly to moderately lithified; 60% silty sandy matrix and 40% clasts of schist, quartzite, tuff, quartz vein and basalt, minor diabase, minor tuff; reaction to acid: none to very weak	trace to minor iron oxide staining	subangular to subrounded chips up to 1.2 cm
60 - 70	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; weakly to moderately lithified; 65% silty sandy matrix and 35% clasts of schist and quartz vein, minor tuff, trace weathered basalt; reaction to acid: none to very weak	trace to minor iron oxide staining	subangular to subrounded chips up to 0.9 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
70 - 80	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 65% silty sandy matrix and 35% clasts of schist and quartz vein, minor tuff, trace weathered basalt; reaction to acid: none to very weak	trace iron oxide staining	subangular to subrounded chips up to 1.1 cm
80 - 90	**Tg**	matrix-supported conglomerate; reddish brown [5YR4/4]; moderately lithified; 65% silty sandy matrix and 35% clasts of schist and quartz vein, minor quartzite, trace to minor diabase, minor weathered basalt; reaction to acid: none to very weak	trace to minor iron oxide staining	subangular to subrounded chips up to 1.1 cm
90 - 100	**Tg**	matrix-supported conglomerate; brown [7.5YR4/4]; moderately lithified; 60% silty sandy matrix and 40% clasts of weathered basalt, schist, quartz vein, minor quartzite, minor diabase; reaction to acid: none to very weak	trace iron oxide staining	subangular to subrounded chips up to 1.3 cm
BASALT (Tb)				
100 - 110	**Tb**	basalt; dusky red [10R3/3]; moderately to well lithified; dusky red, weathered basalt; reaction to acid: none to very weak	moderate to highly weathered; abundant iron oxide staining; common quartz in vesicules on fracture surfaces	angular to subangular chips up to 1.0 cm
110 - 120	**Tb**	basalt; dusky red [10R3/3]; moderately to well lithified; dusky red, weathered basalt; reaction to acid: none to very weak	moderate to highly weathered; abundant iron oxide staining; some quartz vein	angular to subangular chips up to 1.3 cm
120 - 130	**Tb**	basalt; very dusky red [10R2.5/2]; moderately to well lithified; very dusky red, weathered basalt; reaction to acid: none to very weak	common weathering; common quartz in vesicules and on fracture surfaces; common iron oxide staining	angular to subangular chips up to 2.0 cm
130 - 140	**Tb**	basalt; reddish black [10R2.5/1]; well lithified; reddish-black basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; some quartz vein	angular to subangular chips up to 2.2 cm
140 - 150	**Tb**	basalt; reddish black [10R2.5/1]; well to very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace to minor iron oxide staining; minor quartz vein on fracture surfaces	angular to subangular chips up to 1.9 cm
150 - 160	**Tb**	basalt; reddish black [10R2.5/1]; well to very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace to minor iron oxide staining; minor quartz vein on fracture surfaces	angular to subangular chips up to 1.3 cm
160 - 170	**Tb**	basalt; reddish black [10R2.5/1]; well to very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; trace quartz vein on fracture surfaces	angular to subangular chips up to 1.7 cm
170 - 180	**Tb**	basalt; reddish black [10R2.5/1]; well to very well lithified; reddish-black basalt; reaction to acid: none	trace iron oxide staining; trace quartz vein on fracture surfaces	angular to subangular chips up to 2.2 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
180 - 190	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none	trace iron oxide staining; trace quartz vein on fracture surfaces	angular to subangular chips up to 0.8 cm
190 - 200	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none	trace to minor iron oxide staining; minor quartz vein	angular to subangular chips up to 1.0 cm
200 - 210	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none	trace iron oxide staining; trace quartz vein	angular to subangular chips up to 1.1 cm
210 - 220	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none	minor weathering; minor to common iron oxide staining; minor quartz vein	angular to subangular chips up to 1.7 cm
220 - 230	**Tb**	basalt; reddish black [10R2.5/1]; well to very well lithified; reddish-black basalt; reaction to acid: none	minor weathering; minor to common iron oxide staining; minor quartz vein	angular to subangular chips up to 1.9 cm
230 - 240	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor to common iron oxide staining; minor quartz vein; trace calcite coatings	angular to subangular chips up to 1.8 cm
240 - 250	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 2.0 cm
250 - 260	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none	minor weathering; minor iron oxide staining; minor quartz vein	angular to subangular chips up to 2.4 cm
260 - 270	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none	minor weathering; minor iron oxide staining; minor quartz vein	angular to subangular chips up to 1.7 cm
270 - 280	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor iron oxide staining; minor quartz vein; trace calcite	angular to subangular chips up to 1.6 cm
280 - 290	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	minor weathering; trace to minor iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 1.2 cm
290 - 300	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	minor weathering; trace to minor iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 1.0 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
300 - 310	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor to common iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 1.7 cm
310 - 320	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor to common iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 1.9 cm
320 - 330	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor to common iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 1.6 cm
330 - 340	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering; minor to common iron oxide staining; minor quartz vein; trace calcite staining	angular to subangular chips up to 2.0 cm
340 - 350	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	very minor weathering; minor iron oxide staining; minor quartz vein; trace calcite coatings	angular to subangular chips up to 1.5 cm
350 - 360	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.4 cm
360 - 370	**Tb**	basalt; reddish black [10R2.5/1]; very well lithified; reddish-black basalt with trace saponite; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.3 cm
370 - 380	**Tb**	basalt; dusky red [10R3/3]; very well lithified; dusky red, weathered basalt with trace saponite; reaction to acid: none	minor to moderate weathering; common iron oxide staining; trace calcite; trace quartz vein	angular to subangular chips up to 1.2 cm
380 - 390	**Tb**	basalt; dusky red [10R3/2]; well to very well lithified; dusky red, weathered basalt with trace saponite; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.1 cm
390 - 400	**Tb**	basalt; very dusky red [10R2.5/2]; well to very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.0 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
400 - 410	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.4 cm
410 - 420	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.0 cm
420 - 430	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.2 cm
430 - 440	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.1 cm
440 - 450	**Tb**	basalt; very dusky red [10R2.5/2]; very well lithified; very dusky red basalt; reaction to acid: none to very weak	minor weathering and iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 0.7 cm
450 - 460	**Tb**	basalt; reddish black [5R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 0.7 cm
460 - 470	**Tb**	basalt; reddish black [5R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; trace quartz vein; trace calcite coatings	angular to subangular chips up to 1.0 cm
470 - 480	**Tb**	basalt; reddish black [5R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; common quartz vein (up to 1 cm); trace calcite coatings	angular to subangular chips up to 1.1 cm
480 - 490	**Tb**	basalt; reddish black [5R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; some quartz vein; trace calcite coatings	angular to subangular chips up to 0.8 cm
490 - 500	**Tb**	basalt; reddish black [5R2.5/1]; very well lithified; reddish-black basalt; reaction to acid: none to very weak	trace iron oxide staining; some quartz vein; trace calcite coatings	angular to subangular chips up to 0.8 cm
500 - 510	**Tb**	basalt; reddish black [5R2.5/1], dusky red [10R3/4], weak red [10R4/3]; moderately to very well lithified; reddish-black basalt; some weathered basalt; trace weathered dacite tuff; reaction to acid: none to very weak	common iron oxide staining	6-1/2-inch tricone; Flooded Reverse Circulation; angular to subangular chips up to 1.2 cm

C-16. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM HYDROGEOLOGIC TEST WELL DS17-16 [*55-920157*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	GENERAL DESCRIPTION	SECONDARY FEATURES	COMMENTS
APACHE LEAP TUFF - Gray Unit (Tal)				
510 - 520	**Tal**	Gray Unit; dusky red [10R3/4], weak red [10R4/3], reddish black [5R2.5/1]; moderately to well lithified; dacite tuff with phenocrysts of plagioclase, biotite, quartz; some weathered basalt; trace weathered dacite tuff; reaction to acid: none	common iron oxide staining	angular to subangular chips up to 0.9 cm
520 - 530	**Tal**	no sample		
PINAL SCHIST (pCpi)				
530 - 540	**pCpi**	schist; very dark gray [N3], weak red [10R4/3]; well lithified; phyllitic schist; some dacite tuff with phenocrysts of plagioclase, biotite, quartz; reaction to acid: none	common quartz vein	angular to subangular chips up to 0.6 cm
540 - 550	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	common quartz vein	angular to subangular chips up to 1.8 cm
550 - 560	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	common quartz vein	angular to subangular chips up to 0.7 cm
560 - 570	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	some quartz vein	angular to subangular chips up to 0.5 cm
570 - 580	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	some quartz vein	angular to subangular chips up to 0.7 cm
580 - 590	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	common quartz vein	angular to subangular chips up to 0.7 cm
590 - 600	**pCpi**	schist; very dark gray [N3]; well lithified; phyllitic schist; reaction to acid: none	common quartz vein	angular to subangular chips up to 0.6 cm

C-17. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DS17-17 [*55-920368*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Sonic Core / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 33.0 feet / 2221.92 feet msl	DATE DRILLED: Feb. 9, 2017
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (A-1-11)35cbd / 836969 N / 915161 E	NOMINAL BOREHOLE DIAMETER: 8 inches

DEPTH INTERVAL (feet)	FORMATION	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 5.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to very coarse sand 50%, gravel 35%, silt 15%. Gravel fraction: subrounded to rounded to 6 cm consisting of clasts of schist, tuff, basalt, quartzite, trace quartz vein. Non-lithified. Non-plastic. Dry. Poorly sorted. Reaction to acid: strong.
5.0 - 10.0	**Qal**	No sample.
10.0 - 12.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: angular to subrounded to 6 cm consisting of clasts of quartzite, schist, tuff, basalt, trace quartz vein. Non-lithified. Non-plastic. Dry. Poorly sorted. Reaction to acid: strong.
12.0 - 14.0	**Qal**	**SAND AND GRAVEL**: Brown [7.5YR4/3]; gravel 50%, subangular to subrounded, very fine to very coarse sand 45%, silt 5%. Gravel fraction: subangular to subrounded to 4-5 cm consisting of clasts of tuff, quartzite, schist, trace basalt, trace quartz vein. Non-lithified. Non-plastic. Moist. Moderately sorted. Reaction to acid: very weak.
14.0 - 17.0	**Qal**	**SILTY SANDY GRAVEL**: Brown [7.5YR4/3]; gravel 50%, subrounded, very fine to very coarse sand 35%, silt 15%. Gravel fraction: angular to subrounded to 6 cm consisting of clasts of schist, quartzite, tuff, trace basalt, and trace quartz vein. Non-lithified. Non-plastic. Saturated. Poorly sorted. Reaction to acid: none to very weak.
17.0 - 22.5	**Qal**	**SILTY GRAVELLY SAND; TRACE CLAY**: Dark yellowish brown [10YR4/4]; subrounded, very fine to medium sand 60%, gravel 25%, silt and clay 15%. Gravel fraction: subrounded to 5 cm consisting of clasts of schist, quartzite, tuff, and some quartz vein. Non-lithified. Low plasticity. Saturated. Moderately sorted. Reaction to acid: very weak to weak.
22.5 - 29.5	**Qal**	**CLAYEY, SILTY SAND**: Dark yellowish brown [10YR4/4]; subrounded, very fine to medium sand 75%, silt and clay 20%, gravel 5%. Gravel fraction: subrounded to rounded to 2-3 cm consisting of clasts of quartzite, schist, basalt, tuff, and some quartz vein. Non-lithified. Low to medium plasticity. Saturated. Well sorted. Reaction to acid: weak.
29.5 - 31.0	**Qal**	**CLAYEY, SILTY SANDY GRAVEL**: Dark yellowish brown [10YR4/4]; gravel 55%, subrounded, very fine to very coarse sand 35%, silt and clay 10%. Gravel fraction: angular to subrounded to 4-5 cm consisting of clasts of schist, quartz vein, quartzite and trace tuff. Non-lithified. Non to low plasticity. Saturated. Poorly sorted. Reaction to acid: none.
WEATHERED PINAL SCHIST (pCpi)		
31.0 - 32.5	**pCpi**	**VERY WEATHERED PHYLLIC SCHIST**: Bluish gray [5PB6/1], dark yellowish brown [10YR4/4]; gravel 55%, sand 35%, 10%. Weakly lithified. Moist. Reaction to acid: none. Some quartz vein; common iron oxide staining, some low plasticity clay; pulverized core sample.

Gravel/sand division based on USCS scale. Grain size fractions estimated using manual field methods.
Grain size fractions rounded to the nearest five percent.

C-18. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DS17-18 [*55-920363*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Sonic Core / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 65.0 feet / 2221.92 feet msl	DATE DRILLED: Feb. 7 - 8, 2017
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (A-1-11)35cbd / 836971 N / 915151 E	NOMINAL BOREHOLE DIAMETER: 6 inches

DEPTH INTERVAL (feet)	FORMATION	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 5.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to very coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: subrounded to angular to 4 cm consisting of clasts of schist, basalt, tuff, quartzite, trace limestone, trace quartz vein. Non-lithified. Non-plastic. Dry. Poorly sorted. Reaction to acid: strong.
5.0 - 10.0	**Qal**	No sample.
10.0 - 13.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to very coarse sand 50%, gravel 35%, silt 15%. Gravel fraction: angular to subrounded to 4 cm consisting of clasts of quartzite, schist, tuff, some basalt, trace limestone, trace quartz vein. Non-lithified. Non-plastic. Dry. Poorly sorted. Reaction to acid: strong.
13.0 - 15.0	**Qal**	**SAND AND COBBLES**: Brown [7.5YR4/3]; gravel 80%, subrounded, very fine to very coarse sand 15%, silt 5%. Gravel fraction: subangular to subrounded to 4 cm consisting of clasts of tuff, schist, basalt, and quartzite. Non-lithified. Non-plastic. Saturated. Moderately sorted. Reaction to acid: none to very weak.
15.0 - 17.0	**Qal**	**GRAVELLY SAND**: Brown [7.5YR4/3]; subangular to subrounded, very fine to very coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: angular to subrounded to 4 cm consisting of clasts of schist, quartzite, tuff, some basalt, and some quartz vein. Non-lithified. Non-plastic. Saturated. Poorly sorted. Reaction to acid: none to very weak.
17.0 - 21.0	**Qal**	**SILTY GRAVELLY (COBBLY) SAND; TRACE CLAY**: Brown [7.5YR4/3]; subrounded, very fine to medium sand 60%, gravel 25%, silt and clay 15%. Gravel fraction: subrounded to 4 cm consisting of clasts of schist, quartzite, and tuff. Non-lithified. Low plasticity. Saturated. Poorly sorted. Reaction to acid: very weak to weak.
21.0 - 29.0	**Qal**	**SILTY SAND; TRACE CLAY**: Dark yellowish brown [10YR4/4]; subrounded, very fine to medium sand 75%, silt and clay 20%, gravel 5%. Gravel fraction: subrounded to rounded to 3 cm consisting of clasts of schist, quartzite, basalt and some tuff. Non-lithified. Low to medium plasticity. Saturated. Well sorted. Reaction to acid: weak.
29.0 - 32.0	**Qal**	**SILTY GRAVEL AND SAND**: Dark yellowish brown [10YR4/4]; gravel 45%, subangular to subrounded, fine to very coarse sand 45%, silt 10%. Gravel fraction: angular to subrounded to 4 cm consisting of clasts of schist, quartzite and basalt. Non-lithified. Non-plastic. Saturated. Poorly sorted. Reaction to acid: none.
32.0 - 33.0	**Qal**	**CLAYEY, SILTY SANDY GRAVEL**: Dark yellowish brown [10YR4/4]; gravel 55%, subangular to subrounded, very fine to very coarse sand 35%, silt and clay 10%. Gravel fraction: angular to subrounded to 4 cm consisting of clasts of schist, quartz vein and quartzite. Non-lithified. Non to low plasticity. Saturated. Poorly sorted. Reaction to acid: none.

Gravel/sand division based on USCS scale. Grain size fractions estimated using manual field methods.
Grain size fractions rounded to the nearest five percent.

C-18. LITHOLOGIC DESCRIPTIONS FOR
DRILL CUTTINGS FROM MONITOR WELL DS17-18 [*55-920363*]
NEAR WEST
PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	DESCRIPTION
WEATHERED PINAL SCHIST (pCpi)		
		.
33.0 - 45.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: Light bluish gray [10B7/1]; Weakly to moderately lithified. Dry. Reaction to acid: none. Some quartz vein; some iron oxide staining, some low plasticity clay; pulverized core sample.
45.0 - 50.0	**pCpi**	**WEATHERED PHYLLIC AND PSAMMITIC SCHIST**: White [7.5YR8/1]; Moderately lithified. Moist. Reaction to acid: none. Some quartz vein; trace iron oxide staining, common medium plasticity clay; pulverized core sample.
50.0 - 54.0	**pCpi**	**WEATHERED PHYLLIC AND PSAMMITIC SCHIST**: White [10YR8/1]; Moderately lithified. Moist. Reaction to acid: none. Some quartz vein; some iron oxide staining; some low- to medium-plasticity clay; pulverized core sample.
PINAL SCHIST (pCpi)		
		.
54.0 - 65.0	**pCpi**	**COMPETENT PHYLLIC SCHIST**: White [10YR8/1]; Moderately to well lithified. Dry. Reaction to acid: none. Some quartz vein; trace low plasticity clay; pulverized core sample.

C-19. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DS17-19 [*55-920364*]
NEAR WEST
PINAL COUNTY, AZ

DRILLING METHOD / COMPANY: Sonic Core / National EWP	LOGGED BY: M. Shelley
DEPTH DRILLED / LAND SURFACE ELEVATION: 55.0 feet / 2221.92 feet msl	DATE DRILLED: Feb. 11, 2017
CADASTRAL / AZ STATE PLANE CENTRAL NAD83 : (A-1-11)35cbd / 836974 N / 915142 E	NOMINAL BOREHOLE DIAMETER: 6 inches

DEPTH INTERVAL (feet)	FORMATION	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 5.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to very coarse sand 45%, gravel 35%, silt 20%. Gravel fraction: subrounded to rounded to 4 cm consisting of clasts of schist, quartzite, basalt, tuff, and some quartz vein. Non-lithified. Non-plastic. Dry. Poorly sorted. Reaction to acid: very strong.
5.0 - 10.0	**Qal**	No sample.
10.0 - 13.0	**Qal**	**SILTY GRAVELLY SAND**: Light gray [10YR7/2]; subrounded, very fine to very coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: subangular to rounded to 4 cm consisting of clasts of schist, quartzite, tuff, and some basalt and quartz vein. Non-lithified. Non-plastic. Slightly moist. Poorly sorted. Reaction to acid: strong. Some quartz vein; common iron oxide staining; pulverized core sample.
13.0 - 17.0	**Qal**	**SILTY SANDY GRAVEL**: Brown [7.5YR4/3]; gravel 60%, subrounded, very fine to very coarse sand 25%, silt and clay 15%. Gravel fraction: subangular to rounded to 3-4 cm consisting of clasts of mostly schist and tuff, with some quartzite, trace basalt and quartz vein. Non-lithified. Non to low plasticity. Saturated. Poorly sorted. Reaction to acid: weak.
17.0 - 24.0	**Qal**	**SILTY GRAVELLY SAND**: Dark yellowish brown [10YR4/4]; subrounded, very fine to coarse sand 60%, gravel 25%, silt and clay 15%. Gravel fraction: subangular to rounded to 2-3 cm consisting of clasts of mostly schist and tuff, with some quartzite, trace basalt and quartz vein. Non-lithified. Low plasticity. Saturated. Moderately sorted. Reaction to acid: weak.
24.0 - 28.0	**Qal**	**GRAVELLY SILTY SAND; TRACE CLAY**: Dark yellowish brown [10YR4/4]; subrounded, very fine to medium sand 70%, silt and clay 20%, gravel 10%. Gravel fraction: subrounded to rounded to 2-4 cm consisting of clasts of mostly quartzite, with some schist, siltstone and tuff. Non-lithified. Low to moderately plasticity. Saturated. Well sorted. Reaction to acid: very weak to weak.
28.0 - 33.5	**Qal**	**SILTY GRAVELLY SAND**: Brown [7.5YR4/3]; subangular to subrounded, very fine to very coarse sand 55%, gravel 30%, silt and clay 15%. Gravel fraction: angular to subrounded to 4 cm consisting of clasts of schist, quartzite, quartz vein and tuff. Non-lithified. Low plasticity. Saturated. Poorly sorted. Reaction to acid: very weak to weak.
WEATHERED PINAL SCHIST (pCpi)		
		.
33.5 - 37.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: Bluish gray [5PB6/1]; Moderately lithified. Dry. Reaction to acid: none. Some quartz vein; common iron oxide staining; pulverized core sample.

Gravel/sand division based on USCS scale. Grain size fractions estimated using manual field methods.
Grain size fractions rounded to the nearest five percent.

C-19. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL DS17-19 [*55-920364*] NEAR WEST PINAL COUNTY, AZ

DEPTH INTERVAL (feet)	FORMATION	DESCRIPTION
37.0 - 45.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: Bluish gray [5PB6/1]; Weakly to moderately lithified. Moist. Reaction to acid: none. Some quartz vein; common iron oxide staining, common medium-plasticity clay; pulverized core sample.
45.0 - 49.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: White [7.5YR8/1]; Moderately lithified. Dry. Reaction to acid: none. Some quartz vein; some iron oxide staining, trace medium-plasticity clay; pulverized core sample.
49.0 - 52.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: White [7.5YR8/1]; Moderately lithified. Moist. Reaction to acid: none. Some quartz vein; some iron oxide staining, some medium-plasticity clay; pulverized core sample.
52.0 - 55.0	**pCpi**	**WEATHERED PHYLLIC SCHIST**: White [7.5YR8/1]; Moderately lithified. Dry. Reaction to acid: none. Some quartz vein; trace iron oxide staining; pulverized core sample.
PINAL SCHIST (pCpi)		.
55.0 - 57.5	**pCpi**	**COMPETENT PHYLLIC SCHIST**: Bluish gray [5PB6/1]; Moderately to well lithified. Dry. Reaction to acid: none. Some quartz vein; trace iron oxide staining; pulverized core sample.

Appendix D

Borehole Geophysical Logs
(Southwest Exploration Services, LLC)
(Provided on DVD)

MONTGOMERY
& ASSOCIATES

Appendix E

Water Level Hydrographs

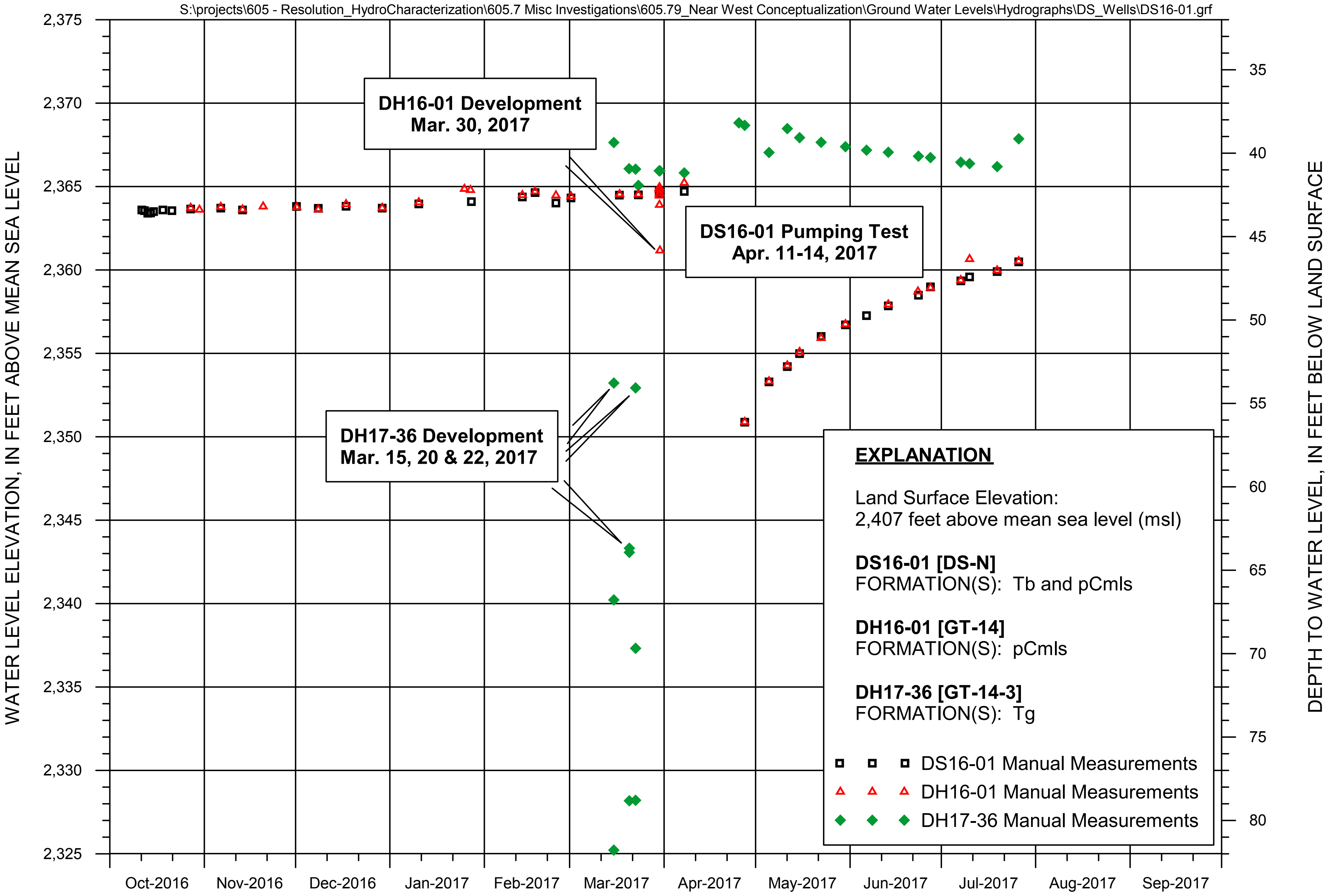


FIGURE E-01. WATER LEVEL HYDROGRAPHS FOR DS16-01, DH16-01, AND DH17-36

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

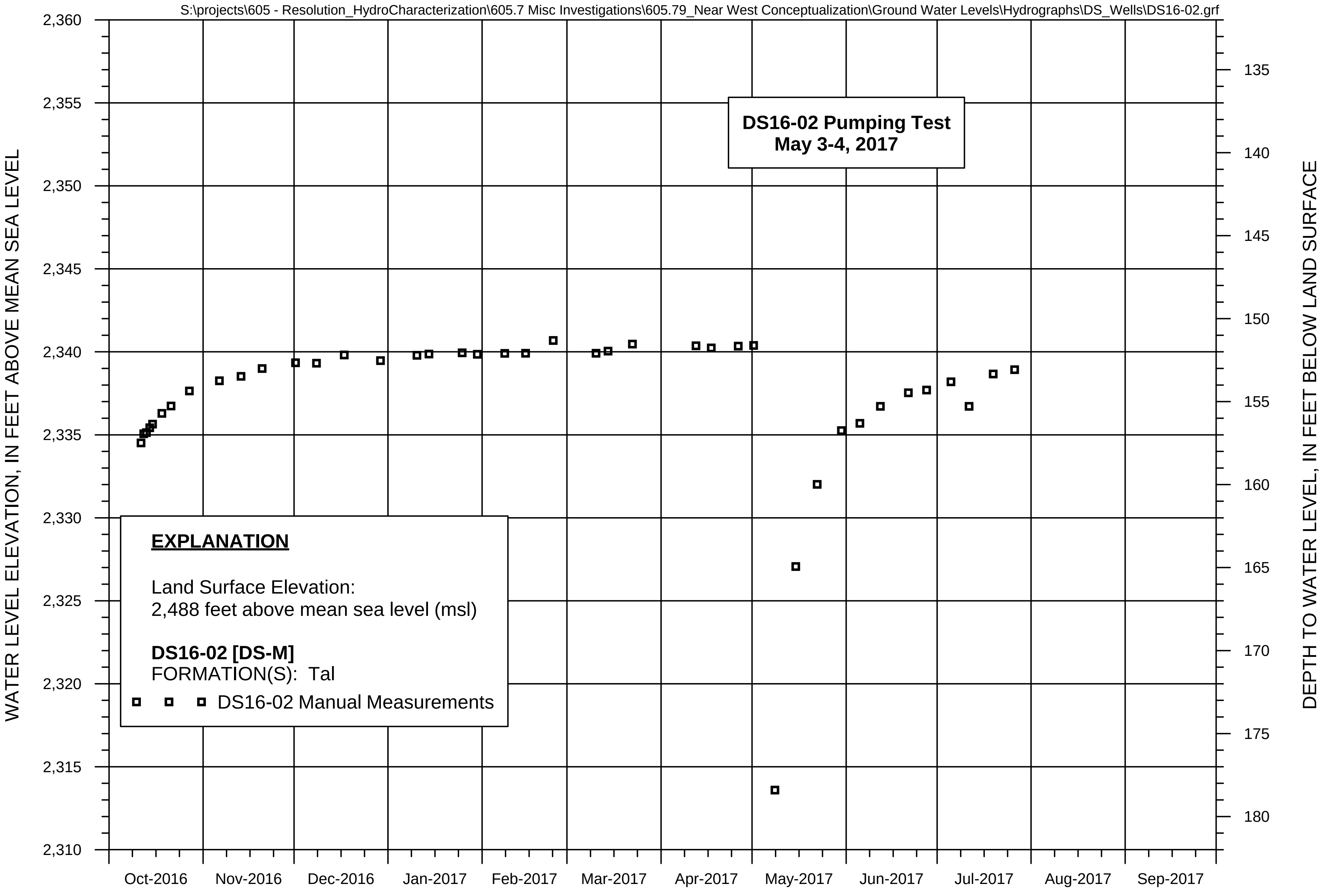


FIGURE E-02. WATER LEVEL HYDROGRAPH FOR DS16-02

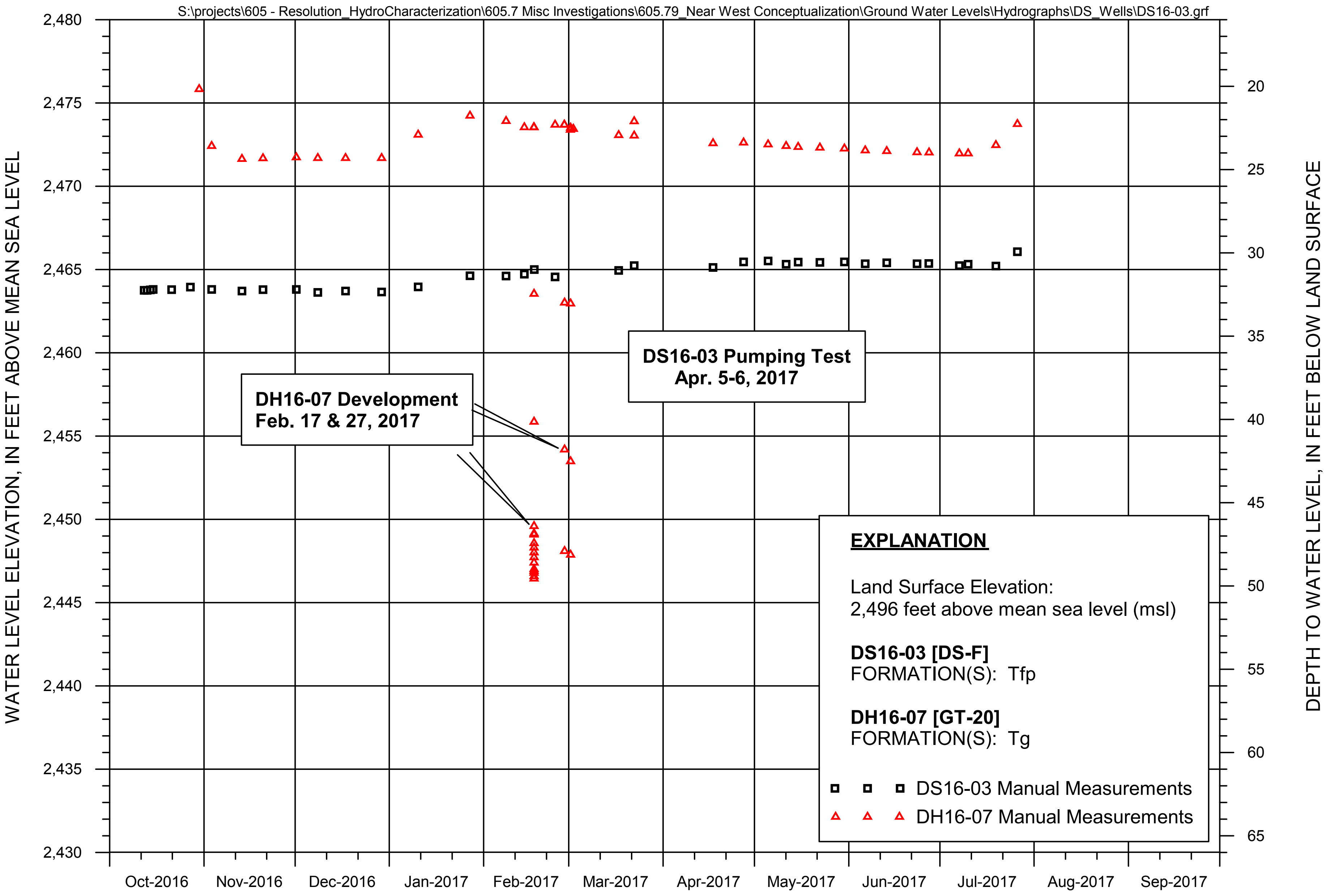


FIGURE E-03. WATER LEVEL HYDROGRAPHS FOR DS16-03 AND DH16-07

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

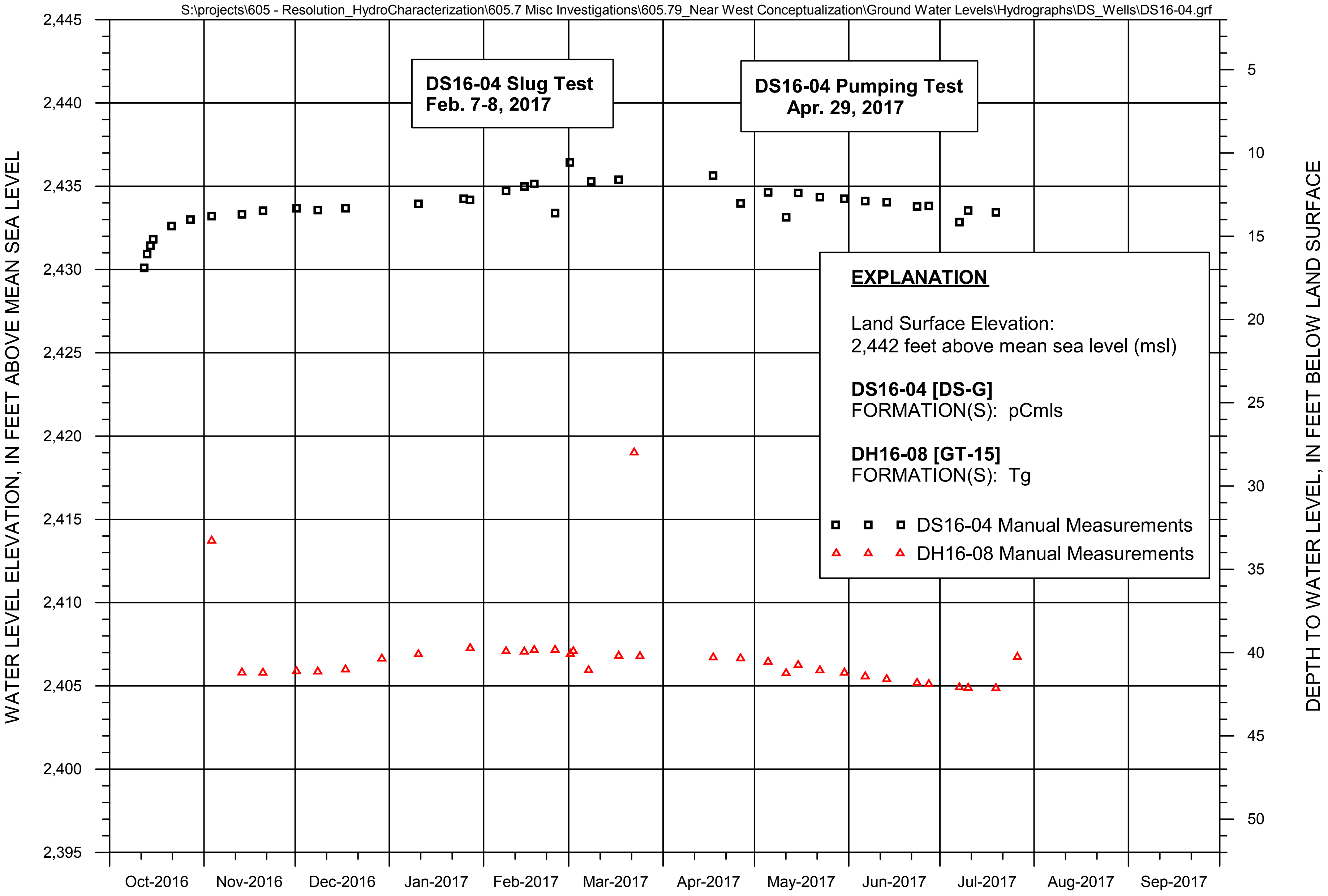


FIGURE E-04. WATER LEVEL HYDROGRAPHS FOR DS16-04 AND DH16-08

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

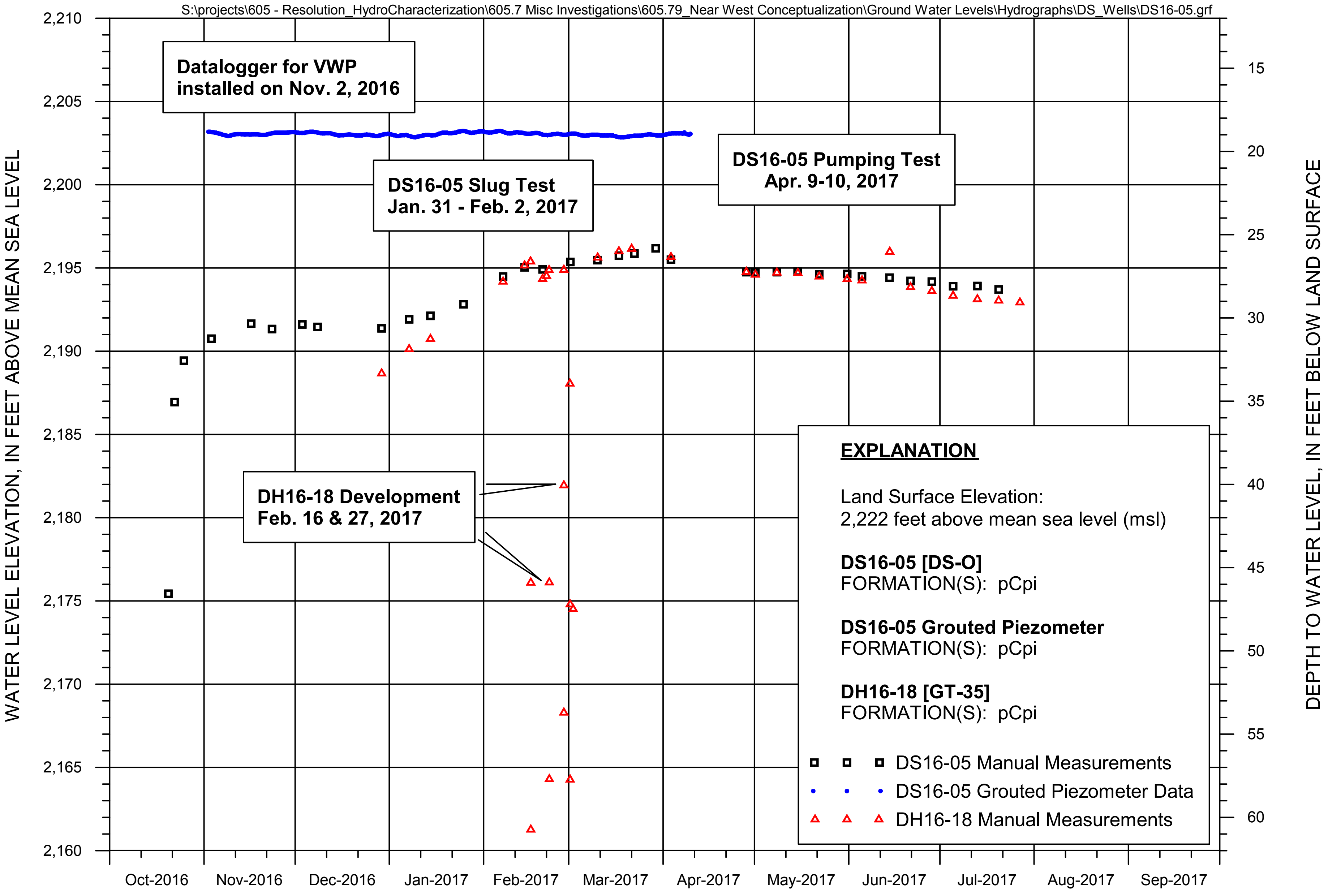


FIGURE E-05. WATER LEVEL HYDROGRAPHS FOR DS16-05 WELL AND GROUTED PIEZOMETER, AND DH16-18

RESOLUTION
COPPER

MONTGOMERY
& ASSOCIATES

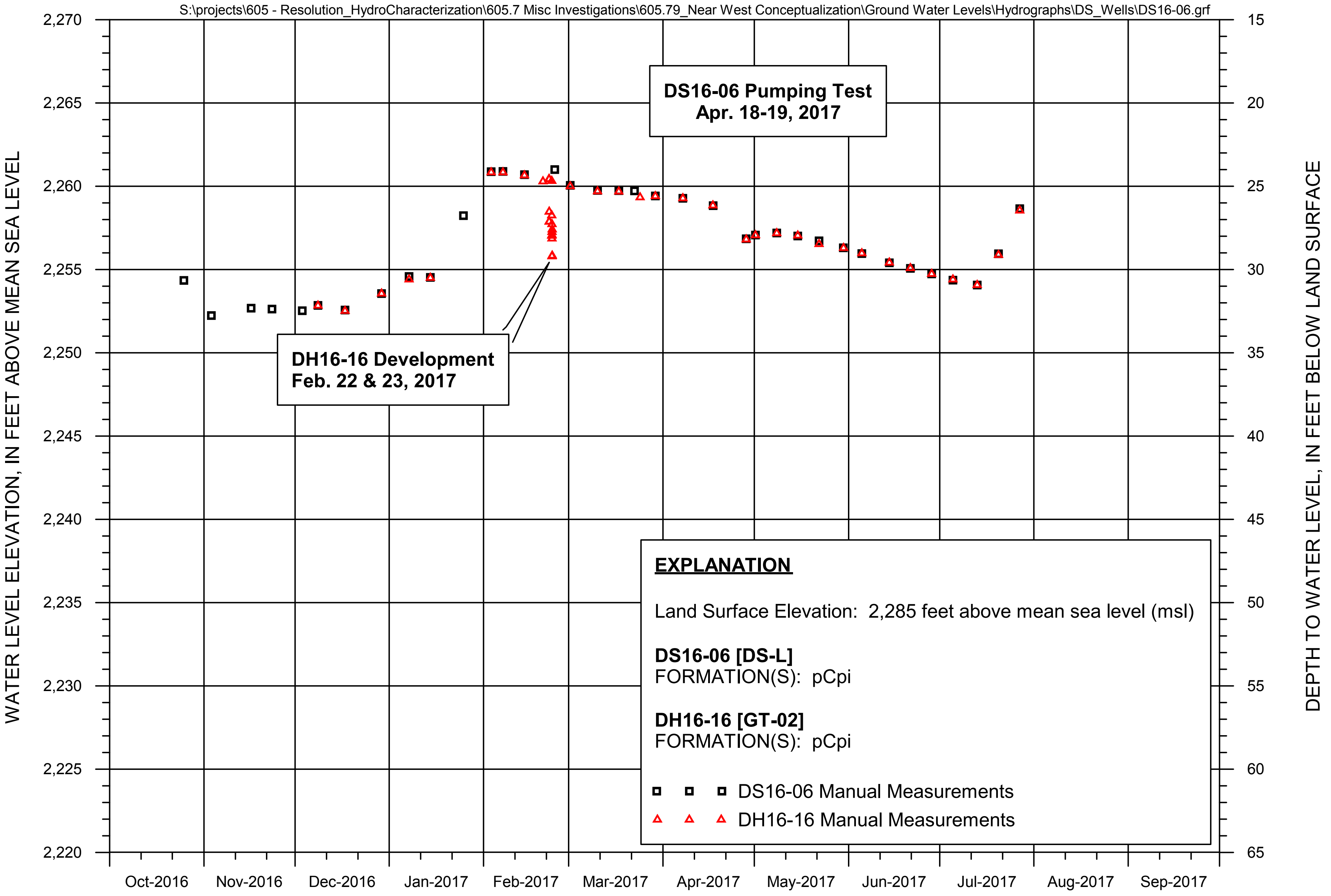


FIGURE E-06. WATER LEVEL HYDROGRAPHS FOR DS16-06 AND DH16-16

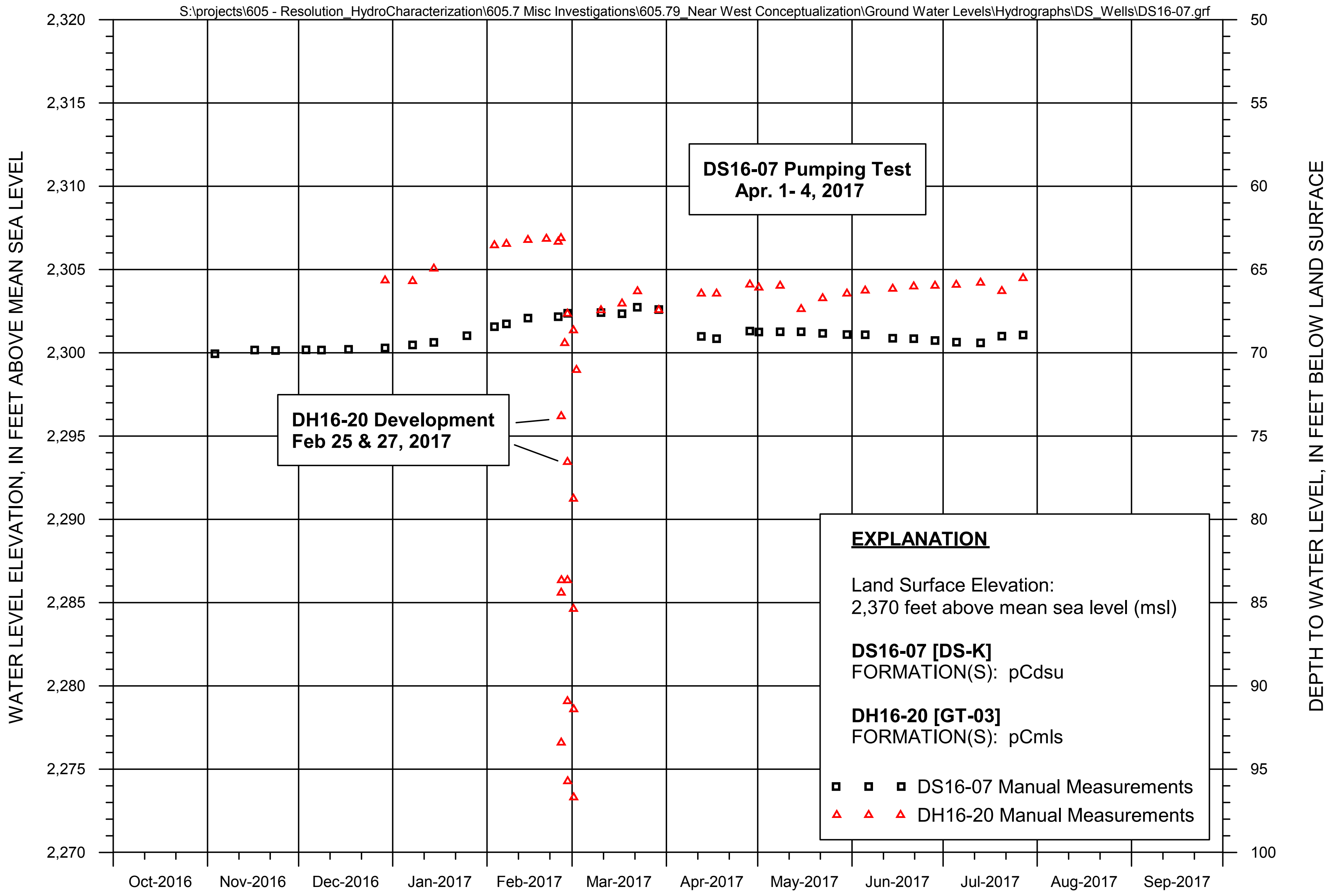


FIGURE E-07. WATER LEVEL HYDROGRAPHS FOR DS16-07 AND DH16-20

RESOLUTION
COPPER

MONTGOMERY
& ASSOCIATES

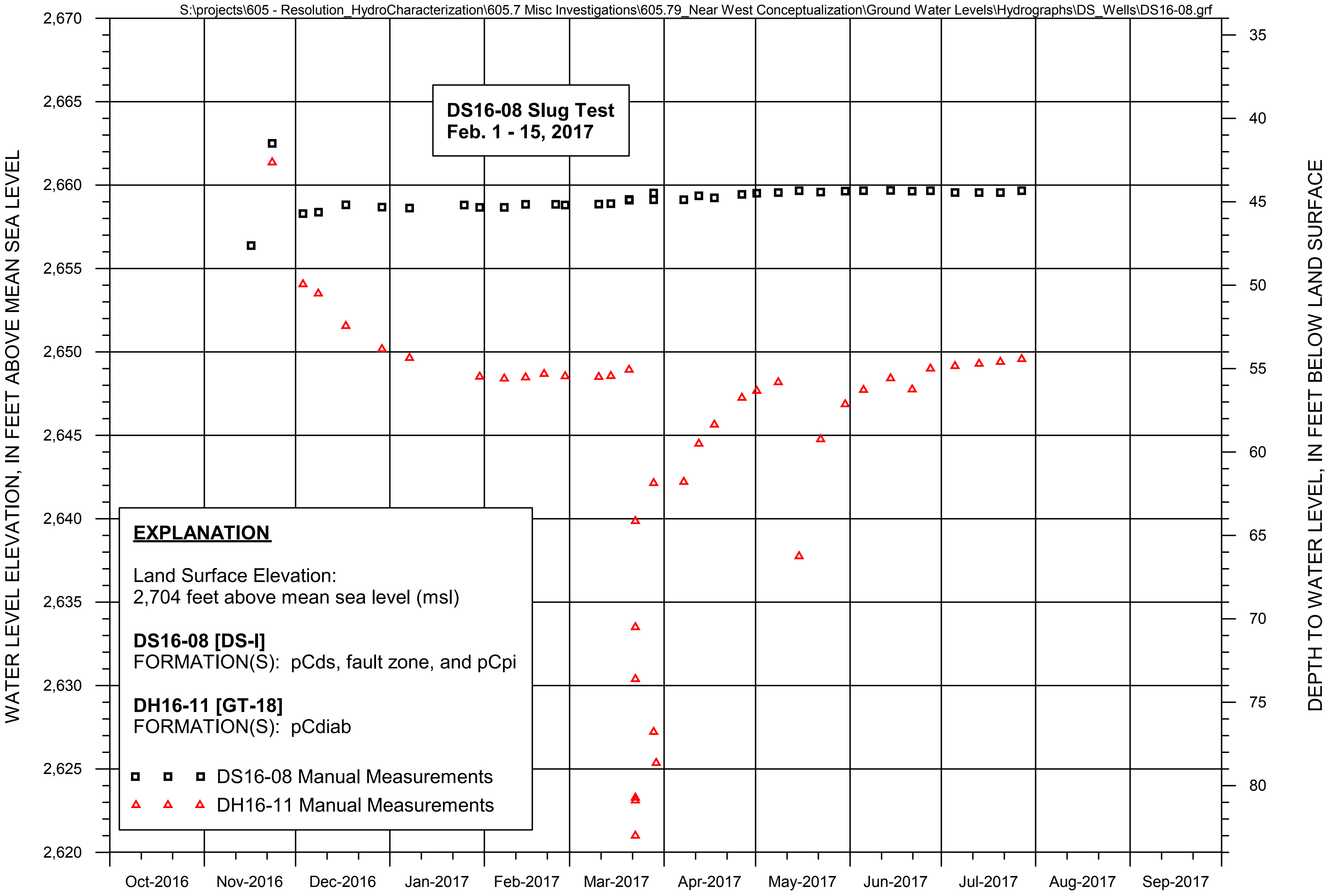


FIGURE E-08. WATER LEVEL HYDROGRAPHS FOR DS16-08 AND DH16-11

RESOLUTION
COPPER

MONTGOMERY
& ASSOCIATES

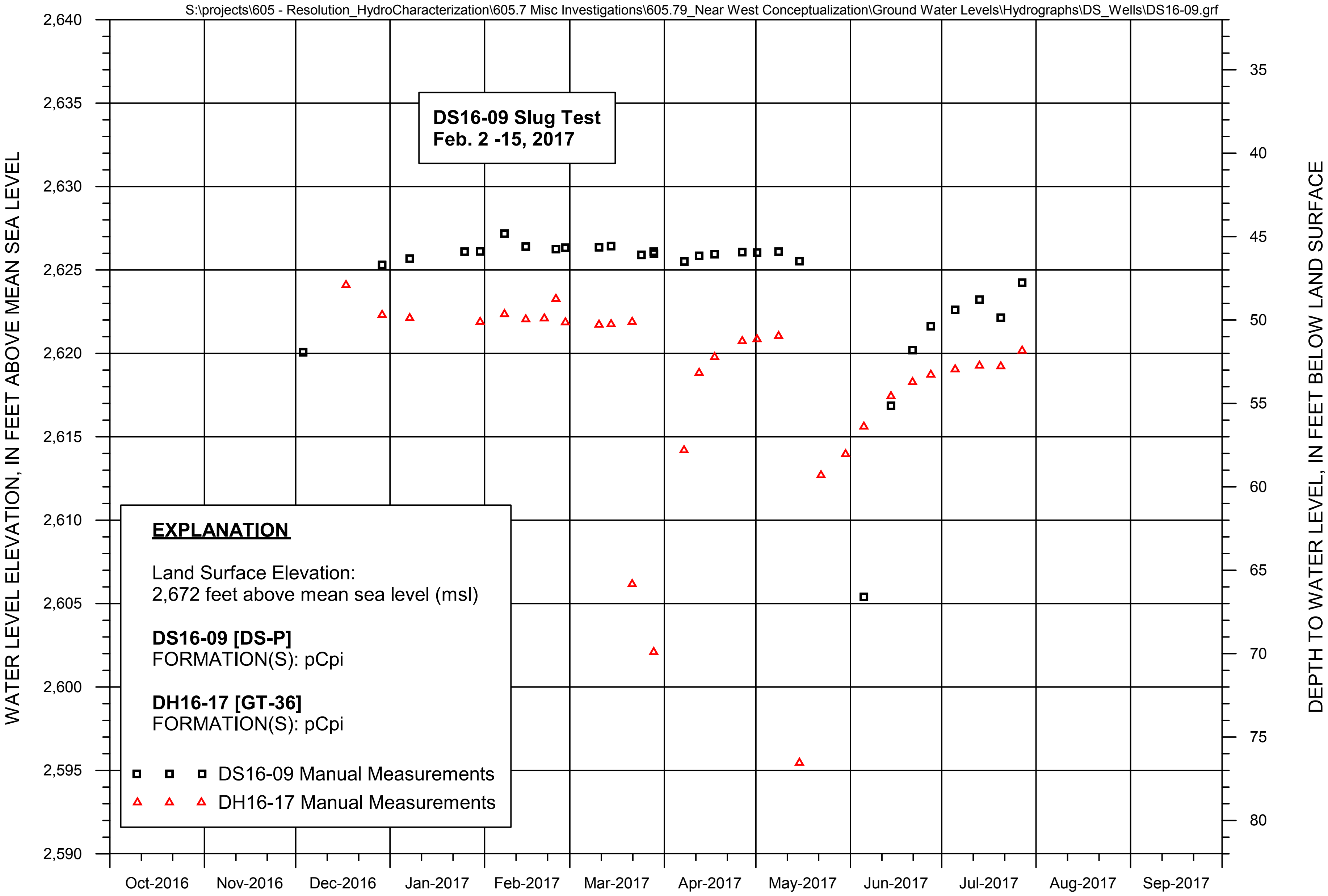


FIGURE E-09. WATER LEVEL HYDROGRAPHS FOR DS16-09 AND DH16-17

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

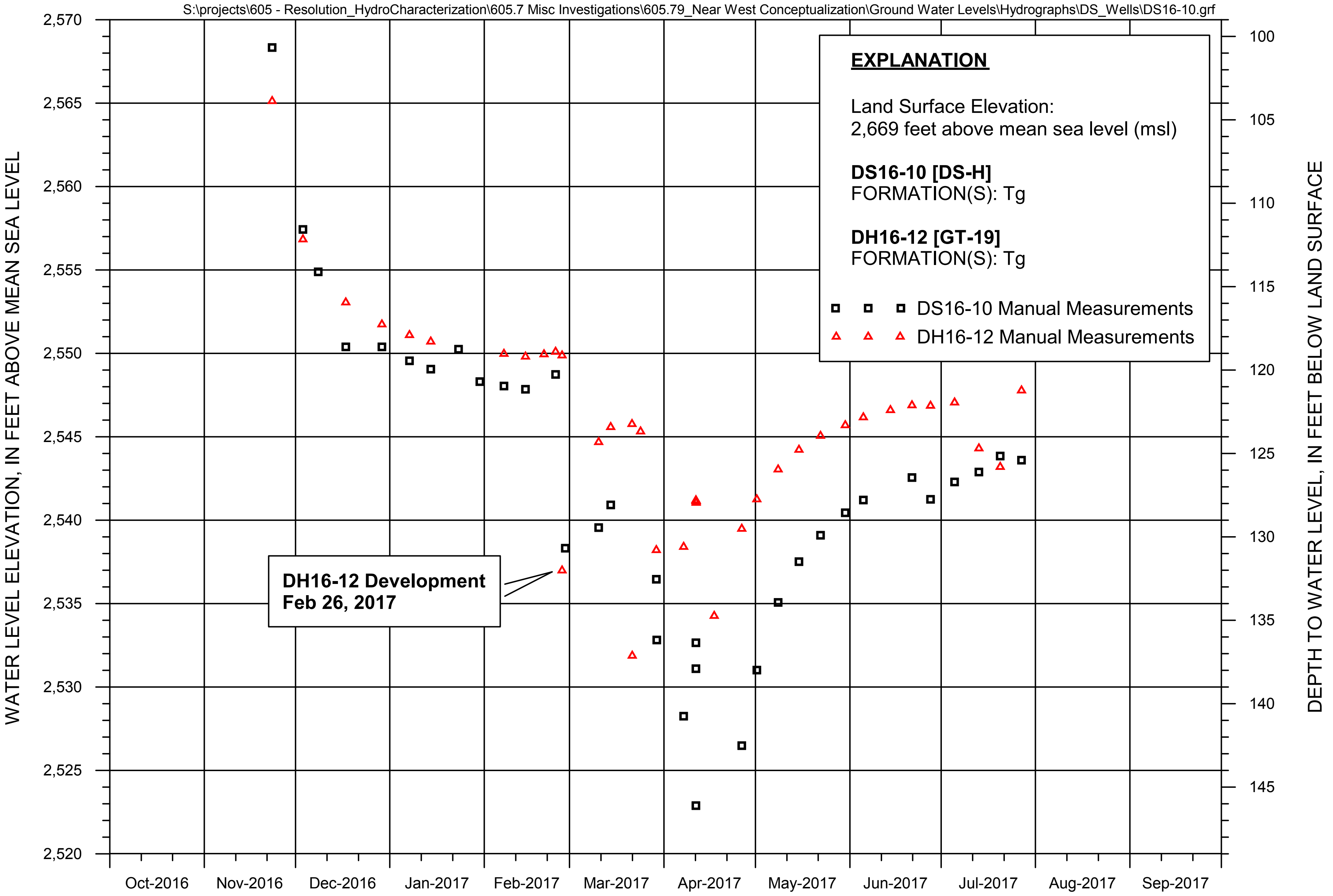


FIGURE E-10. WATER LEVEL HYDROGRAPHS FOR DS16-10 AND DH16-12

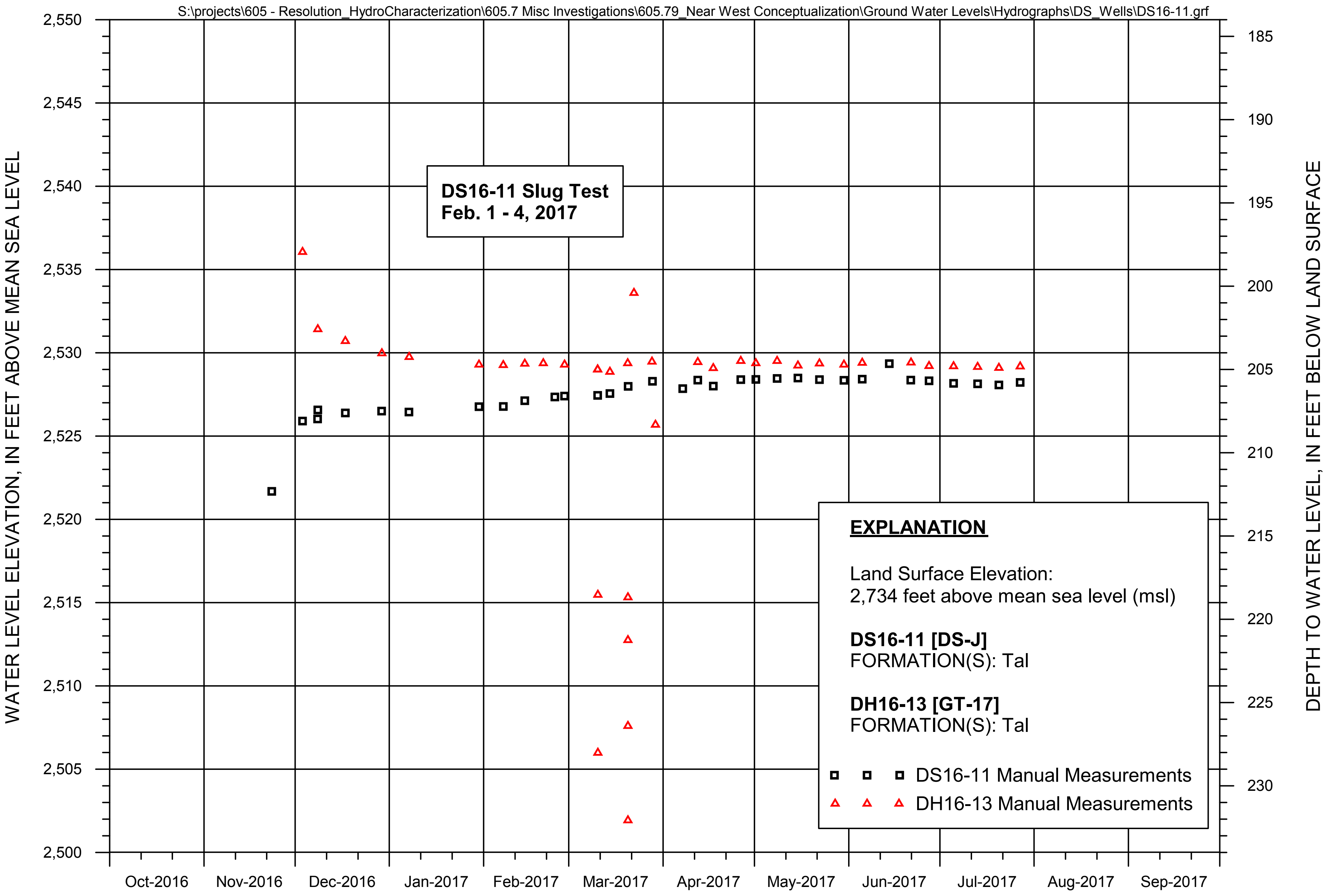


FIGURE E-11. WATER LEVEL HYDROGRAPHS FOR DS16-11 AND DH16-13

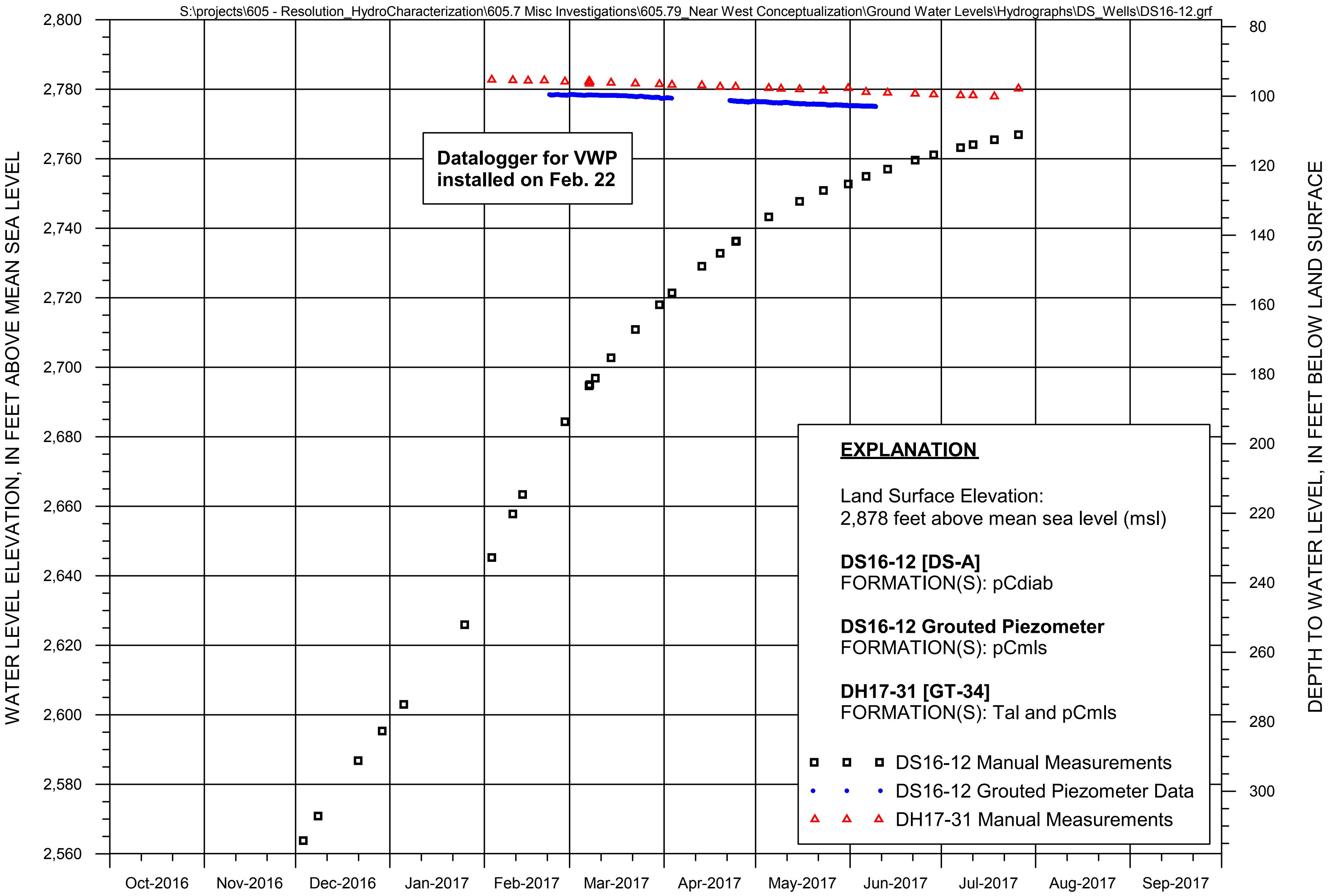


FIGURE E-12. WATER LEVEL HYDROGRAPHS FOR DS16-12 WELL AND GROUTED PIEZOMETER, AND DH17-31

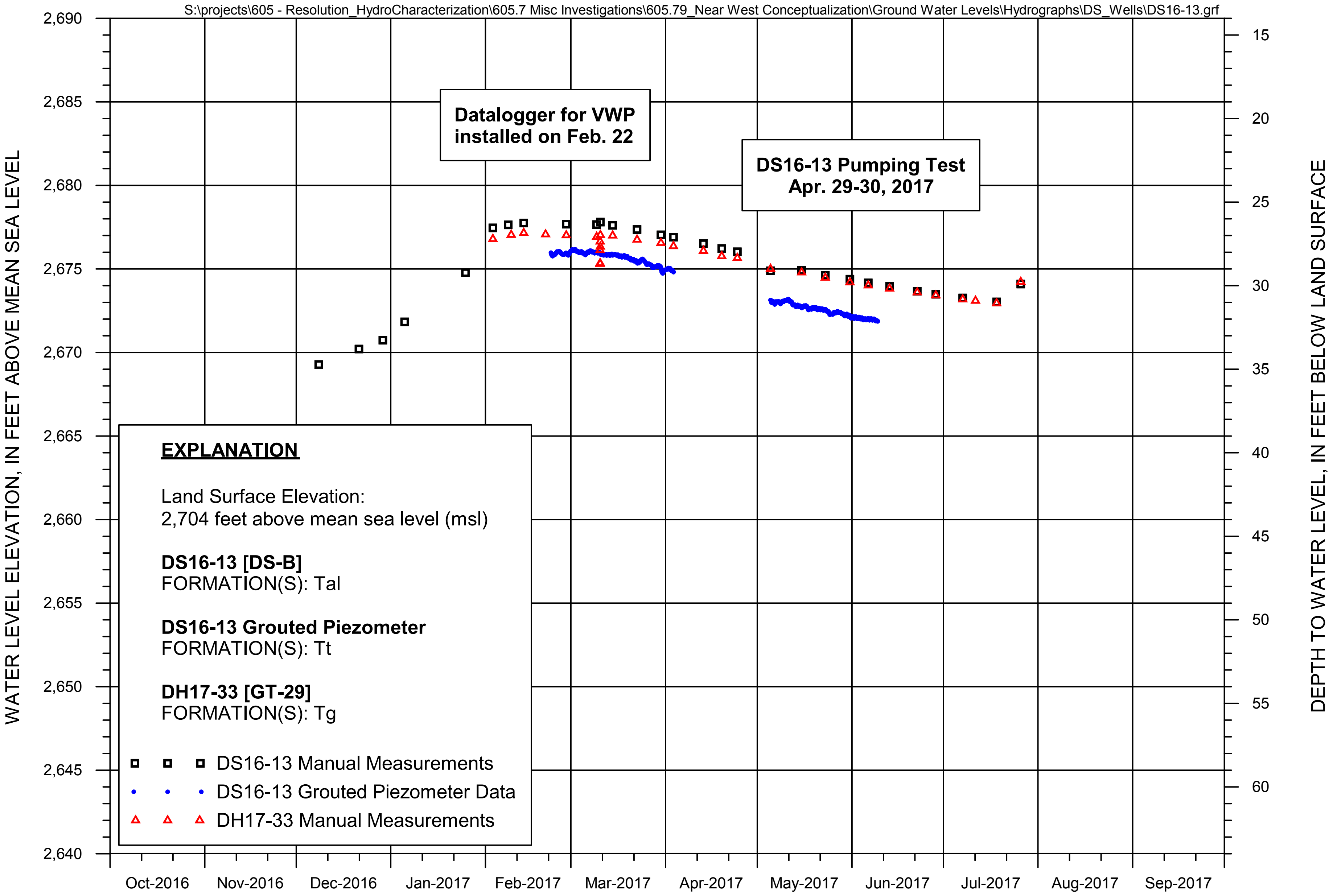
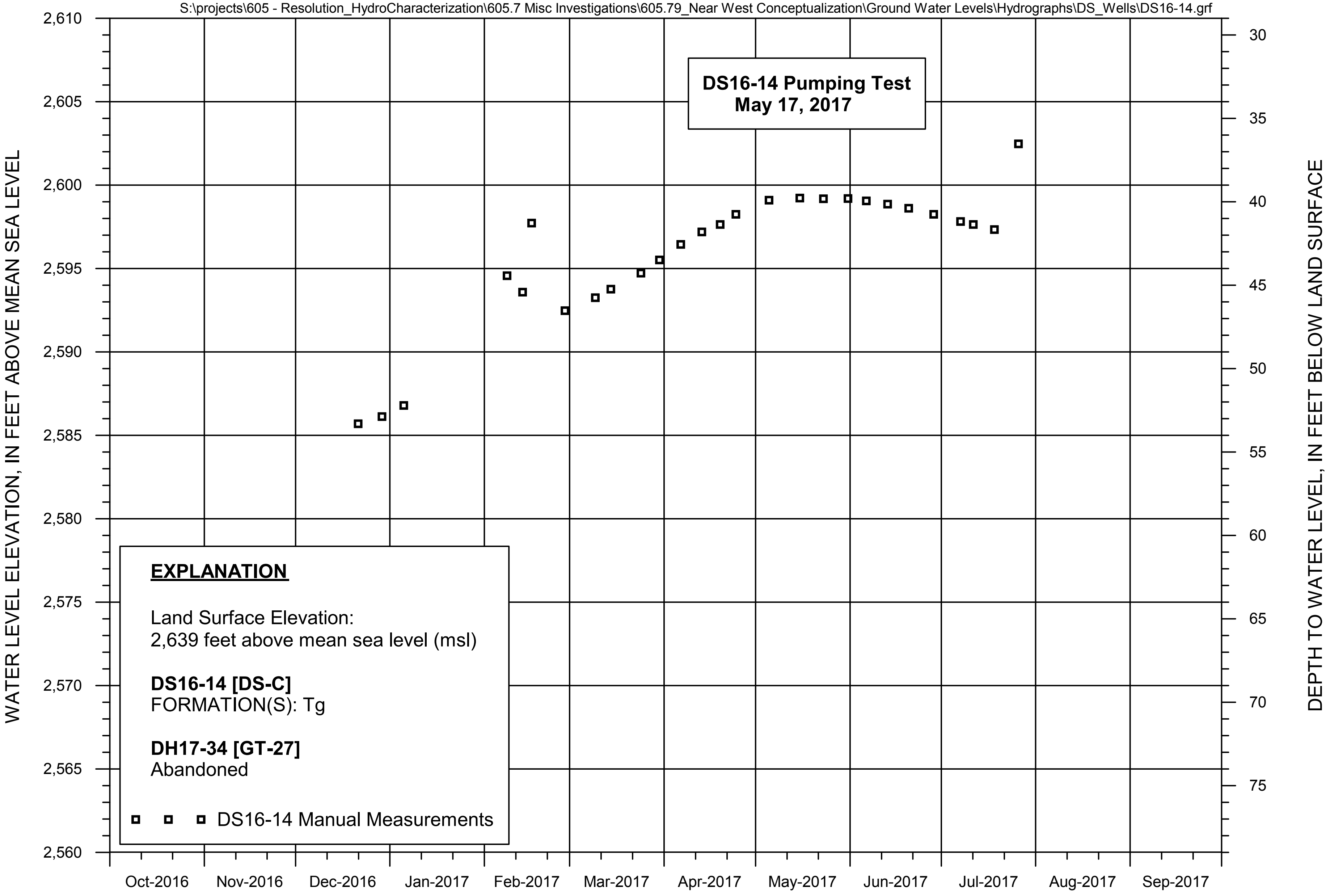


FIGURE E-13. WATER LEVEL HYDROGRAPH FOR DS16-13 WELL AND GROUTED PIEZOMETR, AND DH17-33

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

S:\projects\605 - Resolution_HydroCharacterization\605.7 Misc Investigations\605.79_Near West Conceptualization\Ground Water Levels\Hydrographs\DS_Wells\DS16-14.grf



EXPLANATION

Land Surface Elevation:
2,639 feet above mean sea level (msl)

DS16-14 [DS-C]
FORMATION(S): Tg

DH17-34 [GT-27]
Abandoned

□ □ □ DS16-14 Manual Measurements

FIGURE E-14. WATER LEVEL HYDROGRAPH FOR DS16-14

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

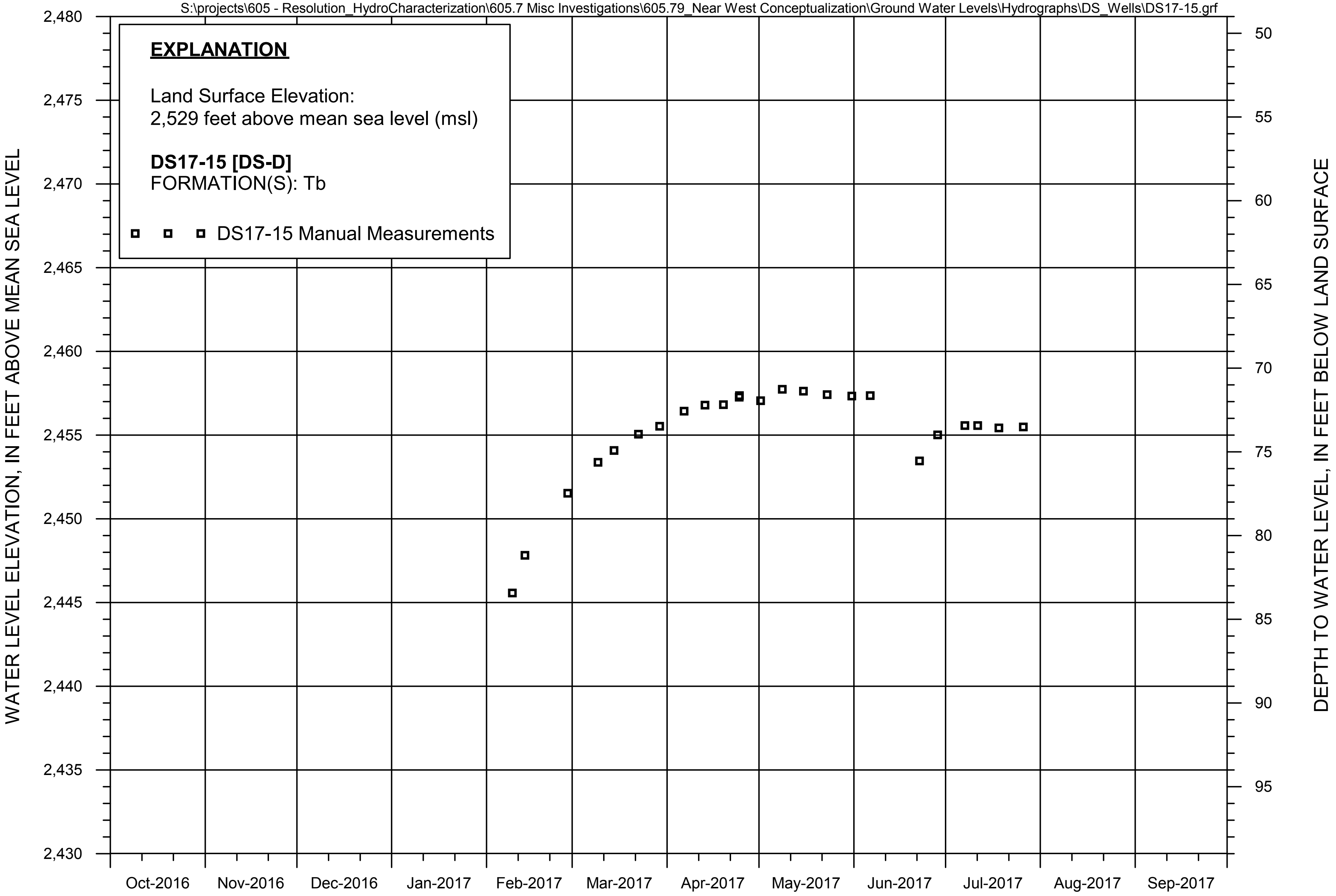


FIGURE E-15. WATER LEVEL HYDROGRAPH FOR DS17-15

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

S:\projects\605 - Resolution_HydroCharacterization\605.7 Misc Investigations\605.79_Near West Conceptualization\Ground Water Levels\Hydrographs\DS_Wells\DS17-16.grf

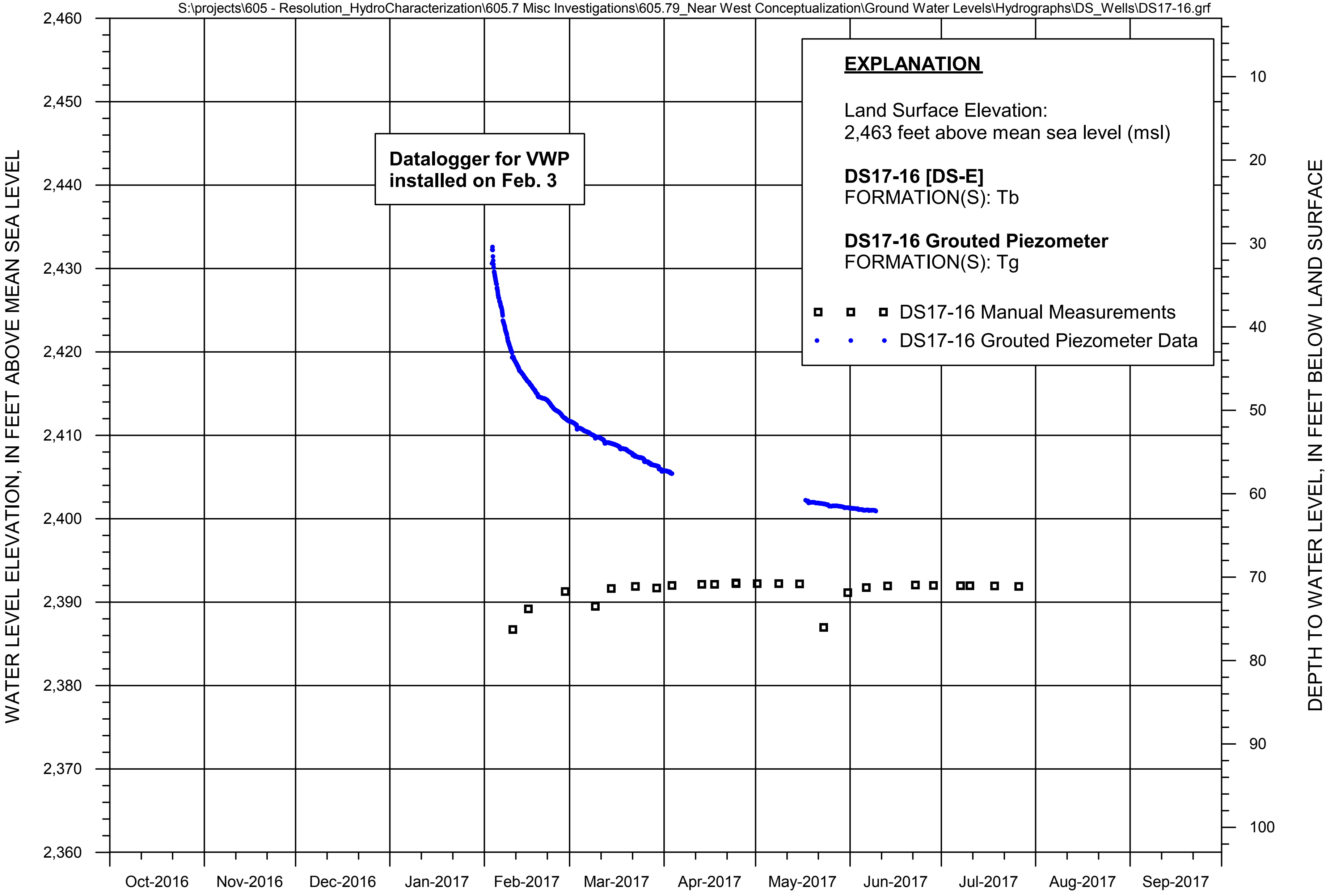


FIGURE E-16. WATER LEVEL HYDROGRAPHS FOR DS17-16 WELL AND GROUTED PIEZOMETER

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

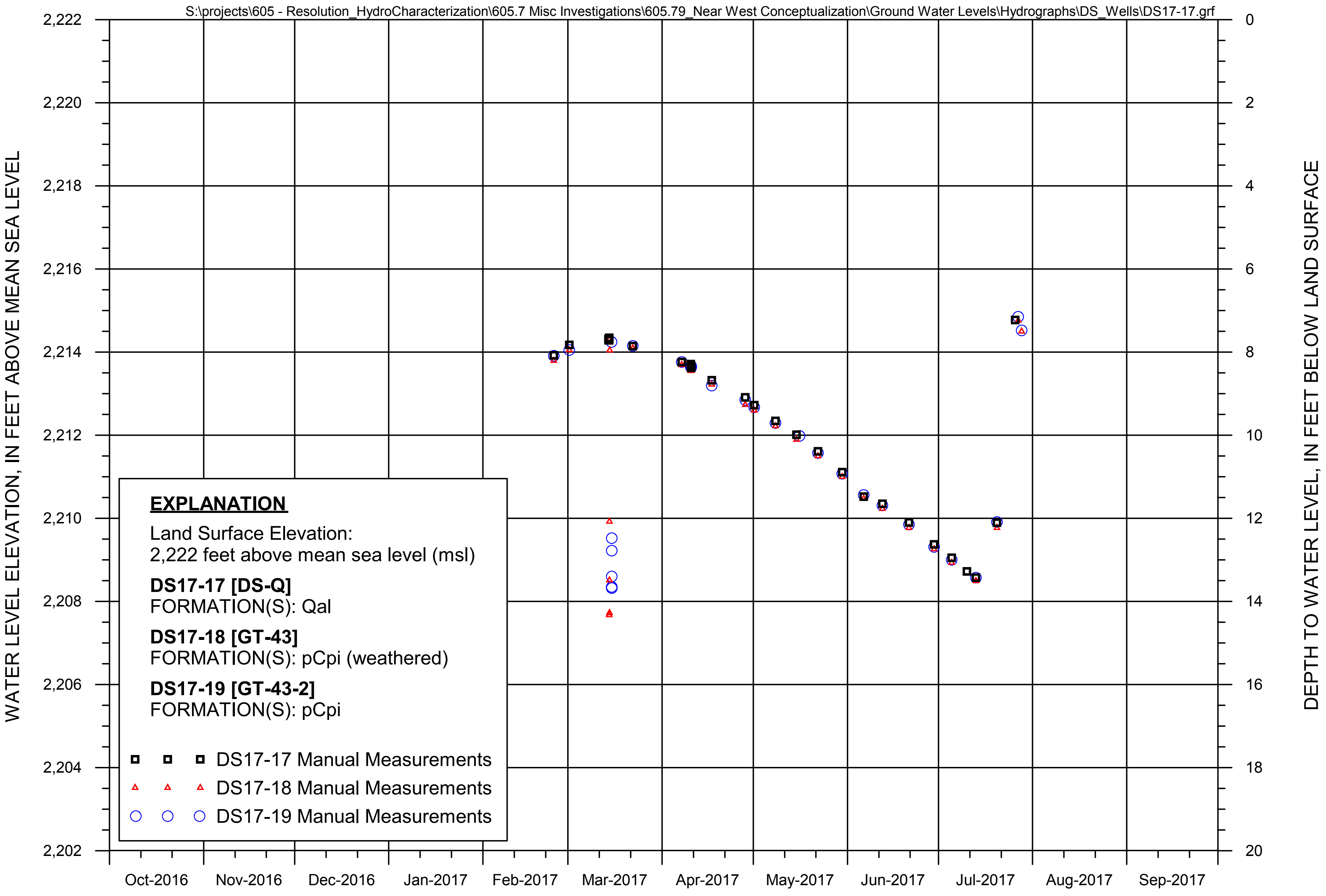


FIGURE E-17. WATER LEVEL HYDROGRAPHS FOR DS17-17, DS17-18, AND DS17-19

RESOLUTION COPPER

MONTGOMERY & ASSOCIATES

Appendix F

Arizona Department of Water Resources Imaged Records for New Wells

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER D1-1-11 36ACA

WELL REGISTRATION NUMBER **55 -** 919892

PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 West San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert AZ 85233	FAX 480-558-3525

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper

MAILING ADDRESS: 102 Magma Hieghts

CITY / STATE / ZIP CODE: Superior AZ 85173

CONTACT PERSON NAME AND TITLE: Mary Morissette Permitting and Approvals

TELEPHONE NUMBER: 520-689-3238

FAX:

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.): DS-N (DS16-01)

Location of Well

WELL LOCATION ADDRESS (IF ANY): Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1 S	11 E	36	NE ¼	SW ¼	NE ¼

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
33 °	18 '	9.5 "N	111 °	11 '	8.2 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2405 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE): ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE): ☐ NAD-83 ☒ Other (*please specify*):

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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: 09/09/2016

DATE WELL CONSTRUCTION COMPLETED: 09/17/2016

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

DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919892

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 875 Feet Below Land Surface	DEPTH OF COMPLETED WELL 520 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 50 Feet Below Land Surface	DATE MEASURED 09/18/2016	TIME MEASURED 1200	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	20	17.5
20	450	10.75
450	875	9.875

Installed 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	12.75	x				x						
+2	420	4.5	x				x						
420	500	4.5	x								x		0.125
500	520	4.5	x				x						

Installed 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	GRAVEL	SIZE
0	20			x								
20	400				x							
400	409						x					3/8
409	410									x		10-20
410	535										x	1/4 x 1/8
535	875				x							

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919892

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	352	Tertiary Gila Conglomerate	
352	440	Tertiary Basalt	
440	450	Weather Younger Pre-Cumbrian Mescal Limestone (weathered)	T(447)
450	528	Precambian Mescal (Dolomitic Limestone)	
528	681	Precambian Dripping Springs	
681	830	Precambian Pioneer (Shale)	
830	875	Precambian Diabase	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919892

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER
Resolution Copper

COUNTY ASSESSOR'S PARCEL ID NUMBER

BOOK	MAP	PARCEL
0	0	0

- ❖ 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.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

1912

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT OF WATER RESOURCES

Phoenix, Arizona 85007

DRILLING CARD

VARIANCE GRANTED

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILLING OPERATIONS

WELL REGISTRATION NO: **55-919893**

AUTHORIZED DRILLER: **NATIONAL EWP, INC.** LICENSE NO: **823**

NOTICE OF INTENT TO **DRILL A ENV - MONITOR WELL** HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: **RESOLUTION COPPER**

ADDRESS: **102 MAGMA HIGHTS, SUPERIOR, AZ, 85273**

THE WELL(S) IS/ARE TO BE LOCATED IN THE:

SE 1/4 of the **NW** 1/4 of the **NE** 1/4 Section **26** Township **01 S** Range **11 E**

NO. OF WELLS IN THIS PROJECT: **1**

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE DAY OF **9/7/2017**

THE DRILLER MUST FILE A WELL DRILLER REPORT AND WELL LOG WITHIN 30 DAYS OF COMPLETION OF DRILLING

1912

This drilling or abandonment authority was granted based upon the certifications made by the above-named Driller in the notice of intent to drill or abandon. Those certifications, along with any variances granted, are listed below. By drilling or abandoning the well pursuant to this authorization, the above-named driller acknowledges the accuracy of the driller certifications. If the certifications are in error, this authorization is invalid and driller must contact the Department of Water Resource's NOI Section in writing at the addres above to correct.

Variance(s) Granted To Driller:

- Well Screen > 10' Variance – Monitor well's screen may be screened greater than 10 feet above the highest seasonal static water level.

Certification(s) Made By Driller:

☑ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

☑ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner's behalf.

☑ By checking this box, I certify that I have read the applicable substantive policy statement regarding each variance that I am requesting, and that I shall comply with all of the requirements set forth therein.

☑ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

☑ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an

☑ approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

☑ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

ARIZONA DEPARTMENT OF WATER RESOURCES
Electronic Filing - NOI Report

Phoenix, Arizona

NOI Type: Notice of Intent to Drill, Deepen, Modify a Monitor/Piezometer/Environmental Well
Well Type: ENV - MONITOR
Date Received at ADWR Website: 9/7/2016

Fee Paid: $150.00 Order Number: -6050

Well Registration Number: 55 - 919893
Number of Wells/Holes: 1 Drilling Authority Expires On: 9/7/2017

Driller's ADWR License Number: 823

Authorized Driller: NATIONAL EWP, INC.
ROC License Number Entered By Driller: 269329
Qualifying Party License Categories: A-4

Well Owner Name: RESOLUTION COPPER
Well Owner Address: 102 MAGMA HIGHTS
Well Owner City, State - Zip: SUPERIOR, AZ - 85273
Well Owner Phone: 520 689-9374

Book: 0 Map:0 Parcel: 0

Is the Land Owner the same as the Well Owner?: No

Land Owner Name: TONTO NATIONAL FOREST
Land Owner Address: 2324 E, MCDOWELL
Land Owner City, State - Zip: PHOENIX, AZ - 85006
Land Owner Phone: 602 225-5200

Well Location: **SE** 1/4 of the **NW** 1/4 of the **NE** 1/4 Section **26** Township **1 S** Range **11 E**

AMA: PHOENIX AMA
County: PINAL
Contamination Site: NOT IN A REMEDIAL ACTION SITE

Primary Water Use: **MONITORING**
Secondary Water Use(s): **N/A**

Is any portion of the land, on which the well is to be located, within 100 feet of a designated municipal provider's operating water distribution system as shown on the municipal provider's most recent digitized service area map filed by the municipal provider with the director of ADWR. **N/A**

Will you be installing a dedicated pump ?: **No**

Will the installed pump have a pumping capacity of greater than 35 GPM, or will the well will be used to withdraw greater than 10 Acre Feet per year?: **N/A**

Variance(s) Granted To Driller:

- Well Screen > 10' Variance – Monitor well’s screen may be screened greater than 10 feet above the highest seasonal static water level.

Certification(s) Made By Driller:

☑ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

☑ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner’s behalf.

☑ By checking this box, I certify that I have read the applicable substantive policy statement regarding each variance that I am requesting, and that I shall comply with all of the requirements set forth therein.

☑ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

☑ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

☑ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

☑ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

NOTICE

A.R.S. § 41-1030(B), (D), (E) and (F) provide as follows:

B. An agency shall not base a licensing decision in whole or in part on a licensing requirement or condition that is not specifically authorized by statute, rule or state tribal gaming compact. A general grant of authority in statute does not constitute a basis for imposing a licensing requirement or condition unless a rule is made pursuant to that general grant of authority that specifically authorizes the requirement or condition.

D. This section may be enforced in a private civil action and relief may be awarded against the state. The court may award reasonable attorney fees, damages and all fees associated with the license application to a party that prevails in an action against the state for a violation of this section.

E. A state employee may not intentionally or knowingly violate this section. A violation of this section is cause for disciplinary action or dismissal pursuant to the agency’s adopted personnel policy.

F. This section does not abrogate the immunity provided by section 12-820.01 or 12-820.02.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-36020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

FILE NUMBER
D(1-11) 26 ABD

WELL REGISTRATION NUMBER
55 - 919893

PERMIT NUMBER (IF ISSUED)

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER

MAILING ADDRESS
102 MAGMA HIGHTS

CITY / STATE / ZIP
SUPERIOR, AZ, 85273

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520 689-9374

FAX

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)
DS-M (DS16-02)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	26	NE 1/4	NW 1/4	SE 1/4

LATITUDE			LONGITUDE		
33 °	18 '	51.1 "N	111 °	12 '	8.5 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2474 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) NAD 27

COUNTY
Pinal

ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)

BOOK	MAP	PARCEL
0	0	0

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
09/19/2016

DATE WELL CONSTRUCTION COMPLETED
09/24/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919893

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 550 Feet Below Land Surface	DEPTH OF COMPLETED WELL 500 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 177.18 Feet Below Land Surface	DATE MEASURED 9.24.2016	TIME MEASURED 10:00AM	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
+03	20	17.5
20	500	10.5

Installed Casing

DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	20	12.75	x				x						
+2	290	4.5	x				x						
290	330	4.5	x								x		0.125
330	390	4.5	x				x						
390	450	4.5	x								x		0.125
450	451	4.5	x				x						

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
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	35			x								
35	269				x							
269	277					x						.375
277	278.1									x		10-20
278.1	346										x	.25 x .125
346	346.2									x		10-20
346.2	367						x					.375
367	454.6										x	.25 x .125
454.6	467.5						x					.375
467.5	500			x								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919893

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	172	Gila Conglomerate	
172	447	Apache Leap Tuff	292'
447	500	Pinal Schist	

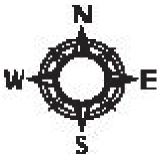
Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919893

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER	0	0	0

- 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.



1" = ______ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2 **Condition of Well,** indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Phoenix, AZ 85007
602-771-8500
azwater.gov

DOUGLAS A. DUCEY
Governor

THOMAS BUSCHATZKE
Director

September 7, 2016

RESOLUTION COPPER
102 MAGMA HIGHTS
SUPERIOR, AZ 85273

Registration No. 55- 919893
File Number: D(1-11) 26 ABD

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling. Although the issuance of this drill card authorizes you to drill the proposed well under state law, the drilling of the well may be subject to restrictions or regulations imposed by other entities.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Engineering and Permits Division
Phoenix, AZ 85007
602-771-8500

NOTICE TO WELL DRILLERS

This is a reminder that a valid drill card be present for the drilling of each and every well constructed on a site.* The problem seems to occur during the construction of a well when an unexpected problem occurs. Either the hole collapses, the hole is dry, a drill bit is lost and can't be recovered, or any number of other situations where the driller feels that he needs to move over and start another well. If you encounter this type of scenario, please be aware drillers do not have the authority to start another well without first obtaining drilling authority for the new well. Please note the following statutes and regulations pertaining to well drilling and construction:

ARIZONA REVISED STATUTE (A.R.S.)

A.R.S. § 45-592.A.

A person may construct, replace or deepen a well in this state only pursuant to this article and section 45-834.01. The drilling of a well may not begin until all requirements of this article and section 45-834.01, as applicable, are met.

***

A.R.S. § 594.A.

The director shall adopt rules establishing construction standards for new wells and replacement wells, the deepening and abandonment of existing wells and the capping of open wells.

***

A.R.S. § 600.A

A well driller shall maintain a complete and accurate log of each well drilled.

ARIZONA ADMINISTRATIVE CODE (A.A.C.)

A.A.C. R12-15-803.A.

A person shall not drill or abandon a well, or cause a well to be drilled or abandoned, in a manner which is not in compliance with A.R.S. Title 45, Chapter 2, Article 10, and the rules adopted thereunder.

***

A.A.C. R12-15-810.A.

A well drilling contractor or single well licensee may commence drilling a well only if the well drilling contractor or licensee has possession of a drilling card at the well site issued by the Director in the name of the well drilling contractor or licensee, authorizing the drilling of the specific well in the specific location.

***

A.A.C. R12-15-816.F.

In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card.

*** THIS REQUIREMENT DOES NOT PERTAIN TO THE DRILLING OF MINERAL EXPLORATION, GEOTECHNICAL OR HEAT PUMP BOREHOLES**

Arizona Department of Water Resources
Groundwater Permitting and Wells Section
PO Box 36020 , Phoenix, AZ 85067-36020
(602) 771-8527 ▪ 1-800-352-8488
www.azwater.gov

Landowner Authorization to Drill or Abandon a Well on Landowner's Parcel

Landowner Authorization to Drill or Abandon a Well by a Third Party on Landowner's Parcel Pursuant to A.R.S. § 45-596 and A.A.C. R12-15-809

FILE NUMBER
D(1-11) 26 ABD

WELL REGISTRATION NUMBER
55 - 919893

The Arizona Department of Water Resources requires a well driller or well owner to obtain written permission from the owner of the land on which they intend to drill or abandon a well. Landowners, or their designated representative, must authorize the well to be drilled or abandoned with their signature on the Notice of Intent or on this form, to be attached to the Notice of Intent form.

PARCEL ADDRESS ______________________________

COUNTY PARCEL ID 0 - 0 - 0 COUNTY PINAL
BOOK MAP PARCEL

In accordance with A.R.S. § 45-496 and A.A.C. R12-15-809, I certify that:

☐ I am the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

☐ I am an authorized representative of the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

SIGNATURE

TYPE OR PRINT NAME OF LANDOWNER / RESPRESENTATIVE	TITLE
SIGNATURE	DATE SIGNED

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER

WELL REGISTRATION NUMBER
55 - 919894

PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP, Inc.	DWR LICENSE NUMBER 823
ADDRESS 1200 West San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert AZ 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Hights

CITY / STATE / ZIP CODE
Superior AZ 85273

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520-689-3238

FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-F (DS16-03)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01 S	12 E	30	NE ¼	SW ¼	NW ¼

LATITUDE			LONGITUDE		
33 ° Degrees	18 ' Minutes	54.6 "N Seconds	111 ° Degrees	10 ' Minutes	31.91 "W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2495 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): Nad 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
9/26/2016

DATE WELL CONSTRUCTION COMPLETED
10/4/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919894

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 715 Feet Below Land Surface	DEPTH OF COMPLETED WELL 240 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 33 Feet Below Land Surface	DATE MEASURED 10/05/2016	TIME MEASURED 8:30	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	20	17.5	+3	20	12.75	x				x						
20	140	10.75	+2	130	4.5	x				x						
140	715	9.875	130	220	4.5	x								x		.125
			220	241	4.5	x				x						

Installed Annular Material

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	109			x								
109	119						x					3/8"
119	120									x		10/20
120	251.5										x	.250x.125
251.5	261						x					3/8"
261	315			x								
315	715				x							

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919894

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)		
0	121	Gila Congolmerate	120
121	400	Perlite	
400	612	Rhyolite	
612	689	Ashflow Tuff	
689	715	Tuff	

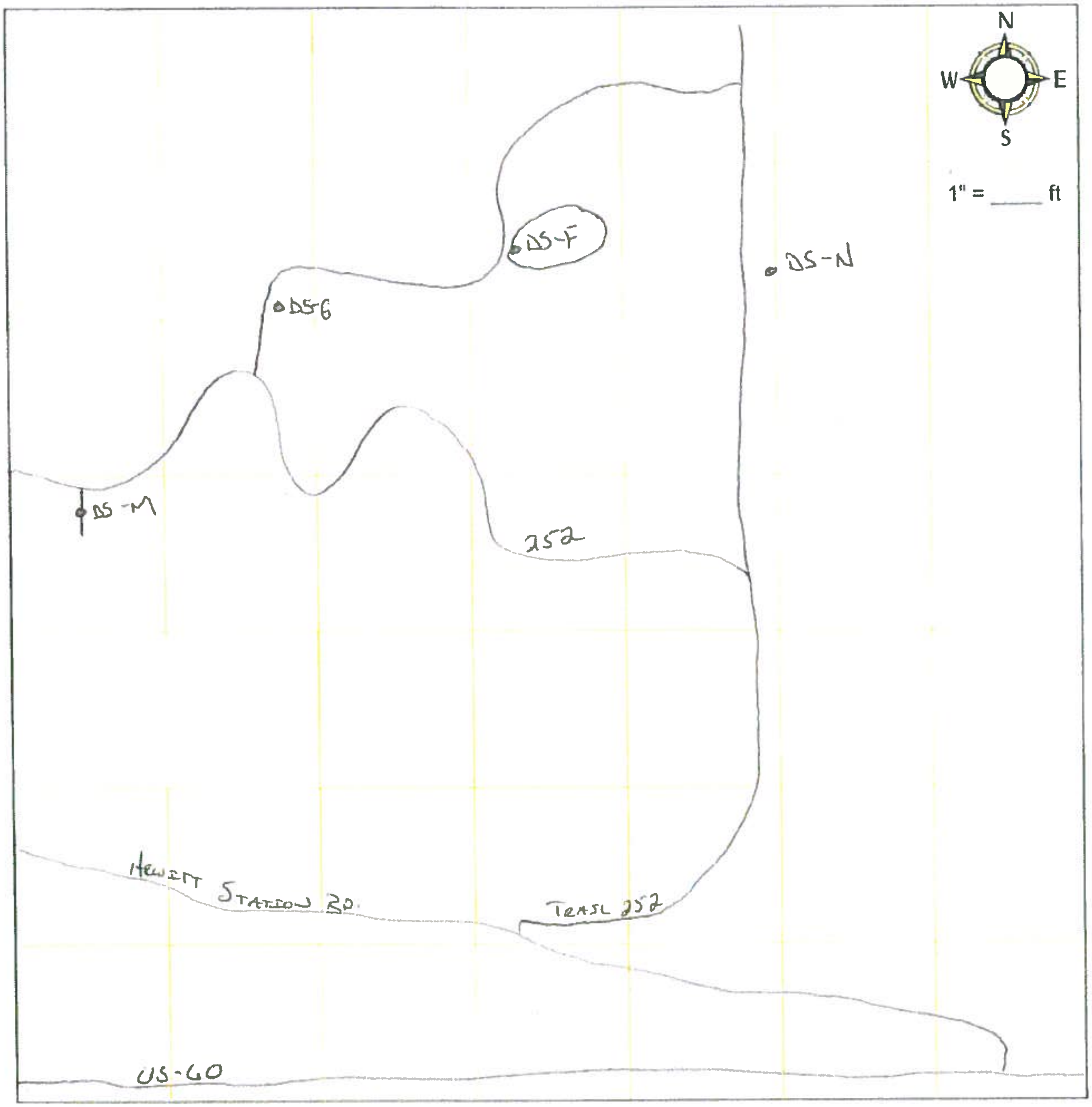
Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919894

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
	BOOK	MAP	PARCEL
Resolution Copper	0	0	0

- ❖ 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.



Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.
- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.
- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.
- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked.

If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

FILE NUMBER

WELL REGISTRATION NUMBER
55 - 919895

PERMIT NUMBER (IF ISSUED)

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER 520-689-3930	FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-G (DS16-04)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01 S	12E	25	NW ¼	NW ¼	SE ¼

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
33 °	18 '	40.6 "N	111 °	11 '	11.3 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2443 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
10/5/2016

DATE WELL CONSTRUCTION COMPLETED
10/9/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919895

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 620 Feet Below Land Surface

DEPTH OF COMPLETED WELL 619 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 33 Feet Below Land Surface

DATE MEASURED 10/10/16

TIME MEASURED 0930

IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	X				X						
20	620	10.5	+2	538	4.5	X				X						
			538	598	4.5	X								X		.125
			598	619	4.5	X				X						

Installed Annular Material

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	100			X								
100	495				X							
495	518						X					
518	519									X		10 x 20
519	620										X	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 919895

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	415	Gila Conglomerate	
415	440	Tuff	
440	481	Gila Conglomerate	
481	543	Diabase	
543	590	Mescal Limestone	
590	620	Diabase	X

WELL REGISTRATION NUMBER
55 - 919895

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER Resolution Copper	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 0	MAP 0	PARCEL 0

- ❖ 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.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

1912

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER D(1-11) 27 CBB
WELL REGISTRATION NUMBER **55 -** 920012
PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper
MAILING ADDRESS: 102 Magma Heights
CITY / STATE / ZIP CODE: Superior, AZ, 85173
CONTACT PERSON NAME AND TITLE: Mary Morissette Permitting
TELEPHONE NUMBER: 520-689-3930
FAX:
WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.): DS16-05 (DS-O)

Location of Well

WELL LOCATION ADDRESS (IF ANY): Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01S	11E	27	NW ¼	NW ¼	SW ¼

LATITUDE: 33 ° Degrees 18 ' Minutes 42.46 " N Seconds
LONGITUDE: 111 ° Degrees 13 ' Minutes 47.04 " W Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2220 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY: Pinal
ASSESSOR'S PARCEL ID NUMBER: BOOK 0 MAP 0 PARCEL 0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Condition of Well

CHECK ONE
- ☒ Capped
- ☐ Pump Installed

Method of Sealing at Reduction Points

CHECK ONE
- ☒ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (*please specify*):

Construction Dates

DATE WELL CONSTRUCTION STARTED: 10/15/2016
DATE WELL CONSTRUCTION COMPLETED: 10/20/2016

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
DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920012

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 320 Feet Below Land Surface	DEPTH OF COMPLETED WELL 319 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 33.12 Feet Below Land Surface	DATE MEASURED 10/25/16	TIME MEASURED 10:45	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	X				X						
20	320	10.5	+2	188	4.5	X				X						
			188	298	4.5	X								X		.125
			298	319	4.5	X				X						

Installed Annular Material

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	20			X								
20	164.5				X							30%
164.5	184.3						X					3/8
184.3	185.3									X		10x20
185.3	320										X	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920012

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	15	Quaternary Allurium	
15	320	Pinal schist	200

Well Driller Report and Well Log

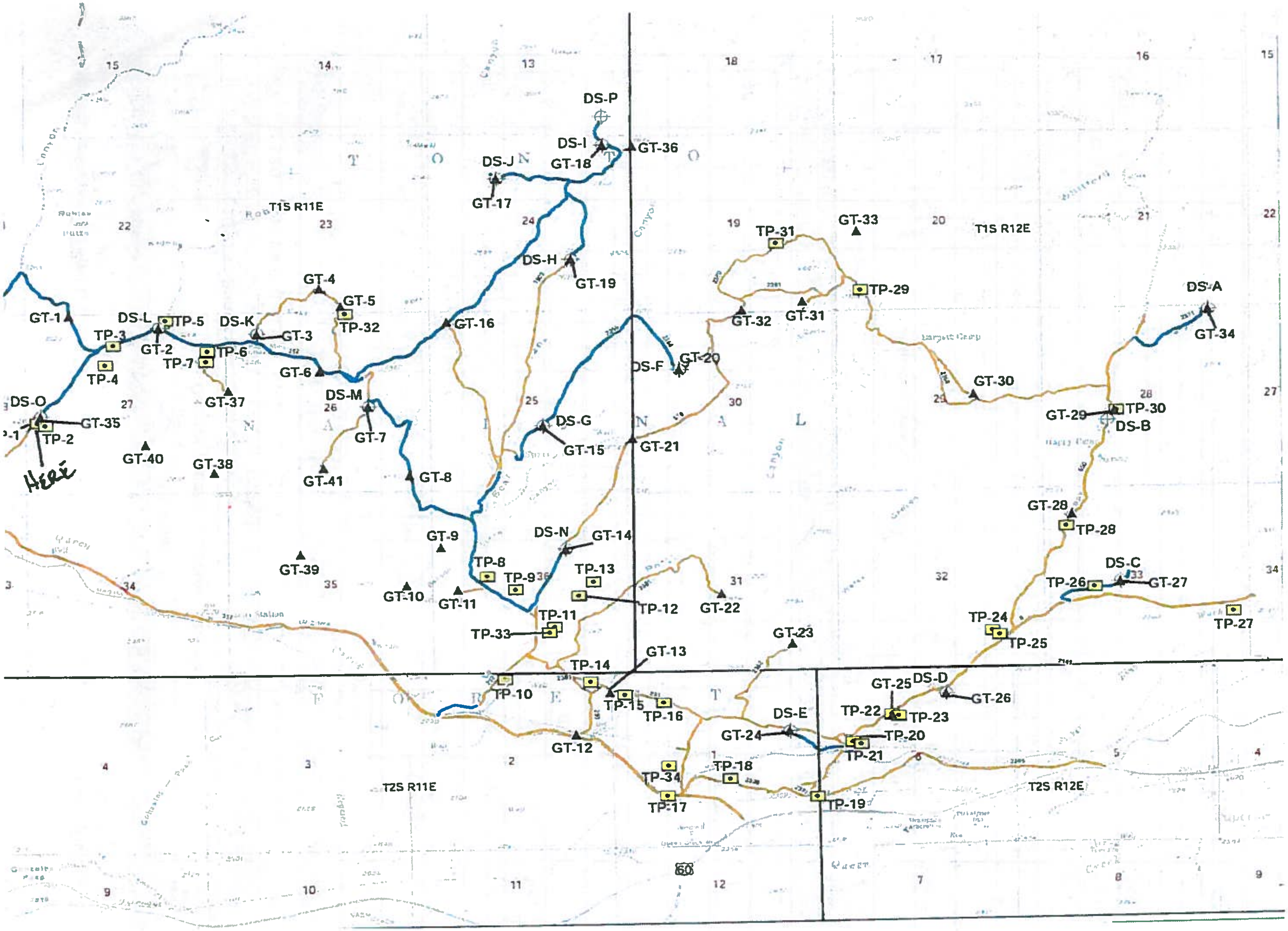
WELL REGISTRATION NUMBER
55 - 920012

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER Resolution Copper	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 0 MAP 0 PARCEL 0

- 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.

1" = _____ ft


DS-P
DS-I
GT-36
GT-18
DS-J
GT-17
T1S R11E
T1S R12E
DS-H
GT-19
GT-33
TP-31
TP-29
DS-A
GT-34
GT-4
GT-5
TP-32
GT-1
DS-L
TP-5
DS-K
GT-3
TP-3
GT-2
TP-6
TP-7
GT-16
GT-32
GT-31
GT-6
TP-4
DS-M
GT-20
DS-F
GT-30
DS-O
GT-35
-1
TP-2
GT-37
GT-7
DS-G
GT-15
GT-21
GT-29
TP-30
DS-B
GT-40
GT-38
GT-41
GT-8
Here
GT-28
TP-28
GT-9
DS-N
GT-14
GT-39
TP-8
TP-9
TP-13
DS-C
TP-26
GT-27
GT-10
GT-11
TP-12
GT-22
TP-11
TP-33
TP-24
TP-25
TP-27
GT-23
GT-13
TP-14
GT-25
DS-D
GT-26
TP-10
TP-15
TP-16
DS-E
TP-22
TP-23
GT-24
TP-20
TP-21
GT-12
TP-18
TP-34
TP-17
TP-19
T2S R11E
T2S R12E
15
14
13
18
17
16
22
23
24
19
20
21
27
26
25
30
29
28
34
35
36
31
32
33
4
3
2
1
6
5
9
10
11
12
7
8
60

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the “Blank or None” box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant’s lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor’s parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR’s main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR’s permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER	D(1-11)27 ABA
WELL REGISTRATION NUMBER	**55 -** 920013
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER 520-689-3930	FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-L (DS16-06)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	27	NE ¼	NW ¼	NE ¼

	Degrees	Minutes	Seconds
LATITUDE	33°	19'	16.1"N
LONGITUDE	-111°	13'	13.8"W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2286 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	BOOK	MAP	PARCEL
Pinal	0	0	0

ASSESSOR'S PARCEL ID NUMBER

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
10/20/2016

DATE WELL CONSTRUCTION COMPLETED
10/22/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920013

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 120 Feet Below Land Surface

DEPTH OF COMPLETED WELL 120 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 32.63 Feet Below Land Surface

DATE MEASURED 10/25/16

TIME MEASURED 10:35

IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	X				X						
20	120	10.5	+2	19	4.5	X				X						
			19	99	4.5	X								X		.125
			99	120	4.5	X				X						

Installed Annular Material

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	20			X								
0	9			X								
9	12.2						X					
12.2	13									X		
20	120										X	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 90013

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	15	Quaternary Alluvium	
15	120	Pinal Schist	45

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 90013

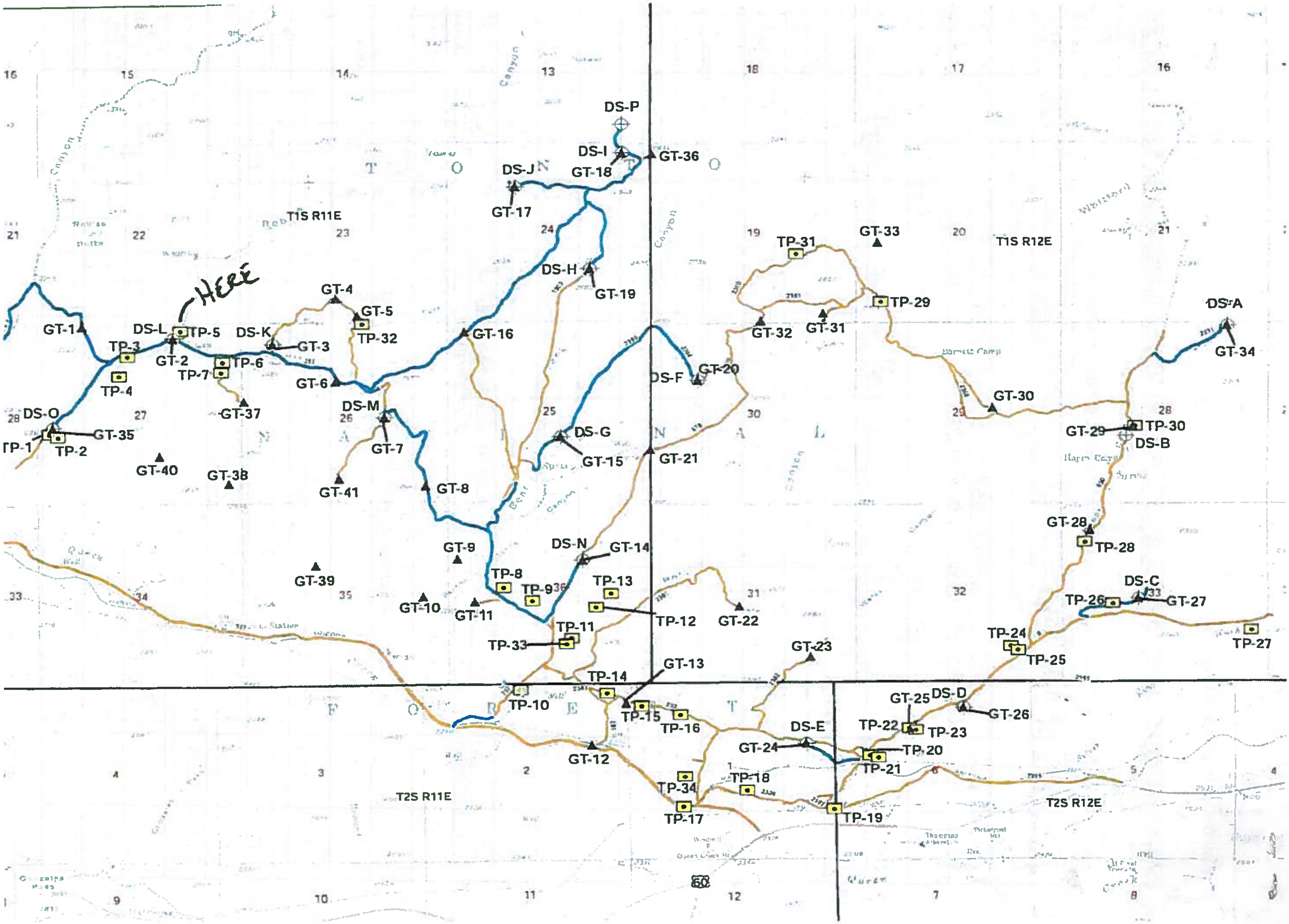
SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER Resolution Copper	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 0	MAP 0	PARCEL 0

- ❖ 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


HERE
DS-A
DS-B
DS-C
DS-D
DS-E
DS-F
DS-G
DS-H
DS-I
DS-J
DS-K
DS-L
DS-M
DS-N
DS-O
DS-P
GT-1
GT-2
GT-3
GT-4
GT-5
GT-6
GT-7
GT-8
GT-9
GT-10
GT-11
GT-12
GT-13
GT-14
GT-15
GT-16
GT-17
GT-18
GT-19
GT-20
GT-21
GT-22
GT-23
GT-24
GT-25
GT-26
GT-27
GT-28
GT-29
GT-30
GT-31
GT-32
GT-33
GT-34
GT-35
GT-36
GT-37
GT-38
GT-39
GT-40
GT-41
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-19
TP-20
TP-21
TP-22
TP-23
TP-24
TP-25
TP-26
TP-27
TP-28
TP-29
TP-30
TP-31
TP-32
TP-33
TP-34
T1S R11E
T1S R12E
T2S R11E
T2S R12E
16
15
14
13
18
17
16
21
22
23
24
19
20
21
28
27
26
25
30
29
28
33
34
35
31
32
33
4
3
2
1
6
5
4
9
10
11
12
7
8
Canyon
Barnett Camp
Harris Camp
Station
60

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER D(1-11)26 BBA

WELL REGISTRATION NUMBER **55 -** 920014

PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP CODE: Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE: Mary Morissette Permitting

TELEPHONE NUMBER: 520-689-3930

FAX:

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.): DS-K (DS16-07)

Location of Well

WELL LOCATION ADDRESS (IF ANY): Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	26	NE ¼	NW ¼	NW ¼

	Degrees	Minutes	Seconds
LATITUDE	33 °	19 '	12.7 "N
LONGITUDE	-111 °	12 '	43.4 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2352 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☐ Other (*please specify*):

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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: 10/23/16

DATE WELL CONSTRUCTION COMPLETED: 10/25/16

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

DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920014

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 320 Feet Below Land Surface

DEPTH OF COMPLETED WELL 319 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 70.23 Feet Below Land Surface

DATE MEASURED 10/31/16

TIME MEASURED 09:45

IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	X				X						
20	320	10.5	+2	238		X				X						
			238	308		X								X		.125
			308	319		X				X						

Installed Annular Material

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	20			X								
0	215				X							
215	226						X					3/8
226	228									X		10x20
228	320										X	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920014

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	52	Diabase	
52	201	Mescal Limestone	
201	320	Upper Dripping Spring Quartzite	

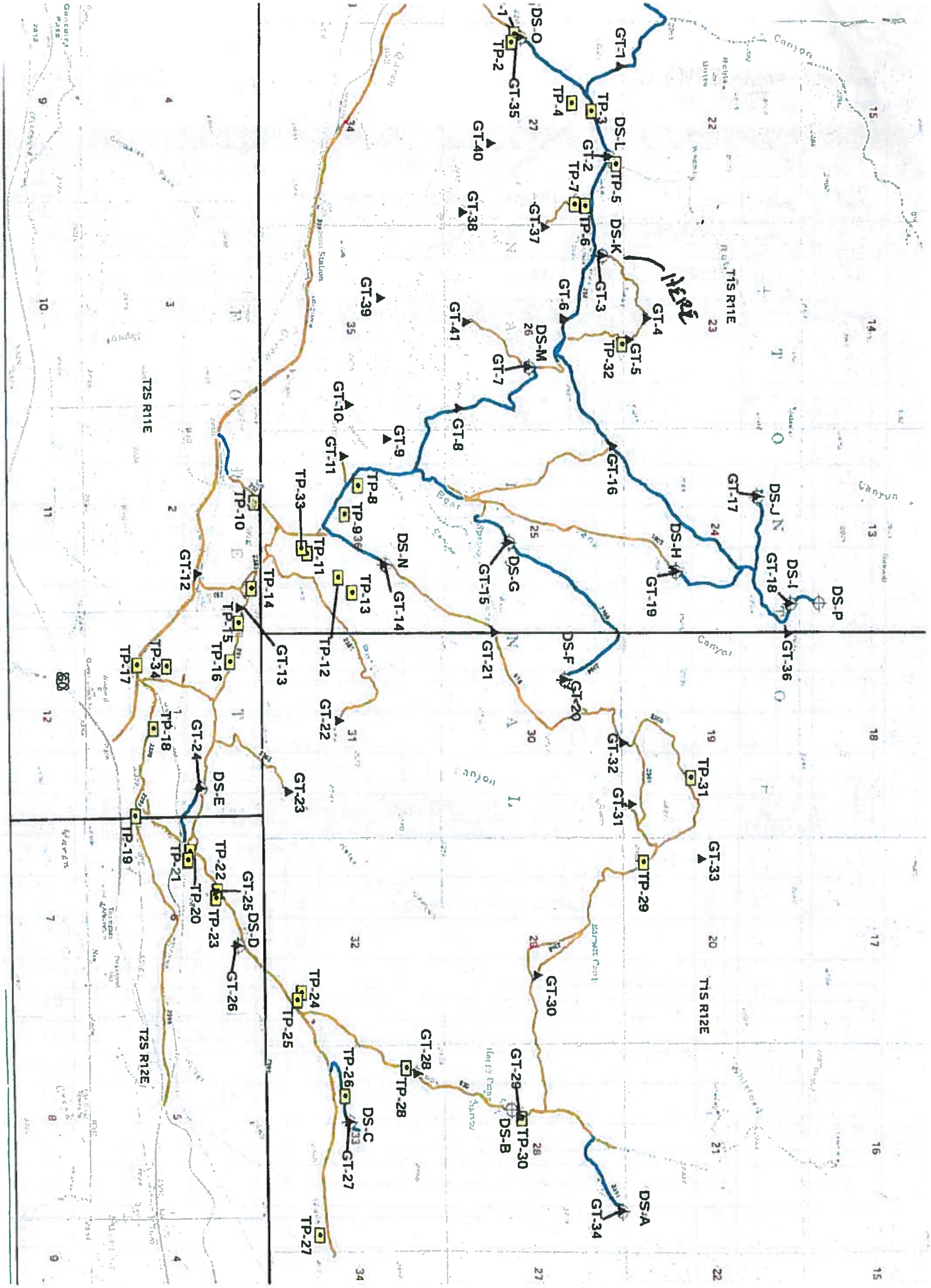
WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
	BOOK	MAP	PARCEL
Resolution Copper	0	0	0

- ❖ 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.

1" = _____ ft



HERE
T1S R11E
T1S R12E
T2S R11E
T2S R12E
DS-A
DS-B
DS-C
DS-D
DS-E
DS-F
DS-G
DS-H
DS-I
DS-J
DS-K
DS-L
DS-M
DS-N
DS-O
DS-P
GT-1
GT-2
GT-3
GT-4
GT-5
GT-6
GT-7
GT-8
GT-9
GT-10
GT-11
GT-12
GT-13
GT-14
GT-15
GT-16
GT-17
GT-18
GT-19
GT-20
GT-21
GT-22
GT-23
GT-24
GT-25
GT-26
GT-27
GT-28
GT-29
GT-30
GT-31
GT-32
GT-33
GT-34
GT-35
GT-36
GT-37
GT-38
GT-39
GT-40
GT-41
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-19
TP-20
TP-21
TP-22
TP-23
TP-24
TP-25
TP-26
TP-27
TP-28
TP-29
TP-30
TP-31
TP-32
TP-33
TP-34
15
14
13
18
17
16
22
23
24
19
20
21
27
26
25
30
29
28
34
35
36
31
32
33
4
3
2
1
6
5
9
10
11
12
7
8
Canyon

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.
- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.
- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.
- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the “Blank or None” box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant’s lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor’s parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR’s main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR’s permanent records.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-36020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

FILE NUMBER
D(1-11) 24 AAB

WELL REGISTRATION NUMBER
55 - 920079

PERMIT NUMBER (IF ISSUED)

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER

MAILING ADDRESS
102 MAGMA HIGHTS

CITY / STATE / ZIP
SUPERIOR, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER	FAX
520 689-9374	

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)
DS-I (DS16-08)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Park

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	24	NW 1/4	NE 1/4	NE 1/4

LATITUDE			LONGITUDE		
33 °	20 '	06.9 "N	-111 °	10 '	55.2 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2695 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) NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	0	0	0

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
10/27/2016

DATE WELL CONSTRUCTION COMPLETED
10/30/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920079

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 400 Feet Below Land Surface

DEPTH OF COMPLETED WELL 378 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 208 Feet Below Land Surface

DATE MEASURED 10/28/16

TIME MEASURED 18:00

IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	20	17.5	+3	20	12.75	x				x						
20	400	4.5	+2	297	4.5	x				x						
			297	377	4.5	x								x		.125
			377	378	4.5	x				x						

Installed Annular Material

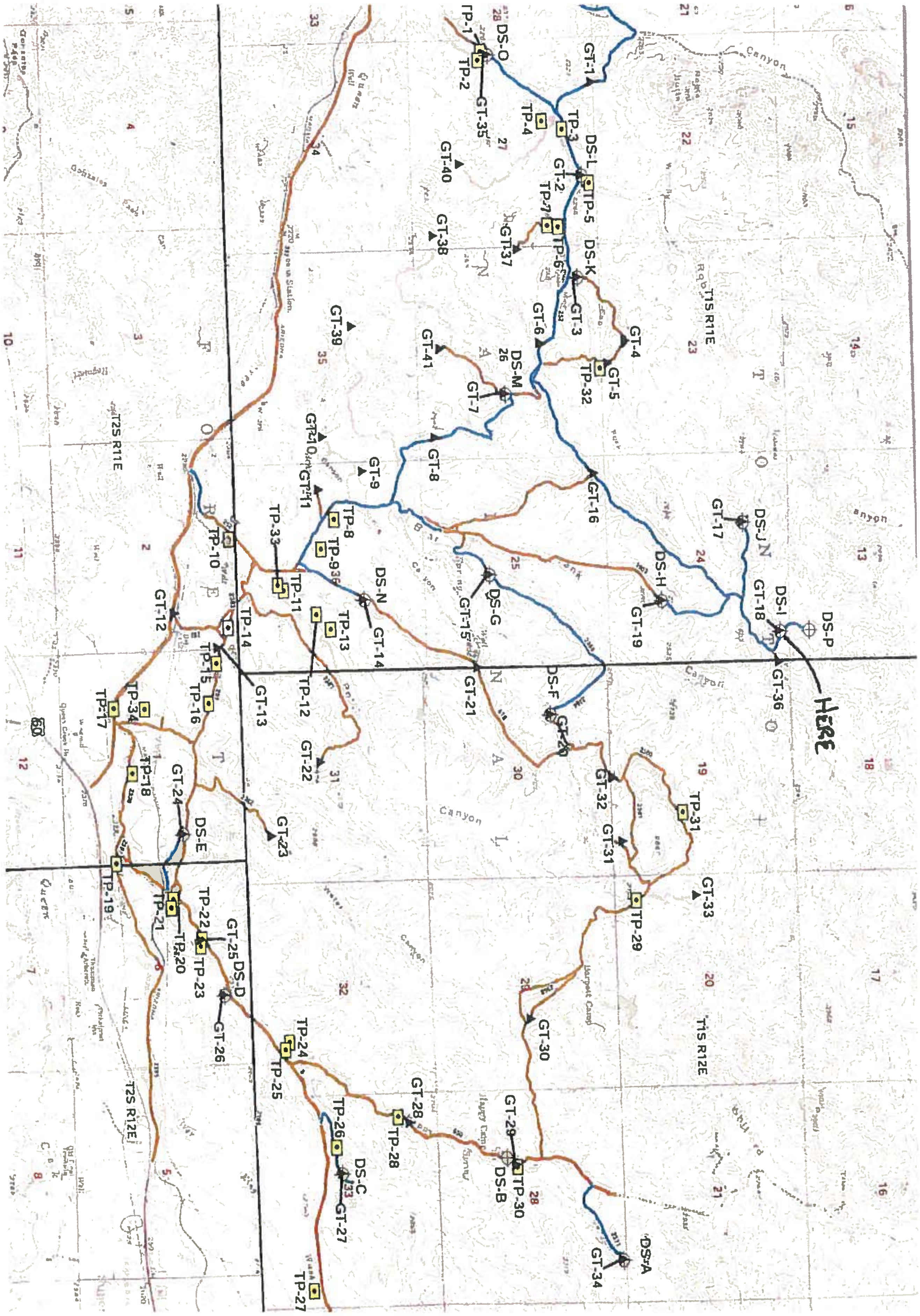
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	20			x								
0	268				x							
268	279						x					3/8
279	280									x		10x20
280	379										x	.250x.125
379	400								Native			

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920079

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	243	Diabase	
243	257	Upper Dripping Spring Quartizte	
257	293	Diabase	x
293	310	Upper Dripping Spring Quartizte	
310	400	Pinal Schist	


HERE
DS-A
DS-B
DS-C
DS-D
DS-E
DS-F
DS-G
DS-H
DS-I
DS-J
DS-K
DS-L
DS-M
DS-N
DS-O
DS-P
GT-1
GT-2
GT-3
GT-4
GT-5
GT-6
GT-7
GT-8
GT-9
GT-10
GT-11
GT-12
GT-13
GT-14
GT-15
GT-16
GT-17
GT-18
GT-19
GT-20
GT-21
GT-22
GT-23
GT-24
GT-25
GT-26
GT-27
GT-28
GT-29
GT-30
GT-31
GT-32
GT-33
GT-34
GT-35
GT-36
GT-37
GT-38
GT-39
GT-40
GT-41
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-11
TP-12
TP-13
TP-14
TP-15
TP-16
TP-17
TP-18
TP-19
TP-20
TP-21
TP-22
TP-23
TP-24
TP-25
TP-26
TP-27
TP-28
TP-29
TP-30
TP-31
TP-32
TP-33
TP-34
TP-936
T1S R11E
T1S R12E
T2S R11E
T2S R12E
Canyon
TONTO
NATIONAL
FOREST
Queen Creek
Superior
60

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-36020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	D(1-11) 13 DDC
WELL REGISTRATION NUMBER	55 - 920076
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: RESOLUTION COPPER

MAILING ADDRESS: 102 MAGMA HIGHTS

CITY / STATE / ZIP: SUPERIOR, AZ, 85173

CONTACT PERSON NAME AND TITLE: Mary Morissette Permitting

TELEPHONE NUMBER: 520 689-9374

FAX:

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.): DS-P (DS16-09)

Location of Well

WELL LOCATION ADDRESS (IF ANY): Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	13	SW 1/4	SE 1/4	SE 1/4

LATITUDE			LONGITUDE		
33 °	20 '	15.8 "N	-111 °	10 '	54.8 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE): ☐ USGS Quad Map ☐ Conventional Survey ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2621 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) NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	0	0	0

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
- ☐ Ball
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Condition of Well

CHECK ONE

- ☒ Capped
- ☐ Pump Installed

Method of Sealing at Reduction Points

CHECK ONE

- ☒ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Construction Dates

DATE WELL CONSTRUCTION STARTED: 11/02/2016

DATE WELL CONSTRUCTION COMPLETED: 11/04/2016

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

DATE: 2-9-~~16~~17 WE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920076

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 400 Feet Below Land Surface	DEPTH OF COMPLETED WELL 177 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION
132 Feet Below Land Surface	11/11/16	19:00	☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	20	17.5	+3	20	12.75	x				x						
20	400	10.5	+2.5	37	4.5	x				x						
			37	177	4.5	x								x		.125
			177	178	4.5	x				x						

Installed Annular Material

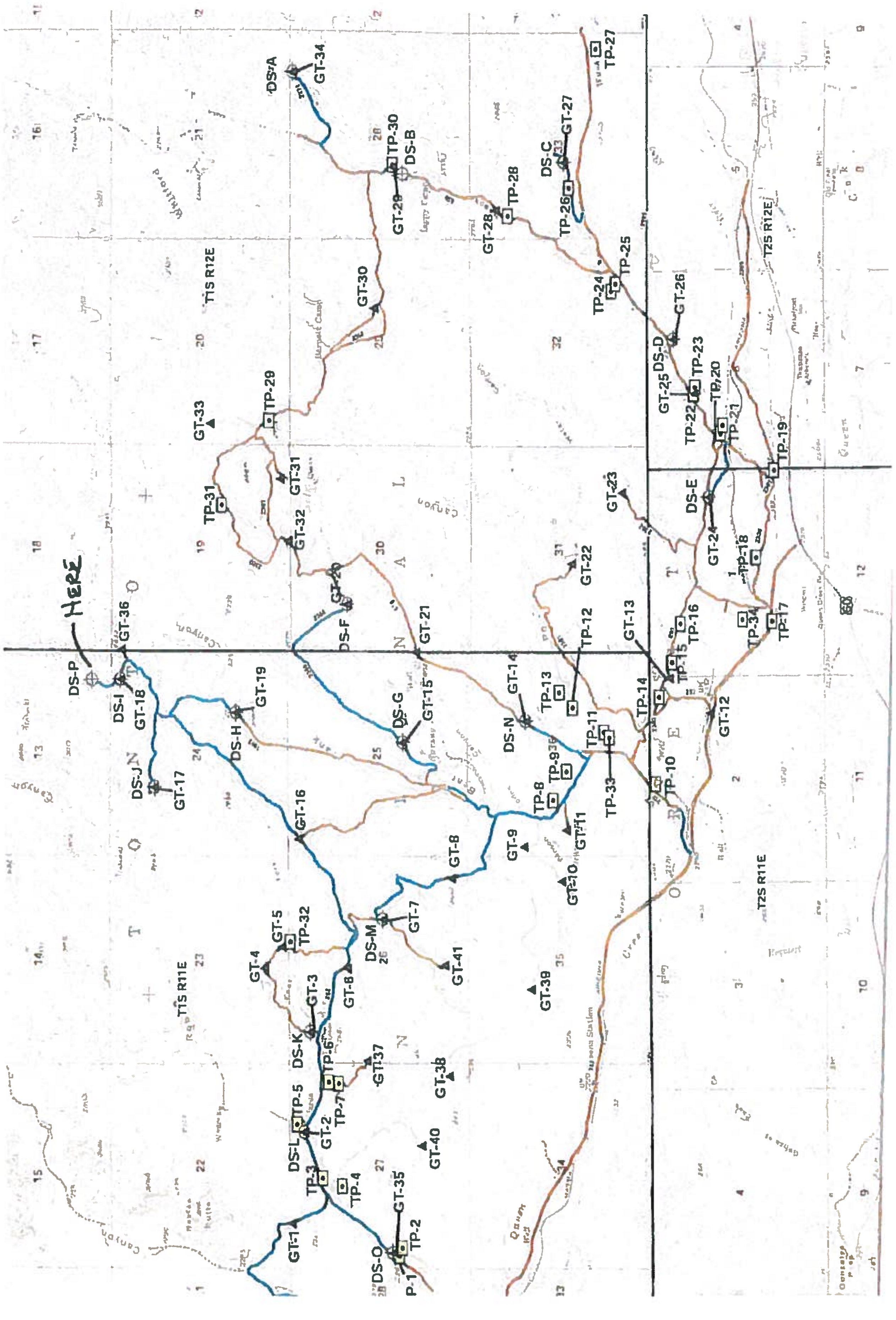
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)								FILTER PACK		
						BENTONITE						
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	GROUT	CHIPS	PELLETS	IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
0	20			x								
0	22			x								
22	26						x					
26	178										x	.250x.125
178	400								Native			

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920076

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Description Describe material, grain size, color, etc.	Check (T) every Interval where water was encountered (If known)
0	10	Alluvium	
10	400	Pinal Schist	


HERE
DS-A
GT-34
TP-30
DS-B
GT-29
TP-28
GT-28
DS-C
GT-27
TP-26
TP-27
TP-25
TP-24
GT-26
DS-D
GT-25
TP-23
TP-22
TP-20
TP-21
TP-19
GT-30
TP-29
GT-33
GT-31
TP-31
GT-32
GT-23
DS-E
GT-24
TP-18
GT-22
GT-20
DS-F
GT-21
TP-12
GT-13
TP-16
TP-15
TP-34
TP-17
GT-36
DS-P
DS-I
GT-18
GT-19
DS-H
DS-G
GT-15
GT-14
DS-N
TP-13
TP-14
TP-11
GT-12
TP-93
TP-8
TP-33
TP-10
GT-11
DS-J
GT-17
GT-16
GT-9
GT-8
GT-10
GT-7
DS-M
GT-41
GT-5
TP-32
GT-4
GT-3
GT-6
GT-39
DS-K
TP-6
TP-7
GT-37
GT-38
TP-5
GT-2
DS-L
GT-40
TP-3
TP-4
GT-35
GT-1
DS-O
TP-2
P-1
T1S R11E
T1S R12E
T2S R11E
T2S R12E
TONTO NATIONAL FOREST

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2 **Condition of Well,** indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR's main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT OF WATER RESOURCES

Phoenix, Arizona 85007

DRILLING CARD
VARIANCE GRANTED

THIS AUTHORIZATION SHALL BE IN POSSESSION OF THE DRILLER DURING ALL DRILLING OPERATIONS

WELL REGISTRATION NO: **55-920080**

AUTHORIZED DRILLER: **NATIONAL EWP, INC.** LICENSE NO: **823**

NOTICE OF INTENT TO **DRILL A ENV - MONITOR WELL** HAS BEEN FILED WITH THE DEPARTMENT BY:

WELL OWNER: **RESOLUTION COPPER**

ADDRESS: **102 MAGMA HIGHTS, SUPERIOR, AZ, 85173**

THE WELL(S) IS/ARE TO BE LOCATED IN THE:

SE 1/4 of the **NW** 1/4 of the **SE** 1/4 Section **24** Township **01 S** Range **11 E**

NO. OF WELLS IN THIS PROJECT: **1**

THIS AUTHORIZATION EXPIRES AT MIDNIGHT ON THE DAY OF **10/24/2017**

1912

THE DRILLER MUST FILE A WELL DRILLER REPORT AND WELL LOG WITHIN 30 DAYS OF COMPLETION OF DRILLING

This drilling or abandonment authority was granted based upon the certifications made by the above-named Driller in the notice of intent to drill or abandon. Those certifications, along with any variances granted, are listed below. By drilling or abandoning the well pursuant to this authorization, the above-named driller acknowledges the accuracy of the driller certifications. If the certifications are in error this authorization is invalid and driller must contact the Department of Water Resource's NOI Section in writing at the addres above to correct.

Variance(s) Granted To Driller:

- Shortened Surface Seal Variance – Surface seal casing may be less than 20 feet, but not be less than 5 feet.
- Well Screen > 10' Variance – Monitor well’s screen may be screened greater than 10 feet above the highest seasonal static water level.

Certification(s) Made By Driller:

☑ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

☑ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner’s behalf.

☑ By checking this box, I certify that I have read the applicable substantive policy statement regarding each variance that I am requesting, and that I shall comply with all of the requirements set forth therein.

☑ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an

☑ existing well.

☑ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

☑ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

ARIZONA DEPARTMENT OF WATER RESOURCES
Electronic Filing - NOI Report

Phoenix, Arizona

NOI Type: Notice of Intent to Drill, Deepen, Modify a Monitor/Piezometer/Environmental Well
Well Type: ENV - MONITOR
Date Received at ADWR Website: 10/24/2016

Fee Paid: $150.00 Order Number: -6308

Well Registration Number: 55 - 920080
Number of Wells/Holes: 1 Drilling Authority Expires On: 10/24/2017

Driller's ADWR License Number: 823

Authorized Driller: NATIONAL EWP, INC.
ROC License Number Entered By Driller: 269329
Qualifying Party License Categories: A-4

Well Owner Name: RESOLUTION COPPER
Well Owner Address: 102 MAGMA HIGHTS
Well Owner City, State - Zip: SUPERIOR, AZ - 85173
Well Owner Phone: 520 689-9374

Book: 0 Map:0 Parcel: 0

Is the Land Owner the same as the Well Owner?: No

Land Owner Name: TONTO NATIONAL FOREST
Land Owner Address: 2324 E. MCDOWELL ROAD
Land Owner City, State - Zip: PHOENIX, AZ - 85006
Land Owner Phone: 602 225-5200

Well Location: **SE** 1/4 of the **NW** 1/4 of the **SE** 1/4 Section **24** Township **1 S** Range **11 E**

AMA: PHOENIX AMA
County: PINAL
Contamination Site: NOT IN A REMEDIAL ACTION SITE

Primary Water Use: **MONITORING**
Secondary Water Use(s): **N/A**

Is any portion of the land, on which the well is to be located, within 100 feet of a designated municipal provider's operating water distribution system as shown on the municipal provider's most recent digitized service area map filed by the municipal provider with the director of ADWR. **N/A**

Will you be installing a dedicated pump ?: **No**

Will the installed pump have a pumping capacity of greater than 35 GPM, or will the well will be used to withdraw greater than 10 Acre Feet per year?: **N/A**

Variance(s) Granted To Driller:

- Shortened Surface Seal Variance – Surface seal casing may be less than 20 feet, but not be less than 5 feet.
- Well Screen > 10' Variance – Monitor well’s screen may be screened greater than 10 feet above the highest seasonal static water level.

Certification(s) Made By Driller:

☑ By checking this box, I certify that I have all necessary Registrar of Contractor (ROC) licenses in all necessary license categories for this drilling or abandonment project and that those licenses are current.

☑ By checking this box, I certify that I have been authorized by the above-named well owner to submit this Notice of Intent on the well owner’s behalf.

☑ By checking this box, I certify that I have read the applicable substantive policy statement regarding each variance that I am requesting, and that I shall comply with all of the requirements set forth therein.

☑ By checking this box, I certify that the information above is complete and correct, and that the well shall be drilled or abandoned in compliance with all pertinent statutes and rules, including any special standards that may be required to protect the aquifer or other water sources.

☑ By checking this box, I certify that this NOI application is not an application to replace, deepen, or modify an existing well.

☑ By checking this box, I understand that the Authorization to drill this well DOES NOT constitute or guarantee an approval to use the well for the purpose of withdrawing groundwater for transportation to an Active Management Area (AMA) pursuant to A.R.S. § 45-552, 45-553, 45-554 or 45-555(A) without official prior approval from the Department.

☑ If the landowner and the well owner are not the same, by checking this box, I certify that I have obtained written approval from the landowner in order to conduct this drilling or abandonment project. A copy of the written approval shall be submitted to ADWR with the Well Driller Report and Well Log or Well Abandonment Completion Report within 30 days of completion of drilling or abandonment.

NOTICE

A.R.S. § 41-1030(B), (D), (E) and (F) provide as follows:

B. An agency shall not base a licensing decision in whole or in part on a licensing requirement or condition that is not specifically authorized by statute, rule or state tribal gaming compact. A general grant of authority in statute does not constitute a basis for imposing a licensing requirement or condition unless a rule is made pursuant to that general grant of authority that specifically authorizes the requirement or condition.

D. This section may be enforced in a private civil action and relief may be awarded against the state. The court may award reasonable attorney fees, damages and all fees associated with the license application to a party that prevails in an action against the state for a violation of this section.

E. A state employee may not intentionally or knowingly violate this section. A violation of this section is cause for disciplinary action or dismissal pursuant to the agency’s adopted personnel policy.

F. This section does not abrogate the immunity provided by section 12-820.01 or 12-820.02.

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-36020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	**D(1-11) 24 DBD**
WELL REGISTRATION NUMBER	**55 - 920080**
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL RESOLUTION COPPER	
MAILING ADDRESS 102 MAGMA HIGHTS	
CITY / STATE / ZIP SUPERIOR, AZ, 85173	
CONTACT PERSON NAME AND TITLE Mary Morissette Permitting	
TELEPHONE NUMBER 520 689-9374	FAX
WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.) DS-H (DS16-10)	

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	24	SE 1/4	NW 1/4	SE 1/4

LATITUDE			LONGITUDE		
33 °	19 '	34.1 "N	-111 °	11 '	04.7 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ USGS Quad Map ☐ Conventional Survey ☐ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
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) NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	0	0	0

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)

Condition of Well

CHECK ONE

- ☒ Capped
- ☐ Pump Installed

Method of Sealing at Reduction Points

CHECK ONE

- ☒ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Construction Dates

DATE WELL CONSTRUCTION STARTED
11/07/2016

DATE WELL CONSTRUCTION COMPLETED
11/13/2016

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920080

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 540 Feet Below Land Surface	DEPTH OF COMPLETED WELL 294 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 290 Feet Below Land Surface	DATE MEASURED 11/26/16	TIME MEASURED 8:00am	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	20	17.5
20	540	10.5

Installed Casing

DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
+3	20	12.75	x				x						
+2	233	4.5	x				x						
233	293	4.5	x								X		.125
293	294	4.5	X				x						

Installed Annular Material

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	20			x								
0	195				x							
195	214						x					
214	216									x		Fine Sand
216	296										x	.250x.125
296	299						x					
299	540			x								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920080

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	298	Gila Conglomerate	
298	492	Apache Leap Tuff	315
492	540	White Tail Conglomerate (TW)	

WELL REGISTRATION NUMBER
55 - 920080

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER RESOLUTION COPPER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK 0	MAP 0	PARCEL 0

- 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

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the “Blank or None” box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant’s lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor’s parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-36020

Completed forms may also be submitted to ADWR’s main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR’s permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Phoenix, AZ 85007
602-771-8500
azwater.gov

October 24, 2016

RESOLUTION COPPER
102 MAGMA HIGHTS
SUPERIOR, AZ 85173

DOUGLAS A. DUCEY
Governor

THOMAS BUSCHATZKE
Director

Registration No. 55- 920080
File Number: D(1-11) 24 DBD

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling. Although the issuance of this drill card authorizes you to drill the proposed well under state law, the drilling of the well may be subject to restrictions or regulations imposed by other entities.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Engineering and Permits Division
Phoenix, AZ 85007
602-771-8500

NOTICE TO WELL DRILLERS

This is a reminder that a valid drill card be present for the drilling of each and every well constructed on a site.* The problem seems to occur during the construction of a well when an unexpected problem occurs. Either the hole collapses, the hole is dry, a drill bit is lost and can't be recovered, or any number of other situations where the driller feels that he needs to move over and start another well. If you encounter this type of scenario, please be aware drillers do not have the authority to start another well without first obtaining drilling authority for the new well. Please note the following statutes and regulations pertaining to well drilling and construction:

ARIZONA REVISED STATUTE (A.R.S.)

A.R.S. § 45-592.A.

A person may construct, replace or deepen a well in this state only pursuant to this article and section 45-834.01. The drilling of a well may not begin until all requirements of this article and section 45-834.01, as applicable, are met.

***

A.R.S. § 594.A.

The director shall adopt rules establishing construction standards for new wells and replacement wells, the deepening and abandonment of existing wells and the capping of open wells.

***

A.R.S. § 600.A

A well driller shall maintain a complete and accurate log of each well drilled.

ARIZONA ADMINISTRATIVE CODE (A.A.C.)

A.A.C. R12-15-803.A.

A person shall not drill or abandon a well, or cause a well to be drilled or abandoned, in a manner which is not in compliance with A.R.S. Title 45, Chapter 2, Article 10, and the rules adopted thereunder.

***

A.A.C. R12-15-810.A.

A well drilling contractor or single well licensee may commence drilling a well only if the well drilling contractor or licensee has possession of a drilling card at the well site issued by the Director in the name of the well drilling contractor or licensee, authorizing the drilling of the specific well in the specific location.

***

A.A.C. R12-15-816.F.

In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card.

*** THIS REQUIREMENT DOES NOT PERTAIN TO THE DRILLING OF MINERAL EXPLORATION, GEOTECHNICAL OR HEAT PUMP BOREHOLES**

Arizona Department of Water Resources
Groundwater Permitting and Wells Section
PO Box 36020 , Phoenix, AZ 85067-36020
(602) 771-8527 ▪ 1-800-352-8488
www.azwater.gov

Landowner Authorization to Drill or Abandon a Well on Landowner's Parcel

Landowner Authorization to Drill or Abandon a Well by a Third Party on Landowner's Parcel Pursuant to A.R.S. § 45-596 and A.A.C. R12-15-809

FILE NUMBER	D(1-11) 24 DBD
WELL REGISTRATION NUMBER	55 - 920080

The Arizona Department of Water Resources requires a well driller or well owner to obtain written permission from the owner of the land on which they intend to drill or abandon a well. Landowners, or their designated representative, must authorize the well to be drilled or abandoned with their signature on the Notice of Intent or on this form, to be attached to the Notice of Intent form.

PARCEL ADDRESS ____________________

COUNTY PARCEL ID 0 (BOOK) - 0 (MAP) - 0 (PARCEL) COUNTY PINAL

In accordance with A.R.S. § 45-496 and A.A.C. R12-15-809, I certify that:

☐ I am the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

☐ I am an authorized representative of the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

SIGNATURE

TYPE OR PRINT NAME OF LANDOWNER / RESPRESENTATIVE	TITLE
SIGNATURE	DATE SIGNED

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report
and
Well Log

FILE NUMBER
D(1-11) 24 BAC

WELL REGISTRATION NUMBER
55 - 920077

PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520-689-3930

FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-J (DS16-11)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01 S	11 E	24	SW ¼	NE ¼	NW ¼

LATITUDE			LONGITUDE		
33 °	19 '	58.0"N	-111 °	11 '	29.9"W
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2748 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY
Pinal

ASSESSOR'S PARCEL ID NUMBER
BOOK 0 MAP 0 PARCEL 0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
11-16-16

DATE WELL CONSTRUCTION COMPLETED
11-17-16

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

DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920077

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 640 Feet Below Land Surface	DEPTH OF COMPLETED WELL 640 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 208.18 Feet Below Land Surface	DATE MEASURED 12/03/16	TIME MEASURED 11:07	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole / Installed Casing

Borehole DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	Installed Casing DEPTH FROM SURFACE FROM (feet)	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	17.5	+3	20	12.75	X				X						
20	640	10.5	+1.1	448.9	4.5	x				x						
			448.9	618.8	4.5	x								x		.125
			618.8	639.8	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								
0	417			x								
417	437						x					
437	438									x		
438	640										x	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920077

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	147	Gila Conglomerate	
147	640	Apache Leap Tuff	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920077

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
Resolution Copper	BOOK 0	MAP 0	PARCEL 0

- ❖ 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.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.
- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.
- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.
- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report
and
Well Log

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 28 AAB

WELL REGISTRATION NUMBER **55 -** 920153

PERMIT NUMBER (IF ISSUED)

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520-689-3930

FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-A (DS16-12)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01 S	12 E	28	NW ¼	NE ¼	NE ¼

LATITUDE			LONGITUDE		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
33 °	19 '	17.1"N	-111 °	07 '	52.6 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2875 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
11-25-16

DATE WELL CONSTRUCTION COMPLETED
11-26-16

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

DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920153

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 340 Feet Below Land Surface	DEPTH OF COMPLETED WELL 340 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 313.98 Feet Below Land Surface	DATE MEASURED 12/03/16	TIME MEASURED 12:44	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole / Installed Casing

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	20	17.5	+3	20	12.75	X				X						
20	340	10.5	+2.5	257.5	4.5	x				x						
			257.5	337.5	4.5	x								x		.125
			337.5	338.5	4.5	x				x						

Installed 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	GRAVEL	SIZE
0	20			X								
0	25			x								
25	241.4				x							
241.4	250.4						x					
250.4	251.8									x		
251.8	340										x	.250x.125

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920153

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	10	Quaternary and Tertiary Basin-Fill Deposits	
10	170	Apache Leap Tuff	
170	238	Mescal Limestone	T
238	340	Precambrian Diabase	T

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920153

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER Resolution Copper	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 0	MAP 0	PARCEL 0

- ❖ 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

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER
D(1-12)28 CAB

WELL REGISTRATION NUMBER
55 - 920154

PERMIT NUMBER (IF ISSUED)

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME
National EWP

DWR LICENSE NUMBER
823

ADDRESS
1200 west San Pedro Street

TELEPHONE NUMBER
480-558-3500

CITY / STATE / ZIP
Gilbert, AZ, 85233

FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520-689-3930

FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-B (DS16-13)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01s	12E	28	NW ¼	NE ¼	SW ¼

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
33 °	18 '	44.9 "N	-111 °	08 '	21.5 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2704 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY
Pinal

ASSESSOR'S PARCEL ID NUMBER
BOOK 0 MAP 0 PARCEL 0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
11/27/2016

DATE WELL CONSTRUCTION COMPLETED
12/06/2016

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

DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920154

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 540 Feet Below Land Surface	DEPTH OF COMPLETED WELL 438 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 34.5 Feet Below Land Surface	DATE MEASURED 12/10/16	TIME MEASURED 14:00	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	20	17.5
20	540	10.5

Installed 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)
+3	20	12.75	X				X						
+2	250	4.5	X				X						
250	420	4.5	X								X		.125
420	431	4.5	X				X						

Installed 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
0	20			X								
20	198				X							
198	209						X					.375
209	211									X		10/20
211	438										X	.250X.125
438	474						X					.375
474	540			X								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920154

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	73	Gila conglomerate	
73	199	Tertiary Tuff	
199	435	Apache Leap Tuff	X
435	444	Apache Leap Tuff - Vitrophyre	
444	470	Precambrian Basalt	
470	482	Precambrian Diabase	
482	510	Mescal Limestone	
510	540	Precambrian Diabase	

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER Resolution Copper	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 0	MAP 0	PARCEL 0

- ❖ 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.

1" = _____ ft

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.
- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.
- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.
- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER	D(1-12)33 CAA
WELL REGISTRATION NUMBER	**55 -** 920155
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL: Resolution Copper

MAILING ADDRESS: 102 Magma Heights

CITY / STATE / ZIP CODE: Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE: Mary Morissette Permitting

TELEPHONE NUMBER: 520-689-3930

FAX:

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.): DS-C (DS16-14)

Location of Well

WELL LOCATION ADDRESS (IF ANY): Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	33	NE ¼	NE ¼	SW ¼

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
33 °	17 '	57 "N	-111 °	08 '	18.9 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL: 2617 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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: 12/8/16

DATE WELL CONSTRUCTION COMPLETED: 12/20/16

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	DATE

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920155

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 895 Feet Below Land Surface	DEPTH OF COMPLETED WELL 285 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 55.2 Feet Below Land Surface	DATE MEASURED 1.5.2017	TIME MEASURED 12:46	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	20	17.5
20	410	10.5
410	895	9.875

Installed Casing

DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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)
+3	20	12.75	X				X						
+2	39	4.5	X				X						
39	279	4.5	X								X		.125
279	284	4.5	X				X						

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
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	31						X					.375
31	32									X		10x20
32	284										X	.250x.125
284	315						X					.375
315	895			X								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920155

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	290	Gila Conglomerate	
290	620	Tertiary Basalt	
620	690	Gila Conglomerate	
690	760	Tertiary Tuffaceous Volcanics	
760	895	Apache Leap Tuff	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
Resolution Copper	BOOK 0	MAP 0	PARCEL 0

- ❖ 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

Form 55-55 Instructions

Well Driller Report and Well Log

1912

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled “Well Driller Report and Well Log.” Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR’s web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 – Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 – Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor’s parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor’s office. Federal or State land will not have a parcel identification number.

Section 3 – Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the “Other” box and describe the method. To the right of that, indicate the method of well development by checking the appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check “Other” and provide a brief explanation. Under

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 – Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 – Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 – Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 3550 N. Central Ave., Phoenix, AZ 85012.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER	D(1-12)6 ABD
WELL REGISTRATION NUMBER	55 - 920156
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
Resolution Copper

MAILING ADDRESS
102 Magma Heights

CITY / STATE / ZIP CODE
Superior, AZ, 85173

CONTACT PERSON NAME AND TITLE
Mary Morissette Permitting

TELEPHONE NUMBER
520-689-3930

FAX

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)
DS-D(DS17-15)

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	12E	6	NE ¼	NW ¼	SE ¼

LATITUDE Degrees	Minutes	Seconds	LONGITUDE Degrees	Minutes	Seconds
33 °	17 '	26.3 "N	-111 °	09 '	12.9 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2537 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ 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
1/18/2017

DATE WELL CONSTRUCTION COMPLETED
1/22/2017

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

DATE
3-9-17

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920156

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 680 Feet Below Land Surface	DEPTH OF COMPLETED WELL 449 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 87.85 Feet Below Land Surface	DATE MEASURED 2/3/2017	TIME MEASURED 12:15	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole / Installed Casing

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	x				x						
20	680	10.5	+2	288	4.5	x				x						
			288	438	4.5	x								x		.125
			438	449	4.5	x				x						

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
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	260			x								
260	278						x					3/8
278	280									x		10x20
280	458										x	.250x.125
458	485						x					3/8
485	680			x								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920156

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	221	Tertiary Basalt	
221	265	Tertiary Sandstone	
265	273	Tertiary Tuff	
273	613	Tertiary Basalt	
613	680	Apache Leap Tuff	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER
Resolution Copper

COUNTY ASSESSOR'S PARCEL ID NUMBER

BOOK	MAP	PARCEL
0	0	0

- ❖ 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

Arizona Department of Water Resources
Water Management Division
P.O. Box 36020 Phoenix, Arizona 85067-6020
(602) 771-8627 • (602) 771-8690 fax
· www.azwater.gov ·

Well Driller Report and Well Log

FILE NUMBER	D(1-11)1 ADB
WELL REGISTRATION NUMBER	**55 -** 920157
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME National EWP	DWR LICENSE NUMBER 823
ADDRESS 1200 west San Pedro Street	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP Gilbert, AZ, 85233	FAX

SECTION 2. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL Resolution Copper	
MAILING ADDRESS 102 Magma Heights	
CITY / STATE / ZIP CODE Superior, AZ, 85173	
CONTACT PERSON NAME AND TITLE Mary Morissette Permitting	
TELEPHONE NUMBER 520-689-3930	FAX
WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.) DS-E(DS17-16)	

Location of Well

WELL LOCATION ADDRESS (IF ANY)
Tonto National Forest

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
1S	11E	01	NE ¼	SE ¼	NW ¼

LATITUDE			LONGITUDE		
33 °	17 '	15.6 "N	-111 °	10 '	00.0 "W
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2425 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)
☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)
☐ NAD-83 ☒ Other (*please specify*): NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER BOOK	MAP	PARCEL
Pinal	0	0	0

SECTION 3. WELL CONSTRUCTION DETAILS

Drill Method

CHECK ALL THAT APPLY
- ☐ 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 ALL THAT APPLY
- ☒ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (*please specify*):

Condition of Well

CHECK ONE
- ☒ Capped
- ☐ Pump Installed

Method of Sealing at Reduction Points

CHECK ONE
- ☒ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (*please specify*):

Construction Dates

DATE WELL CONSTRUCTION STARTED
1/26/2017

DATE WELL CONSTRUCTION COMPLETED
2/1/2017

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	DATE
	3-9-17

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920157

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT) (attach additional page if needed)

Depth

DEPTH OF BORING 600 Feet Below Land Surface	DEPTH OF COMPLETED WELL 165 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL 97.9 Feet Below Land Surface	DATE MEASURED 2/3/2017	TIME MEASURED 11:50	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE			DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
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	20	17.5	+3	20	12.75	X				X						
20	500	10.5	+2	115	4.5	X				X						
500	600	6.5	115	155	4.5	X								X		.125
			155	165	4.5	X				X						

Installed Annular Material

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	20			X								
20	86				X							
86	102						X					3/8
102	104									X		10x20
104	175										X	.250x.125
175	191						X					3/8
191	600			X								

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920157

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)	Describe material, grain size, color, etc.	
0	98	Gila Conglomerate	
98	511	Tertiary Basalt	
511	532	Apache Leap Tuff	
532	600	Pinal Schist	

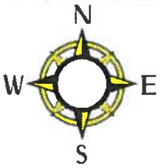
Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 -

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER		
Resolution Copper	BOOK 0	MAP 0	PARCEL 0

- ❖ 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.



1" = _____ ft

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-6020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	**A(1-11) 35 CBD**
WELL REGISTRATION NUMBER	**55 - 920368**
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER COMPANY

MAILING ADDRESS
102 MAGMA HIEGHTS

CITY / STATE / ZIP
SUPERIOR, AZ, 85273

CONTACT PERSON NAME AND TITLE

TELEPHONE NUMBER 520 6893254	FAX

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)
DS17-17

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01N	11E	35	SW 1/4	NW 1/4	SE 1/4

LATITUDE °	'	"N	LONGITUDE °	'	"W
33	17	55.7	-111	12	44.9

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2192 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) NAD27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	104	21	001

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) Sonic

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
2.9.2017

DATE WELL CONSTRUCTION COMPLETED
2.10.2017

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	DATE 3-16-17

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920368

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING: 32.5 Feet Below Land Surface

DEPTH OF COMPLETED WELL: 31 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL: Feet Below Land Surface

DATE MEASURED:

TIME MEASURED:

IF FLOWING WELL, METHOD OF FLOW REGULATION: ☐ Valve ☐ Other:

Borehole / Installed Casing

Borehole DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)	Casing DEPTH FROM SURFACE FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	11	8.5	0	11	4.5		x			x						
11	31	8.5	11	31	4.5									x		.020

Installed Annular Material

DEPTH FROM SURFACE FROM (feet)	TO (feet)	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	GRAVEL	SIZE
0	2		x									
2	7				x							
7	9						x					3/8"
9	32.9									x		10-20

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920368

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
0	31	Quaternary Alluvium	
31	32.5	Pinal Schist - Weathered	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER 55 - 920368

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER COMPANY	104	21	001

- 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.

1" = ______ ft

Form 55-55 Instructions

Well Driller Report and Well Log

1912

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2
Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Phoenix, AZ 85007
602-771-8500
azwater.gov

February 10, 2017

RESOLUTION COPPER COMPANY
102 MAGMA HIEGHTS
SUPERIOR, AZ 85273

DOUGLAS A. DUCEY
Governor

THOMAS BUSCHATZKE
Director

Registration No. 55- 920368
File Number: A(1-11) 35 CBD

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling. Although the issuance of this drill card authorizes you to drill the proposed well under state law, the drilling of the well may be subject to restrictions or regulations imposed by other entities.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Engineering and Permits Division
Phoenix, AZ 85007
602-771-8500

NOTICE TO WELL DRILLERS

This is a reminder that a valid drill card be present for the drilling of each and every well constructed on a site.* The problem seems to occur during the construction of a well when an unexpected problem occurs. Either the hole collapses, the hole is dry, a drill bit is lost and can't be recovered, or any number of other situations where the driller feels that he needs to move over and start another well. If you encounter this type of scenario, please be aware drillers do not have the authority to start another well without first obtaining drilling authority for the new well. Please note the following statutes and regulations pertaining to well drilling and construction:

ARIZONA REVISED STATUTE (A.R.S.)

A.R.S. § 45-592.A.

A person may construct, replace or deepen a well in this state only pursuant to this article and section 45-834.01. The drilling of a well may not begin until all requirements of this article and section 45-834.01, as applicable, are met.

***

A.R.S. § 594.A.

The director shall adopt rules establishing construction standards for new wells and replacement wells, the deepening and abandonment of existing wells and the capping of open wells.

***

A.R.S. § 600.A

A well driller shall maintain a complete and accurate log of each well drilled.

ARIZONA ADMINISTRATIVE CODE (A.A.C.)

A.A.C. R12-15-803.A.

A person shall not drill or abandon a well, or cause a well to be drilled or abandoned, in a manner which is not in compliance with A.R.S. Title 45, Chapter 2, Article 10, and the rules adopted thereunder.

***

A.A.C. R12-15-810.A.

A well drilling contractor or single well licensee may commence drilling a well only if the well drilling contractor or licensee has possession of a drilling card at the well site issued by the Director in the name of the well drilling contractor or licensee, authorizing the drilling of the specific well in the specific location.

***

A.A.C. R12-15-816.F.

In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card.

*** THIS REQUIREMENT DOES NOT PERTAIN TO THE DRILLING OF MINERAL EXPLORATION, GEOTECHNICAL OR HEAT PUMP BOREHOLES**

Arizona Department of Water Resources
Groundwater Permitting and Wells Section
PO Box 36020 , Phoenix, AZ 85067-6020
(602) 771-8527 ▪ 1-800-352-8488
www.azwater.gov

Landowner Authorization to Drill or Abandon a Well on Landowner's Parcel

Landowner Authorization to Drill or Abandon a Well by a Third Party on Landowner's Parcel Pursuant to A.R.S. § 45-596 and A.A.C. R12-15-809

FILE NUMBER A(1-11) 35 CBD
WELL REGISTRATION NUMBER 55 - 920368

The Arizona Department of Water Resources requires a well driller or well owner to obtain written permission from the owner of the land on which they intend to drill or abandon a well. Landowners, or their designated representative, must authorize the well to be drilled or abandoned with their signature on the Notice of Intent or on this form, to be attached to the Notice of Intent form.

PARCEL ADDRESS ______________________________

COUNTY PARCEL ID 104 - 21 - 001 COUNTY PINAL
BOOK MAP PARCEL

In accordance with A.R.S. § 45-496 and A.A.C. R12-15-809, I certify that:

☐ I am the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

☐ I am an authorized representative of the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

SIGNATURE

TYPE OR PRINT NAME OF LANDOWNER / RESPRESENTATIVE	TITLE
SIGNATURE	DATE SIGNED

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-6020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	A(1-11) 35 CBD
WELL REGISTRATION NUMBER	55 - 920363
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

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	
TELEPHONE NUMBER	520 6893254
FAX	
WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)	DS17-18

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01N	11E	35	SW 1/4	NW 1/4	SE 1/4

LATITUDE °	'	"N	LONGITUDE °	'	"W
33	17	55.8	-111	12	45

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL
2197 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) NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	104	21	001

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) Sonic

Method of Well Development

CHECK ONE

- ☐ Airlift
- ☐ Bail
- ☐ Surge Block
- ☐ Surge Pump
- ☐ Other (please specify)

Condition of Well

CHECK ONE

- ☐ Capped
- ☐ Pump Installed

Method of Sealing at Reduction Points

CHECK ONE

- ☐ None
- ☐ Packed
- ☐ Swedged
- ☐ Welded
- ☐ Other (please specify)

Construction Dates

DATE WELL CONSTRUCTION STARTED
2.7.2017

DATE WELL CONSTRUCTION COMPLETED
2.8.2017

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	DATE 3-16-17

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920363

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 65 Feet Below Land Surface	DEPTH OF COMPLETED WELL 65 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL Feet Below Land Surface	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	DEPTH FROM SURFACE TO (feet)	BOREHOLE DIAMETER (inches)
0	55	6.5
55	65	6.5

Installed Casing

DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	55			x									
55	65										x		.020

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
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	2		x									
2	49				x							
49	52						x					
52	53									x		#60
53	65									x		10-12

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920363

SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		**Description** Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)		
0	33	Quaternary Alluvium	
33	54	Pinal Schist - Weathered	
54	65	Pinal Schist	

Well Driller Report and Well Log

WELL REGISTRATION NUMBER	55 - 920363

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER COMPANY	104	21	001

- 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

Form 55-55 Instructions

Well Driller Report and Well Log

Introduction

These instructions are a guide to filling out Form DWR 55-55 (Rev. 06/15/2010), entitled "Well Driller Report and Well Log." Please review the instructions prior to completing the form in black or blue ink. Forms may be obtained at any Arizona Department of Water Resources (ADWR) office and at ADWR's web site, http://www.azwater.gov. For information about the form or these instructions, contact Groundwater Permitting & Wells at (602) 771-8500. There is no fee for filing this form.

When Form DWR 55-55 Must be Filed

Within 30 days after completion of the drilling, deepening or modification of a well, the licensed well driller who performed the work must file a Well Driller Report and Log with ADWR. Because the information in the report describes the well as it was actually constructed, and comes from the person who constructed the well, the information is very valuable to ADWR. For that reason, it is very important to fill out the report with the most accurate information possible.

Instructions for Filling out the Form

Well Registration and Permit Numbers

Fill in the registration number of the well and any ADWR permit number associated with the well in the upper right-hand corner of the first page. Also fill in the well registration number in the upper right-hand corner of all other pages so that the well information on those pages can be identified when the pages are separated during computer imaging.

Section 1 - Drilling Authorization

Fill in the name, address, DWR license number and telephone and fax numbers of the drilling firm filing the report.

Section 2 - Registry Information

Well Owner

Fill in the name, mailing address, telephone number and fax number (if available) of the well owner. If the well owner is a corporation, governmental unit or other entity, provide the name of a contact person.

Location of Well

Fill in the following information relating to the location of the well:

- The street address of the property where the well is located. For monitor wells or other wells associated with contaminant investigations or remedial projects, this will usually be the same as the facility address.

- The legal description of the well site. The legal description is the township, range, section, and in decreasing order, the quarters of that section so that the well location falls in a 10-acre block within that section. Normally, the legal description will be the same as that given in the original Notice of Intent to drill the well, but occasionally a more accurate description is discovered after the Notice is filed.

- The latitude and longitude (in degrees-minutes-seconds format) and land surface elevation at the well, and the method used to determine these data. **Please note this information is mandatory.** Use of a Global Positioning System (GPS) receiver is the only method accepted by the Department. The GPS unit should be adjusted to use the NAD-83 datum. Please indicate if the geographic coordinate datum used was NAD-83, and if not, which datum was used.

- The name of the county and the tax assessor's parcel identification number for the land where the well is located. This information can normally be taken from the original Notice of Intent to drill the well, and may also be obtained from the county tax assessor's office. Federal or State land will not have a parcel identification number.

Section 3 - Well Construction Details

Section 3 requires details on the construction of the well. Indicate the drill method by checking the appropriate box. If the drill method is not listed, check the "Other" box and describe the method. To the right of that, indicate the method of well development by checking the

appropriate box. Next, indicate the method of sealing at reduction points. If the method used is not listed, check "Other" and provide a brief explanation. Under *Well Driller Completion Report and Well Log* Form 55-55 Instructions (Rev. 06/2010) Page 2

Condition of Well, indicate whether the well was capped, or a pump was installed, when you left it. Then fill in the date when well construction started, and the date when well construction was completed.

Signature Block

The form must be signed and dated by the qualifying party of the drilling firm.

Section 4 - Well Construction Design (As Built)

Section 4 contains tables to fill in information on the existing borehole, the installed casing and the installed annular material. The tables are broken down by depth interval.

In the first set of boxes, fill in the depth of the boring and the depth of the completed well, as measured in feet below the land surface.

Under **Water Level Information** please indicate the static water level in the well, as measured in feet below the land surface, and the date and time the water level was measured. If the well is a flowing well, include the method by which the artesian flow is regulated.

In the **Borehole** table, fill in the diameter of the borehole in inches, and indicate the depth interval for each change in diameter. In the **Installed Casing** table, fill in the outer diameter of the casing in inches, check the appropriate boxes indicating the type of casing material and the type of perforations, and fill in the slot size of any perforations. Fill in the depth interval for each change in information. Please note that not every interval will be perforated. Check the "Blank or None" box for non-perforated depth intervals. If the type of casing material or perforations is not listed, describe the type in the appropriate box.

In the **Installed Annular Material** table, check the appropriate boxes indicating the type of annular material or filter pack installed at each depth interval. Fill in the size of the filter pack used. Provide the depth interval for each change in information. If the type of annular material is not listed, describe the material in the appropriate box.

Section 5 - Geologic Log of Well

Section 5 requires the geologic or lithologic log of the well. Describe the various units encountered during drilling. Provide as much description as possible. The log description must be broken down by depth intervals below ground surface, and every interval where groundwater, including perched groundwater, was encountered must be checked. If a consulting firm was involved with the well construction, the consultant's lithologic log may be submitted in lieu of completing Section 5.

Section 6 - Well Site Plan

In the boxes at the top of Section 6, fill in the name of the well owner and the county tax assessor's parcel identification number for the land where the well is located. Below that, provide a scale drawing of where the well was actually constructed on the parcel, illustrating the property boundaries, the well location and any structures on the property. The drawing must also show the location of any septic tank or sewer systems on the property or within 100 feet of the well, even if on neighboring property, and the distance between the well and the septic tank or sewer system. The drawing should closely match the drawing on the original Notice of Intent to drill the well, but the purpose of this drawing is to show where the well was actually drilled, especially if the location is different than originally planned. This information will be shared with the county.

Where to File Form

Completed forms may be mailed to ADWR at the following address:

Arizona Department of Water Resources
Groundwater Permitting and Wells
PO Box 36020
Phoenix, AZ 85067-6020

Completed forms may also be submitted to ADWR's main office at 1110 W. Washington St. Suite 310., Phoenix, AZ 85007.

The completed form must be legible and of good quality when received by ADWR so that it can be scanned into ADWR's permanent records.

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Phoenix, AZ 85007
602-771-8500
azwater.gov

DOUGLAS A. DUCEY
Governor

THOMAS BUSCHATZKE
Director

February 8, 2017

RESOLUTION COPPER COMPANY
102 MAGMA HEIGHTS
SUPERIOR, AZ 85273

Registration No. 55- 920363
File Number: A(1-11) 35 CBD

Dear Well Applicant:

Enclosed is a copy of the Notice of Intention to Drill (NOI) a well which you or your driller recently filed with the Department of Water Resources. This letter is to inform you that the Department has approved the NOI and has mailed, or made available for download, a drilling authorization card to your designated well drilling contractor. The driller may not begin drilling until he/she has received the authorization, and must keep it in their possession at the well site during drilling. Although the issuance of this drill card authorizes you to drill the proposed well under state law, the drilling of the well may be subject to restrictions or regulations imposed by other entities.

Well drilling activities must be completed within one year after the date the NOI was filed with the Department. If drilling is not completed within one year, a new NOI must be filed and authorization from this Department received before proceeding with drilling. If the well cannot be successfully completed as initially intended (dry hole, cave in, lost tools, etc.), the well must be properly abandoned and a Well Abandonment Completion Report must be filed by your driller [as required by A.A.C. R12-15-816(F)].

If you change drillers, you must notify the Department of the new driller's identity on a Request to Change Well Information (form 55-71A). Please ensure that the new driller is licensed by the Department to drill the type of well you require. A new driller may not begin drilling until he/she receives a new drilling authorization card from the Department.

If you find it necessary to change the location of the proposed well(s), you may not proceed with drilling until you file an amended NOI with the Department. An amended drilling authorization card will then be issued to the well drilling contractor, which must be in their possession before drilling begins.

Arizona statute [A.R.S. § 45-600] requires registered well owners to file a Pump Installation Completion Report (form 55-56) with the Department within 30 days after the installation of pumping equipment, if authorized. A blank report is enclosed for your convenience. State statute also requires the driller to file a complete and accurate Well Drillers Report and Well Log (form 55-55) within 30 days after completion of drilling. A blank report form was provided to your driller with the drilling authorization card. You should insist and ensure that all of the required reports are accurately completed and timely filed with the Department.

Please be advised that Arizona statute [A.R.S. § 45-593(C)] requires a registered well owner to notify the Department of a change in ownership of the well and/or information pertaining to the physical characteristics of the well in order to keep this well registration file current and accurate. Any change in well information or a request to change well driller must be filed on a Request to Change Well Information form (form 55-71A) that may be downloaded from the ADWR Internet website at www.azwater.gov.

Sincerely,

Groundwater Permitting and Wells Section

ARIZONA DEPARTMENT of WATER RESOURCES
1110 W. Washington St. Suite 310
Engineering and Permits Division
Phoenix, AZ 85007
602-771-8500

NOTICE TO WELL DRILLERS

This is a reminder that a valid drill card be present for the drilling of each and every well constructed on a site.* The problem seems to occur during the construction of a well when an unexpected problem occurs. Either the hole collapses, the hole is dry, a drill bit is lost and can't be recovered, or any number of other situations where the driller feels that he needs to move over and start another well. If you encounter this type of scenario, please be aware drillers do not have the authority to start another well without first obtaining drilling authority for the new well. Please note the following statutes and regulations pertaining to well drilling and construction:

ARIZONA REVISED STATUTE (A.R.S.)

A.R.S. § 45-592.A.

A person may construct, replace or deepen a well in this state only pursuant to this article and section 45-834.01. The drilling of a well may not begin until all requirements of this article and section 45-834.01, as applicable, are met.

***

A.R.S. § 594.A.

The director shall adopt rules establishing construction standards for new wells and replacement wells, the deepening and abandonment of existing wells and the capping of open wells.

***

A.R.S. § 600.A

A well driller shall maintain a complete and accurate log of each well drilled.

ARIZONA ADMINISTRATIVE CODE (A.A.C.)

A.A.C. R12-15-803.A.

A person shall not drill or abandon a well, or cause a well to be drilled or abandoned, in a manner which is not in compliance with A.R.S. Title 45, Chapter 2, Article 10, and the rules adopted thereunder.

***

A.A.C. R12-15-810.A.

A well drilling contractor or single well licensee may commence drilling a well only if the well drilling contractor or licensee has possession of a drilling card at the well site issued by the Director in the name of the well drilling contractor or licensee, authorizing the drilling of the specific well in the specific location.

***

A.A.C. R12-15-816.F.

In the course of drilling a new well, the well may be abandoned without first filing a notice of intent to abandon and without an abandonment card.

*** THIS REQUIREMENT DOES NOT PERTAIN TO THE DRILLING OF MINERAL EXPLORATION, GEOTECHNICAL OR HEAT PUMP BOREHOLES**

1912

Arizona Department of Water Resources
Groundwater Permitting and Wells Section
PO Box 36020 , Phoenix, AZ 85067-6020
(602) 771-8527 ▪ 1-800-352-8488
www.azwater.gov

Landowner Authorization to Drill or Abandon a Well on Landowner's Parcel

Landowner Authorization to Drill or Abandon a Well by a Third Party on Landowner's Parcel Pursuant to A.R.S. § 45-596 and A.A.C. R12-15-809

FILE NUMBER	A(1-11) 35 CBD
WELL REGISTRATION NUMBER	55 - 920363

The Arizona Department of Water Resources requires a well driller or well owner to obtain written permission from the owner of the land on which they intend to drill or abandon a well. Landowners, or their designated representative, must authorize the well to be drilled or abandoned with their signature on the Notice of Intent or on this form, to be attached to the Notice of Intent form.

PARCEL ADDRESS ____________________

COUNTY PARCEL ID 104 - 21 - 001 (BOOK - MAP - PARCEL) COUNTY PINAL

In accordance with A.R.S. § 45-496 and A.A.C. R12-15-809, I certify that:

☐ I am the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

☐ I am an authorized representative of the owner of the parcel on which I am giving permission for a well to be ☐ drilled or ☐ abandoned.

SIGNATURE

TYPE OR PRINT NAME OF LANDOWNER / RESPRESENTATIVE	TITLE
SIGNATURE	DATE SIGNED

Arizona Department of Water Resources
Information Management Unit
PO Box 36020 • Phoenix, Arizona 85067-6020
(602) 771-8527 • 602-771-8500

Well Driller Report and Well Log

FILE NUMBER	**A(1-11) 35 CBD**
WELL REGISTRATION NUMBER	**55 - 920364**
PERMIT NUMBER (IF ISSUED)	

THIS REPORT MUST BE FILED WITHIN **30 DAYS** OF COMPLETING THE WELL.

PLEASE PRINT CLEARLY USING BLACK OR BLUE INK

SECTION 1. DRILLING AUTHORIZATION

Drilling Firm

Mail To:

NAME NATIONAL EWP, INC.	DWR LICENSE NUMBER 823
ADDRESS 1200 W. SAN PEDRO ST.	TELEPHONE NUMBER 480-558-3500
CITY / STATE / ZIP GILBERT, AZ, 85233	FAX

SECTION 1. REGISTRY INFORMATION

Well Owner

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL
RESOLUTION COPPER COMPANY

MAILING ADDRESS
102 MAGMA HIEGHTS

CITY / STATE / ZIP
SUPERIOR, AZ, 85273

CONTACT PERSON NAME AND TITLE

TELEPHONE NUMBER	FAX
520 6893254	

WELL NAME (e.g., MW-1, PZ-3, lot 25 Well, Smith Well, etc.)
DS 17-19

Location of Well

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S)	RANGE (E/W)	SECTION	160 ACRE	40 ACRE	10 ACRE
01N	11E	35	SW 1/4	NW 1/4	SE 1/4

LATITUDE			LONGITUDE		
33 °	17 '	55.9 "N	-111 °	12 '	45.1 "W

METHOD OF LATITUDE/LONGITUDE (CHECK ONE)
☐ USGS Quad Map ☐ Conventional Survey ☒ *GPS: Hand-Held ☐ *GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL 2197 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) NAD 27

COUNTY	ASSESSOR'S PARCEL ID NUMBER (MOST RECENT) BOOK	MAP	PARCEL
Pinal	104	21	001

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) Sonic

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
02.11.2017

DATE WELL CONSTRUCTION COMPLETED
2.13.2017

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	DATE
	3-16-17

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920364

SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILD) (attach additional page if needed)

Depth

DEPTH OF BORING 57.5 Feet Below Land Surface	DEPTH OF COMPLETED WELL 56 Feet Below Land Surface

Water Level Information

STATIC WATER LEVEL Feet Below Land Surface	DATE MEASURED	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION ☐ Valve ☐ Other:

Borehole

DEPTH FROM SURFACE FROM (feet)	TO (feet)	BOREHOLE DIAMETER (inches)
0	36	6.5
36	56	6.5

Installed Casing

DEPTH FROM SURFACE			MATERIAL TYPE (T)				PERFORATION TYPE (T)						
FROM (feet)	TO (feet)	OUTER (inches)	STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED	IF OTHER TYPE, DESCRIBE	SLOT SIZE (inches)
0	36	6.5		x			x						
36	56	6.5									x		.020

Installed Annular Material

DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE (T)				BENTONITE				FILTER PACK		
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	2		x									
2	32				x							
32	34						x					3/8"
34	56									x		10-20
56	57.5						x					3/8"

Well Driller Report and Well Log

WELL REGISTRATION NUMBER
55 - 920364

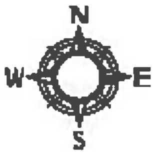
SECTION 5. GEOLOGIC LOG OF WELL

DEPTH FROM SURFACE		Description Describe material, grain size, color, etc.	Check (T) every interval where water was encountered (if known)
FROM (feet)	TO (feet)		
0	34	Quarternary Alluvium	
34	55	Pinal Schist - Weathord	
55	57.5	Pinal Schist	

SECTION 6. WELL SITE PLAN

NAME OF WELL OWNER	COUNTY ASSESSOR'S PARCEL ID NUMBER (MOST RECENT)		
	BOOK	MAP	PARCEL
RESOLUTION COPPER COMPANY	104	21	001

- 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.



1" = ______ ft

Appendix G

Wellhead Survey Reports (Shephard-Wesintzer, Inc.)
(Provided on DVD)

Resolution Copper Mine
Drill Hole Location Report
Section 4 – Near West Drill Holes

U.S. State Plane Coordinate System Of 1983
North American Datum of 1983 (Epoch NA2011)
Arizona Central Zone (0202)

Updated January 23rd, 2017

Shephard – Wesintzer, Inc.
75 Kallof Place
Sedona, AZ 86336

Earl G. Watts, RLS # 27253

PRELIMINARY

Report Index

Drill Hole DS-A

Description -	Drill Hole DS-A Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'17.38776"	Northing -	845403.984
Longitude -	W111°07'55.13149"	Easting -	939691.268
Ellipsoid Height -	2787.515	Elevation -	2880.73

Convergence Angle = 00°25'52"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/18/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2880.17 and is 0.56 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2877.96.
The ground elevation at the base of the collar is 2877.5’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-A

Drill Hole DS-B

Description -	Drill Hole DS-B Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'45.20245"	Northing -	842132.686
Longitude -	W111°08'23.94156"	Easting -	937270.884
Ellipsoid Height -	2613.920	Elevation -	2707.31

Convergence Angle = 00°25'36"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/18/2017

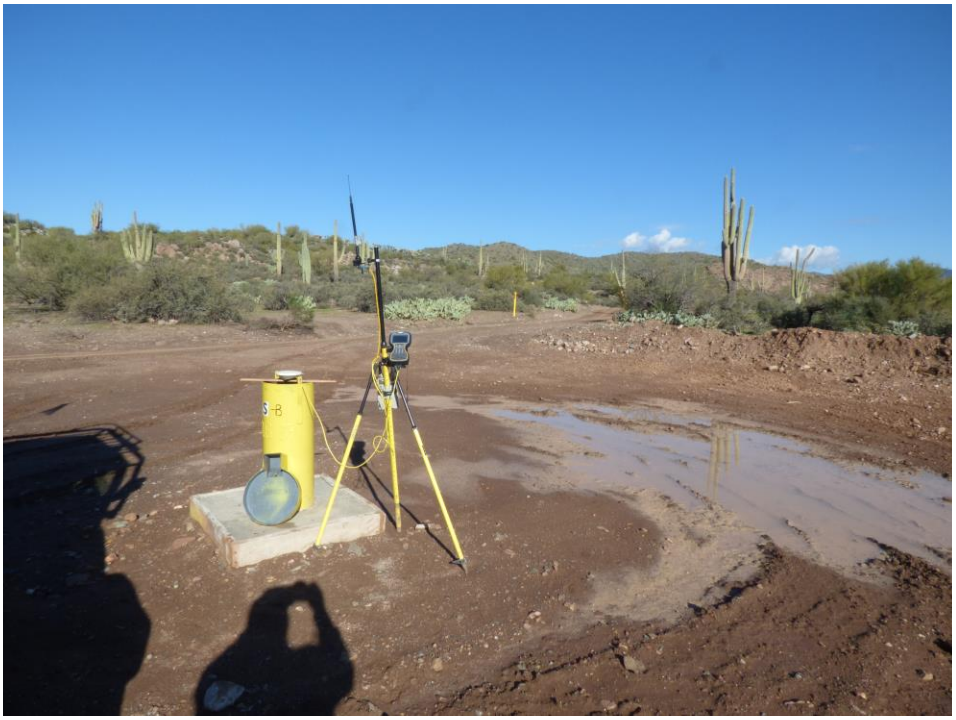
Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2706.28 and is 1.03 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2704.59.
The ground elevation at the base of the collar is 2704.1’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-B



Drill Hole DS-C

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°17'57.21966"	Northing -	837284.669
Longitude -	W111°08'21.34857"	Easting -	937527.062
Ellipsoid Height -	2548.553	Elevation -	2641.99

Convergence Angle = 00°25'37"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/18/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2640.65 and is 1.34 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2639.44.
The ground elevation at the base of the collar is 2639.0’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-C

Drill Hole DS-D

Description -	Drill Hole DS-D Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	Nxx°xx'xx"	Northing -	x.xx
Longitude -	Wxxx°xx'xx"	Easting -	x.xx
Ellipsoid Height -	x.xx	Elevation -	x.xx
Convergence Angle =	xx°xx'xx"		

Drill Hole surveyed by:

Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/18/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is x.xx and is x.xx below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is x.xx.
The ground elevation at the base of the collar is x.xx

See pictures attached on the following page.
RED TEXT IS TO BE EDITED UPON SURVEY OF COMPLETED DRILL HOLE

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-D

Drill Hole DS-E

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	Nxx°xx'xx”	Northing -	x.xx
Longitude -	Wxxx°xx'xx"	Easting -	x.xx
Ellipsoid Height -	x.xx	Elevation -	x.xx
Convergence Angle =	xx°xx'xx"		

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/18/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is x.xx and is x.xx below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is x.xx.
The ground elevation at the base of the collar is x.xx.

See pictures attached on the following page.
RED TEXT IS TO BE EDITED UPON SURVEY OF COMPLETED DRILL HOLE

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-E

Drill Hole DS-F

Description -	Drill Hole DS-F Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'01.00257"	Northing -	843649.087
Longitude -	W111°10'34.43925"	Easting -	926185.385
Ellipsoid Height -	2405.924’	Elevation -	2499.75’

Convergence Angle = 00°24'24"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2497.17 and is 2.58 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2496.82.
The ground elevation at the base of the collar is 2496.5’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-F

Drill Hole DS-G

Description -	Drill Hole DS-G Center/Top Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'47.16774"	Northing -	842227.217
Longitude -	W111°11'13.87216"	Easting -	922849.023
Ellipsoid Height -	2351.464’	Elevation -	2445.44’

Convergence Angle = 00°24'02"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2444.21 and is 1.23 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2442.72.
The ground elevation at the base of the collar is 2442.4’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-G

Drill Hole DS-H

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'34.43172"	Northing -	847008.185
Longitude -	W111°11'07.18593"	Easting -	923382.922
Ellipsoid Height -	2578.167	Elevation -	2672.05

Convergence Angle = 00°24'07"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

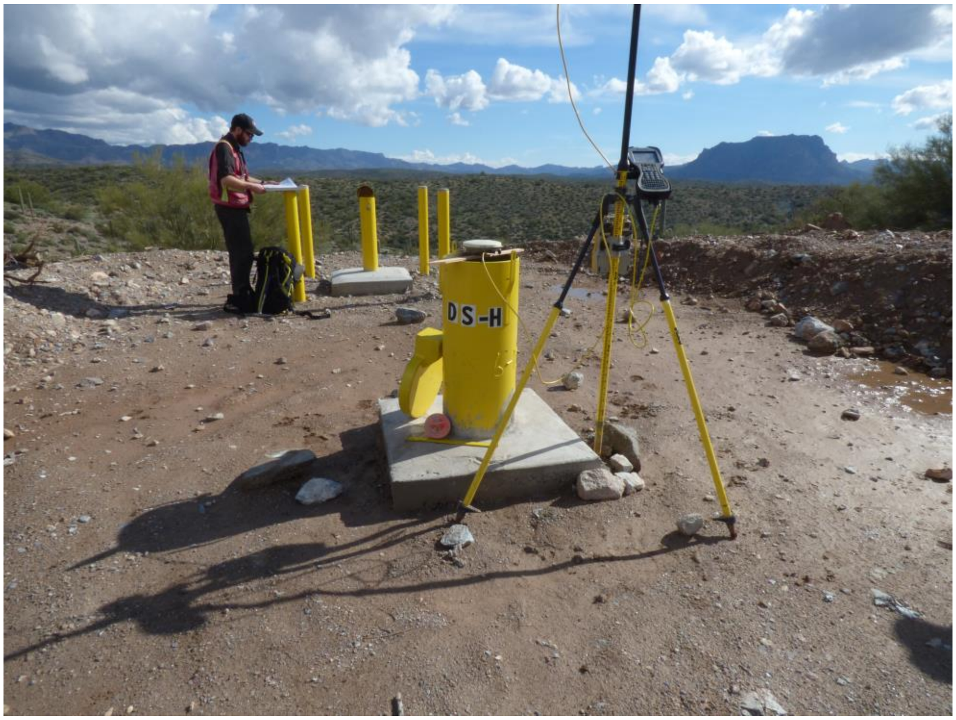
Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2671.04 and is 1.01 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2669.53.
The ground elevation at the base of the collar is 2669.0’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-H



Drill Hole DS-I

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°20'07.11448"	Northing -	850317.104
Longitude -	W111°10'57.71125"	Easting -	924163.573
Ellipsoid Height -	2613.565	Elevation -	2707.34

Convergence Angle = 00°25'37"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2706.81 and is 0.53 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2704.80.
The ground elevation at the base of the collar is 2704.4’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-I

Drill Hole DS-J

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'57.88992"	Northing -	849365.737
Longitude -	W111°11'29.77390"	Easting -	921449.903
Ellipsoid Height -	2643.178	Elevation -	2737.08

Convergence Angle = 00°23'54"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2736.55 and is 0.53 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2734.44.
The ground elevation at the base of the collar is 2734.0’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-J

Drill Hole DS-K

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'12.68246"	Northing -	844753.747
Longitude -	W111°12'43.44778"	Easting -	915230.203
Ellipsoid Height -	2278.913	Elevation -	2373.12

Convergence Angle = 00°23'12"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2371.82 and is 1.30 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2370.55.
The ground elevation at the base of the collar is 2370.0’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-K

Drill Hole DS-L

Description -	Drill Hole DS-C Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'15.95145"	Northing -	845066.885
Longitude -	W111°13'13.73839"	Easting -	912657.744
Ellipsoid Height -	2193.449	Elevation -	2287.73

Convergence Angle = 00°22'57"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point "NEAR WEST" via GPS RTK observation.
Elevation of the top of the inside collar is 2286.90 and is 0.83 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2284.86.
The ground elevation at the base of the collar is 2284.6'

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-L

Drill Hole DS-M

Description -	Drill Hole DS-M Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'51.31068"	Northing -	842612.874
Longitude -	W111°12'10.20549"	Easting -	918065.700
Ellipsoid Height -	2397.202	Elevation -	2491.34

Convergence Angle = 00°23'31"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point "SUPERIOR" via GPS RTK observation.
Elevation of the top of the inside collar is 2490.84 and is 0.50 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2488.55.
The ground elevation at the base of the collar is 2487.8'

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-M

Drill Hole DS-N

Description -	Drill Hole DS-N Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'09.73515"	Northing -	838446.230
Longitude -	W111°11'09.93601"	Easting -	923209.538
Ellipsoid Height -	2315.997	Elevation -	2410.00

Convergence Angle = 00°24’04"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2408.98 and is 1.02 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2407.30.
The ground elevation at the base of the collar is 2406.8’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-N

Drill Hole DS-O

Description -	Drill Hole DS-O Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'49.03698"	Northing -	842326.475
Longitude -	W111°13'49.58943"	Easting -	909633.600
Ellipsoid Height -	2131.141	Elevation -	2225.55

Convergence Angle = 00°22'37"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2224.24 and is 1.31 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2222.83.
The ground elevation at the base of the collar is 2222.4’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-O

Drill Hole DS-P

Description -	Drill Hole DS-P Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°20'15.68420"	Northing -	851183.525
Longitude -	W111°10'57.25461"	Easting -	924196.215
Ellipsoid Height -	2581.525	Elevation -	2675.27
Convergence Angle = 00°24'12"			

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2674.75 and is 0.52 below the top of collar.
The casing is 1.07 round steel.
The inside collar is 0.38 round steel.
The elevation of the concrete base around the casing is 2672.65.
The ground elevation at the base of the collar is 2672.2’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole DS-P

Drill Hole GT-1

Description -	Drill Hole GT-1 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'18.07368"	Northing -	845266.163
Longitude -	W111°13'40.74773"	Easting -	910364.525
Ellipsoid Height -	2224.726	Elevation -	2319.07

Convergence Angle = 00°22'42"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2318.72 and is 0.35 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2316.43.
The ground elevation at the base of the collar is 2316.0’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-1

Drill Hole GT-2

Description - Drill Hole GT-2 Center/Top of Casing
Datum (w/ Epoch) - NAD83 (NA2011)

Latitude -	N33°19'16.09318"	Northing -	845081.212
Longitude -	W111°13'13.73308"	Easting -	912658.099
Ellipsoid Height -	2193.492	Elevation -	2287.77

Convergence Angle = 00°22'57"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2287.25 and is 0.52 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2284.91.
The ground elevation at the base of the collar is 2284.5’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-2

Drill Hole GT-3

Description -	Drill Hole GT-3 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'12.68917"	Northing -	844754.324
Longitude -	W111°12'43.62328"	Easting -	915215.307
Ellipsoid Height -	2278.582	Elevation -	2372.79
Convergence Angle = 00°23’13"			

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2372.58 and is 0.21 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2370.09.
The ground elevation at the base of the collar is 2369.5’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-3

Drill Hole GT-4

Description - Drill Hole GT-4 Center/Top of Casing
Datum (w/ Epoch) - NAD83 (NA2011)

Latitude -	N33°19'25.89850"	Northing -	846100.601
Longitude -	W111°12'24.15103"	Easting -	916858.501
Ellipsoid Height -	2352.561	Elevation -	2446.69

Convergence Angle = 00°23'24"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2446.20 and is 0.49 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2444.19.
The ground elevation at the base of the collar is 2443.4’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-4

Drill Hole GT-5

Description -	Drill Hole GT-5 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'20.85986"	Northing -	845595.128
Longitude -	W111°12'17.60678"	Easting -	917417.254
Ellipsoid Height -	2315.914	Elevation -	2410.03

Convergence Angle = 00°23’28"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2409.58 and is 0.45 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2407.33.
The ground elevation at the base of the collar is 2406.9’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-5

Drill Hole GT-6

Description -	Drill Hole GT-6 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'01.72435"	Northing -	843657.734
Longitude -	W111°12'23.41864"	Easting -	916937.281
Ellipsoid Height -	2328.961	Elevation -	2423.12

Convergence Angle = 00°23’24"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2422.74 and is 0.38 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2420.44.
The ground elevation at the base of the collar is 2419.8’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-6

Drill Hole GT-7

Description -	Drill Hole GT-7 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'51.32081"	Northing -	842613.827
Longitude -	W111°12'10.32876"	Easting -	918055.233
Ellipsoid Height -	2396.567	Elevation -	2490.71

Convergence Angle = 00°23’31"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2490.15 and is 0.56 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2487.89.
The ground elevation at the base of the collar is 2487.7’

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-7

Drill Hole GT-8

Description -	Drill Hole GT-8 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'31.49466"	Northing -	840617.685
Longitude -	W111°11'57.11453"	Easting -	919190.361
Ellipsoid Height -	2299.935	Elevation -	2394.06

Convergence Angle = 00°23'38"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point "SUPERIOR" via GPS RTK observation.
Elevation of the top of the inside collar is 2393.43 and is 0.63 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2391.42.
The ground elevation at the base of the collar is 2391.1.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-8

Drill Hole GT-13

Description - Drill Hole GT-13 Center/Top of Casing
Datum (w/ Epoch) - NAD83 (NA2011)
Latitude - N33°17'27.66975" Northing - 834202.623
Longitude - W111°10'56.58842" Easting - 924372.266
Ellipsoid Height - 2292.879 Elevation - 2386.87
Convergence Angle = 00°24'11"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/18/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2386.87 and is 0.33 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2384.27.
The ground elevation at the base of the collar is 2383.8

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-13

Drill Hole GT-14

Description -	Drill Hole GT-14 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'09.82382"	Northing -	838455.257
Longitude -	W111°11'09.82616"	Easting -	923218.798
Ellipsoid Height -	2316.726	Elevation -	2410.73

Convergence Angle = 00°24’04"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2410.28 and is 0.45 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2406.87.
The ground elevation at the base of the collar is 2406.7.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-14

Drill Hole GT-15

Description -	Drill Hole GT-15 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'47.00645"	Northing -	842210.905
Longitude -	W111°11'13.89000"	Easting -	922847.623
Ellipsoid Height -	2351.288	Elevation -	2445.26

Convergence Angle = 00°24’02"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2444.90 and is 0.36 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2442.35.
The ground elevation at the base of the collar is 2441.6.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-15

Drill Hole GT-16

Description -	Drill Hole GT-16 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'15.93495"	Northing -	845116.286
Longitude -	W111°11'45.13929"	Easting -	920175.596
Ellipsoid Height -	2576.814	Elevation -	2670.84

Convergence Angle = 00°23'45"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2670.31 and is 0.53 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2668.25.
The ground elevation at the base of the collar is 2667.7.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-16

Drill Hole GT-17

Description -	Drill Hole GT-17 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'57.79946"	Northing -	849356.590
Longitude -	W111°11'29.78245"	Easting -	921449.241
Ellipsoid Height -	2643.192	Elevation -	2737.09

Convergence Angle = 00°23'54"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2736.61 and is 0.48 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2734.27.
The ground elevation at the base of the collar is 2733.8.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-17

Drill Hole GT-18

Description -	Drill Hole GT-18 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°20'06.93333"	Northing -	850298.738
Longitude -	W111°10'57.80767"	Easting -	924155.522
Ellipsoid Height -	2612.980	Elevation -	2706.75

Convergence Angle = 00°24'12"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2706.38 and is 0.37 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2704.33.
The ground elevation at the base of the collar is 2704.0.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-18

Drill Hole GT-19

Description -	Drill Hole GT-19 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'34.36736"	Northing -	847001.768
Longitude -	W111°11'07.03820"	Easting -	923395.502
Ellipsoid Height -	2578.547	Elevation -	2672.43

Convergence Angle = 00°24’07"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2671.79 and is 0.64 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2669.75.
The ground elevation at the base of the collar is 2669.1.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-19

Drill Hole GT-20

Description - Drill Hole GT-20 Center/Top of Casing
Datum (w/ Epoch) - NAD83 (NA2011)

Latitude -	N33°19'00.90877"	Northing -	843639.644
Longitude -	W111°10'34.37583"	Easting -	926190.834
Ellipsoid Height -	2405.863	Elevation -	2499.69

Convergence Angle = 00°24’24"

Drill Hole surveyed by:
Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2444.90 and is 0.36 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2442.35.
The ground elevation at the base of the collar is 2441.6.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-20

Drill Hole GT-21

Description -	Drill Hole GT-21 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'41.50839"	Northing -	841669.359
Longitude -	W111°10'50.15756"	Easting -	924865.486
Ellipsoid Height -	2471.388	Elevation -	2565.30

Convergence Angle = 00°24’15"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2564.84 and is 0.46 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2562.05.
The ground elevation at the base of the collar is 2561.6.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-21

Drill Hole GT-31

Description -	Drill Hole GT-31 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'22.78105"	Northing -	845876.567
Longitude -	W111°09'51.10736"	Easting -	929846.504
Ellipsoid Height -	2609.349	Elevation -	2702.99

Convergence Angle = 00°24’48"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2702.48 and is 0.51 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2700.19.
The ground elevation at the base of the collar is 2699.5.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-31

Drill Hole GT-32

Description -	Drill Hole GT-32 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°19'18.06270"	Northing -	845384.351
Longitude -	W111°10'16.26363"	Easting -	927715.383
Ellipsoid Height -	2529.577	Elevation -	2623.32

Convergence Angle = 00°24’34"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2622.79 and is 0.53 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2620.77.
The ground elevation at the base of the collar is 2619.7.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-32

Drill Hole GT-35

Description -	Drill Hole GT-35 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'48.96138"	Northing -	842318.905
Longitude -	W111°13'49.46361"	Easting -	909644.327
Ellipsoid Height -	2130.824	Elevation -	2225.23
Convergence Angle = 00°22'37"			

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2224.95 and is 0.28 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2222.63.
The ground elevation at the base of the collar is 2222.0.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-35

Drill Hole GT-36

Description -	Drill Hole GT-36 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°20'15.68552"	Northing -	851183.542
Longitude -	W111°10'57.44912"	Easting -	924179.712
Ellipsoid Height -	2581.389	Elevation -	2675.14

Convergence Angle = 00°24’12"

Drill Hole surveyed by: Shephard – Wesnitzer, Inc.
Earl G. Watts, RLS # 27253
Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2674.72 and is 0.42 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2672.56.
The ground elevation at the base of the collar is 2671.9.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-36

Drill Hole GT-37

Description -	Drill Hole GT-37 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'56.09227"	Northing -	843072.096
Longitude -	W111°12'51.96731"	Easting -	914518.583
Ellipsoid Height -	2259.947	Elevation -	2354.20

Convergence Angle = 00°23’09"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 01/17/2017

Additional Notes:

Coordinates were collected from RCM control point “NEAR WEST” via GPS RTK observation.
Elevation of the top of the inside collar is 2353.76 and is 0.44 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2351.13.
The ground elevation at the base of the collar is 2350.4.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-37

Drill Hole GT-41

Description -	Drill Hole GT-41 Center/Top of Casing		
Datum (w/ Epoch) -	NAD83 (NA2011)		
Latitude -	N33°18'33.65172"	Northing -	840820.525
Longitude -	W111°12'23.24584"	Easting -	916971.26
Ellipsoid Height -	2339.387	Elevation -	2433.59

Convergence Angle = 00°23'24"

Drill Hole surveyed by:	Shephard – Wesnitzer, Inc. Earl G. Watts, RLS # 27253 Surveyed 12/01/2016

Additional Notes:

Coordinates were collected from RCM control point “SUPERIOR” via GPS RTK observation.
Elevation of the top of the inside collar is 2433.07 and is 0.52 below the top of collar.
The casing is 0.55 round steel.
The inside collar is 0.20 round PVC.
The elevation of the concrete base around the casing is 2430.02.
The ground elevation at the base of the collar is 2429.4.

See pictures attached on the following page.

For a copy of the Resolution Copper Standards Manual or if you have any questions, please contact Mike Alvarez (GIS Analyst) (520) 689-3203.

Drill Hole GT-41

North American Datum of 1983 (NA2011) Geodetic Coordinates

Name	Latitude	Longitude	Ellip. Hgt.	Conv. Ang.
DS-A	N33°19'17.38776"	W111°07'55.13149"	2787.515	00°25'52"
DS-B	N33°18'45.20245"	W111°08'23.94156"	2613.920	00°25'36"
DS-C	N33°17'57.21966"	W111°08'21.34857"	2548.553	00°25'37"
DS-D				
DS-E				
DS-F	N33°19'01.00257"	W111°10'34.43925"	2405.924	00°24'24"
DS-G	N33°18'47.16774"	W111°11'13.87216"	2351.464	00°24'02"
DS-H	N33°19'34.43172"	W111°11'07.18593"	2578.167	00°24'07"
DS-I	N33°20'07.11448"	W111°10'57.71125"	2613.565	00°24'12"
DS-J	N33°19'57.88992"	W111°11'29.77390"	2643.178	00°23'54"
DS-K	N33°19'12.68246"	W111°12'43.44778"	2278.913	00°23'12"
DS-L	N33°19'15.95145"	W111°13'13.73839"	2193.449	00°22'57"
DS-M	N33°18'51.31068"	W111°12'10.20549"	2397.202	00°23'31"
DS-N	N33°18'09.73515"	W111°11'09.93601"	2315.997	00°24'04"
DS-O	N33°18'49.03698"	W111°13'49.58943"	2131.141	00°22'37"
DS-P	N33°20'15.68420"	W111°10'57.25461"	2581.525	00°24'12"
GT-1	N33°19'18.07368"	W111°13'40.74773"	2224.726	00°22'42"
GT-2	N33°19'16.09318"	W111°13'13.73308"	2193.492	00°22'57"
GT-3	N33°19'12.68917"	W111°12'43.62328"	2278.582	00°23'13"
GT-4	N33°19'25.89850"	W111°12'24.15103"	2352.561	00°23'24"
GT-5	N33°19'20.85986"	W111°12'17.60678"	2315.914	00°23'28"
GT-6	N33°19'01.72435"	W111°12'23.41864"	2328.961	00°23'24"
GT-7	N33°18'51.32081"	W111°12'10.32876"	2396.567	00°23'31"
GT-8	N33°18'31.49466"	W111°11'57.11453"	2299.935	00°23'38"
GT-13	N33°17'27.66975"	W111°10'56.58842"	2292.879	00°24'11"
GT-14	N33°18'09.82382"	W111°11'09.82616"	2316.726	00°24'04"
GT-15	N33°18'47.00645"	W111°11'13.89000"	2351.288	00°24'02"
GT-16	N33°19'15.93495"	W111°11'45.13929"	2576.814	00°23'45"
GT-17	N33°19'57.79946"	W111°11'29.78245"	2643.192	00°23'54"
GT-18	N33°20'06.93333"	W111°10'57.80767"	2612.980	00°24'12"
GT-19	N33°19'34.36736"	W111°11'07.03820"	2578.547	00°24'07"
GT-20	N33°19'00.90877"	W111°10'34.37583"	2405.863	00°24'24"
GT-21	N33°18'41.50839"	W111°10'50.15756"	2471.388	00°24'15"

North American Datum of 1983 (NA2011) Geodetic Coordinates				
Name	**Latitude**	**Longitude**	**Ellip. Hgt.**	**Conv. Ang.**
GT-31	N33°19'22.78105"	W111°09'51.10736"	2609.349	00°24'48"
GT-32	N33°19'18.06270"	W111°10'16.26363"	2529.577	00°24'34"
GT-35	N33°18'48.96138"	W111°13'49.46361"	2130.824	00°22'37"
GT-36	N33°20'15.68552"	W111°10'57.44912"	2581.389	00°24'12"
GT-37	N33°18'56.09227"	W111°12'51.96731"	2259.947	00°23'09"
GT-41	N33°18'33.65172"	W111°12'23.24584"	2339.387	00°23'24"

U.S. State Plane of 1983, Arizona Central Zone (0202) Grid Coordinates				
Name	**Northing**	**Easting**	**Elevation**	**Page No.**
DS-A	845403.984	939691.268	2880.73	3
DS-B	842132.686	937270.884	2707.31	5
DS-C	837284.669	937527.062	2641.99	7
DS-D				9
DS-E				11
DS-F	843649.087	926185.385	2499.75	13
DS-G	842227.217	922849.023	2445.44	15
DS-H	847008.185	923382.922	2672.05	17
DS-I	850317.104	924163.573	2707.34	19
DS-J	849365.737	921449.903	2737.08	21
DS-K	844753.747	915230.203	2373.12	23
DS-L	845066.885	912657.744	2287.73	25
DS-M	842612.874	918065.700	2491.34	27
DS-N	838446.230	923209.538	2410.00	29
DS-O	842326.475	909633.600	2225.55	31
DS-P	851183.525	924196.215	2675.27	33
GT-1	845266.163	910364.525	2319.07	35
GT-2	845081.212	912658.099	2287.77	37
GT-3	844754.324	915215.307	2372.79	39
GT-4	846100.601	916858.501	2446.69	41
GT-5	845595.128	917417.254	2410.03	43
GT-6	843657.734	916937.281	2423.12	45
GT-7	842613.827	918055.233	2490.71	47
GT-8	840617.685	919190.361	2394.06	49

U.S. State Plane of 1983, Arizona Central Zone (0202) Grid Coordinates				
Name	**Northing**	**Easting**	**Elevation**	**Page No.**
GT-13	834202.623	924372.266	2386.87	51
GT-14	838455.257	923218.798	2410.73	53
GT-15	842210.905	922847.623	2445.26	55
GT-16	845116.286	920175.596	2670.84	57
GT-17	849356.590	921449.241	2737.09	59
GT-18	850298.738	924155.522	2706.75	61
GT-19	847001.768	923395.502	2672.43	63
GT-20	843639.644	926190.834	2499.69	65
GT-21	841669.359	924865.486	2565.30	67
GT-31	845876.567	929846.504	2702.99	69
GT-32	845384.351	927715.383	2623.32	71
GT-35	842318.905	909644.327	2225.23	73
GT-36	851183.542	924179.712	2675.14	75
GT-37	843072.096	914518.583	2354.20	77
GT-41	840820.525	916971.260	2433.59	79

U.S. State Plane of 1983, Arizona Central Zone (0202) at grid:

Coordinate System:	Site
Zone:	Arizona Central 0202
Datum:	NAD 1983 (NA2011)
Ellipsoid Name:	Geodetic Ref System 1980
Geoid Model:	GEOID12A (Conus)
Site:	None
Vertical Datum:	NAVD88
Unit of Measure:	International Foot

Ellipsoid Name:	Geodetic Ref System 1980
Flattening 1/f:	298.257
Semi Major Axis:	20925646.32546

Datum Transformation:	Three Parameter		
WGS84 to Geodetic Ref System 1980			
Translation X:	0.00000	Rotation X:	N/A
Translation Y:	0.00000	Rotation Y:	N/A
Translation Z:	0.00000	Rotation Z:	N/A
Scale Factor:	N/A ppm		

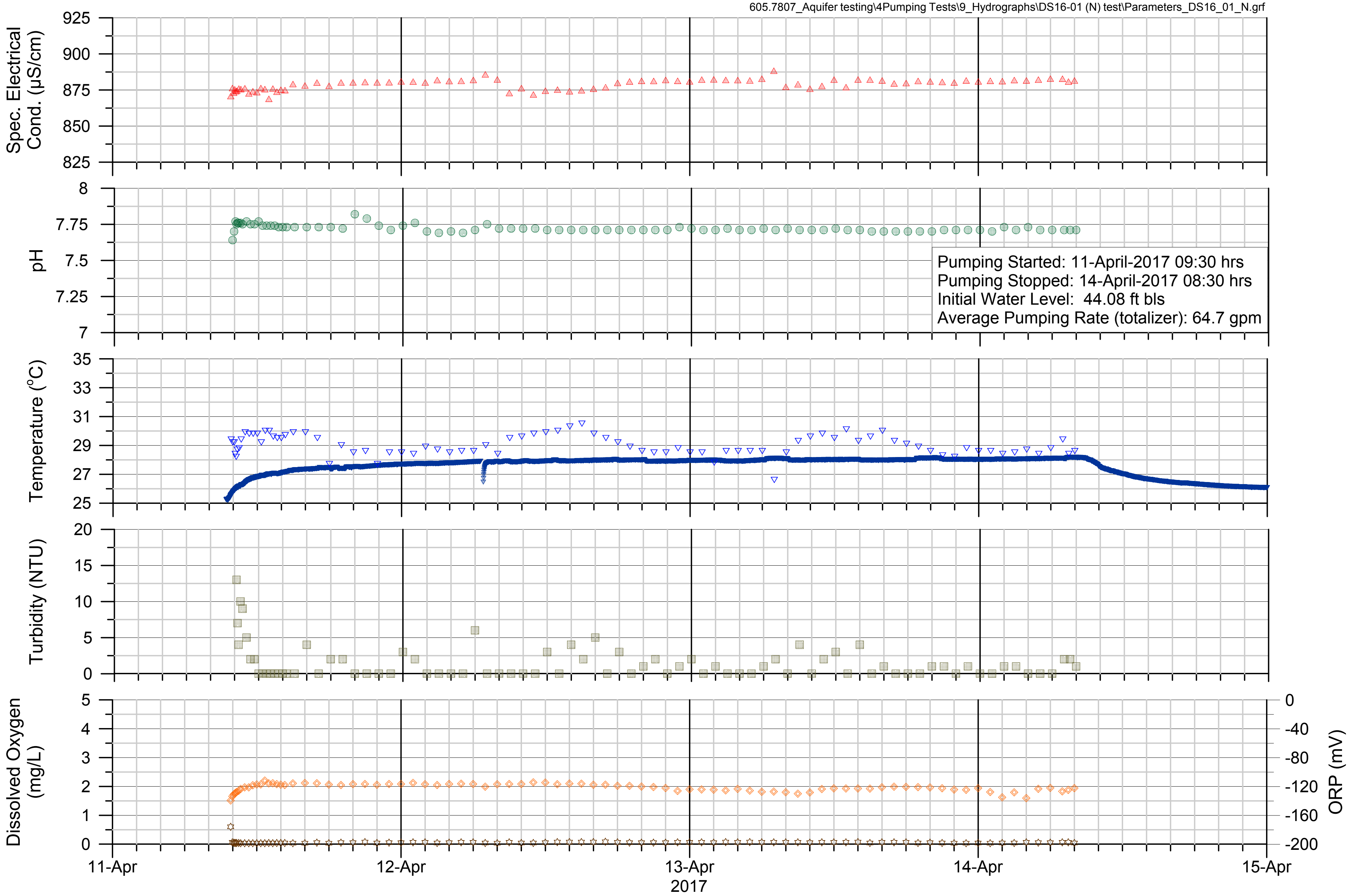
Transverse Mercator Projection			
Projection Origin		False Origin	
Latitude:	31°00'00.00000"N	False Northing:	0.00000ift
Longitude:	111°55'00.00000"W	False Easting:	700000.000
Height :	N/A	False Elevation:	N/A
Scale Factor:	0.9999 (exact)		

MONTGOMERY
& ASSOCIATES

Appendix H

Field Parameters of Constant-rate Pumping Tests

605.7807_Aquifer testing\4Pumping Tests\9_Hydrographs\DS16-01 (N) test\Parameters_DS16_01_N.grf



Pumping Started: 11-April-2017 09:30 hrs
Pumping Stopped: 14-April-2017 08:30 hrs
Initial Water Level: 44.08 ft bls
Average Pumping Rate (totalizer): 64.7 gpm

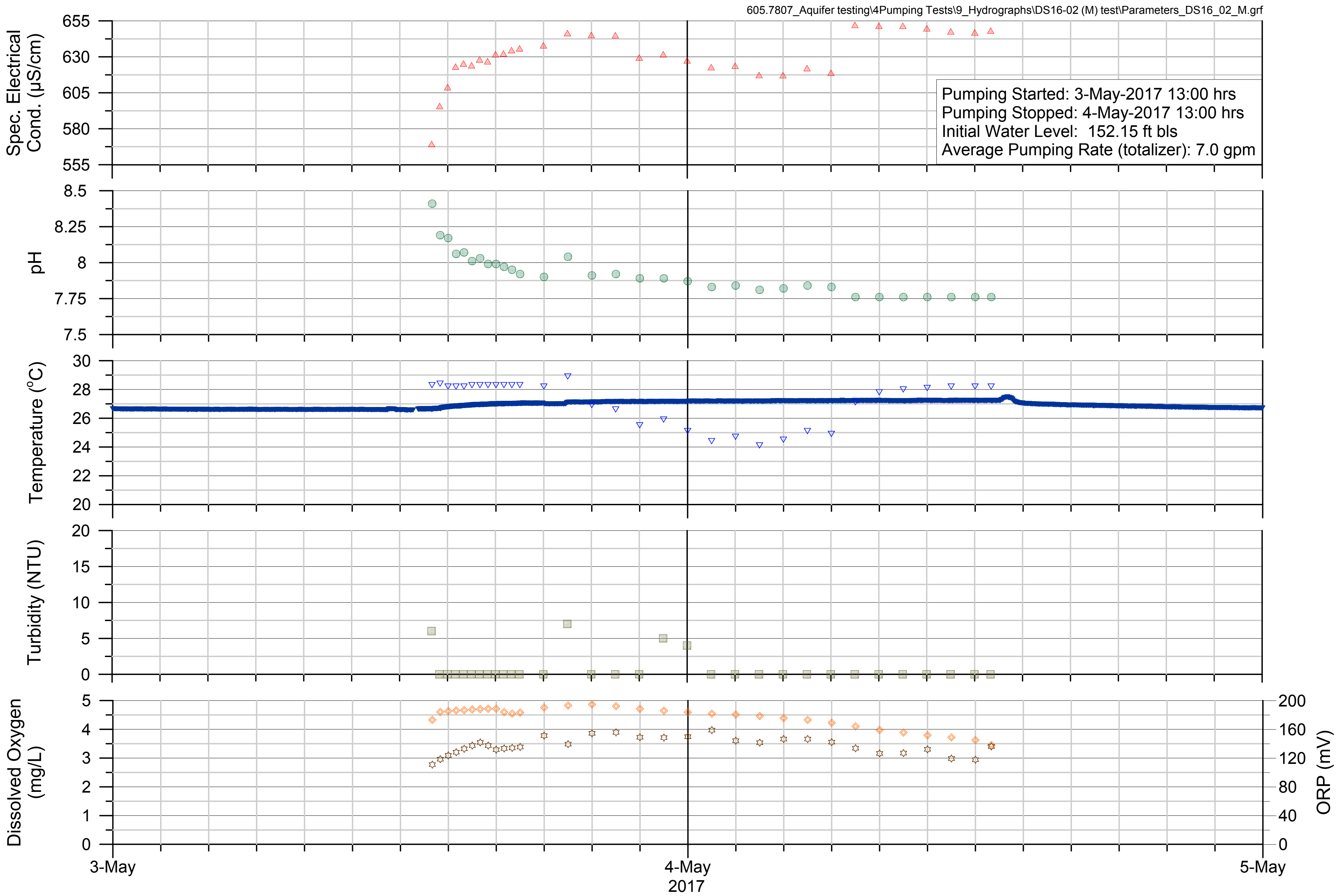
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH ▨ Turbidity ◇ ORP ☆ DO

FIGURE 1. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH, OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN DURING TESTING AT WELL DS16-01

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



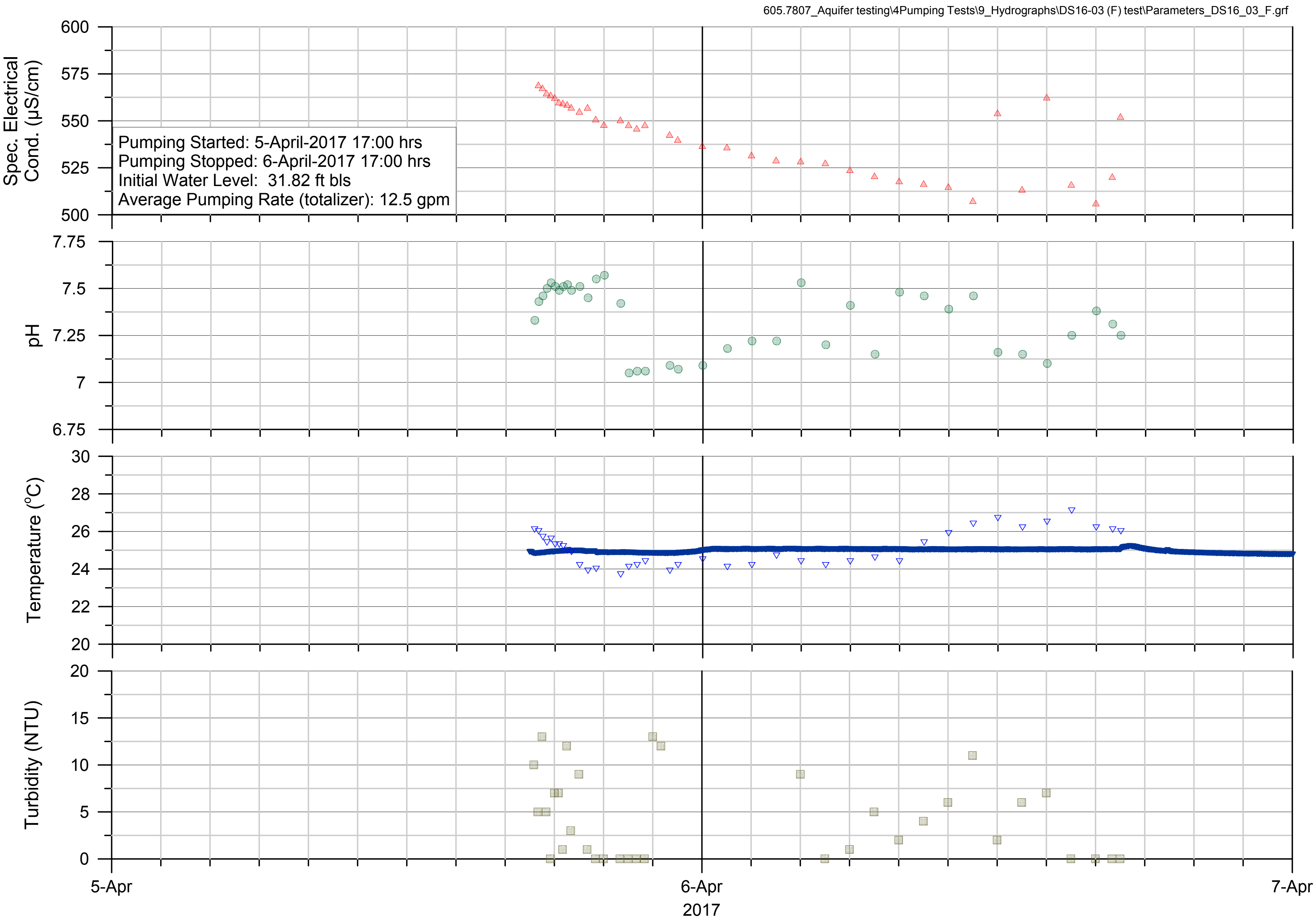
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH ▨ Turbidity ◇ ORP ☆ DO

FIGURE 2. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH, TURBIDITY, OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN DURING TESTING AT WELL DS16-02

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 5-April-2017 17:00 hrs
Pumping Stopped: 6-April-2017 17:00 hrs
Initial Water Level: 31.82 ft bls
Average Pumping Rate (totalizer): 12.5 gpm

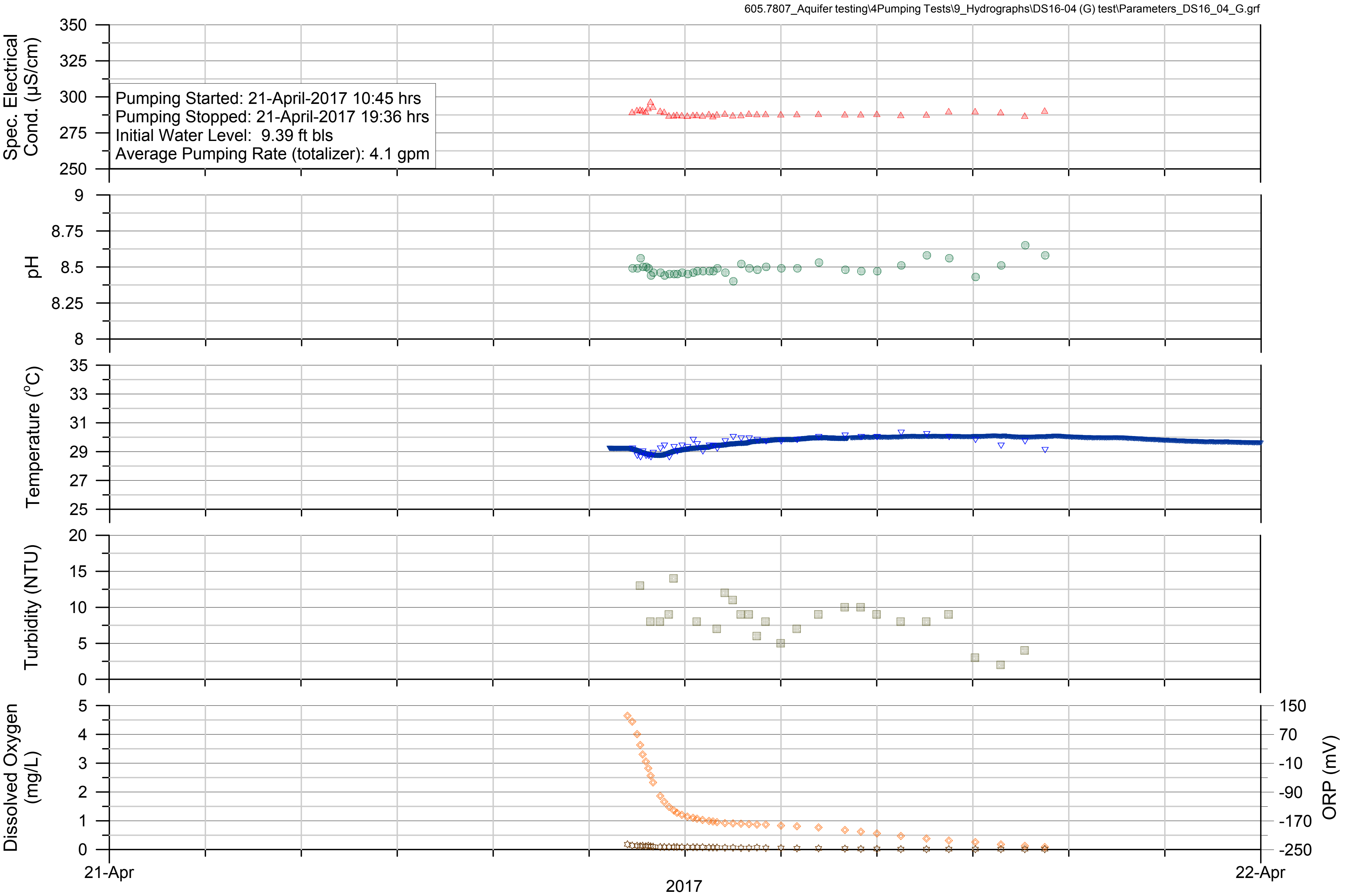
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH ▨ Turbidity

FIGURE 3. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH AND TURBIDITY DURING TESTING AT WELL DS16-03

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 21-April-2017 10:45 hrs
Pumping Stopped: 21-April-2017 19:36 hrs
Initial Water Level: 9.39 ft bls
Average Pumping Rate (totalizer): 4.1 gpm

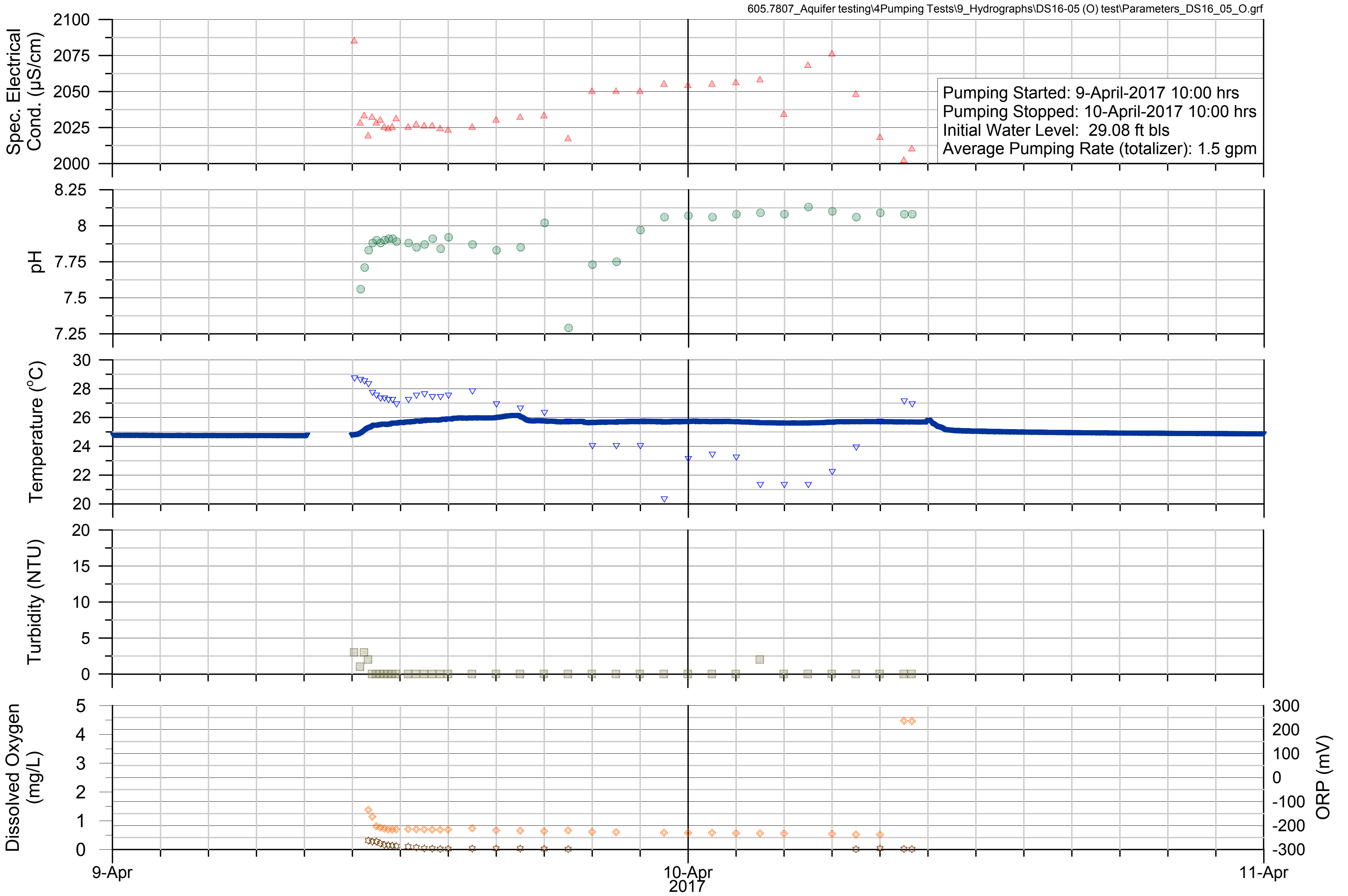
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH ■ Turbidity ◇ ORP ☆ DO

FIGURE 4. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH, TURBIDITY, OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN DURING TESTING AT WELL DS16-04

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Pumping Started: 9-April-2017 10:00 hrs
Pumping Stopped: 10-April-2017 10:00 hrs
Initial Water Level: 29.08 ft bls
Average Pumping Rate (totalizer): 1.5 gpm

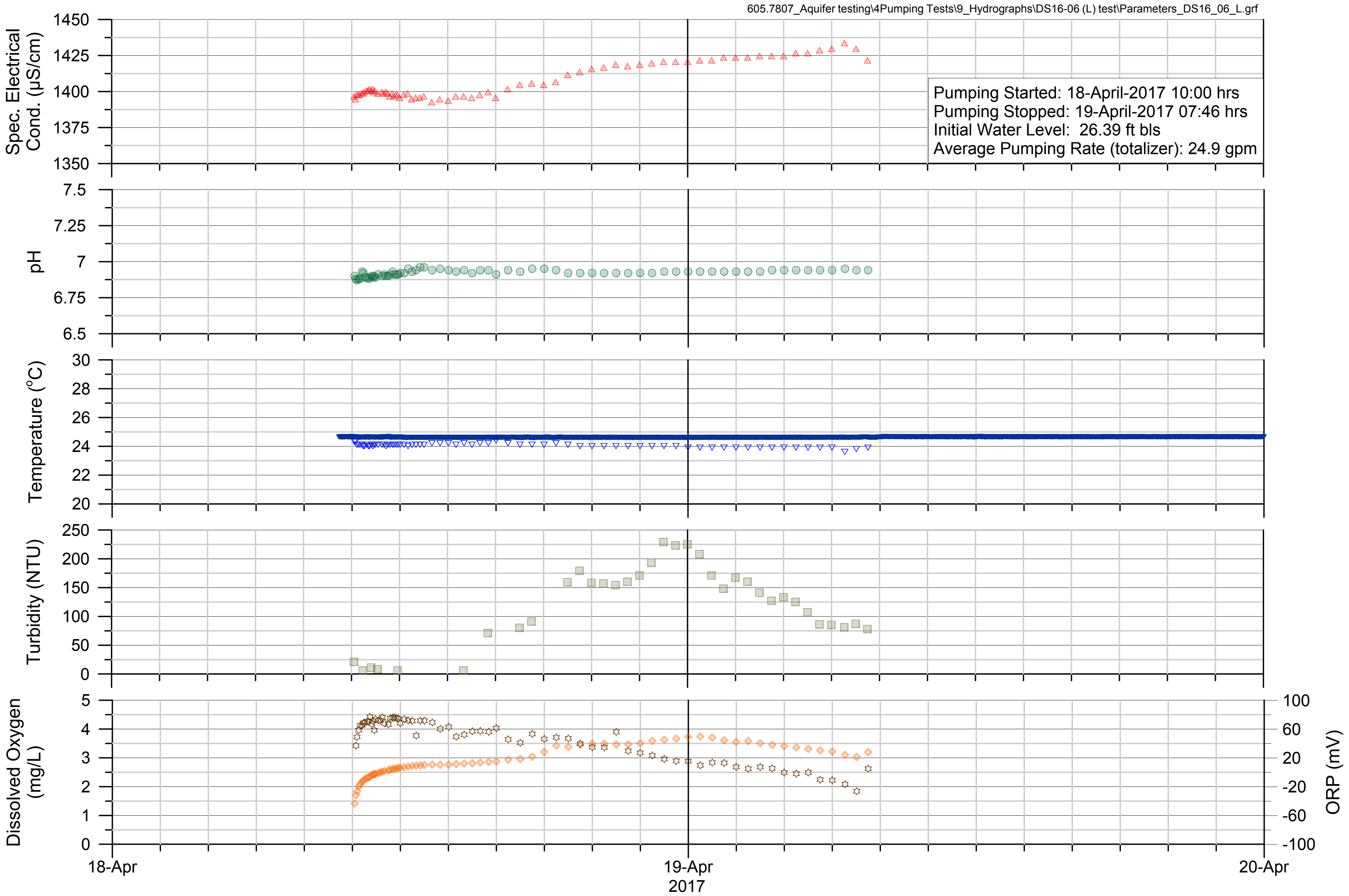
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH ▨ Turbidity ◇ ORP

FIGURE 5. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH AND TURBIDITY AND DURING TESTING AT WELL DS16-05

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

△ Specific Electrical Conductance

▽ Temperature (well head)

▼ Temperature (downhole transducer)

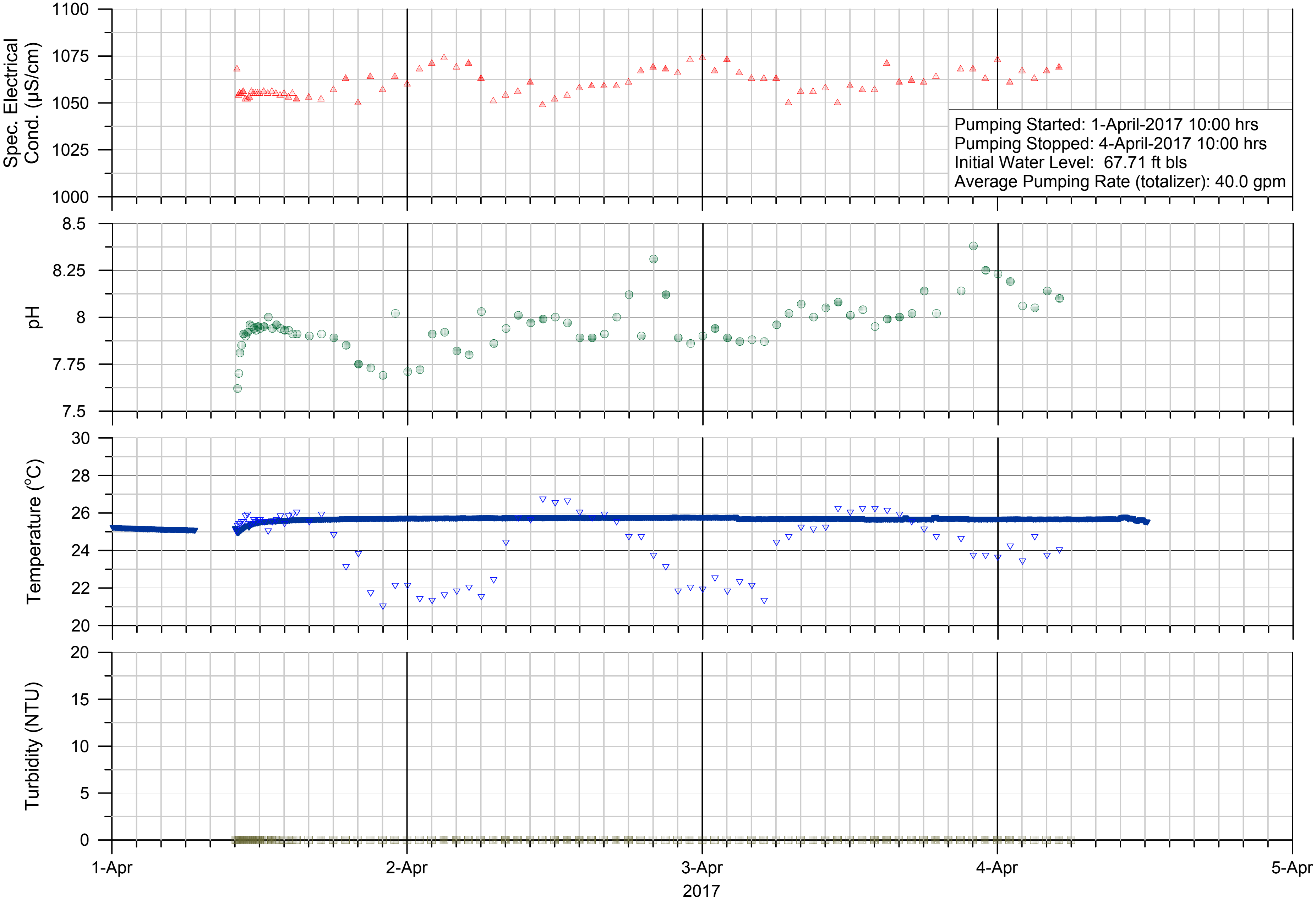
⊕ pH ▨ Turbidity ◇ ORP ✡ DO

FIGURE 6. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH, TURBIDITY, OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN DURING TESTING AT WELL DS16-06

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

605.7807_Aquifer testing\4Pumping Tests\9_Hydrographs\DS16-07 (K) test\Parameters_DS16_07_K.grf



Pumping Started: 1-April-2017 10:00 hrs
Pumping Stopped: 4-April-2017 10:00 hrs
Initial Water Level: 67.71 ft bls
Average Pumping Rate (totalizer): 40.0 gpm

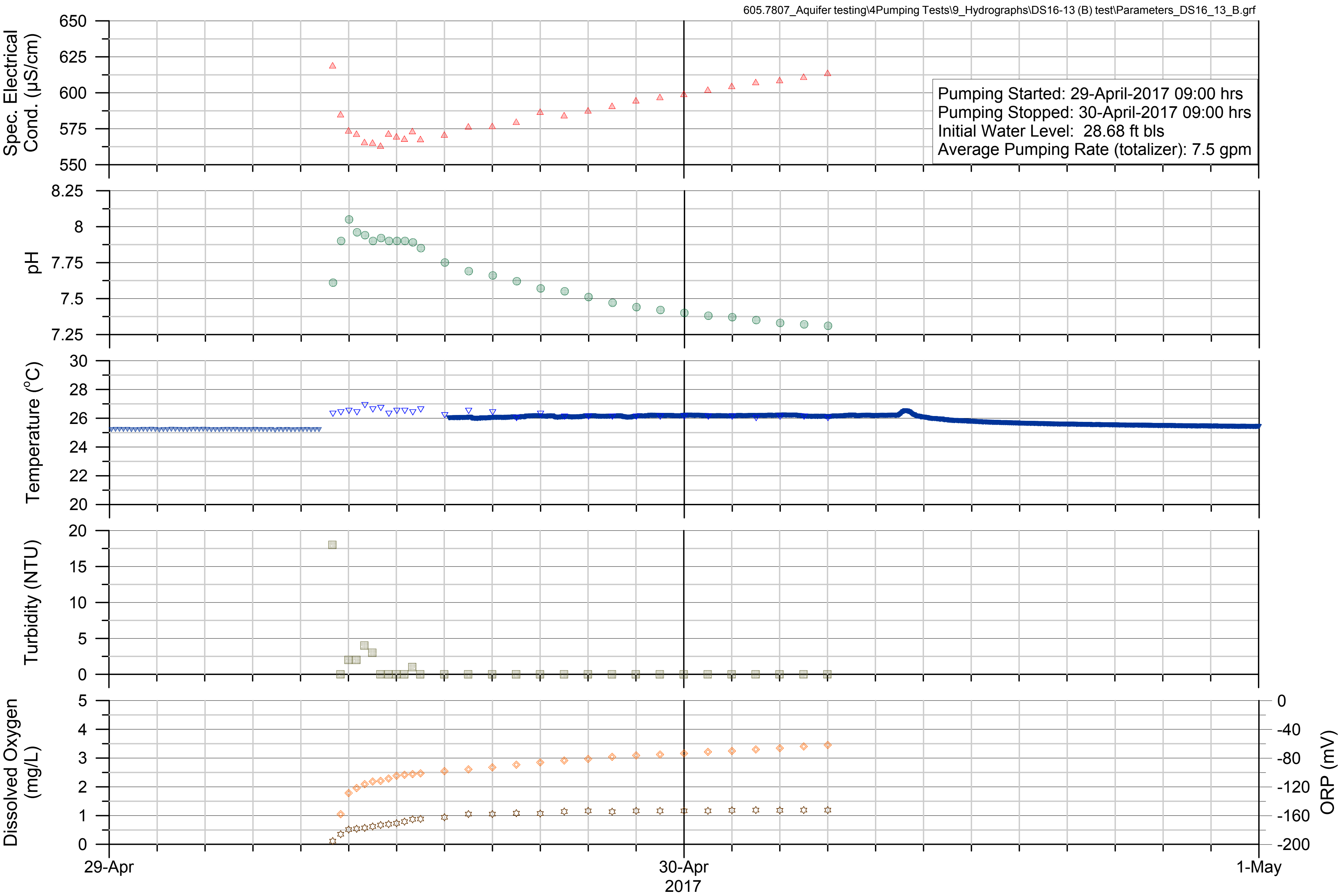
EXPLANATION

- △ Specific Electrical Conductance
- ▽ Temperature (well head)
- ▼ Temperature (downhole transducer)
- ● pH   ▨ Turbidity

FIGURE 7. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH AND TURBIDITY DURING TESTING AT WELL DS16-07

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

△ Specific Electrical Conductance

▽ Temperature (well head)

▼ Temperature (downhole transducer)

● pH ▨ Turbidity ◇ ORP ✩ DO

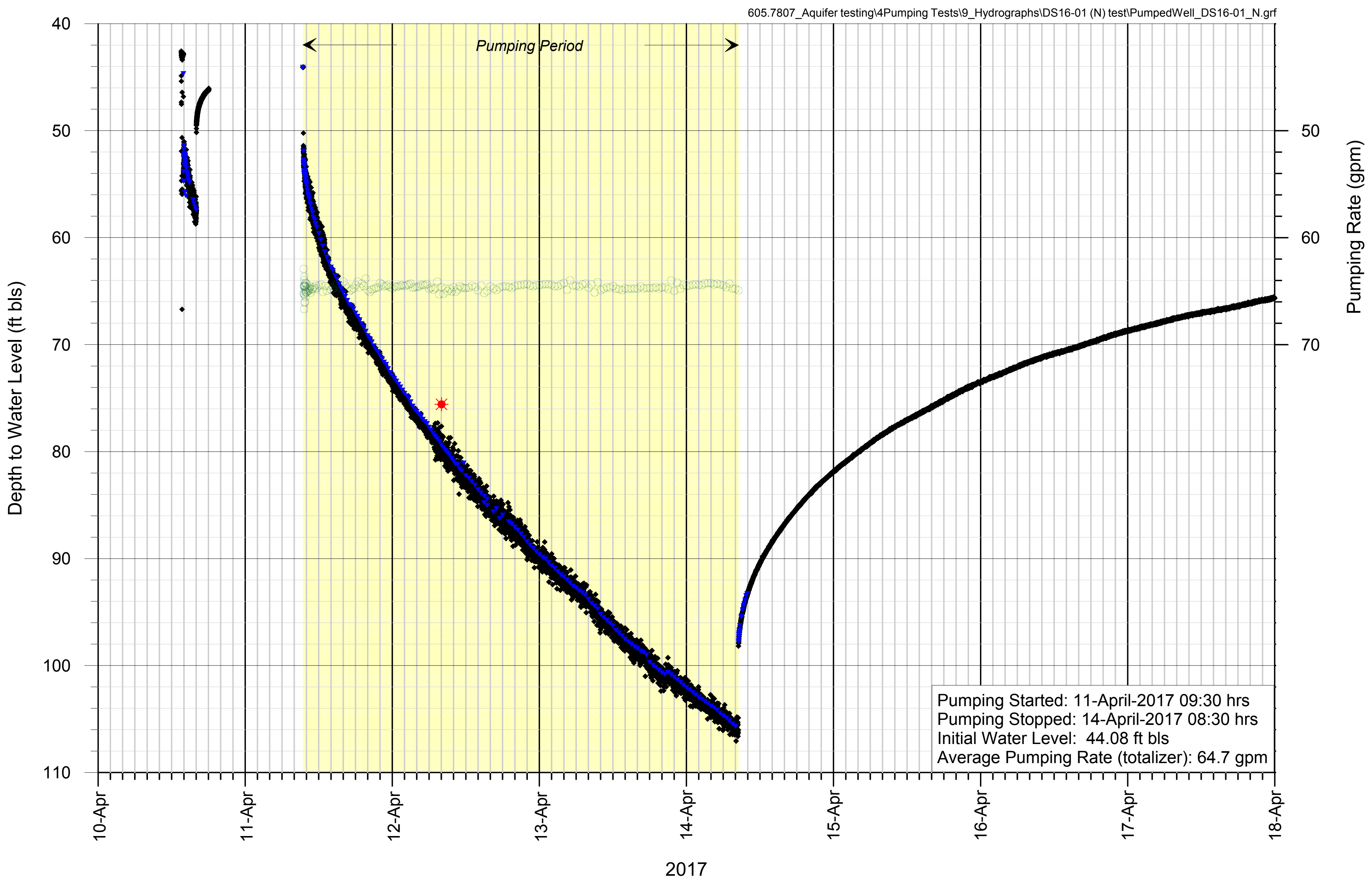
FIGURE 8. FIELD MEASUREMENTS OF SPECIFIC ELECTRICAL CONDUCTANCE, TEMPERATURE, pH, TURBIDITY, OXIDATION-REDUCTION POTENTIAL AND DISSOLVED OXYGEN DURING TESTING AT WELL DS16-13

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

Appendix I

Hydrographs of Constant-rate Pumping Tests



Pumping Started: 11-April-2017 09:30 hrs
Pumping Stopped: 14-April-2017 08:30 hrs
Initial Water Level: 44.08 ft bls
Average Pumping Rate (totalizer): 64.7 gpm

EXPLANATION

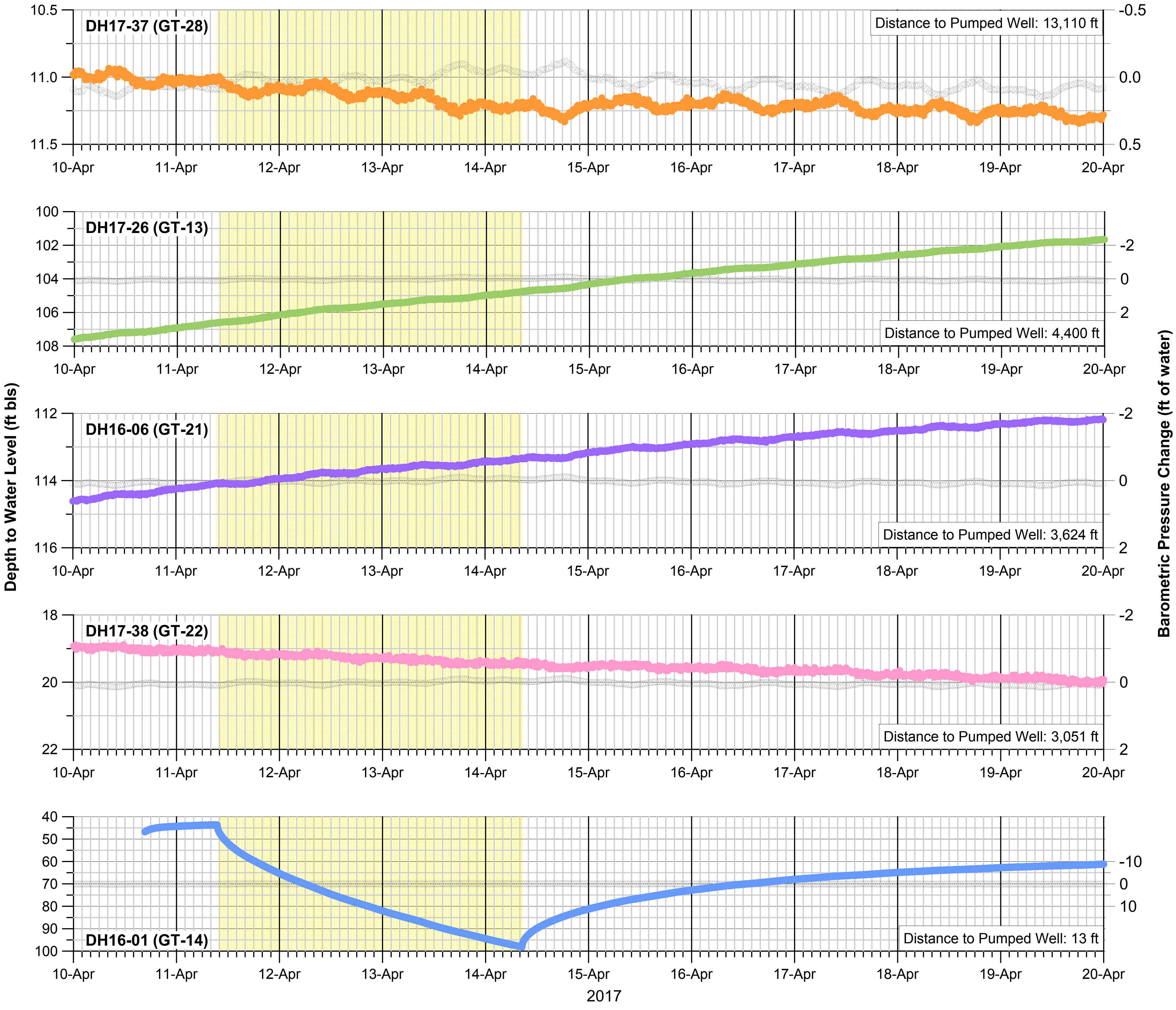
- ▼ Water Level (manual measurement)
- ◆ Water Level (transducer measurement)
- ○ Pumping Rate (totalizer)
- ✷ Decreased signal to noise caused by installation of higher pressure range transducer

FIGURE 1. HYDROGRAPH FOR PUMPED WELL DS16-01

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

605.7807_Aquifer testing\4Pumping Tests\9_Hydrographs\DS16-01 (N) test\All_ObserWells_DS16_01_N.grf



EXPLANATION

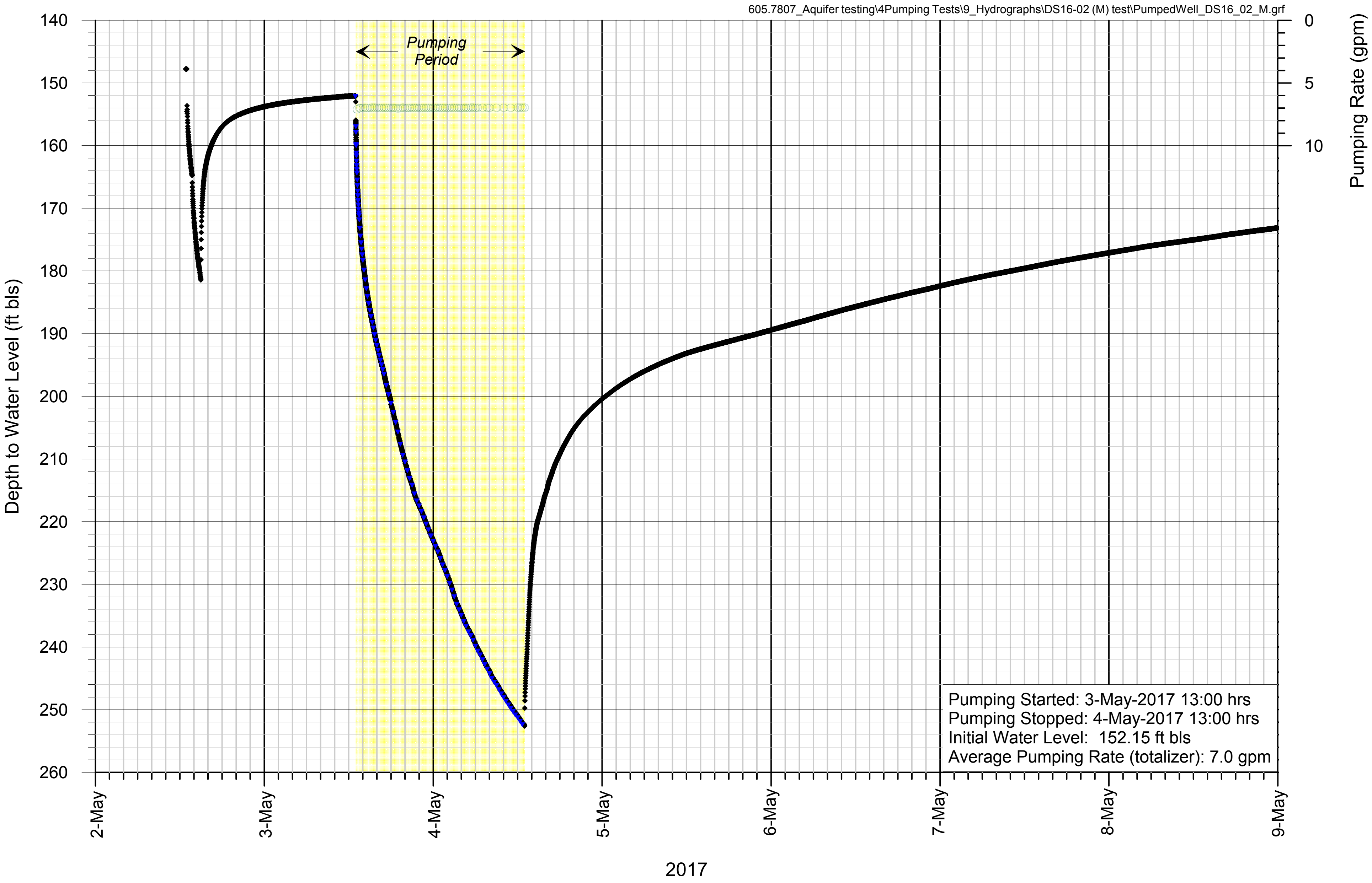
○ Barometric Pressure

🟨 Pumping Period

FIGURE 2. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-01 71-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 3-May-2017 13:00 hrs
Pumping Stopped: 4-May-2017 13:00 hrs
Initial Water Level: 152.15 ft bls
Average Pumping Rate (totalizer): 7.0 gpm

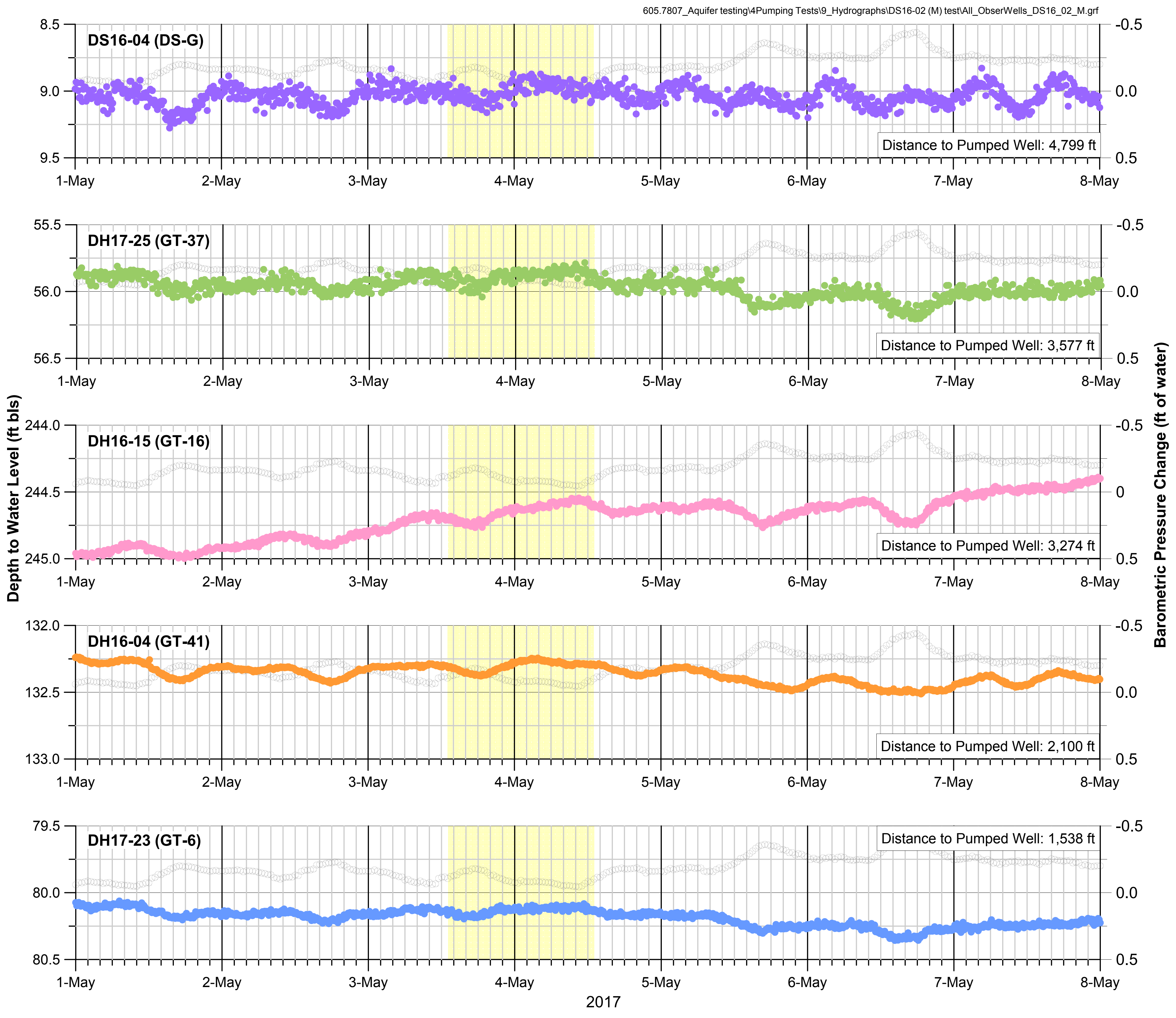
EXPLANATION

▼ Water Level (manual measurement)
◆ Water Level (transducer measurement)
○ Pumping Rate (totalizer)

FIGURE 3. HYDROGRAPH FOR PUMPED WELL DS16-02

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

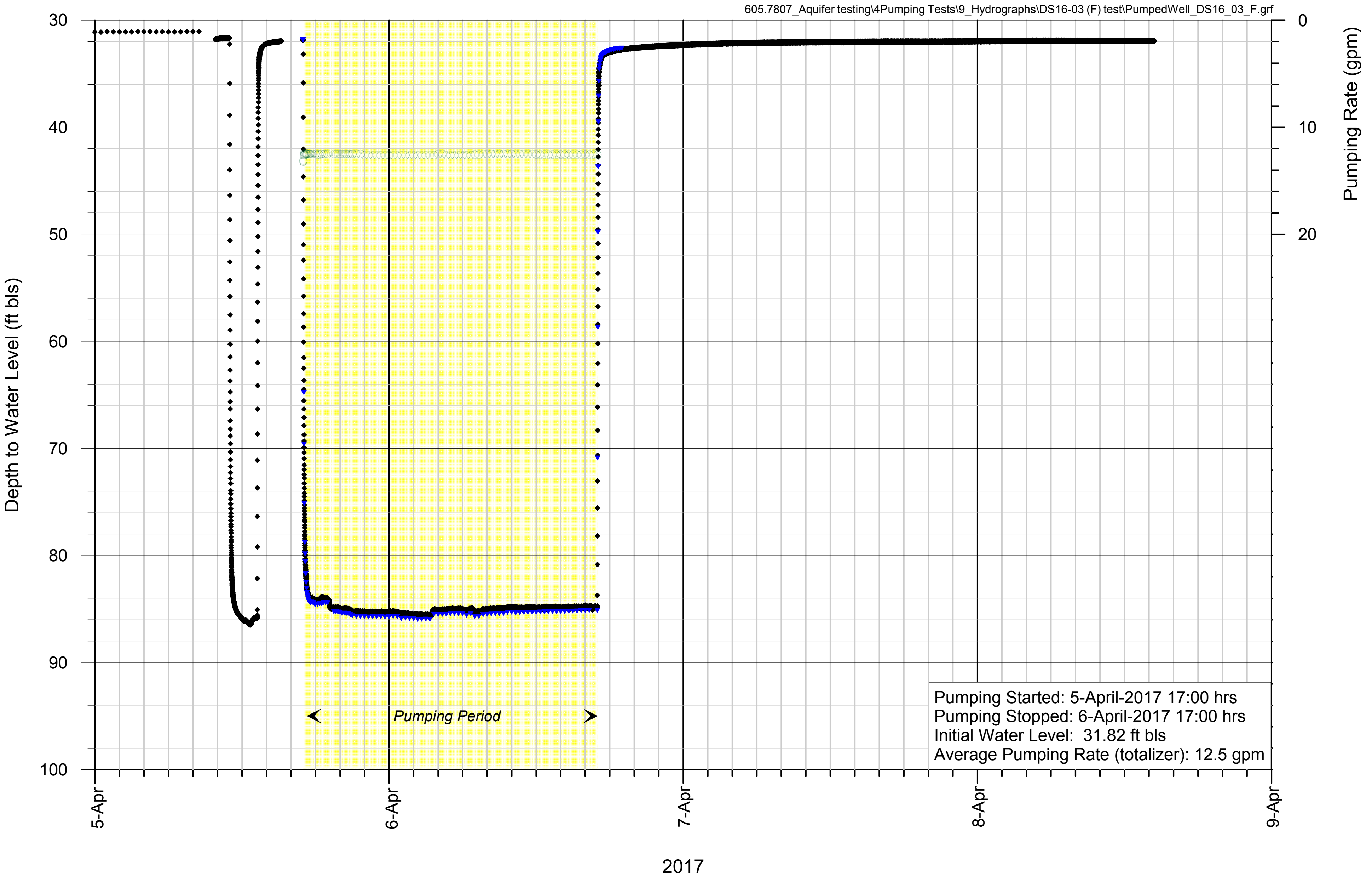
○ Barometric Pressure

▨ Pumping Period

FIGURE 4. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-02 24-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



Pumping Started: 5-April-2017 17:00 hrs
Pumping Stopped: 6-April-2017 17:00 hrs
Initial Water Level: 31.82 ft bls
Average Pumping Rate (totalizer): 12.5 gpm

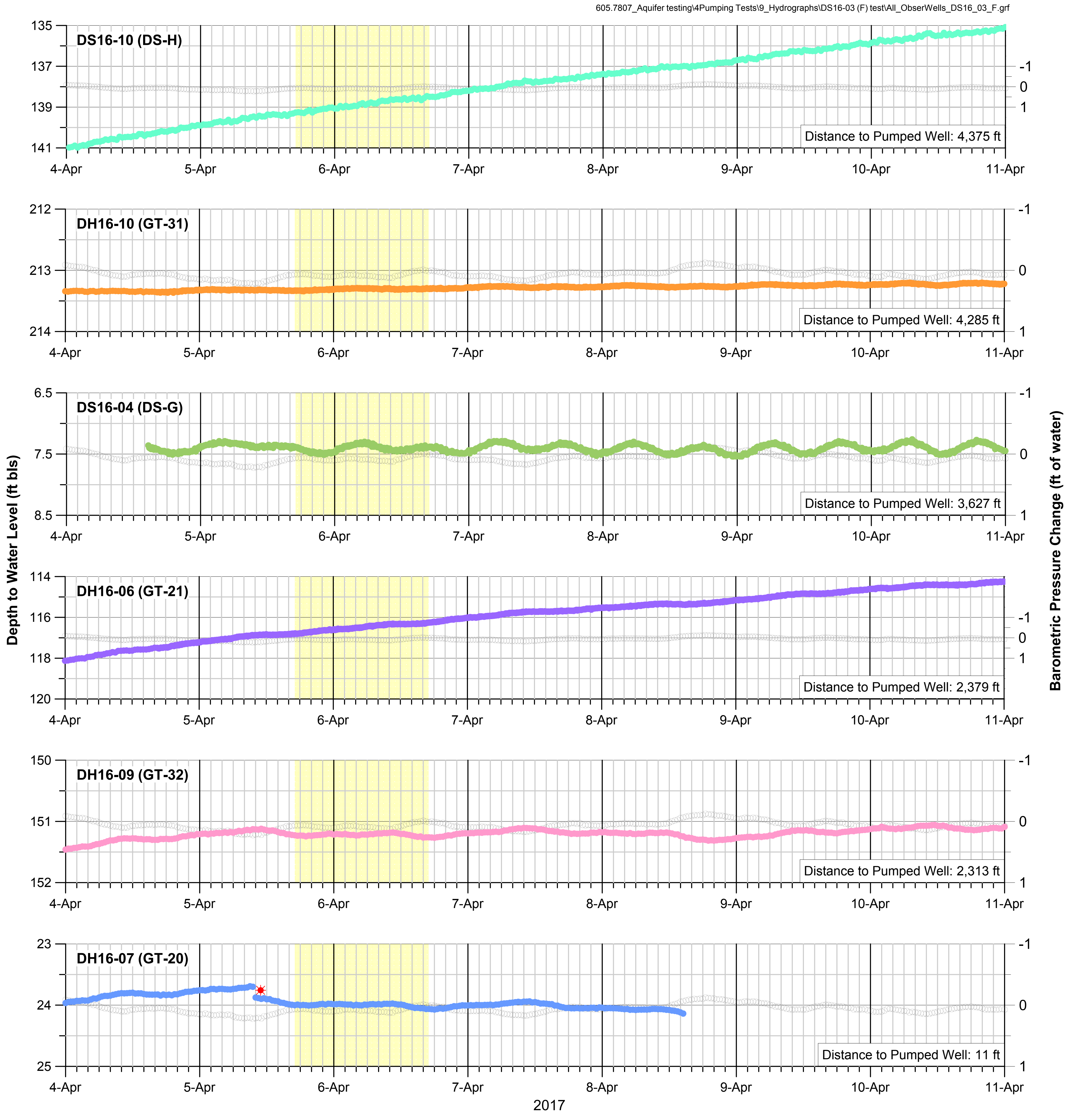
EXPLANATION

- ▼ Water Level (manual measurement)
- ◆ Water Level (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 5. HYDROGRAPH FOR PUMPED WELL DS16-03

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



EXPLANATION

○ Barometric Pressure

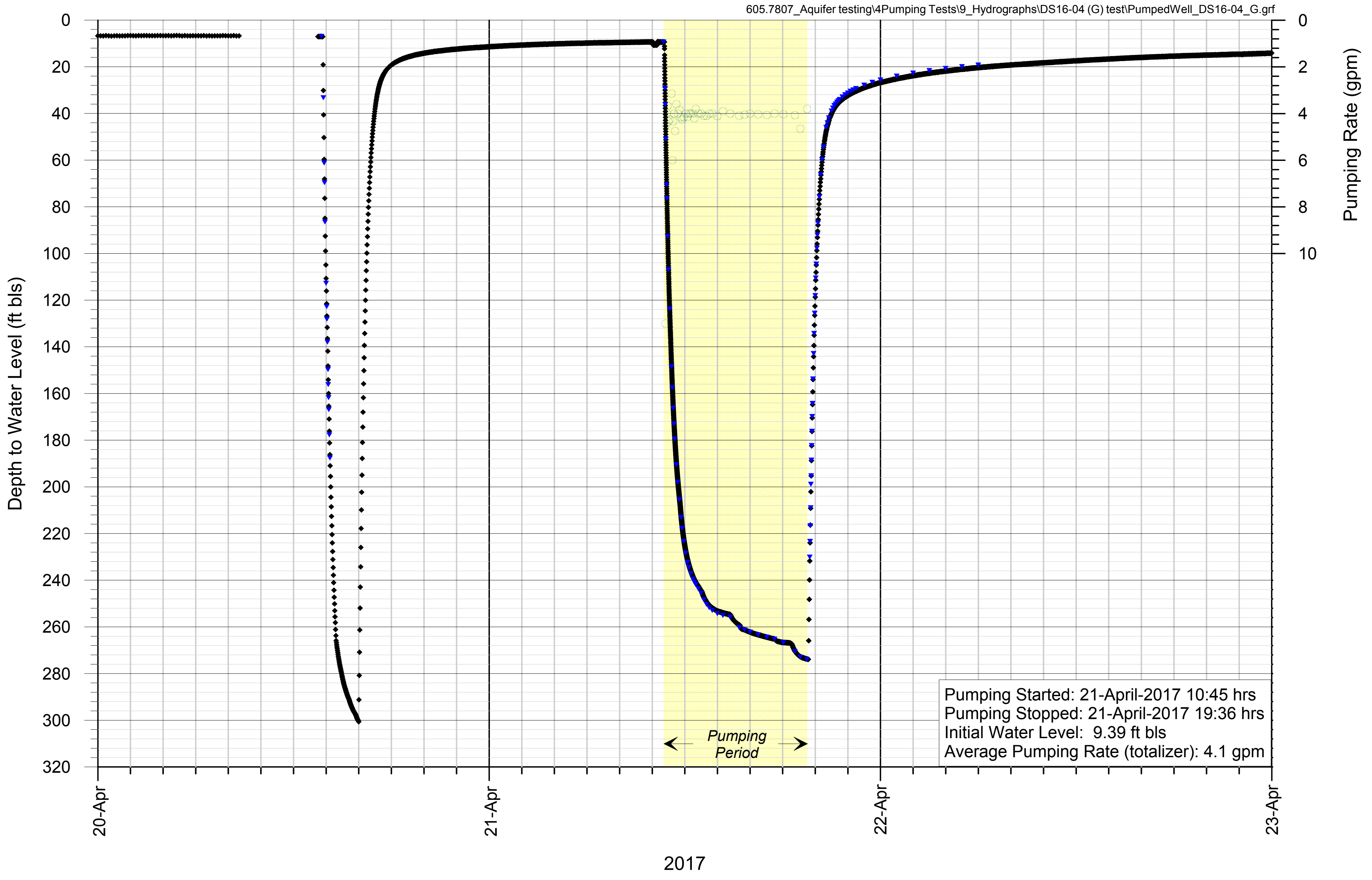
🟨 Pumping Period

✷ Transducer Reset

FIGURE 6. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-03 24-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



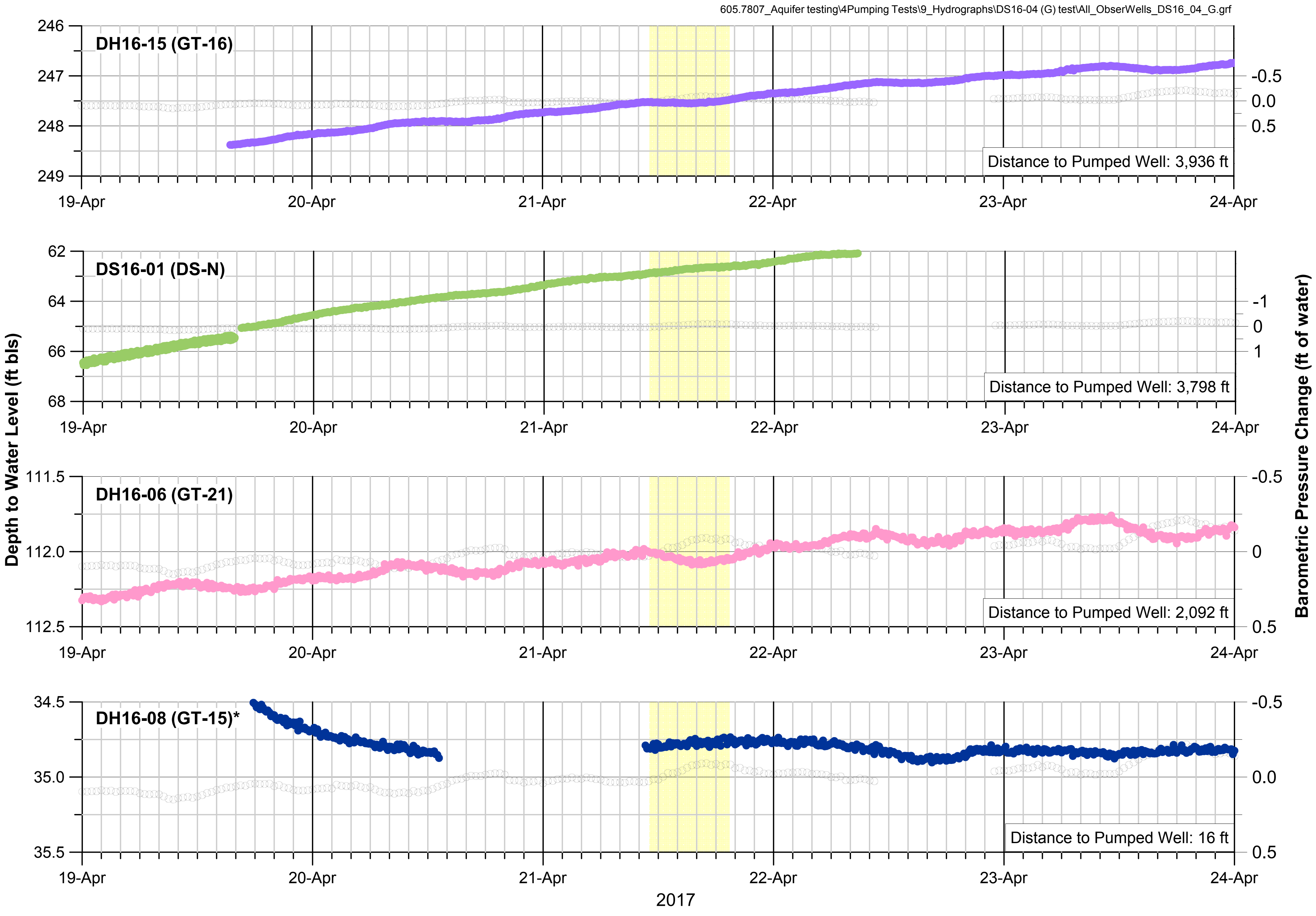
EXPLANATION

- ▼ Water Level (manual measurement)
- ◆ Water Level (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 7. HYDROGRAPH FOR PUMPED WELL DS16-04 (G)

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



EXPLANATION

○ Barometric Pressure

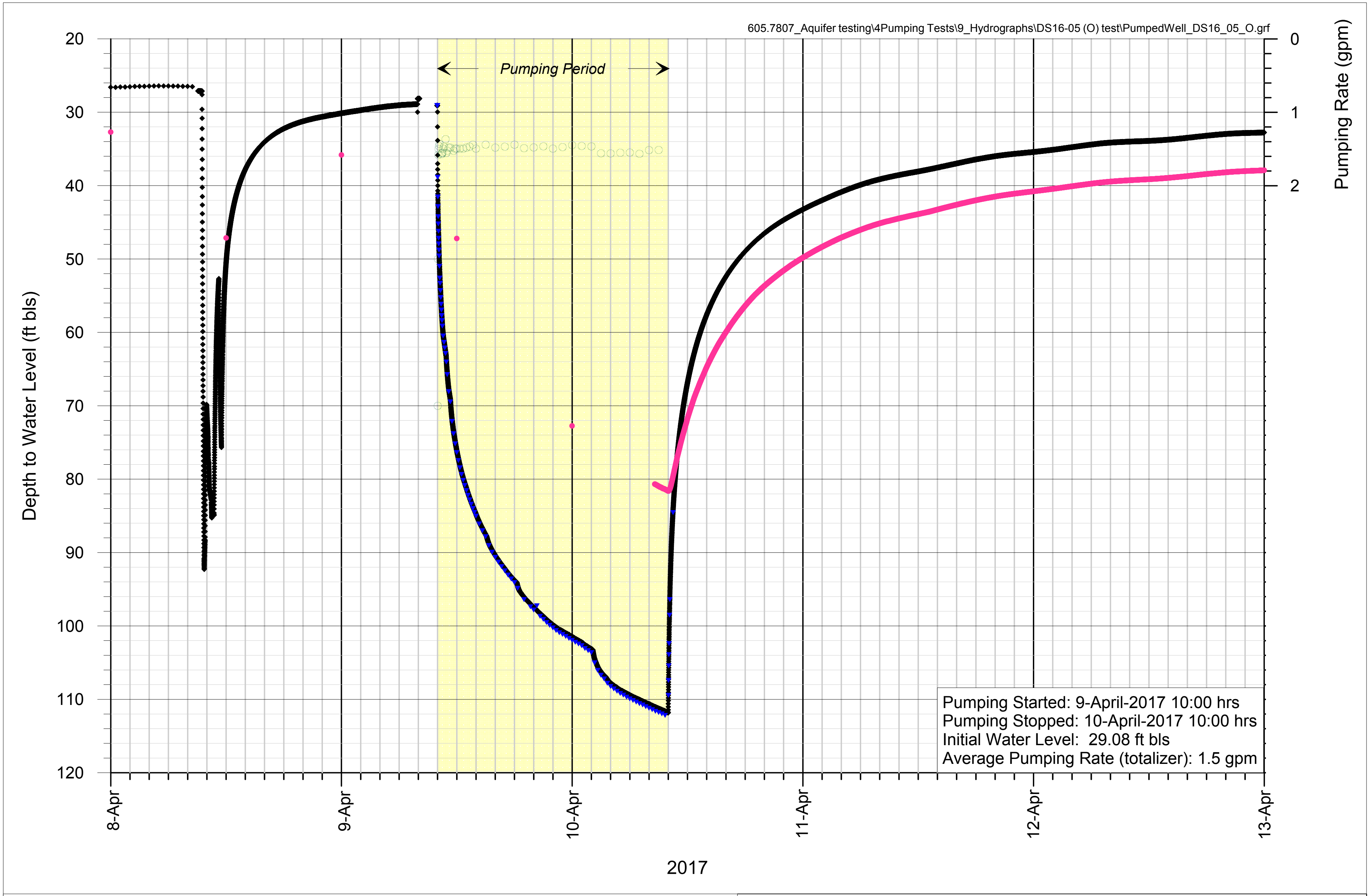
🟨 Pumping Period

* Barometric Pressure Corrected

FIGURE 8. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-04 8.9-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 9-April-2017 10:00 hrs
Pumping Stopped: 10-April-2017 10:00 hrs
Initial Water Level: 29.08 ft bls
Average Pumping Rate (totalizer): 1.5 gpm

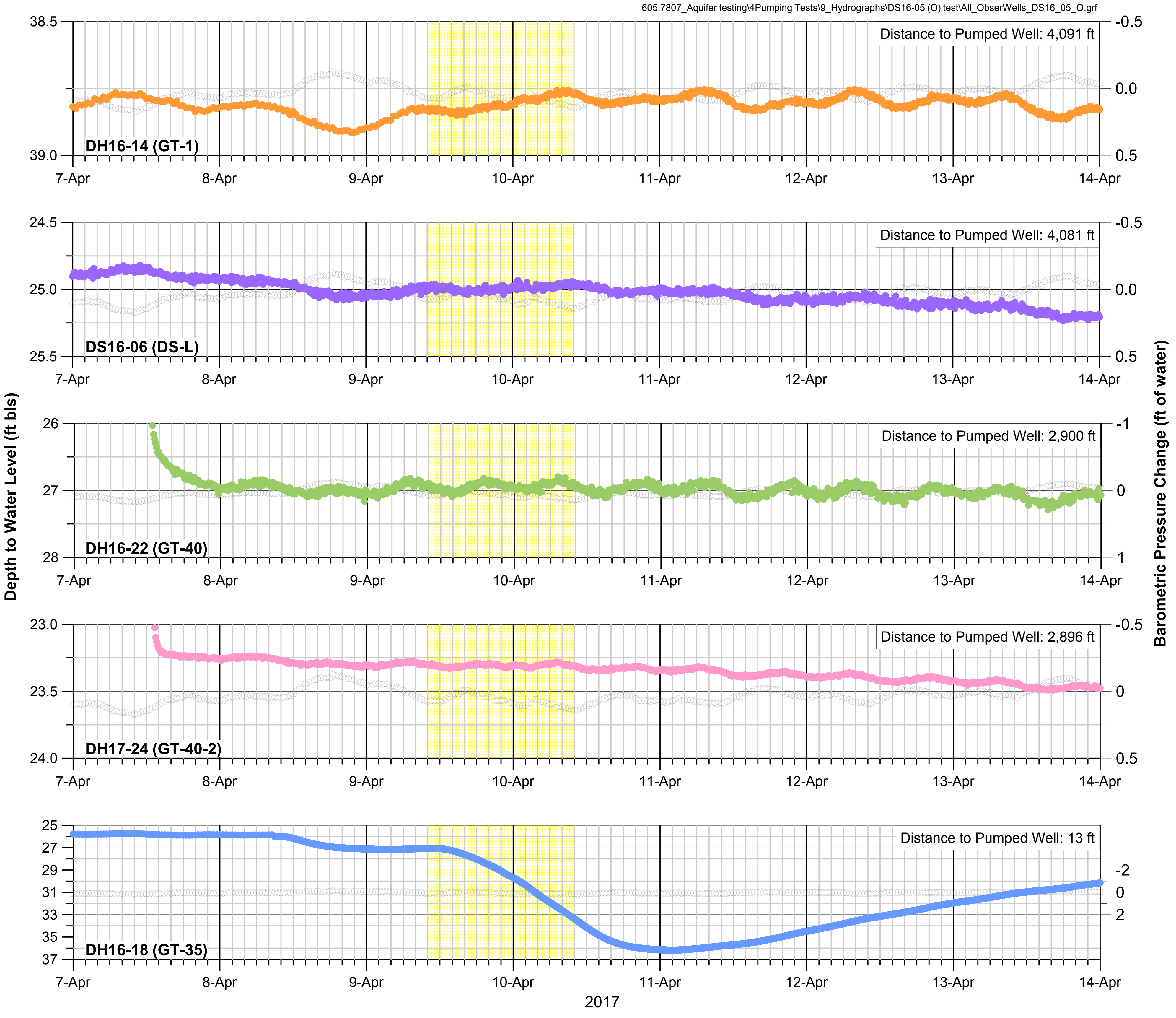
EXPLANATION

- ▼ DS16-05 Water Level (manual measurement)
- ◆ DS16-05 Water Level (transducer measurement)
- ● DS16-05 VW Piezometer (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 9. HYDROGRAPH FOR PUMPED WELL DS16-05 AND DS16-05 VW PIEZOMETER

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

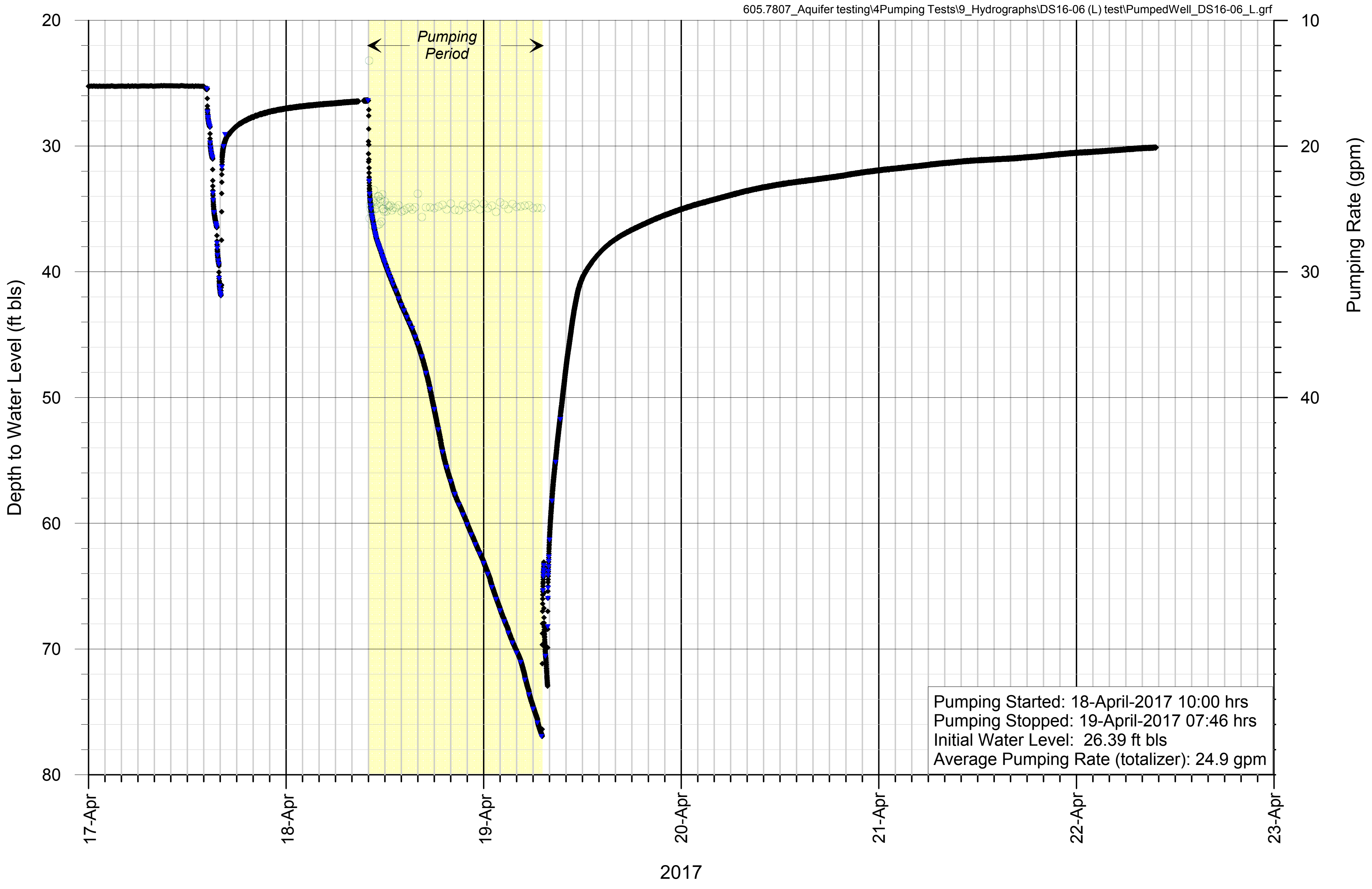
○ Barometric Pressure

🟨 Pumping Period

FIGURE 10. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-05 24-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 18-April-2017 10:00 hrs
Pumping Stopped: 19-April-2017 07:46 hrs
Initial Water Level: 26.39 ft bls
Average Pumping Rate (totalizer): 24.9 gpm

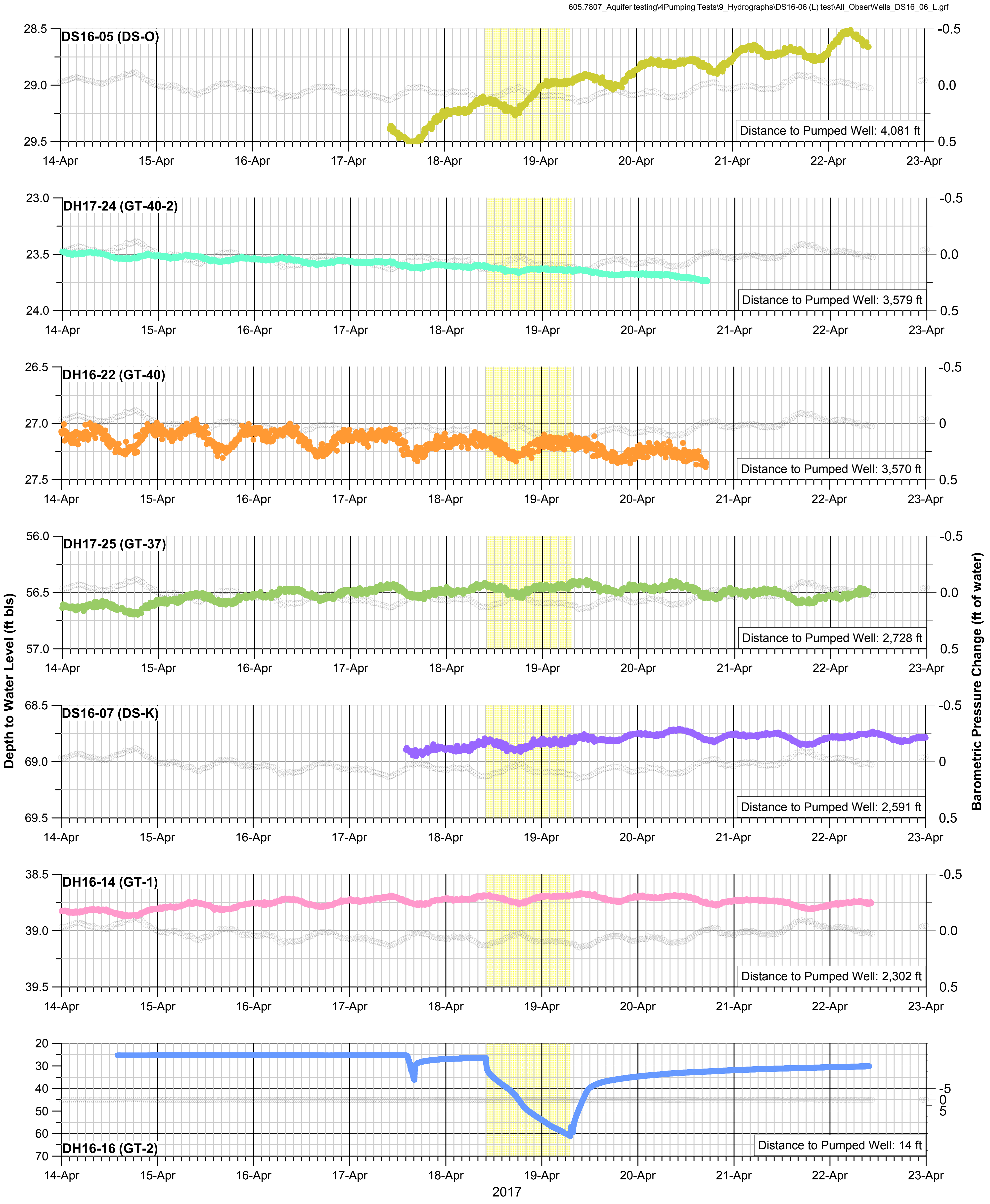
EXPLANATION

- ▼ Water Level (manual measurement)
- ◆ Water Level (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 11. HYDROGRAPH FOR PUMPED WELL DS16-06

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

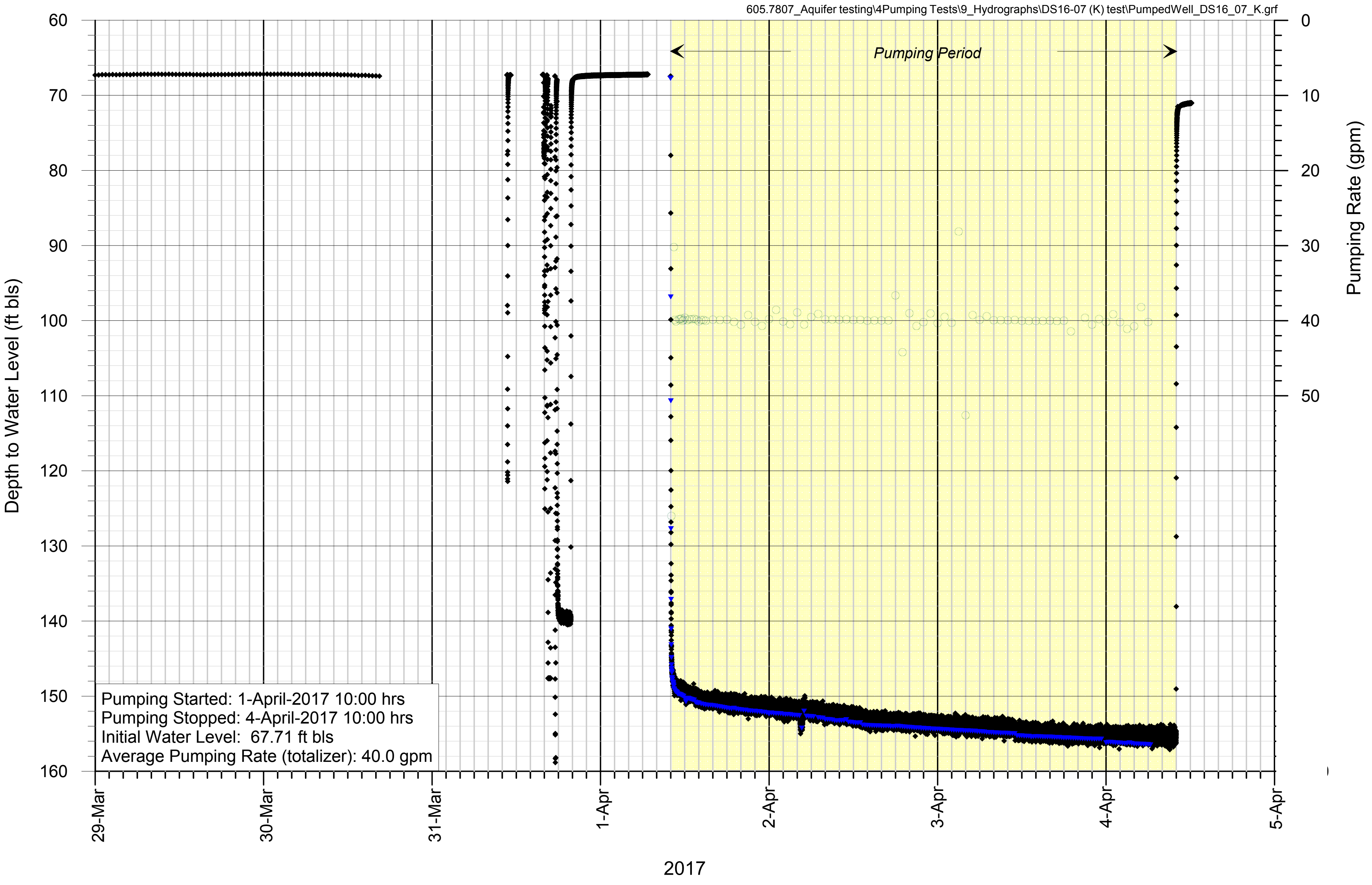
○ Barometric Pressure

🟨 Pumping Period

FIGURE 12. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-06 21.8-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 1-April-2017 10:00 hrs
Pumping Stopped: 4-April-2017 10:00 hrs
Initial Water Level: 67.71 ft bls
Average Pumping Rate (totalizer): 40.0 gpm

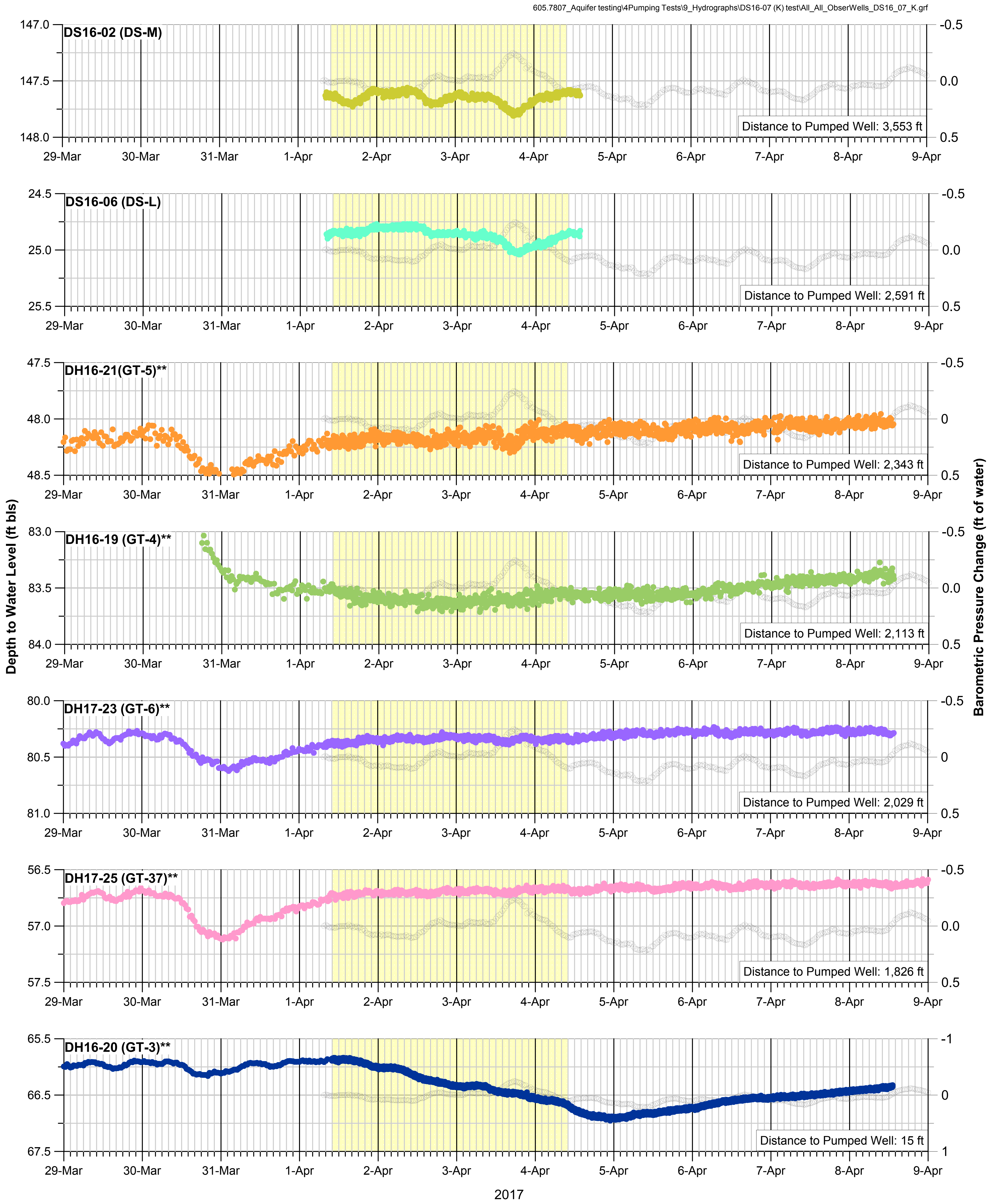
EXPLANATION

- ▼ Water Level (manual measurement)
- ◆ Water Level (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 13. HYDROGRAPH FOR PUMPED WELL DS16-07

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



EXPLANATION

○ Barometric Pressure

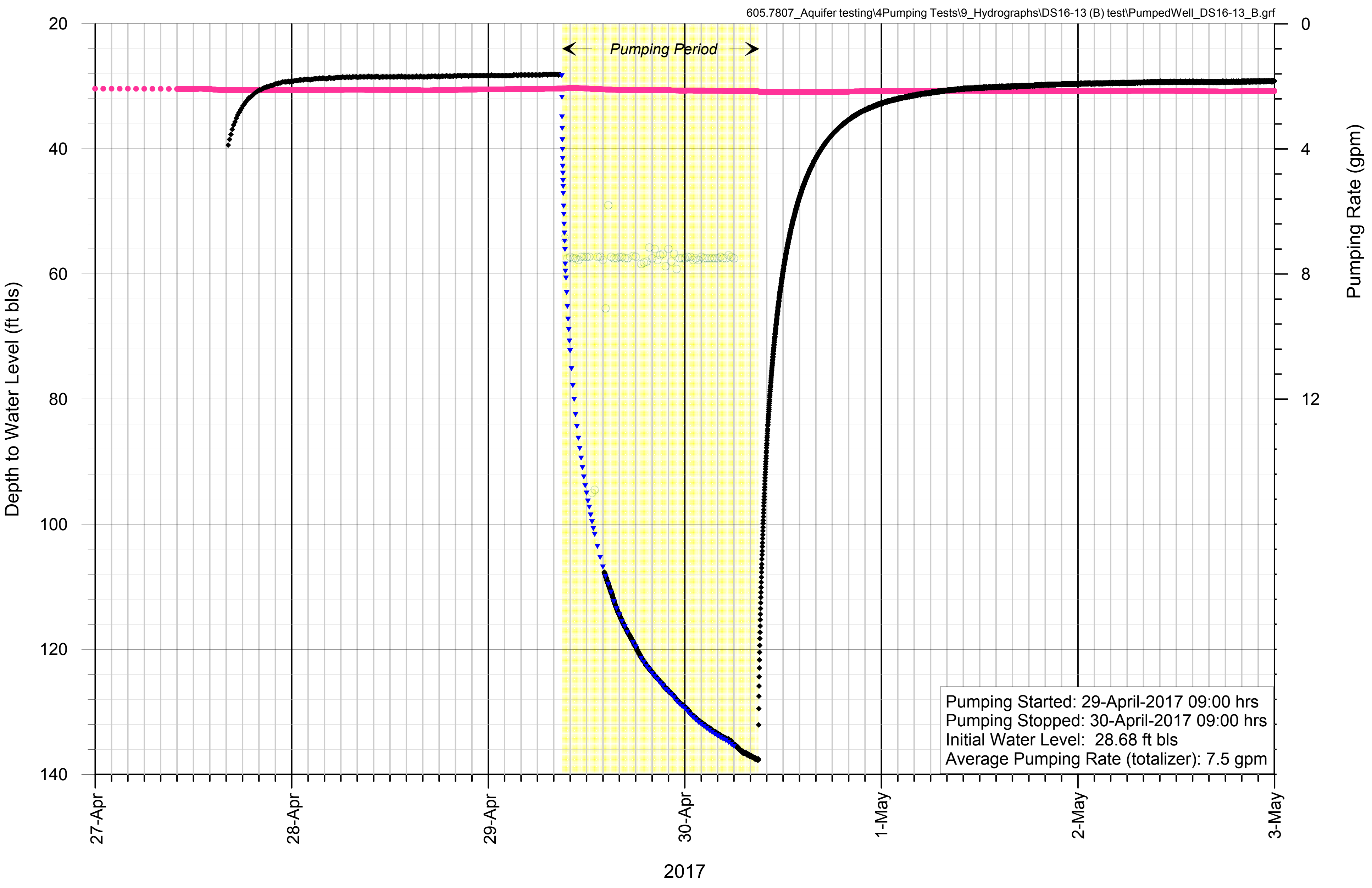
🟨 Pumping Period

** Barometric Efficiency Corrected

FIGURE 14. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-07 72-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES



Pumping Started: 29-April-2017 09:00 hrs
Pumping Stopped: 30-April-2017 09:00 hrs
Initial Water Level: 28.68 ft bls
Average Pumping Rate (totalizer): 7.5 gpm

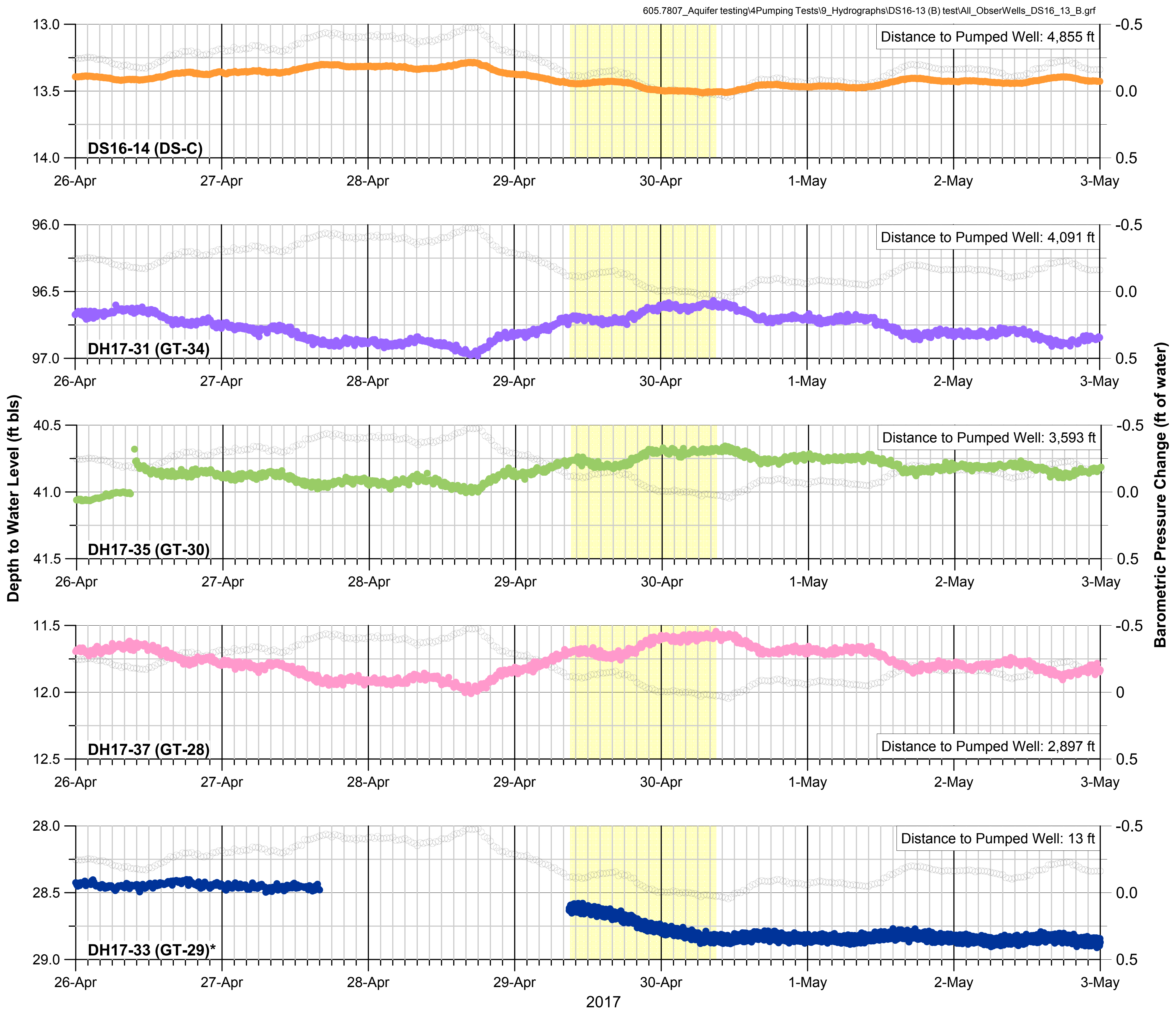
EXPLANATION

- ▼ DS16-13 Water Level (manual measurement)
- ◆ DS16-13 Water Level (transducer measurement)
- ● DS16-13 VW Piezometer (transducer measurement)
- ○ Pumping Rate (totalizer)

FIGURE 15. HYDROGRAPH FOR PUMPED WELL DS16-13 AND DS16-13 VW PIEZOMETER

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES



EXPLANATION

○ Barometric Pressure

🟨 Pumping Period

* Barometric Pressure Corrected

FIGURE 16. HYDROGRAPH FOR OBSERVATION WELLS DURING DS16-13 24-HOUR PUMPING TEST

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

Appendix J

Geotechnical Piezometers Records and Diagrams

(Golder Associates)

DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

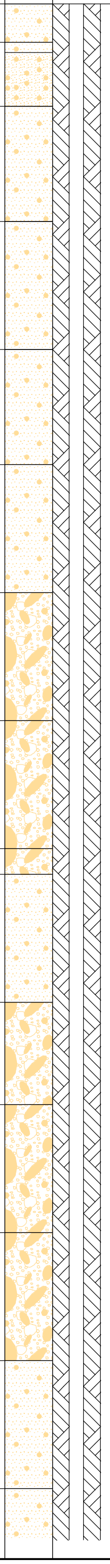
DRILLING START: September 21, 2016 15:26
DRILLING END: September 26, 2016 16:26
COORDINATES: N: 838,455 E: 923,219

SHEET: 1 of 8
GS ELEV.: 2406.7
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	DESCRIPTION	Elev
0.0		2406.7
1.5	Gila conglomerate (Tss): completely weathered surface materials.	2405.2
4.0	Gila Sandstone (Tss): brown, medium bedding, fine to coarse SANDSTONE, few fine gravel, clasts quartzite, tuff, basalt, moderate HCl reaction, small roots in discontinuities.	2402.7
8.5	Moderately weathered, thinly bedded, brown, medium grained to very coarse grained, weak rock, CALCAREOUS SANDSTONE, As above.	2398.2
13.5	As above, Becomes more gravelly. Continues brown SANDSTONE medium bedding, silty fine to coarse sand, thin interbeds with fine to coarse gravel, and thin silty interbeds, clasts quartzite, tuff, schist, basalt, very weak HCl reaction.	2393.2
18.0	As above, but slightly weathered with some lost core.	2388.7
23.0	As above, moderately weathered, trace to no HCl reaction.	2383.7
28.0	Becomes Gila Conglomerate (Tcg): thickly bedded, matrix supported, polylithic CONGLOMERATE, coarse sand and fine gravel, some coarse gravel, silty interbeds, clasts are tuff, quartzite, basalt, very weak to no HCl reaction, brown, slightly weathered.	2378.7
33.0	As above, becomes less gravelly.	2373.7
34.0	As above.	2372.7
39.0	Becomes SANDSTONE, thickly bedded, fine to coarse sand, little fine to coarse gravel, clasts are tuff, quartzite, gneiss, weak to moderate HCl reaction, brown.	2367.7
43.0	Becomes matrix supported, polylithic CONGLOMERATE, thickly bedded, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2363.7
48.0	As above, becomes weak to no HCl reaction.	2358.7
53.0	As above.	2353.7
58.0	Becomes SANDSTONE, thickly bedded, fine to coarse sand, little fine to coarse gravel, clasts are tuff, quartzite, gneiss, weak to moderate HCl reaction, brown.	2348.7
	As above, silty interbeds, small fault.	

Log continued on next page



RUN NO.	CORE RECOVERY %
1	33
2	84
3	100
4	100
5	100
6	100
7	100
8	100
9	100
10	100
11	100
12	100
13	100
14	100
15	100

NOTES:

26: lost circulation

30: Drillers set casing to 30 ft, surface circulation returned

44 - 303: Hydro test #1 SI

59: Core tube slipped, core is stuck inside the

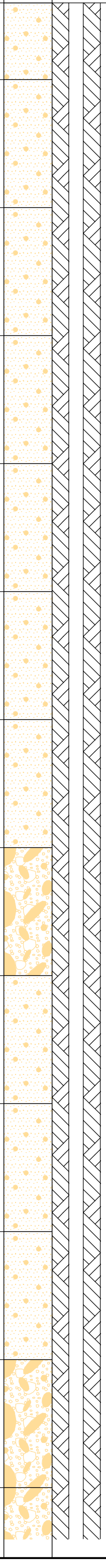
DRILLING CO.: Boart Longyear
DRILLER:
DRILL RIG: BK-30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT:	RCML Near West TSF	DRILLING START:	September 21, 2016 15:26	SHEET:	2 of 8
PROJECT NO.:	1531436	DRILLING END:	September 26, 2016 16:26	GS ELEV.:	2406.7
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 838,455 E: 923,219	TOC ELEV.:	na
				DATUM:	



DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0	As above, silty interbeds, small fault. *(continued)*	2346.7				15	100	core barrel. Drillers trip out the core barrel to remove it.	
65		63.0	As above.	2343.7				16	100		
70		68.0	As above, more silty interbeds.	2338.7				17	100		
75		73.0	As above. Some iron staining on discontinuities.	2333.7				18	100		
80		78.0	As above, fewer silty interbeds.	2328.7				19	100		
85		83.0	As above, few cobbles.	2323.7				20	100		
90		88.0	As above, some drilling damage to this run.	2318.7				21	100		
95		93.0	Becomes matrix supported, polylithic CONGLOMERATE, thickly bedded, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2313.7				22	100		
100		98.0	Becomes SANDSTONE, thickly bedded, fine to coarse sand, little fine to coarse gravel, clasts are tuff, quartzite, gneiss, weak to moderate HCl reaction, brown.	2308.7				23	100		
105		103.0	As above, quartzite cobble.	2303.7				24	100		
110		108.0	As above, tuff cobble.	2298.7				25	100		
115		113.0	Becomes matrix supported, polylithic CONGLOMERATE, thickly bedded, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2293.7				26	100		
120		118.0	As above, few cobbles.	2288.7				27	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:		CHECKED:	G Smith
DRILL RIG:	BK-30	REVIEWED:	R Post

Golder Associates

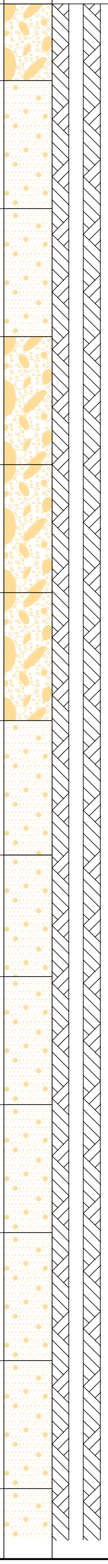
DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 21, 2016 15:26
DRILLING END: September 26, 2016 16:26
COORDINATES: N: 838,455 E: 923,219

SHEET: 3 of 8
GS ELEV.: 2406.7
TOC ELEV.: na
DATUM:



DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0	As above, few cobbles. *(continued)*	2286.7		27	100		
		123.0	Becomes SANDSTONE, thickly bedded, fine to coarse sand, little fine to coarse gravel, clasts are tuff, quartzite, gneiss, weak to moderate HCl reaction, brown.	2283.7		28	100		
		128.0	Becomes fine to coarse sand, few fine to coarse gravel.	2278.7		29	100		
		133.0	Becomes matrix supported, polylithic CONGLOMERATE, thickly bedded, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2273.7		30	100		
		138.0	As above.	2268.7		31	100		
		143.0	As above.	2263.7		32	100		
		148.0	Becomes SANDSTONE, fine to coarse sand, little fine to coarse gravel, clasts are tuff, quartzite, gneiss, weak to moderate HCl reaction, brown.	2258.7		33	101	148: Broken core at top of run from overdrilling.	
		153.3	As above, gravel interbed 154-155.5	2253.5		34	101		
		158.0	As above, silty fine to coarse sand, trace fine to coarse gravel, silty interbeds.	2248.7		35	100		
		163.0	As above.	2243.7		36	100		
		168.0	As above.	2238.7		37	100		
		173.0	As above, becomes few quartz and tuff cobbles, little fine to coarse gravel, weak to no HCl reaction.	2233.7		38	100		
		178.0	As above, gravelly.	2228.7		39	100		
180									

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER:
DRILL RIG: BK-30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

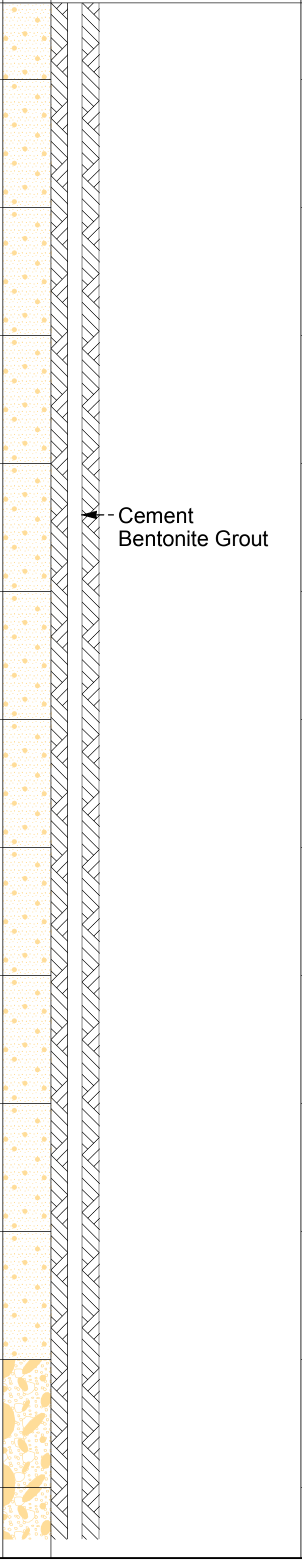
RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 21, 2016 15:26
DRILLING END: September 26, 2016 16:26
COORDINATES: N: 838,455 E: 923,219

SHEET: 4 of 8
GS ELEV.: 2406.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above, gravelly. *(continued)*	2226.7		39	100		
185		183.0	As above.	2223.7		40	100		
190		188.0	As above.	2218.7		41	100		
195		193.0	As above.	2213.7		42	100		
200		198.0	As above.	2208.7		43	100		
205		203.0	As above, silty interbeds, clasts are quartzite, tuff, schist, few basalt.	2203.7		44	96		
210		208.0	As above.	2198.7		45	96		
215		213.0	As above.	2193.7		46	100		
220		218.0	As above.	2188.7		47	100		
225		223.0	As above.	2183.7		48	100		
230		228.0	As above.	2178.7		49	100		
235		233.0	Becomes matrix supported, polylithic CONGLOMERATE, thickly bedded, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2173.7		50	100		
240		238.0	As above, some coarse gravel.	2168.7		51	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER:
DRILL RIG: BK-30

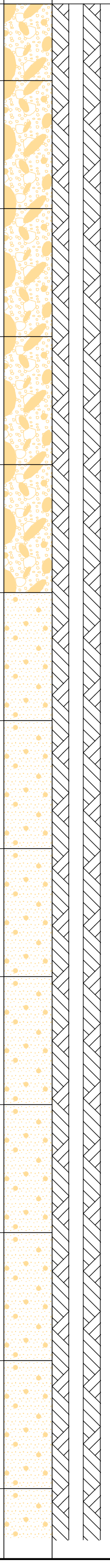
LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT:	RCML Near West TSF	DRILLING START:	September 21, 2016 15:26	SHEET:	5 of 8
PROJECT NO.:	1531436	DRILLING END:	September 26, 2016 16:26	GS ELEV.:	2406.7
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 838,455 E: 923,219	TOC ELEV.:	na
				DATUM:	



DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above, some coarse gravel. *(continued)*	2166.7		51	100		
245		243.0	As above, silty fine to coarse sand.	2163.7		52	100		
250		248.0	As above, more coarse gravel and cobbles.	2158.7		53	100		
255		253.0	As above.	2153.7		54	100	254: Fracturing at 257 from overdrilling the run.	
260		258.0	As above.	2148.7		54	100		
265		263.0	Becomes SANDSTONE, poorly sorted fine to coarse sand, silty matrix, little fine gravel, trace coarse gravel, clasts are quartz, gneiss, schist, quartzite, very weak to no HCl reaciton, brown.	2143.7		55	100		
270		268.0	As above, few cobbles.	2138.7		56	100		
275		273.0	As above, gravel interbeds.	2133.7		57	100		
280		278.0	As above.	2128.7		58	100	278: Fractures in core from overdrilling run.	
285		283.0	As above.	2123.7		59	100		
290		288.0	As above, clasts predominantly schist, quartzite, and tuff with trace other lithologies, very weak to no HCl reaction in matrix.	2118.7		60	100		
295		293.0	As above.	2113.7		61	100		
300		298.0	As above.	2108.7		62	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:		CHECKED:	G Smith
DRILL RIG:	BK-30	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:44
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

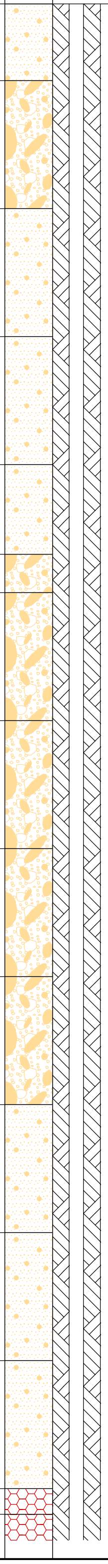
DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 21, 2016 15:26
DRILLING END: September 26, 2016 16:26
COORDINATES: N: 838,455 E: 923,219

SHEET: 6 of 8
GS ELEV.: 2406.7
TOC ELEV.: na
DATUM:



BORING METHOD	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
HQ3	300.0	As above. *(continued)*	2106.7		62	100		
	303.0	Gila conglomerate (Tcg): fine sand to coarse gravel, poorly sorted, clasts predominantly tuff, quartzite, and breccia, little schist, trace other lithics, weak to no HCl reaction, brown.	2103.7		63	100		
	308.0	Gila conglomerate (Tss): silty fine to coarse sand, little fine gravel, silty interbeds, clasts predominantly schist, tuff, quartzite, trace limestone and other lithics, weak to no HCl reaction, brown.	2098.7		64	100		
	313.0	As above	2093.7		65	100		
	318.0	As above.	2088.7		66	100		
	321.5	321.5-323 gravel and cobbles, tuff and schist, matrix supported	2085.2					
	323.0	Becomes matrix supported, polylithic CONGLOMERATE, fine to coarse gravel with fine to coarse sand matrix and silty interbeds, clasts are quartzite, tuff, basalt, diabase, schist, weak to moderate HCl reaction, brown.	2083.7		67	100		
	328.0	As above.	2078.7		68	100		
	333.0	As above.	2073.7		69	100		
	338.0	As above, with fine to coarse gravel interbeds.	2068.7		70	100		
	343.0	Becomes SANDSTONE medium to thickly bedded, interbedded silty fine sand, silt beds, and fine to coarse sand with trace fine gravel, weak to no HCl reaction, brown.	2063.7		71	100		
	348.0	As above.	2058.7		72	100		
	353.0	As above, volcaniclastic, fine to coarse sand, brown, moderate HCl reaction.	2053.7		73	100	354 - 424: Hydro test #2 SI	
	358.0		2048.7		74	100		
	359.0	Becomes BASALT, dark brown, vesicles infilled with quartz and calcite.	2047.7		75	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER:
DRILL RIG: BK-30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

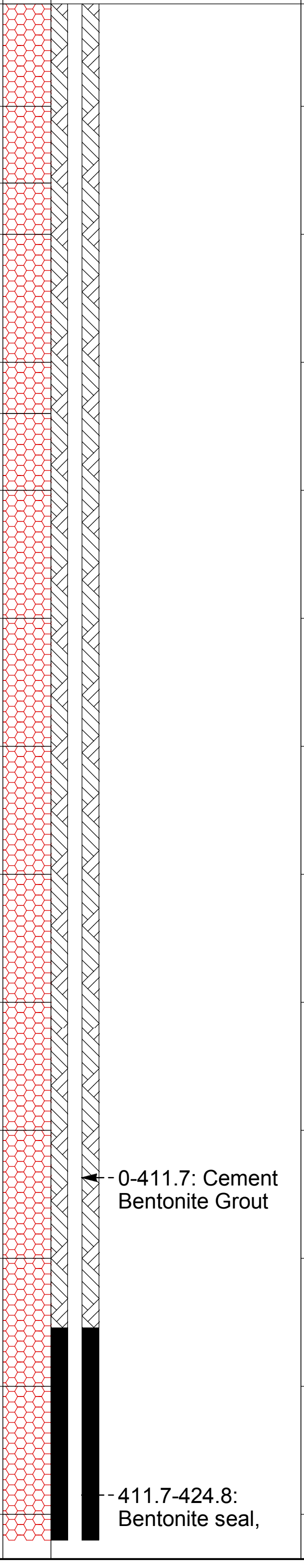
DRILLING START: September 21, 2016 15:26
DRILLING END: September 26, 2016 16:26
COORDINATES: N: 838,455 E: 923,219

SHEET: 7 of 8
GS ELEV.: 2406.7
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth (ft)	DESCRIPTION	Elev	USCS
360.0	As above. Few voids. Pockets of volcaniclastic sediments. Dark brown to dark red brown *(continued)*	2046.7	
364.0	As above.	2042.7	
367.0	Becomes flow brecciated BASALT, altered and weak, argillized, minor calcite stockwork, red brown.	2039.7	
369.0	As above with calcite stockwork.	2037.7	
374.0	As above.	2032.7	
376.0	As above, vesicular with breccia veins.	2030.7	
379.0	Continues BASALT breccia, few voids, intermittent calcite stockwork, zeolites.	2027.7	
384.0	As above.	2022.7	
389.0	As above, vesicular, calcite/quartz infilling and veining, few voids with zeolites.	2017.7	
394.0	As above.	2012.7	
399.0	As above.	2007.7	
404.0	Continues BASALT, dark brown, minor calcite stockwork and vesicles, few discontinuous voids.	2002.7	
409.0	As above.	1997.7	
414.0	As above.	1992.7	
419.0	As above.	1987.7	

Log continued on next page



CORE INFO

Depth (ft)	RUN NO.	CORE RECOVERY %
360.0–364.0	75	100
364.0–369.0	76	100
369.0–374.0	77	100
374.0–379.0	78	100
379.0–384.0	79	100
384.0–389.0	80	100
389.0–394.0	81	100
394.0–399.0	82	100
399.0–404.0	83	100
404.0–409.0	84	100
409.0–414.0	85	100
414.0–419.0	86	100
419.0–	86	100

DRILLING CO.: Boart Longyear
DRILLER:
DRILL RIG: BK-30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

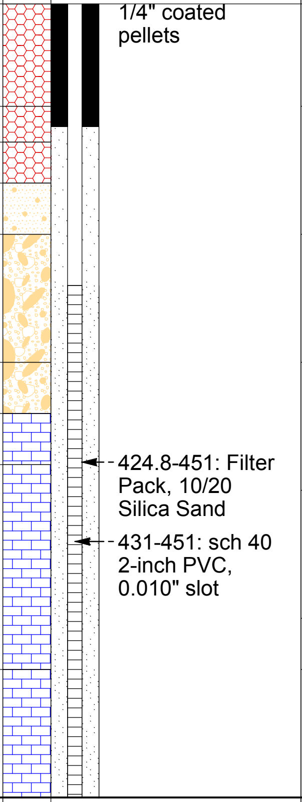
RECORD OF BOREHOLE DH16-01 (GT-14)

PROJECT:	RCML Near West TSF	DRILLING START:	September 21, 2016 15:26	SHEET:	8 of 8
PROJECT NO.:	1531436	DRILLING END:	September 26, 2016 16:26	GS ELEV.:	2406.7
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 838,455 E: 923,219	TOC ELEV.:	na
				DATUM:	

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION
420.0	1986.7	As above. *(continued)*
424.0	1982.7	As above.
425.4	1981.3	Becomes contact between SANDSTONE and BASALT, red brown, strong HCl reaction.
427.0	1979.7	
429.0	1977.7	Becomes volcaniclastic, orange brown SANDSTONE, poorly sorted fine to coarse sand and fine gravel, clasts are weathered basalt, basalt, quartzite, CaCO3 cementation.
434.0	1972.7	Becomes volcaniclastic CONGLOMERATE, altered, poorly sorted, fine gravel to cobbles, matrix (fine to coarse sand) supported, CaCO3 cementation, clasts weathered basalt.
436.0	1970.7	As above.
438.0	1968.7	Becomes Mescal Limestone (pCmls): pinkish gray brown, fine grained LIMESTONE, silicified. As above, weakly calcareous sediments, zones of alteration and brecciation, little iron staining.
446.0	1960.7	As above.
451.0	1955.7	Bottom of borehole at 451.0 ft. Completed as well. Refer to diagram.

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
86	100
87	100
88	100
89	100
90	100
91	100
92	100

NOTES

435 - 451: Hydro test #3 SI & CRI

445: Lost surface circulation.

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:		CHECKED:	G Smith
DRILL RIG:	BK-30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-02 (GT-8)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 28, 2016 07:15
DRILLING END: October 2, 2016 11:40
COORDINATES: N: 840,618 E: 919,190

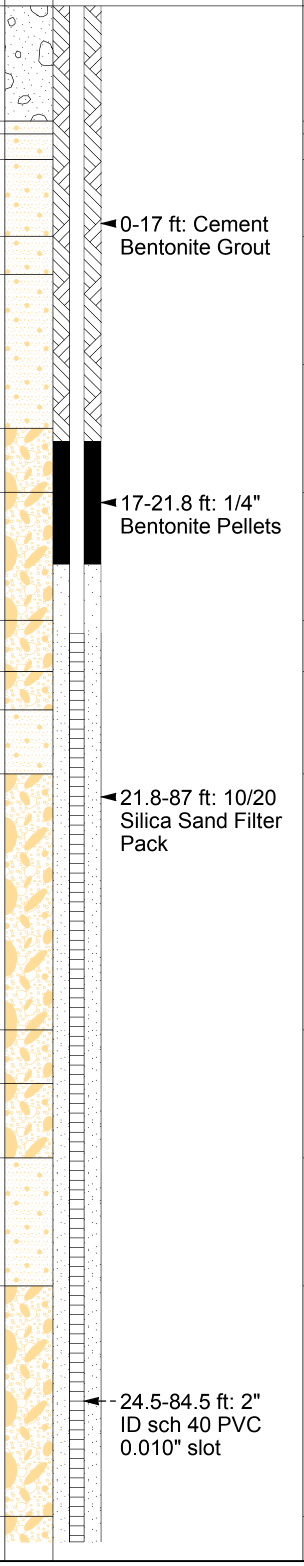
SHEET: 1 of 5
GS ELEV.: 2391.1
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev
0.0	Surface residual soil, no recovery.	2391.1
4.5		2386.6
5.0	Gila Sandstone (Tss): fine to coarse SANDSTONE, light brown, mainly schist, low to non HCL reaction	2386.1
6.0	As above. As above, some gravel.	2385.1
9.0	No recovery	2382.1
10.5	Continues fine to coarse SANDSTONE with some fine gravel, matrix supported, clasts of schist, gneiss, quartzite, light brown.	2380.6
16.5	Becomes Gila conglomerate (Tcg): matrix supported, polylithic CONGLOMERATE, gravel to cobble clasts consisting of gneiss, quartzite, schist, tuff, matrix has moderate HCl reaction, light brown.	2374.6
19.0	As above.	2372.1
24.0	Washed-out coarse gravel with no matrix - clasts of quartzite, schist, tuff.	2367.1
26.0	As above.	2365.1
27.5	Becomes fine to coarse SANDSTONE with few gravel clasts of gneiss, schist, quartz, weak to moderate HCl reaction, brown.	2363.6
30.0	Becomes matrix supported, polylithic CONGLOMERATE, gravel to cobble clasts consisting of gneiss, quartzite, schist, tuff, matrix has moderate HCl reaction, light brown.	2361.1
40.0	As above.	2351.1
42.1	As above.	2349.0
45.0	As above.	2346.1
50.0	As above. 55.9-59: Rock is friable, weak, highly weathered, lost recovery	2341.1
59.0	As above.	2332.1

Log continued on next page



CORE INFO

RUN NO.	CORE RECOVERY %
1	0
2	100
3	100
4	50
5	80
6	90
7	100
8	50
9	88
10	100
11	100
12	96
13	91
14	96

NOTES

0: no drilling additives

24: advanced surface casing to 15 ft (HW pipe)

55 - 99: Hydro test #1 SI

59: core tube slipped, core is stuck inside the

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-02 (GT-8)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 28, 2016 07:15
DRILLING END: October 2, 2016 11:40
COORDINATES: N: 840,618 E: 919,190

SHEET: 2 of 5
GS ELEV.: 2391.1
TOC ELEV.: na
DATUM:

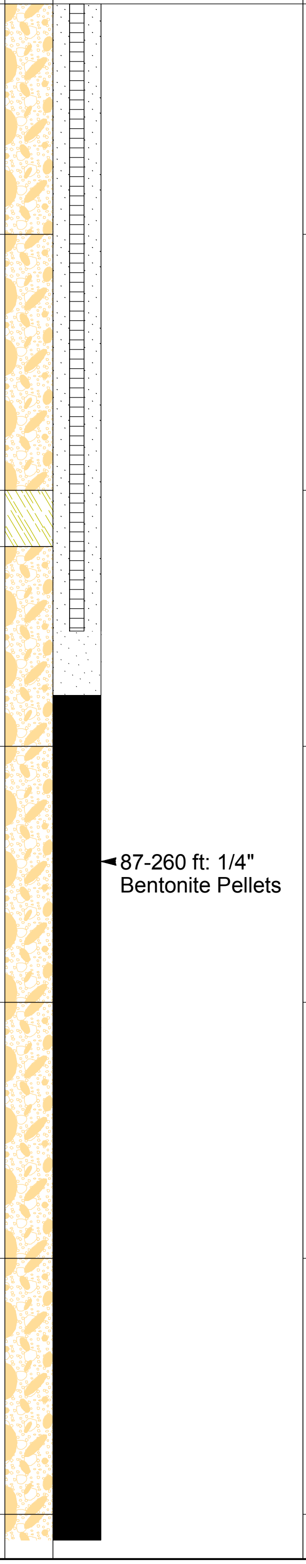
BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
60.0	As above. *(continued)*	2331.1	
69.0	As above.	2322.1	
79.0	Vertical fault zone, upper wall is highly weathered, clayey gougey infill.	2312.1	
81.2	Becomes matrix supported, polylithic CONGLOMERATE, gravel to cobble clasts consisting of gneiss, quartzite, schist, tuff, matrix has moderate HCl reaction, light brown.	2309.9	
89.0	As above.	2302.1	
99.0	As above.	2292.1	
109.0	As above.	2282.1	
119.0	As above, few limestone clasts.	2272.1	

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
14	96
15	91
16	95
17	100
18	100
19	100
20	100

NOTES

core barrel. Drillers trip out the core barrel to remove it.

105 - 250: Hydro test #2 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-02 (GT-8)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 28, 2016 07:15
DRILLING END: October 2, 2016 11:40
COORDINATES: N: 840,618 E: 919,190

SHEET: 3 of 5
GS ELEV.: 2391.1
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0	As above, few limestone clasts. *(continued)*	2271.1		20	100		
		129.0	As above.	2262.1		21	100		
		139.0	As above, large quartzite cobble.	2252.1		22	100		
		144.5	As above, some cobbles, weak to no HCl reaction.	2246.6		23	100		
		150.0	As above, with some schist clasts.	2241.1		24	100		
		160.0	As above, some basalt, rhyolite, chert clasts, weak HCl reaction.	2231.1		25	100		
		170.0	As above, some cobbles, clasts basalt, quartzite, diabase, gneiss, quartzite.	2221.1		26	100		
180		180.0		2211.1					

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-02 (GT-8)

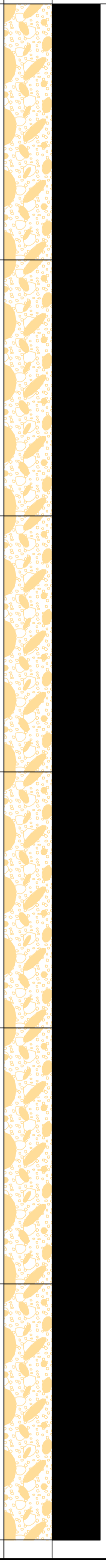
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 28, 2016 07:15
DRILLING END: October 2, 2016 11:40
COORDINATES: N: 840,618 E: 919,190

SHEET: 4 of 5
GS ELEV.: 2391.1
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above.	2211.1		27	100		
190		190.0	Continues matrix supported, polylithic CONGLOMERATE, gravel to cobble clasts consisting of gneiss, quartzite, schist, tuff, matrix has moderate HCl reaction, light brown.	2201.1		28	100	197 - 260: Hydro test #4 SI	
200		200.0	As above, few calcite veins.	2191.1		29	99		
210		210.0	As above, clasts become tuff cobbles, quartzite, chert, diabase.	2181.1		30	100		
220		220.0	As above. Some diabase clasts	2171.1		31	100		
230		230.0	As above.	2161.1		32	100	237 - 250: Hydro test #3 SI	
240		240.0		2151.1					

GRAPHIC LOG / WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

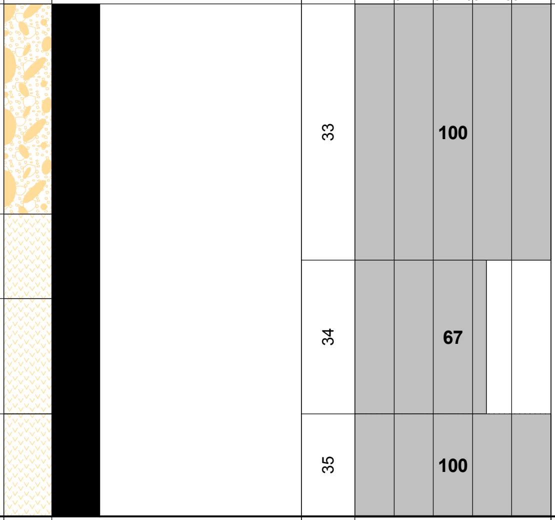
RECORD OF BOREHOLE DH16-02 (GT-8)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: September 28, 2016 07:15
DRILLING END: October 2, 2016 11:40
COORDINATES: N: 840,618 E: 919,190

SHEET: 5 of 5
GS ELEV.: 2391.1
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0		2151.1					
			As above.			33	100		
		248.2		2142.9					
			Contact zone with Apache Leap Tuff (Talg), highly weathered, TUFF, clayey, friable and weak. Some iron staining.						
		251.5		2139.6					
			As above, small vesicles, few quartz phenocrysts.			34	67		
		256.0		2135.1					
			As above.			35	100		
260		260.0		2131.1					
			Bottom of borehole at 260.0 ft. Completed as well. Refer to diagram.						



DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-03 (GT-7)

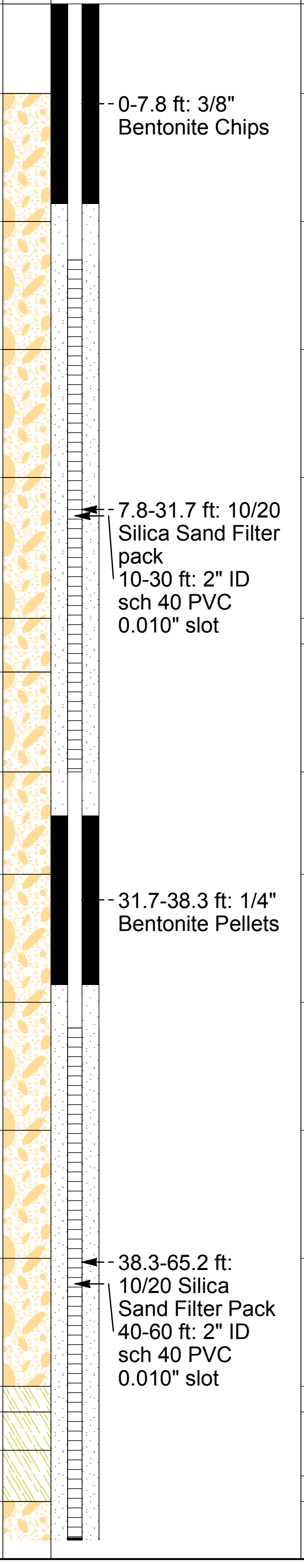
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Up 252 from GT8

DRILLING START: October 2, 2016 14:45
DRILLING END: October 6, 2016 17:05
COORDINATES: N: 842,614 E: 918,055

SHEET: 1 of 3
GS ELEV.: 2487.7
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth (ft)	DESCRIPTION	Elev	USCS
0.0	No recovery, surface soils.	2487.7	
3.5	Gila conglomerate (Tcg): matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction.	2484.2	
8.5	As above, becomes more fine to coarse sand.	2479.2	
13.5	As above.	2474.2	
18.5	As above, matrix is weathered and weak.	2469.2	
24.0	Becomes faulted and completely weathered, matrix partially washed out from drilling.	2463.7	
26.1	Continues matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction, slightly weathered.	2461.6	
30.0	As above, few tuff clasts.	2457.7	
34.0	As above.	2453.7	
39.0	As above, predominantly coarse gravel, clast supported.	2448.7	
44.0	Gila conglomerate (Tcg): fine to coarse gravel with fine to coarse sand, matrix supported, brown, clasts gneiss, schist, quartzite, diabase, brown, no HCl reaction.	2443.7	
49.0	As above, with completely weathered zone, weak HCl reaction.	2438.7	
54.0		2433.7	
55.0	Becomes completely weathered, Fault zone, coarse gravel with partially washed out matrix.	2432.7	
56.5	Continues Fault zone, matrix washed out.	2431.2	
58.5	Continues rubble zone, corestones of Gila conglomerate in loose gravel.	2429.2	



CORE INFO

RUN NO.	CORE RECOVERY %
1	100
2	100
3	100
4	91
5	100
6	100
7	100
8	100
9	100
10	100
11	100
12	100
13	80
14	50
15	100

NOTES

45 - 59: Hydro test #2 SI & CRI

55.5 - 58: Drillers lose surface circulation, zone taking a lot of water.

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-03 (GT-7)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Up 252 from GT8

DRILLING START: October 2, 2016 14:45
DRILLING END: October 6, 2016 17:05
COORDINATES: N: 842,614 E: 918,055

SHEET: 2 of 3
GS ELEV.: 2487.7
TOC ELEV.: na
DATUM:

BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
HQ3	60.0		2427.7					
	63.5	Becomes matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction, slightly weathered. *(continued)*	2424.2		15	100		
	68.5	As above, matrix to clast supported, few cobbles.	2419.2		16	100	64 - 164: Hydro test #1 SI & CRI	
	73.5	As above, fine to coarse gravel and coarse sand, clast supported.	2414.2		17	96		
	78.5	As above.	2409.2		18	100		
	83.5	As above.	2404.2		19	100		
	88.5	As above.	2399.2		20	100		
	93.5	As above, weak HCl reaction.	2394.2		21	100		
	98.5	Continues matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction, slightly weathered.	2389.2		22	100		
	103.5	Becomes fine to coarse SANDSTONE, little gravel, brown, tuff, quartz, chert, limestone, diabase, weak HCl reaction.	2384.2		23	100		
	109.0	Becomes matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction, slightly weathered.	2378.7		24	100		
	114.0	As above.	2373.7		25	100		
	119.0	As above, few limestone clasts.	2368.7		26	100	114 - 164: Hydro test #3 SI	
		As above few cobbles.			27	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK-30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-03 (GT-7)

PROJECT:	RCML Near West TSF	DRILLING START:	October 2, 2016 14:45	SHEET:	3 of 3
PROJECT NO.:	1531436	DRILLING END:	October 6, 2016 17:05	GS ELEV.:	2487.7
LOCATION:	Up 252 from GT8	COORDINATES:	N: 842,614 E: 918,055	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE

BORING METHOD	Depth	DESCRIPTION	Elev	USCS
HQ3	120.0	As above few cobbles. *(continued)*	2367.7	
	124.0	As above no cobbles.	2363.7	
	126.0	As above, weak HCl reaction.	2361.7	
	131.0	As above, few limestone clasts.	2356.7	
	136.0	Continues matrix supported, polylithic CONGLOMERATE fine to coarse gravel, fine to coarse sandy matrix, clasts: gneiss, quartz, schist, no HCl reaction, slightly weathered.	2351.7	
	139.0	As above.	2348.7	
	144.0	As above.	2343.7	
	149.0	As above.	2338.7	
	154.5	As above.	2333.2	
	161.0	Becomes Apache leap Tuff (Talg), fine grained, TUFF, whitish gray, fresh.	2326.7	
	164.0	Bottom of borehole at 164.0 ft. Completed as well. Refer to diagram.	2323.7	

WELL DIAGRAM

CORE INFO

RUN NO.	CORE RECOVERY %
27	100
28	100
29	100
30	100
31	100
32	100
33	100
34	100
35	96
36	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK-30	REVIEWED:	R Post

Golder Associates

DRAFT

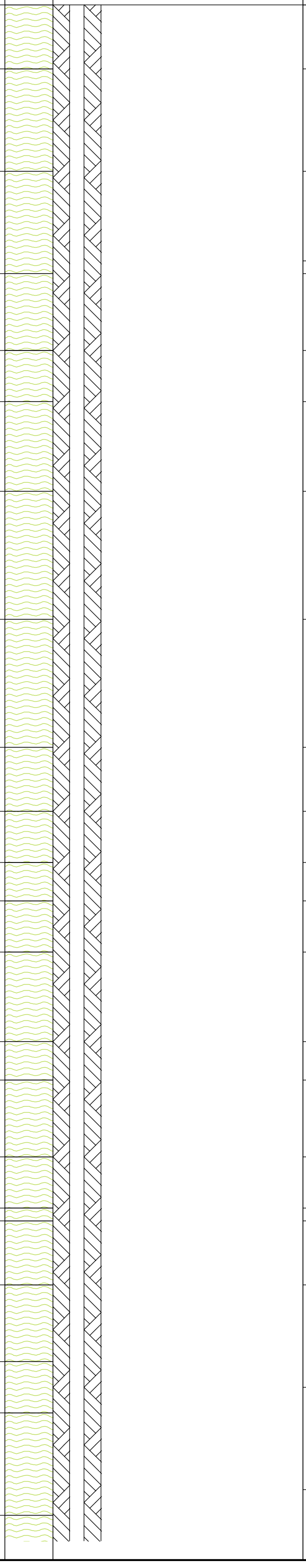
RECORD OF BOREHOLE DH16-04 (GT-41)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 6, 2016 14:10
DRILLING END: October 10, 2016 09:30
COORDINATES: N: 840,821 E: 916,971

SHEET: 1 of 4
GS ELEV.: 2429.4
TOC ELEV.: na
DATUM:

BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
HQ3	0.0	Completely weathered surface outcroppings of steeply dipping schist, iron oxide staining	2429.4		1	20	0 - 35: Hydro test #1 FHT	
	2.5	Pinal schist (pCpi): interbedded SCHIST and METASILTSTONE, foliated, crenulated, weathered, jointed, FeOx and MnOx staining and faulting.	2426.9		2	100		
	6.5	As above.	2422.9		3 4	100 100		
	10.5	Continues gray, METASILTSTONE partial iron staining, faulted and crushed.	2418.9		5	100		
	13.5	Becomes entirely crushed, breccia and sand, trace clay, little iron staining. Drillers note they are losing some fluid.	2415.9		6	100		
	15.5	Becomes gray METASANDSTONE, fine to med grained, jointed with minor faulting, interbeds of METASILTSTONE are foliated and weak, trace iron staining.	2413.9		7	100		
	19.0	As above.	2410.4		8	100	23 - 50: Hydro test #2 SI & CRI	
	24.0	As above, with faults, little iron staining across fault.	2405.4		9	100		
	29.0	Continues METASILTSTONE, foliated, crenulated, fine grained, gray, brecciated and crushed, trace chloritic alteration, MnOx dendrites.	2400.4		10	100		
	31.5	As above, quartz veins.	2397.9		11	100		
	33.5	As above.	2395.9		12	100	35: drillers set surface casing to 5ft	
	35.0	As above, with more clayey gouge.	2394.4		13	100		
	37.0	As above.	2392.4		14	100		
	40.5	As above.	2388.9		15	100		
	42.0	As above.	2387.4		16	50		
	45.0	As above.	2384.4		17	100		
	47.0	As above.	2382.4		18	100		
	47.5	Becomes purple gray, METASANDSTONE, fine to med grained, calcite veining, extensive iron staining on all discontinuities, broken.	2381.9		19	100		
	50.0	Becomes fault gouge, sandy clay, some breccia.	2379.4		20	38		
	53.0	Becomes METASANDSTONE brownish gray, fine to med grained, foliated, boudined quartz veins, calcite veining, fractured, iron oxide staining on discontinuities.	2376.4		21	50		
	55.0	Fault gouge, sandy clay.	2374.4					
	59.0	As above.	2370.4		21	75		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-04 (GT-41)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

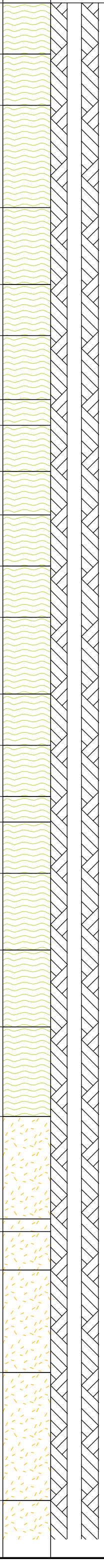
DRILLING START: October 6, 2016 14:10
DRILLING END: October 10, 2016 09:30
COORDINATES: N: 840,821 E: 916,971

SHEET: 2 of 4
GS ELEV.: 2429.4
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
60.0		2369.4	
62.0	As above. *(continued)*	2367.4	
64.0	As above.	2365.4	
68.0	Becomes gray to brown gray, interbeds of SCHIST and METASANDSTONE, foliated along bedding, crenulated, boudined quartz, brecciated zones, few calcite veins.	2361.4	
71.0	As above, brecciated.	2358.4	
73.0	As above.	2356.4	
75.5	As above.	2353.9	
76.5	As above.	2352.9	
78.3	As above, quartz vein.	2351.1	
80.0	Becomes gray, interbedded METASILTSTONE and METASANDSTONE, fine grained, boudined quartz veins, strong.	2349.4	
82.0	As above, broken.	2347.4	
84.0	Poor recovery, brownish gray breccia and sand, iron oxide staining on discotinuities.	2345.4	
87.0	Becomes pinkish gray, medium grained, SCHIST, foliated along bedding, iron oxide staining throughout and on discontinuities, fractured, trace fine grained garnets.	2342.4	
89.0	As above, but with zone of gougey crushed rock.	2340.4	
91.0	As above.	2338.4	
92.0	As above.	2337.4	
94.0	As above.	2335.4	
97.0	As above.	2332.4	
100.0	Becomes gray brown, interbedded METASANDSTONE and METASILTSTONE, foliated along bedding, quartz boudins, fractured, iron oxide haloes around joints.	2329.4	
103.5	Contact with intrusive, poor recovery.	2325.9	
107.5	Becomes dark greenish gray, DIABASE, aphanitic, foliated, brecciated, extensive iron oxide staining on fracture surfaces.	2321.9	
108.0		2321.4	
109.5	As above, some calcite.	2319.9	
113.5	Continues dark greenish gray, DIABASE, aphanitic to very fine grained phaneritic, fabric slightly foliated, quartz veining, fractured with FeOx (limonite and hematite) coating all fracture surfaces, with partial healing by calcite veins.	2315.9	
	As above, trace calcite in fractures.		
118.5	As above, becomes less fractured.	2310.9	
	As above.		



CORE INFO

RUN NO.	CORE RECOVERY %
21	75
22	75
23	100
24	100
25	75
26	80
27	100
28	100
29	100
30	50
31	83
32	60
33	100
34	100
35	100
36	100
37	100
38	67
39	60
40	50
41	100
42	100
43	100
44	100
45	100

NOTES

79 - 108: Hydro test #3 SI & CRI

87: Driller notes he is losing ~ 40% fluid circulation, and increasing.

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-04 (GT-41)

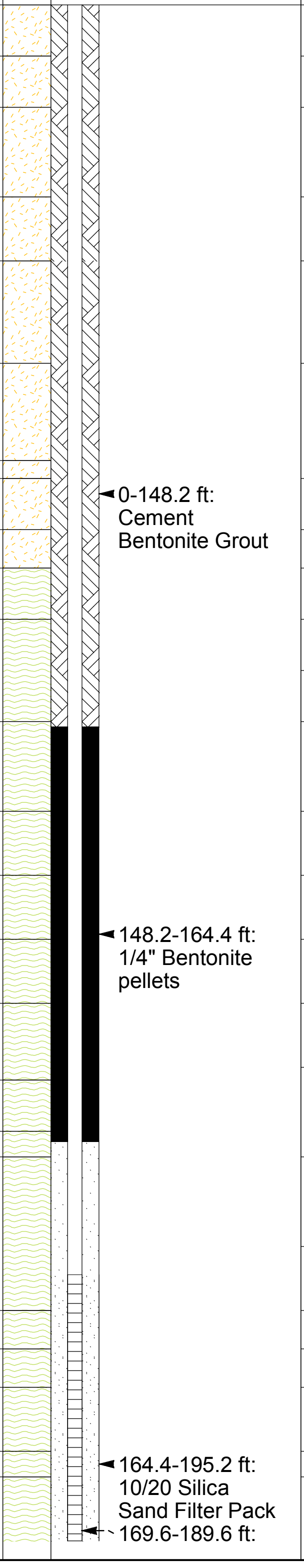
PROJECT:	RCML Near West TSF	DRILLING START:	October 6, 2016 14:10	SHEET:	3 of 4
PROJECT NO.:	1531436	DRILLING END:	October 10, 2016 09:30	GS ELEV.:	2429.4
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 840,821 E: 916,971	TOC ELEV.:	na
				DATUM:	

BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
120.0		2309.4	
	As above. *(continued)*		
122.0		2307.4	
	Becomes extensively fractured, but completely healed with calcite.		
124.0		2305.4	
	Continues dark greenish gray, DIABASE, aphanitic, fabric slightly foliated, quartz veining, fractured with FeOx coating all fracture surfaces, with zones of healing by calcite veins.		
127.5		2301.9	
	As above but becomes completely brecciated, partially healed.		
130.0		2299.4	
	As above.		
134.0		2295.4	
	As above, lightly fractured and jointed with FeOx coating all fracture surfaces, completely healed with calcite veins.		
137.8		2291.6	
138.5	As above.	2290.9	
	As above, less brecciated.		
140.5		2288.9	
	Contact with host rock, very poor recovery.		
142.0		2287.4	
	Becomes Pinal schist (pCpi): METASILTSTONE, pinkish brown, fine grained, highly fractured, large quartz veins.		
144.0		2285.4	
	As above.		
148.0		2281.4	
	As above.		
151.5		2277.9	
	As above, highly fractured.		
154.0		2275.4	
	As above, gougey fault zone.		
156.5		2272.9	
	Becomes gray, METASANDSTONE, lightly foliated, trace calcite veining, fractured zones.		
159.0		2270.4	
	As above.		
162.0		2267.4	
	As abvoe, crushed gougey rock with little iron oxide staining.		
164.0		2265.4	
165.0	Continues gray, interbedded METASANDSTONE and METASILTSTONE, foliated, slightly crenulated, fractured zones.	2264.4	
	Becomes fault zone.		
171.0		2258.4	
172.5	Continues pink gray, interbedded METASANDSTONE and METASILTSTONE, foliated, slightly crenulated, fractured zones.	2256.9	
174.0		2255.4	
	No recovery.		
	As above.		
176.5		2252.9	
177.5	As above.	2251.9	
	As above.		

Log continued on next page



0-148.2 ft: Cement Bentonite Grout

148.2-164.4 ft: 1/4" Bentonite pellets

164.4-195.2 ft: 10/20 Silica Sand Filter Pack

169.6-189.6 ft:

CORE INFO

RUN NO.	CORE RECOVERY %
45	100
46	100
47	100
48	100
49	100
50	100
51	75
52	33
53	100
54	100
55	100
56	91
57	100
58	100
59	100
60	100
61	57
62	71
63	40
64	100
65	20
66	80
67	100
68	57

NOTES

177.5 - 181: Driller notes zone is taking some water, poor recovery.

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

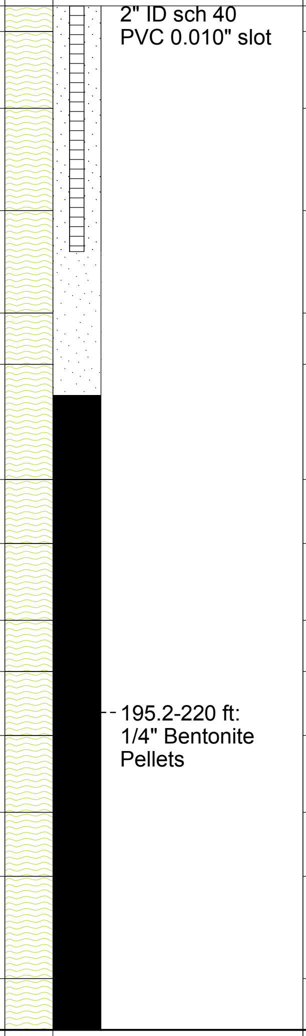
DRAFT

RECORD OF BOREHOLE DH16-04 (GT-41)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona
DRILLING START: October 6, 2016 14:10
DRILLING END: October 10, 2016 09:30
COORDINATES: N: 840,821 E: 916,971
SHEET: 4 of 4
GS ELEV.: 2429.4
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Description	Elev	Run No.	Core Recovery %	Notes
180.0		2249.4			
181.0	As above. *(continued)*	2248.4	68	57	
184.0	Very poor recovery, rubble only, iron oxide staining.	2245.4	69	33	
188.0	Becomes gray, fine grained, METASILTSTONE, foliated on bedding, some crenulations, some calcite and FeOx along foliations.	2241.4	70	75	
192.0	As above.	2237.4	71	100	189 - 220: Hydro test #4 SI
194.0	As above.	2235.4	72	100	
198.5	As above.	2230.9	73	100	
201.0	As above, but more fractured.	2228.4	74	68	
204.0	As above.	2225.4	75	100	
206.0	As above, brecciated, trace staining on discontinuities.	2223.4	76	100	
208.5	Rock as above, but competent with gougey fault zone.	2220.9	77	92	
211.5	Continues pinkish gray, fine to medium grained, METASANDSTONE foliated, sheared, brecciated and partially healed, some calcite stockwork, little FeOx staining.	2217.9	78	100	
214.0	As above.	2215.4	79	100	
218.0	As above, increased quartz veining.	2211.4	80	88	
220.0	As above.	2209.4	81	100	



Bottom of borehole at 220.0 ft.
Completed as well. Refer to diagram.

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30
LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 13, 2016 10:30
DRILLING END: October 18, 2016 11:30
COORDINATES: N: 838,291 E: 916,378

SHEET: 1 of 5
GS ELEV.: 2247.0
TOC ELEV.: na
DATUM:

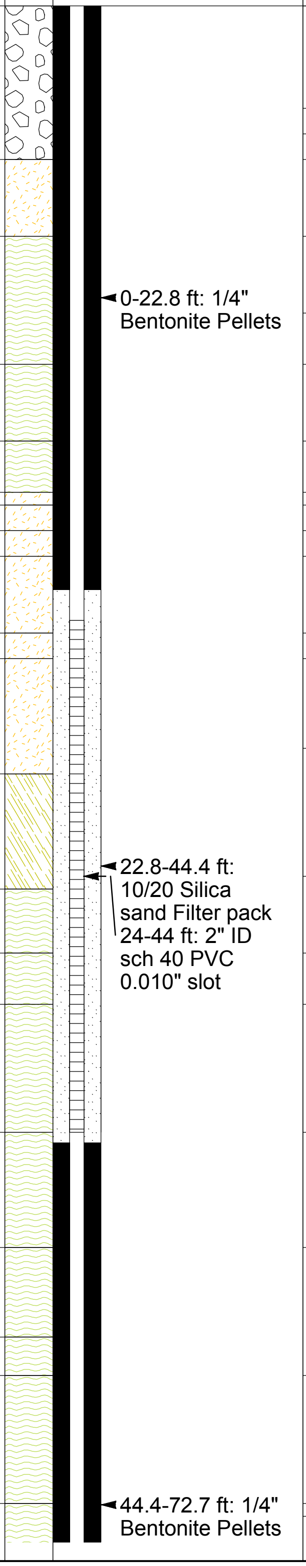
BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2247.0	
	Alluvial material: washed gravels: schist, gneiss, quartzite, and quartz clasts.		
6.0		2241.0	
	Completely weathered DIABASE, clayey gravel with sand, mottled red brown, clasts are dark green, mafic.		
9.0		2238.0	
	Becomes Pinal Schist (pCpi): completely weathered psammitic SCHIST, yellow brown, clayey sand and gravel, some dark green intrusive clasts. SPT blows @ 9 (per 3"): 7-50/3"		
14.0		2233.0	
	Washed gravel, clasts are pinkish brown. SPT blows @ 14 (per 3"): 13-50/1"		
17.0		2230.0	
	As above.		
19.0		2228.0	
	Becomes dark greenish gray, DIABASE, aphanitic intrusive, abundant FeOx on discontinuities.		
19.5		2227.5	
	No recovery.		
20.5		2226.5	
	Continues dark greenish gray, DIABASE, aphanitic intrusive, abundant FeOx on discontinuities, siltstone gravel as well.		
21.5		2225.5	
	As above.		
24.5		2222.5	
	As above, becomes weathered to clay.		
25.5		2221.5	
	Becomes slightly foliated DIABASE, variably altered from very weak rock to soft clay.		
30.0		2217.0	
	Becomes contact DIABASE with Pinal schist, soft clayey, sandy gouge.		
34.5		2212.5	
	Becomes Pinal Schist (pCpi): light pinkish brown, medium grained, psammitic SCHIST, light foliation, fractured and jointed.		
37.0		2210.0	
	As above.		
39.0		2208.0	
	As above.		
44.0		2203.0	
	As above.		
48.5		2198.5	
	As above.		
52.0		2195.0	
	As above, becomes gray.		
53.5		2193.5	
	As above.		
58.5		2188.5	
	As above.		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



0-22.8 ft: 1/4" Bentonite Pellets

22.8-44.4 ft: 10/20 Silica sand Filter pack
24-44 ft: 2" ID sch 40 PVC 0.010" slot

44.4-72.7 ft: 1/4" Bentonite Pellets

CORE INFO

RUN NO.	CORE RECOVERY %
1	25
2	50
3	50
4	17
5	33
6	25
7	33
8	15
9	100
10	0
11	50
12	67
13	50
14	86
15	20
16	83
17	100
18	100
19	100
20	100
21	100
22	100
23	100

NOTES

20: Hole is caving and drillers can't get back to bottom. Cannot perform falling head test because of cave. Drillers to advance casing to 20.
21.5: Driller puts bag of holeplug down hole before start of drilling to help with hole washout.
22: Drillers add some polymer after setting casing to lift sand in hole.
29 - 44: Hydro test #1 FHT

49 - 62: Hydro test #5 SI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39)

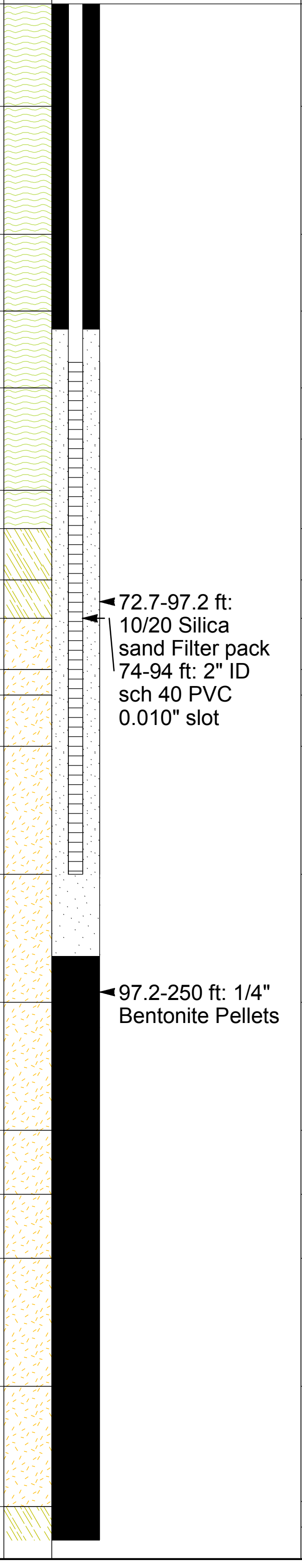
PROJECT:	RCML Near West TSF	DRILLING START:	October 13, 2016 10:30	SHEET:	2 of 5
PROJECT NO.:	1531436	DRILLING END:	October 18, 2016 11:30	GS ELEV.:	2247.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 838,291 E: 916,378	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE — BORING METHOD: HQ3

Depth	DESCRIPTION	Elev	USCS
60.0	As above. *(continued)*	2187.0	
64.0	As above, abundant fine grained boudins.	2183.0	
69.0	As above.	2178.0	
72.0	Continues light brown gray, fine to medium grained, psammitic SCHIST, slightly foliated, healed hairline fractures, trace FeOx staining, faulted.	2175.0	
75.0	As above, fractured.	2172.0	
79.0	As above.	2168.0	
80.5	Contact with intrusive, only washed-out gravel.	2166.5	
82.5	Contact continues as above.	2164.5	
84.0	Becomes dark green, DIABASE, aphanitic, fractured, extensive FeOx on discontinuities.	2163.0	
86.0	As above, slightly phaneritic, slight foliation.	2161.0	
87.0	As above, becomes brecciated.	2160.0	
89.0	Continues dark green gray, DIABASE, aphanitic to very fine grained phaneritic, competent, closed calcite-quartz-epidote veining, calcite and FeOx coated discontinuities, healed fractures,	2158.0	
94.0	As above.	2153.0	
99.0	As above, some open calcite veining.	2148.0	
104.0	As above.	2143.0	
106.5	As above.	2140.5	
109.0	As above.	2138.0	
114.0	As above.	2133.0	
118.7	As above.	2128.3	

Log continued on next page

WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
23	100
24	100
25	93
26	100
27	100
28	100
29	50
30	67
31	100
32	100
33	100
34	100
35	100
36	100
37	100
38	100
39	100
40	100
41	100
42	

NOTES

69 - 99: Hydro test #2 SI & CRI

80.5 - 82: Driller notes that zone is taking water.

86: Driller notes zone taking water.

99 - 189: Hydro test #3 SI & CRI

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 13, 2016 10:30
DRILLING END: October 18, 2016 11:30
COORDINATES: N: 838,291 E: 916,378

SHEET: 3 of 5
GS ELEV.: 2247.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	SOIL PROFILE DESCRIPTION
120.0	2127.0	
120.5	2126.5	As above
123.0	2124.0	As above, large quartz vein.
125.5	2121.5	Becomes Pinal Schist (pCpi): olive gray, fine to medium grained, foliated, SCHIST, small boudined quartz veins and large quartz veins, faults.
127.5	2119.5	
129.0	2118.0	As above with 6" quartz vein.
		Becomes psammitic METASILTSTONE, slightly foliated, quartz and calcite veining, fractured crushed and gougey.
133.0	2114.0	As above.
138.0	2109.0	As above, brownish gray and pinkish gray, calcite crystals on fractures.
141.5	2105.5	Continues interbedded METASILTSONE and METASANDSTONE, foliated and faulted along bedding, fractured with little calcite healing.
146.0	2101.0	As above.
149.0	2098.0	As above weak, fractured throughout.
151.0	2096.0	As above, becomes more schistose.
153.5	2093.5	As above.
156.5	2090.5	Continues gray, medium grained METASANDSTONE, foliated along bedding, schistose, competent.
163.0	2084.0	As above, crenulated.
168.0	2079.0	As above, entirely fractured and crushed, some quartz veining.
172.0	2075.0	As above.
174.5	2072.5	As above, quartz vein.
176.0	2071.0	Becomes brecciated dark gray SCHIST, quartz veining.
179.0	2068.0	

Log continued on next page

CORE INFO

RUN NO.	CORE RECOVERY %
	50
43	40
44	33
45	100
46	80
47	100
48	63
49	100
50	100
51	100
52	100
53	100
54	100
55	100
56	100
57	100
58	50
59	100
60	100
61	100
62	100
63	100

NOTES

153.5 - 156.5: Driller notes losing some circulation.

163 - 168: Driller notes almost full circulation.

168 - 172: Driller notes zone taking a little water.

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

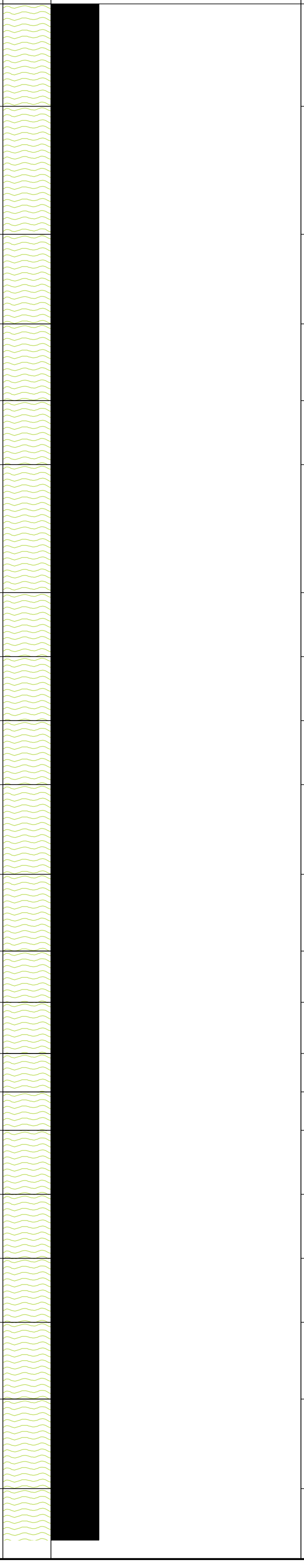
DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 13, 2016 10:30
DRILLING END: October 18, 2016 11:30
COORDINATES: N: 838,291 E: 916,378

SHEET: 4 of 5
GS ELEV.: 2247.0
TOC ELEV.: na
DATUM:



DEPTH (ft)	BORING METHOD	SOIL PROFILE: Depth	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: Elev	USCS	CORE INFO: RUN NO.	CORE INFO: CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0		2067.0					
		184.0	Continues dark gray and pinkish gray, fine grained METASILTSTONE, laminated, tightly folded, foliated, little FeOx staining, quartz veins. *(continued)*	2063.0		63	100		
185		189.0	Becomes pinkish gray to pink, SCHIST, sheared, quartz veins.	2058.0		64	100	184 - 250: Hydro test #4 SI	
190		192.5	Becomes pinkish brown to gray, schistose METASANDSTONE, sheared and foliated along bedding.	2054.5		65	100		
195		195.5	Becomes gray, SCHIST, brecciated with bands of sheared gouge.	2051.5		66	100		
		198.0	As above.	2049.0		67	100		
200		203.0	As above.	2044.0		68	100		
205		205.5	As above, but fractured and faulted throughout.	2041.5		69	80		
		208.0	As above.	2039.0		70	60		
210		210.5	As above.	2036.5		71	100		
		214.0	Becomes gray, medium grained METASANDSTONE with zones of silicification, lightly foliated.	2033.0		72	80		
215		217.0	As above.	2030.0		73	67		
		219.0	As above.	2028.0		74	100		
220		221.0	As above with zones of clayey gouge.	2026.0		75	100		
		222.5	As above, fractured and crushed.	2024.5		76	100		
		224.0	As above.	2023.0		77	100		
225		226.5	As above, fractured and crushed.	2020.5		78	100		
		229.0	As above, clayey gougey crushed rock.	2018.0		79	80		
230		231.5	Becomes olive gray, SCHIST, foliated, faulted and crushed with clayey gouge.	2015.5		80	100		
		234.5	As above.	2012.5		81	100		
235		238.0	As above, fractured, less faulted.	2009.0		82	100		
240			As above, gray to olive gray, fractured throughout.			83	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 13, 2016 10:30
DRILLING END: October 18, 2016 11:30
COORDINATES: N: 838,291 E: 916,378

SHEET: 5 of 5
GS ELEV.: 2247.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2007.0							
	HQ3	241.0		2006.0				83	100		
		243.0	As above.	2004.0				84	100		
245		247.0	As above.	2000.0				85	100		
		249.0	As above.	1998.0				86	100		
250		250.0	As above.	1997.0				87	100		
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-05 (GT-39) Soil

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 13, 2016 10:30
DRILLING END: October 18, 2016 11:30
COORDINATES: N: 838,291 E: 916,378

SHEET: 1 of 1
GS ELEV.: 2247.0
TOC ELEV.: na
DATUM:

DEPTH (ft) | BORING METHOD | SOIL PROFILE | WELL DIAGRAM | CORE INFO | NOTES | ADDITIONAL LAB TESTING

Depth	Elev	USCS
0.0	2247.0	
6.0	2241.0	
9.0	2238.0	GC
14.0	2233.0	
15.0	2232.0	SC
19.0	2228.0	
19.5	2227.5	
20.5	2226.5	
21.5	2225.5	

DESCRIPTION

Washed out by drilling. Recover washed gravel, multi-lithic, schist, quartz, quartzite, gneiss Alluvial material: poor recovery, washed gravels only. Mixed lithics: schist, gneiss, quartzite, quartz.

(GC), CLAYEY GRAVEL, fine to coarse, subrounded to subangular, medium to coarse subrounded to subangular sand, medium plasticity fines, gray-green mottled orange-brown, ALLUVIUM; non-cohesive, dense, w < PL, 2-11-14-14-17-16; clasts dk green, aphanitic, wxd Completely weathered bedrock: clayey gravel with sand, mottled red brown, clasts are dark green, mafic, aphanitic intrusive.

SPT blows @ 6 (per 3")': 2-11-14-14-17-16

Becomes completely weathered psammitic schist, yellow brown, clayey sand and gravel, some dark green intrusive clasts.

SPT blows @ 9 (per 3"): 7-50/3"

(SC), CLAYEY SAND, medium to coarse, subangular to angular, medium plasticity fines, some fine subangular to angular gravel, yellow-brown mottled olive-brown; cohesive, w > PL, 13-50/1" Poor recovery, returns are washed gravel, clasts are pinkish brown silicified metasiltstone.

SPT blows @ 14 (per 3"): 13-50/1"

As above.

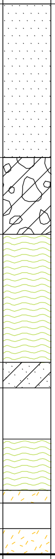
Poor recovery, washed gravel, clasts are dark greenish gray, mafic, aphanitic intrusive, abundant FeOx on discontinuities

No recovery

Poor recovery, clasts mixed intrusive and pinkish gray silicified siltstone

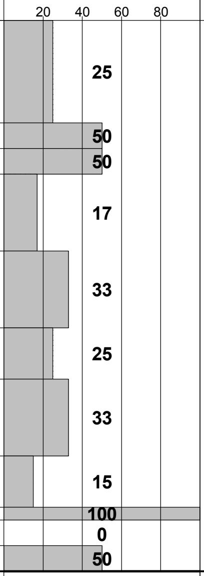
Bottom of borehole at 21.5 ft.
Completed as well. Refer to diagram.

GRAPHIC LOG



CORE INFO

RUN NO.	CORE RECOVERY %
1	25
2	50
3	50
4	17
5	33
6	25
7	33
8	15
9	100
10	0
11	50



DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

DRAFT

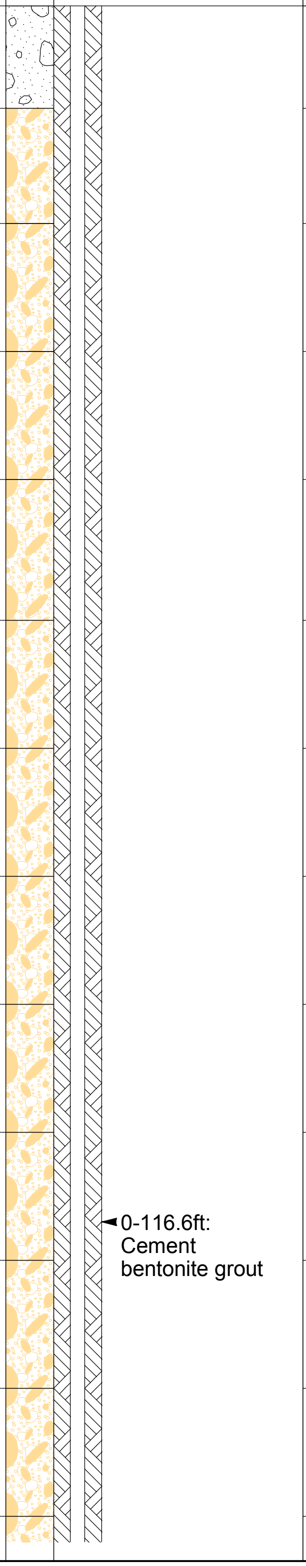
RECORD OF BOREHOLE DH16-06 (GT-21)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 21, 2016 07:55
DRILLING END: October 23, 2016 11:30
COORDINATES: N: 841,669 E: 924,865

SHEET: 1 of 5
GS ELEV.: 2561.6
TOC ELEV.: na
DATUM:

Depth	Elev	DESCRIPTION (SOIL PROFILE)	BORING METHOD	RUN NO.	CORE RECOVERY %	NOTES
0.0	2561.6	Surficial soils, no recovery.	HQ3	1	13	0 - 29: Hydro test #1 FHT
4.0	2557.6	Gila conglomerate (Tcg): no matrix recovered, gneiss, schist, quartz clasts		2	33	
8.5	2553.1	Gila conglomerate (Tcg): slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.		3	90	
13.5	2548.1	As above.		4	88	
18.5	2543.1	As above, becomes clast dominant.		5	100	
24.0	2537.6	As above. Moderate HCl reaction.		6	100	
29.0	2532.6	As above, matrix dominant.		7	100	
34.0	2527.6	As above.		8	96	34 - 64: Hydro test #2 SI
39.0	2522.6	As above, some diabase clasts.		9	100	
44.0	2517.6	As above.		10	100	
49.0	2512.6	As above.		11	100	
54.0	2507.6	As above, strong HCl reaction.		12	100	
59.0	2502.6	As above.		13	100	



WELL DIAGRAM

0-116.6ft: Cement bentonite grout

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

RECORD OF BOREHOLE DH16-06 (GT-21)

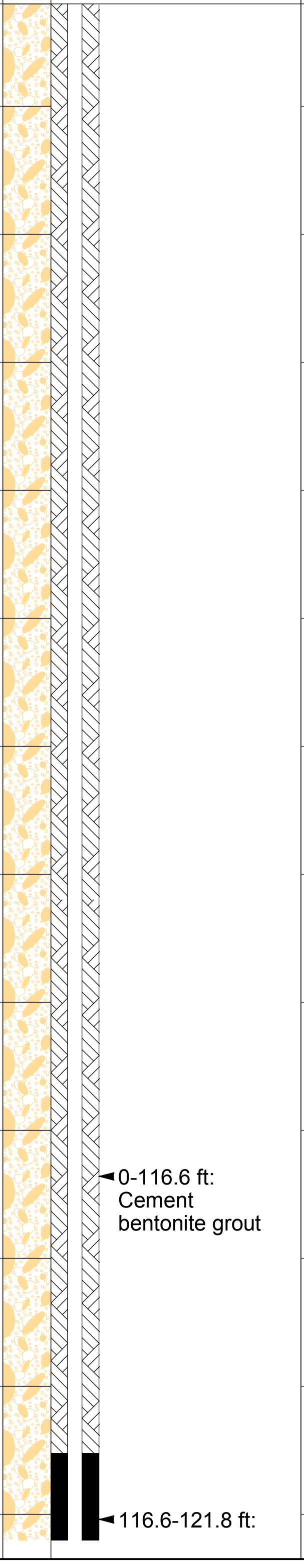
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 21, 2016 07:55
DRILLING END: October 23, 2016 11:30
COORDINATES: N: 841,669 E: 924,865

SHEET: 2 of 5
GS ELEV.: 2561.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0	As above. *(continued)*	2501.6		13	100		
65		64.0	Continues slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.	2497.6		14	100	64 - 109: Hydro test #3 SI	
70		69.0	As above.	2492.6		15	100		
75		74.0	As above.	2487.6		16	100		
80		79.0	As above, clast dominant.	2482.6		17	100		
85		84.0	As above.	2477.6		18	100	87 - 87.5: water was shut off and it ground up the core.	
90		89.0	As above.	2472.6		19	100		
95		94.0	As above, becomes matrix dominant, no HCl reaction.	2467.6		20	100		
100		99.0	As above, no cobbles, some schist clasts.	2462.6		21	100		
105		104.0	As above.	2457.6		22	100		
110		109.0	Continues slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.	2452.6		23	100		
115		114.0	As above.	2447.6		24	100	114 - 139: Hydro test #4 SI & CRI	
120		119.0	As above, some calcite veins.	2442.6		25	100		

GRAPHIC LOG / WELL DIAGRAM



0-116.6 ft: Cement bentonite grout

116.6-121.8 ft:

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

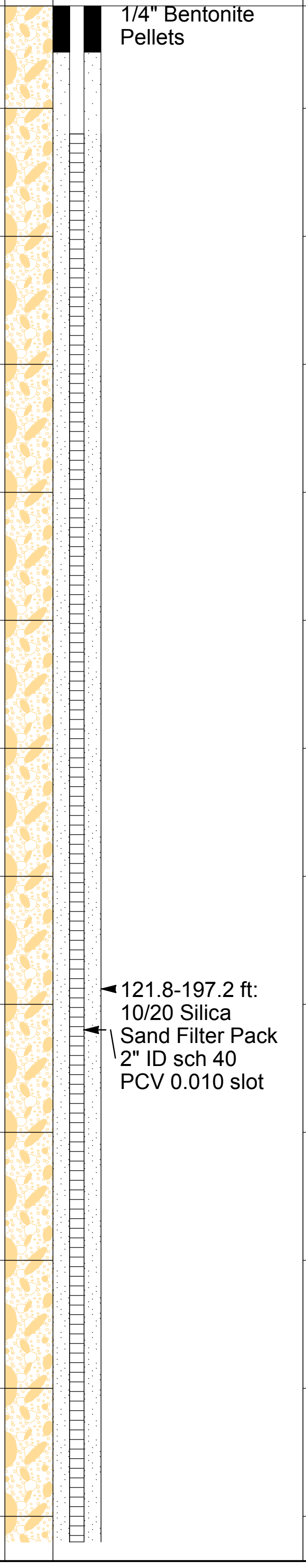
RECORD OF BOREHOLE DH16-06 (GT-21)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 21, 2016 07:55
DRILLING END: October 23, 2016 11:30
COORDINATES: N: 841,669 E: 924,865

SHEET: 3 of 5
GS ELEV.: 2561.6
TOC ELEV.: na
DATUM:

BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
HQ3	120.0	As above, some calcite veins. *(continued)*	2441.6		25	100		
	124.0	Gila conglomerate (Tcg): matrix dominated, some gravel, brown, schist, tuff, chert, gneiss, diabase, limestone, weak HCl reaction.	2437.6		26	100	125: Started losing mud around 125 where fault was observed.	
	129.0	As above.	2432.6		27	100		
	134.0	As above.	2427.6		28	100		
	139.0	Continues slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.	2422.6		29	100	139 - 249: Hydro test #5 SI	
	144.0	As above.	2417.6		30	100		
	149.0	As above.	2412.6		31	100		
	154.0	As above, some cobbles.	2407.6		32	100		
	159.0	As above.	2402.6		32	100		
	164.0	As above.	2397.6		33	100		
	169.0	As above, some cobbles.	2392.6		34	100		
	174.0	Continues matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.	2387.6		35	100		
	179.0	As above.	2382.6		36	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

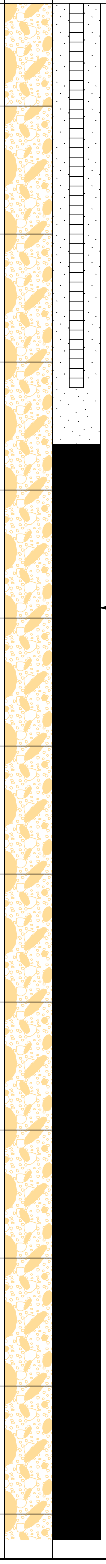
DRAFT

RECORD OF BOREHOLE DH16-06 (GT-21)

PROJECT:	RCML Near West TSF	DRILLING START:	October 21, 2016 07:55	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	October 23, 2016 11:30	GS ELEV.:	2561.6
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 841,669 E: 924,865	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above. *(continued)*	2381.6		36	100		
185		184.0	As above.	2377.6		37	100		
190		189.0	As above.	2372.6		38	100		
195		194.0	As above.	2367.6		39	100		
200		199.0	As above.	2362.6		40	100		
205		204.0	As above.	2357.6		41	100		
210		209.0	Continues matrix dominated, brown CONGLOMERATE, gravel to cobble clasts consisting of schist, gneiss, quartz, diabase, weak HCl reaction.	2352.6		42	100		
215		214.0	As above.	2347.6		43	100		
220		219.0	As above, no cobbles	2342.6		44	100		
225		224.0	As above, some gneiss clasts.	2337.6		45	100		
230		229.0	As above.	2332.6		46	100		
235		234.0	As above.	2327.6		47	100		
240		239.0	As above.	2322.6		48	100		

GRAPHIC LOG / WELL DIAGRAM



197.2-249 ft: 1/4" Bentonite Pellets

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-06 (GT-21)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 21, 2016 07:55
DRILLING END: October 23, 2016 11:30
COORDINATES: N: 841,669 E: 924,865

SHEET: 5 of 5
GS ELEV.: 2561.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2321.6							
	HQ3		As above. *(continued)*			▨	■	48	**100**		
		244.0		2317.6							
245	HQ3		As above.			▨	■	49	**100**		
		249.0		2312.6							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-07 (GT-20)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

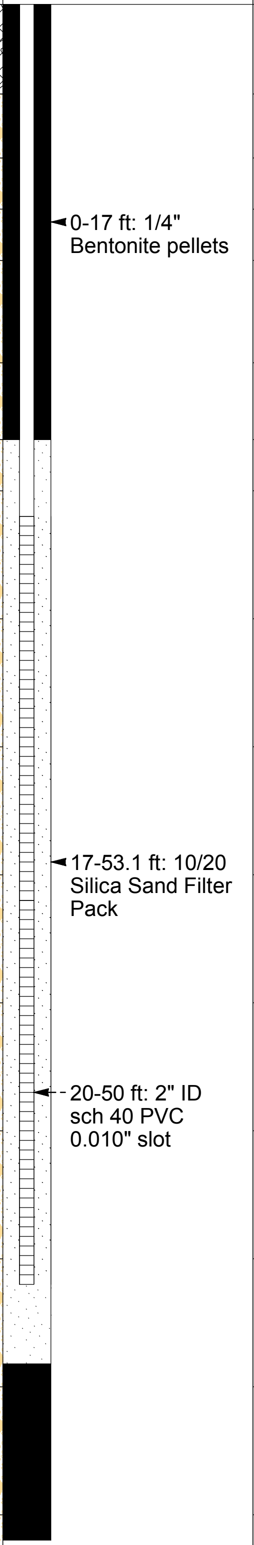
DRILLING START: October 23, 2016 00:00
DRILLING END: October 27, 2016 00:00
COORDINATES: N: 843,640 E: 926,191

SHEET: 1 of 5
GS ELEV.: 2496.6
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION	RUN NO.	CORE RECOVERY %	NOTES
0.0	2496.6	Surficial soils, no recovery			
3.5	2493.1	Gila conglomerate (Tcg): weathered, brown CONGLOMERATE, washed out from drilling.	1	60	
6.0	2490.6	As above.	2	50	
8.0	2488.6	Gila conglomerate (Tcg): matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, matrix is weak, no HCl reaction.	3	60	
10.0	2486.6	As above, matrix to clast oriented.	4	95	
14.0	2482.6	As above, completely weathered, matrix is weak and friable.	5	67	
17.0	2479.6	As above.	6	80	
19.0	2477.6	As above.	7	96	
24.0	2472.6	As above.	8	96	24 - 49: Hydro test #1 SI
29.0	2467.6	As above, becomes slightly weathered.	9	100	
34.0	2462.6	Continues slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, matrix is weak, no HCl reaction.	10	100	
39.0	2457.6	As above, large cobbles with gravel.	11	100	
44.0	2452.6	As above.	12	100	
49.0	2447.6	As above, becomes clast dominant.	13	100	49 - 104: Hydro test #2 SI
54.0	2442.6	Continues slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, no HCl reaction.	14	100	
59.0	2437.6	As above.	15	100	

WELL DIAGRAM



0-17 ft: 1/4" Bentonite pellets

17-53.1 ft: 10/20 Silica Sand Filter Pack

20-50 ft: 2" ID sch 40 PVC 0.010" slot

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-07 (GT-20)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 23, 2016 00:00
DRILLING END: October 27, 2016 00:00
COORDINATES: N: 843,640 E: 926,191

SHEET: 2 of 5
GS ELEV.: 2496.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0	As above. *(continued)*	2436.6		15	100		
65		64.0	As above, becomes clast dominated.	2432.6		16	100		
70		69.0	As above.	2427.6		17	100		
75		74.0	As above.	2422.6		18	100		
80		79.0	As above.	2417.6		19	100		
85		84.0	As above.	2412.6		20	100		
90		89.0	Becomes fresh, clast dominated CONGLOMERATE, some gravel, brown, schist, quartz, diabase, tuff, limestone, weak HCl reaction.	2407.6		21	100		
95		94.0	As above.	2402.6		22	100		
100		99.0	As above.	2397.6		23	100		
105		104.0	As above.	2392.6		24	100		
110		109.0	As above.	2387.6		25	100		
115		114.0	As above.	2382.6		26	100		
120		119.0		2377.6		27	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

RECORD OF BOREHOLE DH16-07 (GT-20)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 23, 2016 00:00
DRILLING END: October 27, 2016 00:00
COORDINATES: N: 843,640 E: 926,191

SHEET: 3 of 5
GS ELEV.: 2496.6
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

WELL DIAGRAM: 53.1-249 ft: 1/4" Bentonite Pellets

Depth	Elev	DESCRIPTION	USCS	RUN NO.	CORE RECOVERY %	NOTES
120.0	2376.6	Continues fresh, clast dominated CONGLOMERATE with gravel to fine to coarse sand, brown, clasts are rhyolite, diabase, tuff, no HCl reaction. *(continued)*		27	100	
122.7	2373.9	Becomes perlitic, pale grayish brown RHYOLITE, aphanitic, some autobreccia, matrix is light brown, weak, fine grained.				
124.0	2372.6	As above, perlite is fractured and vitreous.		28	100	124 - 152.5: Hydro test #3 SI
129.0	2367.6	As above.		29	100	
134.0	2362.6	Continues perlitic RHYOLITE moderately weathered, zones of very weak, friable, argillic rock. Some flow banding.		30	100	
139.0	2357.6	As above.		31	100	
142.5	2354.1	As above.		32	88	
147.5	2349.1	As above.		33	94	
152.5	2344.1	As above, becomes highly brecciated, matrix dominated, matrix is white, weak.		34	92	
157.2	2339.4	As above.		35	53	
159.0	2337.6	As above, zones of very weak matrix.		36	100	
164.0	2332.6	Becomes perlitic RHYOLITE breccia, perlite is highly vitreous, gray brown, in matrix.		37	100	
169.0	2327.6	As above.		38	100	
174.0	2322.6	Continues perlitic RHYOLITE breccia, perlite is highly vitreous, gray brown, in matrix.		39	100	
179.0	2317.6	As above.		40	100	

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-07 (GT-20)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 23, 2016 00:00
DRILLING END: October 27, 2016 00:00
COORDINATES: N: 843,640 E: 926,191

SHEET: 4 of 5
GS ELEV.: 2496.6
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180.0	2316.6	As above. *(continued)*		40	100		
184.0	2312.6	As above.		41	100		
189.0	2307.6	As above.		42	100		
194.0	2302.6	As above.		43	100	194 - 249: Hydro test #4 SI & CRI	
197.5	2299.1	Becomes brown RHYOLITE breccia with white matrix, brittle and ductile deformation, matrix is very soft and soapy.		44 45	100 100		
204.0	2292.6	Becomes more matrix donimant with corestones, soft, white, soapy, talc.		46	100	205.5 - 207: At 205.5 water presure got blocked, chewed up core from 205.5 to 207.	
207.0	2289.6	As above vesicular, less white matrix.		47	50		
209.0	2287.6	As above.		48	100		
214.0	2282.6	As above.		49	100		
219.0	2277.6	As above, white soapy matrix.		50	100		
224.0	2272.6	Becomes brown and white RHYOLITE breccia, fault zone rock with secondary alteration, weak.		51	100		
225.3	2271.3	As above.					
229.0	2267.6	As above.		52	100		
234.0	2262.6	As above.		53	100		
239.0	2257.6	As above.		54	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-07 (GT-20)

PROJECT:	RCML Near West TSF	DRILLING START:	October 23, 2016 00:00	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	October 27, 2016 00:00	GS ELEV.:	2496.6
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 843,640 E: 926,191	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0		2256.6							
			As above. *(continued)*					54	100		
		244.0		2252.6							
245			As above.					55	100		
		249.0		2247.6							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DH16-07 (GT-20)

DRAFT

RECORD OF BOREHOLE DH16-08 (GT-15)-A

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 29, 2016 11:08
DRILLING END: October 29, 2016 18:05
COORDINATES: N: 842,211 E: 922,848

SHEET: 1 of 1
GS ELEV.: 2441.6
TOC ELEV.: na
DATUM:

Depth (ft)	Description	Elev	USCS	Run No.	Core Recovery %
0.0	(SW-SM), SAND, well graded, trace fine angular gravel, trace low plasticity fines, brown, weathered, no odor, COLLUVIUM; Schist, gneiss, quartz gravel; moist, SPT @ 6ft: 29-50/1"	2441.6	SW-SM		
6.0	Gila conglomerate (Tcg): slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, matrix is weak, no HCl reaction.	2435.6		1	52
8.5	As above.	2433.1		2	54
13.5	As above.	2428.1		3	64
18.0	As above.	2423.6		4	14
23.0	As above.	2418.6		5	100
24.0	As above.	2417.6		6	90
29.0	As above.	2412.6		7	100
34.0	Bottom of borehole at 34.0 ft. Completed as well. Refer to diagram.	2407.6			

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DH16-08 (GT-15)-A

DRAFT

RECORD OF BOREHOLE DH16-08 (GT-15)-B

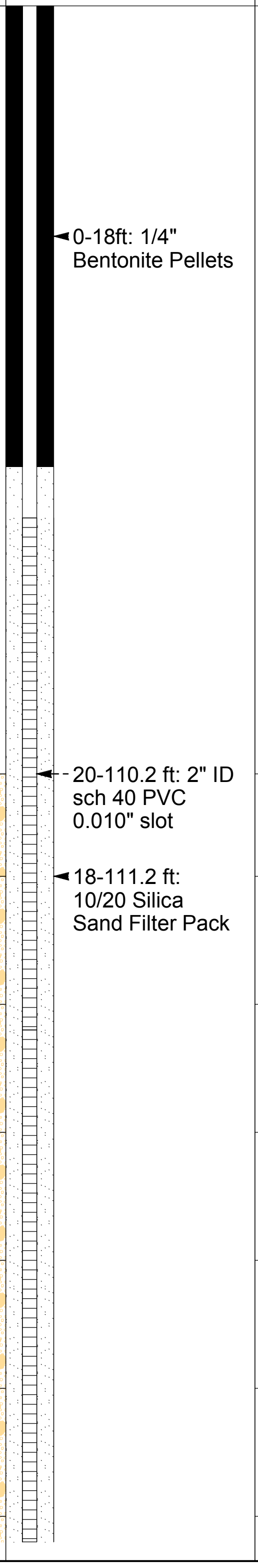
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 30, 2016 09:23
DRILLING END: November 1, 2016 08:25
COORDINATES: N: 842,211 E: 922,848

SHEET: 1 of 5
GS ELEV.: 2441.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0	Tricone	0.0	Drillhole GT-15-B is the continuation of GT-15-A.	2441.6					0 - 30: Continuation of DH16-08 (GT-15)-A. Tri-cone down to 30'.	
30	HQ3	30.0	Gila conglomerate (Tcg): slightly weathered, matrix dominated, brown CONGLOMERATE, gravel clasts consisting of schist, gneiss, quartz, diabase, matrix is weak, no HCl reaction.	2411.6			1	100		
		34.0	As above, core pitted.	2407.6			2	100	34 - 69: Hydro test #1 SI	
		39.0	As above. Highly weathered core with fractured/weak zone from 56 to 57.5. Slightly weathered 57.5-59 ft.	2402.6			3	100		
		44.0	As above, becomes clast dominant, weak, fracture zone.	2397.6			4	90		
		49.0	As above, matrix dominant, competent.	2392.6			5	100		
		54.0	As above.	2387.6			6	100		
		59.0		2382.6			7	96		

WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

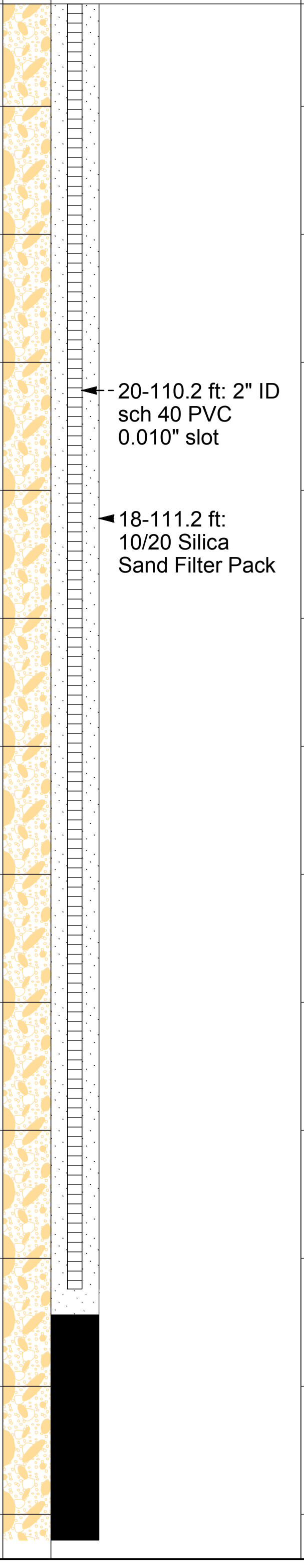
RECORD OF BOREHOLE DH16-08 (GT-15)-B

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 30, 2016 09:23
DRILLING END: November 1, 2016 08:25
COORDINATES: N: 842,211 E: 922,848

SHEET: 2 of 5
GS ELEV.: 2441.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0	Continues slightly weathered, matrix dominated, brown, CONGLOMERATE, large gravel clasts, clasts consist of schist, gneiss, diabase, tuff, quartz, no HCl reaction. *(continued)*	2381.6		7	96		
65		64.0	As above, some limestone clasts.	2377.6		8	100		
70		69.0	As above.	2372.6		9	100		
75		74.0	As above.	2367.6		10	100	74 - 139: Hydro test #2 SI	
80		79.0	As above, slightly weathered, pitted.	2362.6		11	100		
85		84.0	As above.	2357.6		12	100		
90		89.0	As above.	2352.6		13	94		
95		94.0	As above.	2347.6		14	100		
100		99.0	Continues slightly weathered, matrix dominated, brown, CONGLOMERATE, large gravel clasts, clasts consist of schist, gneiss, diabase, tuff, quartz, weak HCl reaction.	2342.6		15	100		
105		104.0	As above, moderate HCl reaction.	2337.6		16	100		
110		109.0	As above, weak HCl reaction.	2332.6		17	100		
115		114.0	As above, lenses of fine grained sandstone, competent, no clasts.	2327.6		18	100		
120		119.0		2322.6		19	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-08 (GT-15)-B

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 30, 2016 09:23
DRILLING END: November 1, 2016 08:25
COORDINATES: N: 842,211 E: 922,848

SHEET: 3 of 5
GS ELEV.: 2441.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0		2321.6					
	HQ3	124.0	As above. 116.5-117 sand lens: fine grained sand no clasts, very competent *(continued)*	2317.6		19	100		
125		129.0	As above.	2312.6		20	100		
130		132.0	As above, no HCl reaction.	2309.6		21	100		
135		137.0	As above.	2304.6		22	100		
		139.0	As above.	2302.6		23	100		
140		144.0	Continues fresh, matrix dominated, brown CONGLOMERATE, gravel clasts of diabase, quartz, schist, limestone, gneiss, tuff, matrix is fine to coarse sand, no HCl reaction.	2297.6		24	100	139 - 249: Hydro test #3 SI	
145		149.0	As above.	2292.6		25	100		
150		154.0	As above.	2287.6		26	100		
155		159.0	As above.	2282.6		27	100		
160		164.0	As above, becomes weak HCl reaction.	2277.6		28	100		
165		169.0	As above, clast dominant, some oxidation.	2272.6		29	100		
170		174.0	As above.	2267.6		30	100		
175		179.0	As above.	2262.6		31	100		
180			As above.			32	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-08 (GT-15)-B

PROJECT:	RCML Near West TSF	DRILLING START:	October 30, 2016 09:23	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	November 1, 2016 08:25	GS ELEV.:	2441.6
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 842,211 E: 922,848	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above. *(continued)*	2261.6		111.2-249 ft: 1/4" Bentonite Pellets	32	100		
185		184.0	Continues fresh, matrix dominated, brown CONGLOMERATE, gravel clasts of diabase, quartz, schist, limestone, gneiss, tuff, no HCl reaction.	2257.6			33	100		
190		189.0	As above.	2252.6			34	100		
195		194.0	As above.	2247.6			35	100		
200		199.0	As above, clast dominant.	2242.6			36	100		
205		204.0	As above.	2237.6			37	100		
210		209.0	As above.	2232.6			38	100		
215		214.0	Continues fresh, matrix dominated, brown CONGLOMERATE, gravel clasts of diabase, quartz, schist, limestone, gneiss, tuff, no HCl reaction.	2227.6			39	100		
220		219.0	As above.	2222.6			40	100		
225		224.0	As above, clast dominant.	2217.6			41	100		
230		229.0	As above.	2212.6			42	100		
235		234.0	As above, matrix dominant.	2207.6			43	100		
240		239.0	As above.	2202.6			44	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-08 (GT-15)-B

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: October 30, 2016 09:23
DRILLING END: November 1, 2016 08:25
COORDINATES: N: 842,211 E: 922,848

SHEET: 5 of 5
GS ELEV.: 2441.6
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above. *(continued)*	2201.6				44	100		
		244.0		2197.6							
245			As above.					45	100		
		249.0		2192.6							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:45
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-09-(GT-32)

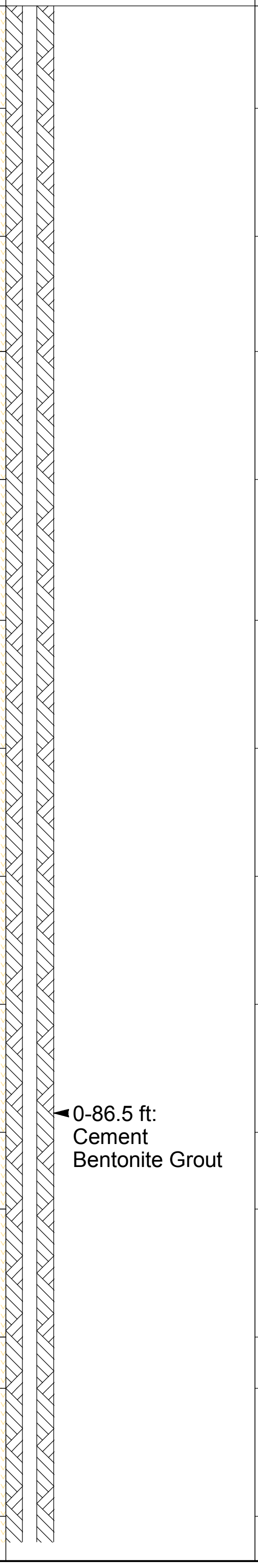
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 2, 2016 16:58
DRILLING END: November 6, 2016 15:45
COORDINATES: N: 845,384 E: 927,715

SHEET: 1 of 5
GS ELEV.: 2619.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0	HQ3	0.0	Dark gray, perlitic, RHYOLITE, glassy, flow-banded.	2619.7		1	83	0 - 24: Hydro test #1 FHT	
5		4.0	As above, flow-banding is alternating gray, pale pink, orange red, some crenulation, jointed, slightly weathered.	2615.7		2	100		
10		9.0	Continues perlitic RHYOLITE, flow banded, aphanitic rhyolite, red brown, vesicles infilled with quartz, FeOx, and dark gray and white perlitic rock, webbed texture, glassy, crenulated.	2610.7		3	100		
15		13.5	As above.	2606.2		4	100		
20		18.5	As above, folded and crenulated.	2601.2		5	100	24: Set casing.	
25		24.0	As above.	2595.7		6	90		
30		29.0	As above.	2590.7		7	100		
35		34.0	As above.	2585.7		8	100		
40		39.0	As above.	2580.7		9	100		
45		44.0	As above, becomes more jointed along the flow banding.	2575.7		10	100		
50		47.0	As above, jointed fractured.	2572.7		11	100		
		52.0	As above.	2567.7		12	75	54 - 97: Hydro test #2 SI & CRI	
55		54.0	Becomes aphanitic white and brown RHYOLITE, flow banding, layered and boudined, few vesicles.	2565.7		13	100		
60		59.0	As above.	2560.7		14	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-09-(GT-32)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

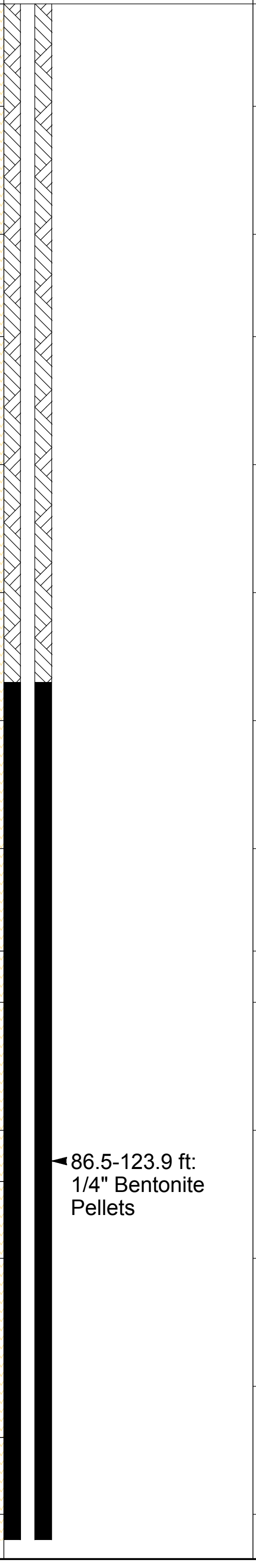
DRILLING START: November 2, 2016 16:58
DRILLING END: November 6, 2016 15:45
COORDINATES: N: 845,384 E: 927,715

SHEET: 2 of 5
GS ELEV.: 2619.7
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION	USCS
60.0	2559.7	As above. *(continued)*	
64.0	2555.7	As above.	
69.0	2550.7	As above, brittle and fractured throughout.	
73.0	2546.7	Continues brown and gray flow banded RHYOLITE, crenulated, oxidized phenocrysts, vesicular and pitted, returns to perlitic, glassy texture.	
78.0	2541.7	As above, fractured and sheared.	
83.0	2536.7	As above, weak and altered.	
88.0	2531.7	As above.	
93.0	2526.7	As above, fault zone.	
97.0	2522.7	Continues RHYOLITE, orange brown with light gray, flow banding, aphanitic, oxidized biotites, pitted.	
99.0	2520.7	As above.	
104.0	2515.7	As above.	
106.0	2513.7	As above.	
109.0	2510.7	As above, near vertical joint set, fresh and competent.	
116.0	2503.7	As above.	
119.0	2500.7		

Log continued on next page



86.5-123.9 ft: 1/4" Bentonite Pellets

CORE INFO

RUN NO.	CORE RECOVERY %
14	100
15	90
16	58
17	90
18	100
19	100
20	100
21	75
22	100
23	100
24	100
25	100
26	100
27	90

NOTES

69: Poor recovery, driller notes ~40% fluid return.

94 - 109: Hydro test #3 SI & CRI

95: Fault zone, lost circulation.

97: At 97 ft hole goes completely dry. Packer test fails.

99: Circulation returns, remains ~ 60%

114 - 168: Hydro test #4 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-09-(GT-32)

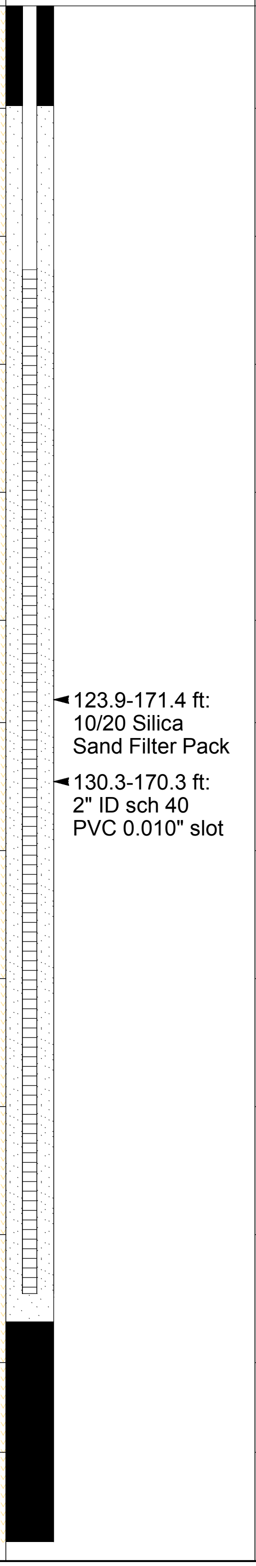
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 2, 2016 16:58
DRILLING END: November 6, 2016 15:45
COORDINATES: N: 845,384 E: 927,715

SHEET: 3 of 5
GS ELEV.: 2619.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE – DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0	Becomes predominantly orange brown, RHYOLITE gray boudins, flow laminations, gray rock is very weak and argillized. *(continued)*	2499.7		27	90		
125		124.0	As above.	2495.7		28	100		
130		129.0	As above.	2490.7		29	100		
135		134.0	As above, sheared zones along foliation	2485.7		30	100		
140		139.0	As above, more crenulated, brown with gray.	2480.7		31	90		
145		144.0	As above.	2475.7		32	88		
150		148.0	As above.	2471.7		33	100		
155		153.0	As above.	2466.7		34	100		
160		158.0	Continues RHYOLITE, moth eaten texture, flow-banded, folded brown and gray, weak.	2461.7		35	100	161: Lost circulation.	
165		163.0	As above.	2456.7		36	100		
170		168.0	As above.	2451.7		37	100		
175		173.0	As above, becomes more pinkish brown and gray, coarser, anhedral phenocrysts, trace FeOx.	2446.7		38	100		
180		176.5	As above.	2443.2		39	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-09-(GT-32)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 2, 2016 16:58
DRILLING END: November 6, 2016 15:45
COORDINATES: N: 845,384 E: 927,715

SHEET: 4 of 5
GS ELEV.: 2619.7
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes
180.0	As above. *(continued)*	2439.7		39	100	
181.5	As above.	2438.2		40	100	183 - 250: Hydro test #5 SI & CRI
184.0	Becomes RHYOLITE, moth eaten zone, flow-banded brown and gray, folded and crenulated, gray rock vesicular, weaker, and slightly porous.	2435.7		41	100	
189.0	As above.	2430.7		42	100	
193.0	As above.	2426.7		43	100	
198.0	As above.	2421.7		44	100	
203.0	As above, but gray rock more vesicular to pumaceous.	2416.7		45	100	
208.0	As above, zones of weak, rubbly rock.	2411.7		46	100	
213.0	As above.	2406.7		47	90	
218.0	As above, fractured.	2401.7		48	100	
223.0	As above.	2396.7		49	100	
228.0	As above.	2391.7		50	100	
233.0	As above.	2386.7		51	100	
238.0	As above, more brittle deformation and fracturing.	2381.7		52	100	

WELL DIAGRAM: 171.4-250 ft: 1/4" Bentonite Pellets

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

RECORD OF BOREHOLE DH16-09-(GT-32)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 2, 2016 16:58
DRILLING END: November 6, 2016 15:45
COORDINATES: N: 845,384 E: 927,715

SHEET: 5 of 5
GS ELEV.: 2619.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above, more brittle deformation and fracturing. *(continued)*	2379.7				52	100		
		243.0	As above.	2376.7				53	100		
245											
		248.0	As above.	2371.7				54	100		
250		250.0	Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.	2369.7							
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

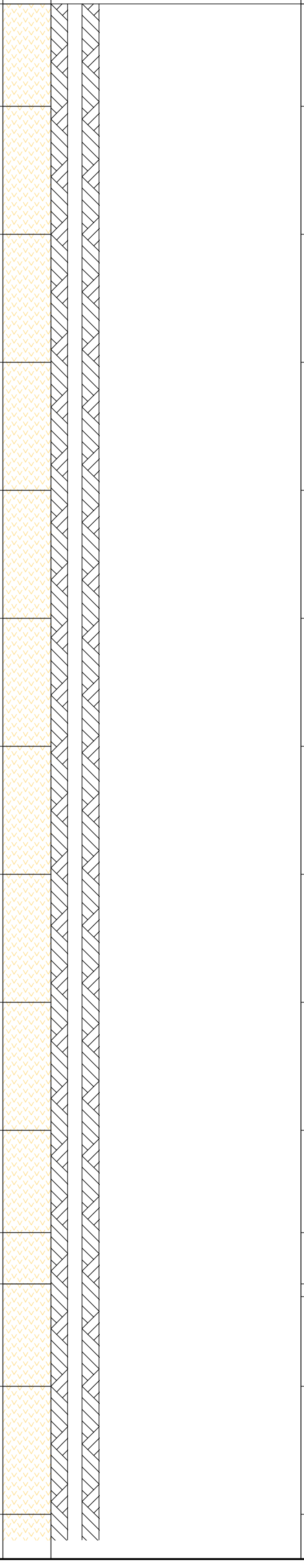
RECORD OF BOREHOLE DH16-10 (GT-31)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 8, 2016 12:02
DRILLING END: November 11, 2016 17:30
COORDINATES: N: 845,877 E: 929,847

SHEET: 1 of 5
GS ELEV.: 2699.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0	HQ3	0.0		2699.5					
			Perlitic, aphyric, gray RHYOLITE breccia with aphanitic rhyolite inclusions, shattered, highly vitreous, roots and iron staining.			1	88	0 - 24: Hydro test # 1 FHT	
		4.0		2695.5					
5			As above.			2	70		
		9.0		2690.5					
10			Continues perlitic aphyric RHYOLITE breccia, highly vitreous, shattered texture and brecia zones, abundant voids on veining, botryoidal opal in voids			3	100		
		14.0		2685.5					
15			As above. Rock is extremely brittle, with weak zones and full of voids.			4	100		
		19.0		2680.5					
20			As above, abundant voids, more brown rhyolite veins/inclusions, still highly shattered texture.			5	100		
		24.0		2675.5					
25			Becomes matrix dominant RHYOLITE breccia, clasts both perlite and brown rhyolite, fewer voids, massive.			6	100		
		29.0		2670.5					
30			Becomes flow-banded, perlitic RHYOLITE, highly vitreous, some voids with botryoidal opal and chalcedony, some FeOx, some brown rhyolite inclusions, very brittle.			7	100		
		34.0		2665.5					
35			As above.			8	100		
		39.0		2660.5					
40			As above.			9	100	43 - 109: Hydro test #2 SI	
		44.0		2655.5					
45			As above.			10	100		
		48.0		2651.5					
			As above			11	100	48 - 50: Mislatch with core tube, drilling damage.	
50		50.0		2649.5		12	40		
			Continues flow-banded, perlitic RHYOLITE, highly vitreous, some voids with botryoidal opal and chalcedony, some FeOx, some brown rhyolite inclusions, very brittle.			13	100		
		54.0		2645.5					
55			As above.			14	100		
		59.0		2640.5					
60			As above.			15	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-10 (GT-31)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

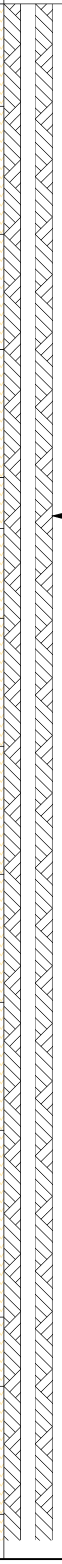
DRILLING START: November 8, 2016 12:02
DRILLING END: November 11, 2016 17:30
COORDINATES: N: 845,877 E: 929,847

SHEET: 2 of 5
GS ELEV.: 2699.5
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60.0	2639.5	As above. *(continued)*		15	100		
64.0	2635.5	As above.		16	100		
69.0	2630.5	As above.		17	78		
73.5	2626.0	Continues flow-banded, perlitic RHYOLITE, highly vitreous, some voids with botryoidal opal and chalcedony, some FeOx, some brown rhyolite inclusions, very brittle.		18	100		
78.5	2621.0	As above.		19	100		
80.5	2619.0	As above.		20	100		
84.0	2615.5	As above.		21	100		
89.0	2610.5	As above.		22	100		
94.0	2605.5	As above.		23	100		
99.0	2600.5	Continues flow-banded, perlitic RHYOLITE, highly vitreous, some voids with botryoidal opal and chalcedony, some FeOx, some brown rhyolite inclusions, very brittle.		24	100		
104.0	2595.5	As above.		25 26	100 100	104 - 208.5: Hydro test #3 SI	
111.3	2588.2	As above, folded and crenulated.					
114.0	2585.5	As above.		27 28	100 100		
119.0	2580.5			29	100		

WELL DIAGRAM



0-174.9 ft: Cement Bentonite Grout

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-10 (GT-31)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 8, 2016 12:02
DRILLING END: November 11, 2016 17:30
COORDINATES: N: 845,877 E: 929,847

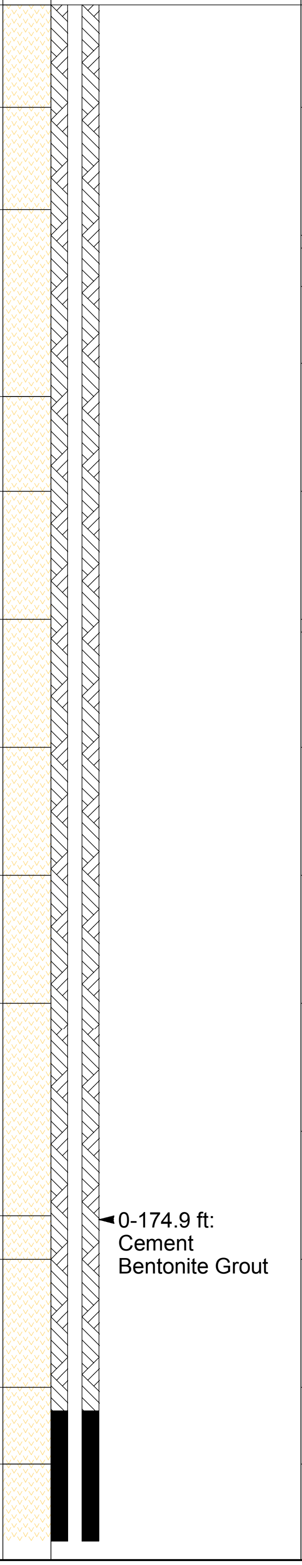
SHEET: 3 of 5
GS ELEV.: 2699.5
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Elev	DESCRIPTION	USCS
120.0	2579.5	Becomes silicified brown RHYOLITE with softer white laminations, vesicles. *(continued)*	
124.0	2575.5	As above.	
128.0	2571.5	Becomes flow-banded, perlitic RHYOLITE, highly vitreous, some voids with botryoidal opal and chalcedony, some FeOx, some brown rhyolite inclusions, very brittle.	
135.3	2564.2	As above.	
139.0	2560.5	As above.	
144.0	2555.5	As above.	
149.0	2550.5	As above.	
154.0	2545.5	As above, brecciated.	
159.0	2540.5	As above.	
167.3	2532.2	Becomes highly vesicular, weak.	
169.0	2530.5	As above.	
174.0	2525.5	RHYOLITE breccia, abundant quartz, trace opal.	
177.0	2522.5	As above, large voids.	

Log continued on next page

WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
29	100
30	100
31	100
32	100
33	100
34	100
35	100
36	100
37	100
38	100
39	100
40	100
41	100
42	100
43	100
44	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-10 (GT-31)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 8, 2016 12:02
DRILLING END: November 11, 2016 17:30
COORDINATES: N: 845,877 E: 929,847

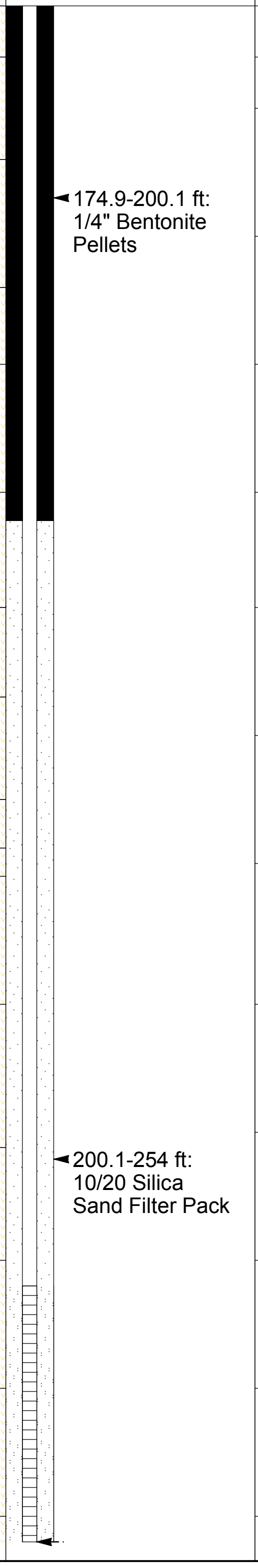
SHEET: 4 of 5
GS ELEV.: 2699.5
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Description	Elev	USCS	Graphic Log
180.0	As above, large voids. *(continued)*	2519.5		
182.0	RHYOLITE breccia, brown "thundereggs" inclusion of chalcedony, in gray perlitic matrix.	2517.5		
186.0	Becomes RHYOLITE, brown, brecciated texture, completely silicified, vesicles infilled with chalcedony.	2513.5		
191.0	Becomes perlitic, dark gray RHYOLITE, highly vitreous, little brown rhyolite stockwork.	2508.5		
194.0	As above.	2505.5		
199.0	As above.	2500.5		
203.5	As above.	2496.0		
207.0	As above.	2492.5		
211.0	Continues gray perlitic RHYOLITE, highly vitreous, little brown inclusions are FeOx stained.	2488.5		
212.9	Becomes brown RHYOLITE, brecciated texture, completely silicified, slightly vesicular, large pink inclusions.	2486.6		
214.0	Becomes gray perlitic RHYOLITE, highly vitreous, little brown inclusions are FeOx stained.	2485.5		
219.0	As above.	2480.5		
224.6	As above.	2474.9		
229.0	As above.	2470.5		
234.0	Continues RHYOLITE breccia, becomes matrix dominant, pinkish gray, slightly vitreous rhyolite clasts in darkk pinkish orange red matrix, clasts angular, sand to cobble size, weak, massive	2465.5		
239.0	As above, breccia clasts sand to gravel size.	2460.5		

Log continued on next page

WELL DIAGRAM



174.9-200.1 ft: 1/4" Bentonite Pellets

200.1-254 ft: 10/20 Silica Sand Filter Pack

CORE INFO

RUN NO.	CORE RECOVERY %
44	100
45	100
46	100
47	100
48	100
49	100
50	100
52	100
53	100
54	100
55	100
56	100
57	100
58	100

NOTES

214 - 254: Hydro test #4, 5 SI & CRI

ADDITIONAL LAB TESTING

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

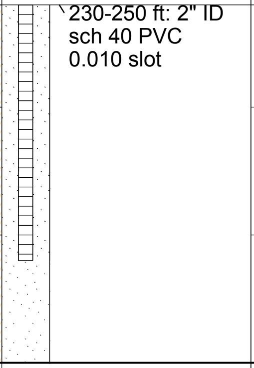
Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-10 (GT-31)

PROJECT:	RCML Near West TSF			SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING START:	November 8, 2016 12:02	GS ELEV.:	2699.5
		DRILLING END:	November 11, 2016 17:30	TOC ELEV.:	na
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 845,877 E: 929,847	DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above, breccia clasts sand to gravel size. *(continued)*	2459.5			230-250 ft: 2" ID sch 40 PVC 0.010 slot	58	100		
245		244.0	As above.	2455.5				59	100	244 - 249: Drillers note losing some water.	
250		249.0	As above	2450.5				60	100		
255		254.0	Bottom of borehole at 254.0 ft. Completed as well. Refer to diagram.	2445.5							
260											
265											
270											
275											
280											
285											
290											
295											
300											



DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

RECORD OF BOREHOLE DH16-11 (GT-18)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

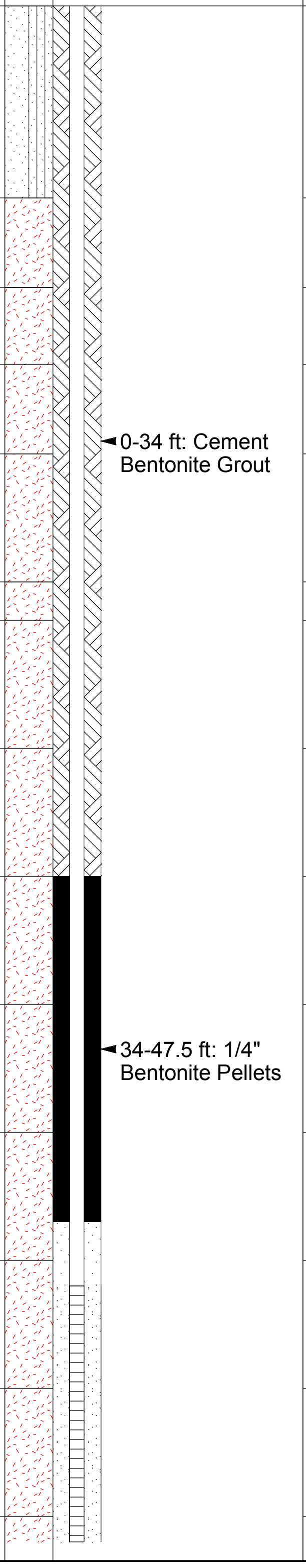
DRILLING START: November 12, 2016 14:10
DRILLING END: November 16, 2016 08:45
COORDINATES: N: 850,299 E: 924,156

SHEET: 1 of 5
GS ELEV.: 2704.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
0.0		2704.0				
7.5	(SP-SM), SAND, poorly graded, some low plasticity fines, trace gravel, brown, weathered, friable, iron oxide staining; moist	2696.5	SP-SM			0 - 29: Hydro test #1 FHT
11.0	Highly weathered DIABASE, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, pervasive oxidation throughout groundmass, calcite veins. Rubble.	2693.0		1	31	
14.0	As above.	2690.0		2	43	
17.5	Continues highly weathered DIABASE, pervasisve oxidation, slightly fractured, two joint sets with calcite infilling.	2686.5		3	100	
22.5	As above.	2681.5		4	80	
24.0	As above.	2680.0		5	100	
29.0	As above.	2675.0		6	100	24 - 69: Hydro test #2 SI & CRI
34.0	As above.	2670.0		7	100	
39.0	As above.	2665.0		8	92	
44.0	Continues slighty weathered DIABASE light iron staining, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, some calcite veins.	2660.0		9	100	
49.0	As above. less calcite.	2655.0		10	96	
54.0	As above.	2650.0		11	100	
59.0	As above, becomes fresh.	2645.0		12	100	
	As above, only one joint set.			13	100	

ADDITIONAL LAB TESTING



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

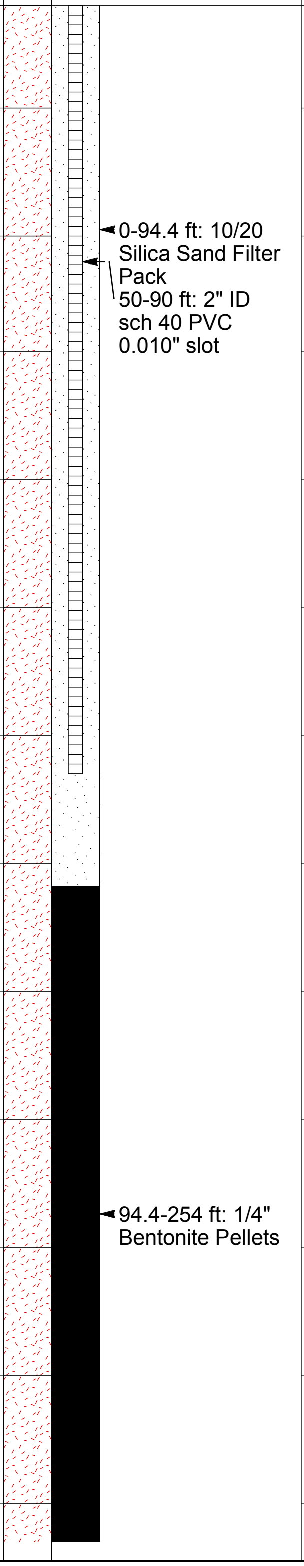
RECORD OF BOREHOLE DH16-11 (GT-18)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 12, 2016 14:10
DRILLING END: November 16, 2016 08:45
COORDINATES: N: 850,299 E: 924,156

SHEET: 2 of 5
GS ELEV.: 2704.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0	As above, only one joint set. *(continued)*	2644.0		13	100		
65		64.0	As above, two joint sets.	2640.0		14	100		
70		69.0	Continues slightly weathered DIABASE, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, penetrative oxidation, some calcite veins.	2635.0		15	96		
75		73.5	As above.	2630.5		16	100	74 - 133.5: Hydro test #3 SI	
80		78.5	As above.	2625.5		17	100		
85		83.5	As above.	2620.5		18	100		
90		88.5	As above.	2615.5		19	100		
95		93.5	As above.	2610.5		20	100		
100		98.5	As above.	2605.5		21	100		
105		103.5	As above.	2600.5		22	100		
110		108.5	Continues slightly weathered DIABASE, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, penetrative oxidation, some calcite veins.	2595.5		23	100		
115		113.5	As above.	2590.5		24	100		
120		118.5	As above.	2585.5		25	100		



0-94.4 ft: 10/20 Silica Sand Filter Pack

50-90 ft: 2" ID sch 40 PVC 0.010" slot

94.4-254 ft: 1/4" Bentonite Pellets

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH16-11 (GT-18)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 12, 2016 14:10
DRILLING END: November 16, 2016 08:45
COORDINATES: N: 850,299 E: 924,156

SHEET: 3 of 5
GS ELEV.: 2704.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0	As above. *(continued)*	2584.0		25	100		
125		123.5	As above.	2580.5		26	100		
130		128.5	As above.	2575.5		27	100		
135		133.5	As above.	2570.5		28	100		
140		138.5	As above.	2565.5		29	100		
145		143.5	As above.	2560.5		30	100		
150		148.5	As above.	2555.5		31	100		
155		153.5	Continues slightly weathered DIABASE, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, penetrative oxidation, some calcite veins.	2550.5		32	100	154 - 254: Hydro test #4 SI	
160		158.5	As above.	2545.5		33	96		
165		163.5	As above.	2540.5		34	100		
		166.5	As above.	2537.5		35	100		
170		171.5	As above.	2532.5		35	100		
175		174.0	As above.	2530.0		36	100		
180		179.0	As above.	2525.0		37	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH16-11 (GT-18)

PROJECT:	RCML Near West TSF	DRILLING START:	November 12, 2016 14:10	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	November 16, 2016 08:45	GS ELEV.:	2704.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 850,299 E: 924,156	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above. *(continued)*	2524.0				37	100		
185		184.0	As above.	2520.0				38	100		
190		189.0	As above.	2515.0				39	100		
195		194.0	As above.	2510.0				40	100		
200		199.0	As above, less calcite.	2505.0				41	100		
205		204.0	Continues slightly weathered DIABASE, phaneritic, medium grained, mm-scale plagioclase lathe phenocrysts, penetrative oxidation, some calcite veins.	2500.0				42	100		
210		209.0	As above, no joints.	2495.0				43	100		
215		214.0	As above.	2490.0				44	100		
220		219.0	As above.	2485.0				45	100		
225		224.0	As above.	2480.0				46	100		
230		229.0	As above.	2475.0				47	100		
235		234.0	As above, interval of fault infilled with breccia, minor fault gouge and some iron staining.	2470.0				48	96		
240		239.0	As above.	2465.0				49	100		

Core recovery scale: 20 40 60 80

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-11 (GT-18)

PROJECT:	RCML Near West TSF	DRILLING START:	November 12, 2016 14:10
PROJECT NO.:	1531436	DRILLING END:	November 16, 2016 08:45
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 850,299 E: 924,156

SHEET: 5 of 5
GS ELEV.: 2704.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above. *(continued)*	2464.0							
		244.0		2460.0				49	100		
245			As above.								
		249.0		2455.0				50	100		
250			As above.								
		254.0		2450.0				51	100		
255			Bottom of borehole at 254.0 ft. Completed as well. Refer to diagram.								
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-12 (GT-19)

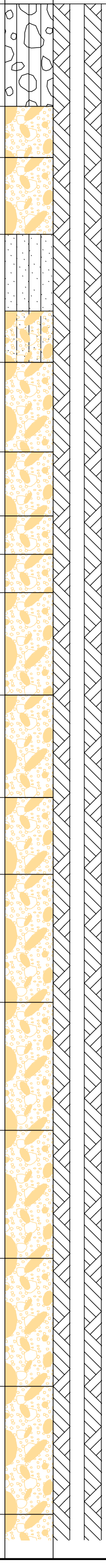
PROJECT:	RCML Near West TSF	DRILLING START:	November 16, 2016 15:51	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	November 19, 2016 17:00	GS ELEV.:	2669.1
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 847,002 E: 923,396	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2669.1	
4.0	Surficial soils.	2665.1	
6.0	Gila conglomerate (Tcg): Recovered only gravel with few broken pieces of matrix. Clasts consist of schist, tuff, and quartz.	2663.1	
9.0	Poor recovery, as above.	2660.1	
14.0	(SM), SILTY SAND, fine to coarse, angular, medium plasticity fines, trace gravel, brown, weathered, lense; Ran SPT after 0 recovery core run fron 9' to 12', probably just a more weathered zone in the gila with less gravel. No recovery.	2655.1	SM
17.5	Gila conglomerate (Tcg): highly weathered, matrix dominant, brown CONGLOMERATE, few gravel clasts, clasts consist of schist, tuff, quartz, diabase, gneiss.	2651.6	
	Poor recovery, as above.		
20.0	Poor recovery, as above.	2649.1	
21.5	Continues Gila conglomerate (Tcg): highly weathered, clast dominated, brown CONGLOMERATE, gravel clasts, clasts consist of schist, tuff, quartz, diabase, gneiss.	2647.6	
23.0		2646.1	
	As above.		
27.0	Continues highly weathered, brown CONGLOMERATE matrix dominated with gravel, few cobbles, clasts consist of schist, tuff, quartz, and gneiss, friable and weak matrix.	2642.1	
31.0	As above, becomes clast dominated.	2638.1	
34.0	As above.	2635.1	
39.0	As above, becomes weak HCl reaction.	2630.1	
44.0	As above, becomes matrix dominated.	2625.1	
49.0	As above, clasts schist, quartz, and tuff.	2620.1	
54.0	As above. Becomes no HCl reaction. Slightly weathered but competent and unjointed.	2615.1	
59.0	As above.	2610.1	

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
1	50
2	43
	0
3	43
4	40
5	87
6	67
7	85
8	88
9	73
10	86
11	100
12	100
13	100
14	100
15	100

NOTES

0 - 31: Hydro test #1 FHT

34 - 69: Hydro test #2 SI

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-12 (GT-19)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 16, 2016 15:51
DRILLING END: November 19, 2016 17:00
COORDINATES: N: 847,002 E: 923,396

SHEET: 2 of 5
GS ELEV.: 2669.1
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	Description	Elev
60.0	Continues fresh, matrix dominated, brown CONGLOMERATE, clasts are gravel and few cobbles and consist of schist, tuff, quartz, gneiss, chert, no HCl reaction, competent and unjointed. *(continued)*	2609.1
64.0	As above, clasts are schist, tuff, quartz, gneiss, limestone, weak HCl reaction.	2605.1
69.0	As above.	2600.1
74.0	As above, clasts are tuff, quartz, gneiss, limestone.	2595.1
79.0	As above.	2590.1
84.0	As above.	2585.1
89.0	As above, Becomes very fine grained matrix, more friable, slightly weathered.	2580.1
94.0	Continues CONGLOMERATE highly weathered, very weak, can indent matrix with thumb , matrix dominated with few gravel, brown, clasts consist of schist, tuff, quartz, gneiss, limestone, granite, no HCl reaction.	2575.1
100.0	As above, slightly weathered.	2569.1
104.0	As above, unweathered.	2565.1
109.0	As above, clasts become tuff, quartz, gneiss, limestone, diabase.	2560.1
114.0	As above.	2555.1
119.0	As above.	2550.1

Log continued on next page

WELL DIAGRAM

0-140.7 ft: Cement bentonite grout

CORE INFO

Run No.	Core Recovery %
15	100
16	100
17	100
18	100
19	100
20	100
21	100
22	94
23	100
24	100
25	100
26	100
27	100

NOTES

74 - 119: Hydro test #3 SI

109 - 174: Hydro test #4 SI & CRI

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

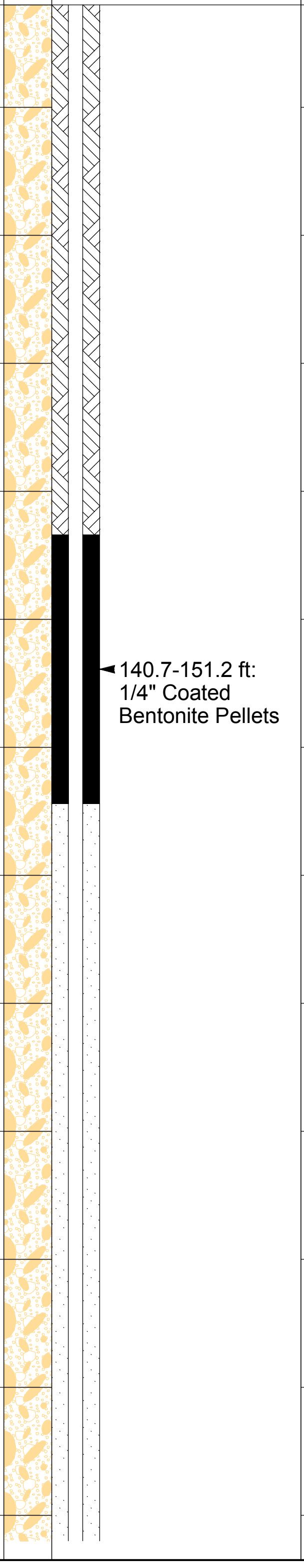
RECORD OF BOREHOLE DH16-12 (GT-19)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 16, 2016 15:51
DRILLING END: November 19, 2016 17:00
COORDINATES: N: 847,002 E: 923,396

SHEET: 3 of 5
GS ELEV.: 2669.1
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0	As above. *(continued)*	2549.1		27	100		
125		124.0	As above.	2545.1		28	90	124: At 124.3 drill head dropped 4-6in, started losing water.	
130		129.0	Continues fresh, matrix dominated CONGLOMERATE gravel clasts consisting of tuff, quartz, gneiss, limestone, diabase, weak HCl reaction, competent and unjointed.	2540.1		29	100		
135		134.0	As above. Core is competent.	2535.1		30	100		
140		139.0	As above.	2530.1		31	100		
145		144.0	As above.	2525.1		32	100		
150		149.0	As above.	2520.1		33	100		
155		154.0	As above.	2515.1		34	100		
160		159.0	As above.	2510.1		35	100		
165		164.0	As above.	2505.1		35	100		
170		169.0	As above.	2500.1		35	100		
175		174.0	As above, becomes slightly weathered, slightly weaker matrix.	2495.1		36	100		
180		179.0		2490.1		37	97		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

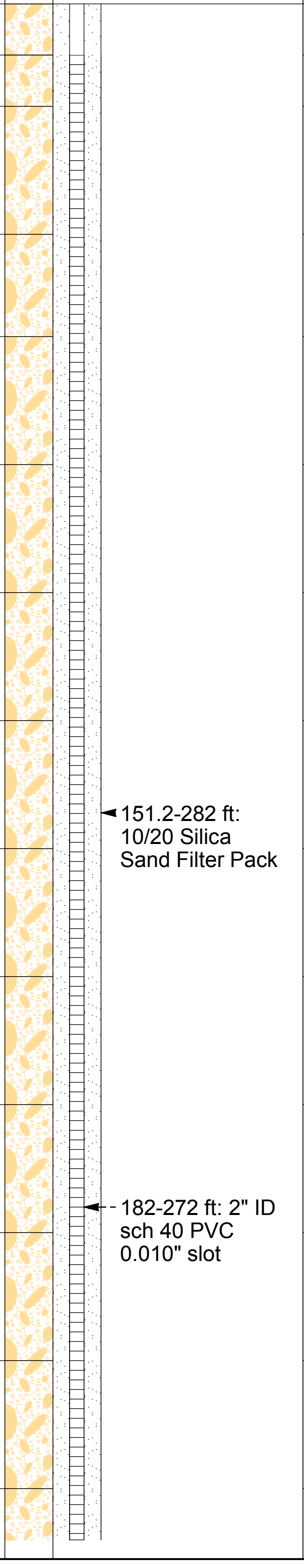
DRAFT

RECORD OF BOREHOLE DH16-12 (GT-19)

PROJECT:	RCML Near West TSF	DRILLING START:	November 16, 2016 15:51	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	November 19, 2016 17:00	GS ELEV.:	2669.1
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 847,002 E: 923,396	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	Continues fresh, matrix dominated CONGLOMERATE, gravel and few cobbles clasts consisting of tuff, schist, quartz, gneiss, limestone, diabase, weak HCl reaction, competent and unjointed. *(continued)*	2489.1		37	97		
		182.0	As above.	2487.1		37	100		
185		184.0	As above.	2485.1		38	100		
190		189.0	As above.	2480.1		39	100		
195		193.0	As above.	2476.1		40	100	194 - 293: Hydro test #5 SI	
200		198.0	As above. Very fine grained matrix more friable.	2471.1		41	100		
205		203.0	As above.	2466.1		42	100		
210		208.0	Continues slightly weathered, matrix dominated CONGLOMERATE, gravel and few cobbles clasts consisting of tuff, schist, quartz, gneiss, limestone, diabase, weak HCl reaction.	2461.1		43	100		
215		213.0	As above.	2456.1		44	96		
220		218.0	As above.	2451.1		45	100		
225		223.0	As above.	2446.1		46	100		
230		228.0	As above.	2441.1		47	100		
235		233.0	As above.	2436.1		48	100		
240		238.0	As above.	2431.1		49	100		

GRAPHIC LOG / WELL DIAGRAM



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

DRAFT

RECORD OF BOREHOLE DH16-12 (GT-19)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

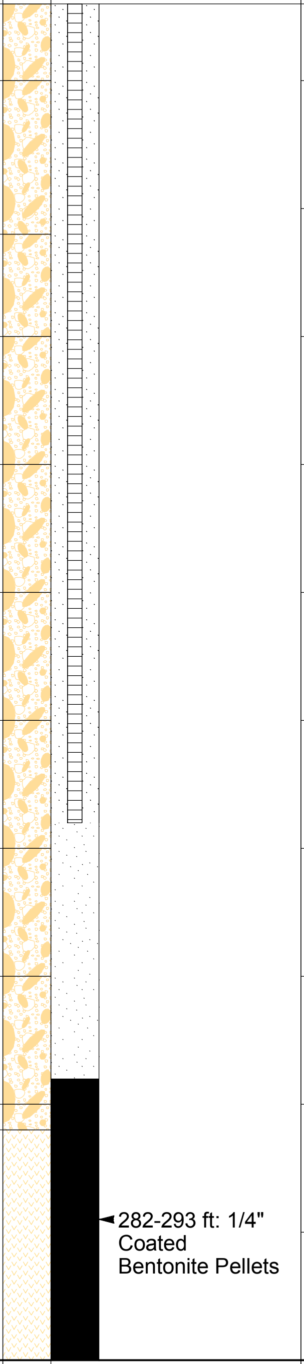
DRILLING START: November 16, 2016 15:51
DRILLING END: November 19, 2016 17:00
COORDINATES: N: 847,002 E: 923,396

SHEET: 5 of 5
GS ELEV.: 2669.1
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
240.0	As above. *(continued)*	2429.1	
243.0	As above, clasts are tuff, schist, chert, quartz, limestone.	2426.1	
249.0	As above.	2420.1	
253.0	As above.	2416.1	
258.0	As above.	2411.1	
263.0	As above.	2406.1	
268.0	As above.	2401.1	
273.0	As above,	2396.1	
278.0	Continues slightly weathered, matrix dominated CONGLOMERATE, gravel and few cobbles clasts consisting of tuff, schist, quartz, gneiss, limestone, diabase, weak HCl reaction.	2391.1	
283.0	As above.	2386.1	
284.0	Gradational contact with Apache Leap Tuff (Talg). Contact is closed.	2385.1	
293.0	Bottom of borehole at 293.0 ft. Completed as well. Refer to diagram.	2376.1	

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

DEPTH (ft)	RUN NO.	CORE RECOVERY %	NOTES
240–243	49	100	
243–249	50	100	
249–253	51	96	
253–258	52	100	
258–263	53	100	
263–268	54	100	
268–273	55	96	
273–278	58	70	273: Lost core, possibly due to mis-seated core tube.
278–283	59	100	
283–288	60	100	
288–293	61	100	

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

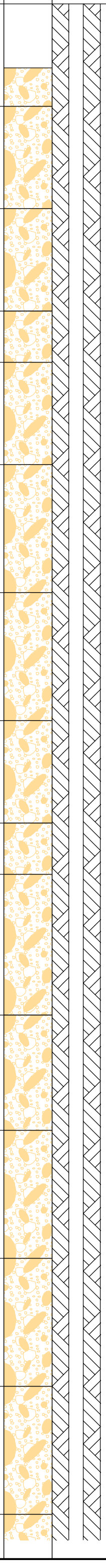
RECORD OF BOREHOLE DH16-13 (GT-17)

PROJECT:	RCML Near West TSF	DRILLING START:	November 28, 2016 12:12	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	November 28, 2016 12:12	GS ELEV.:	2733.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 849,357 E: 921,449	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE (Depth 0.0, Elev 2733.8)

Depth (top)	Description	Depth (bottom)	Elev	USCS
0.0	Gila conglomerate (Tcg): clast dominated, brown, CONGLOMERATE, some gravel, few cobbles, clasts consist of schist, quartz, gneiss.	4.0	2729.8	
4.0	As above, becomes matrix dominant.	8.0	2725.8	
8.0	As above, matrix washed out, poor recovery.	12.0	2721.8	
12.0	As above, matrix washed out, poor recovery.	14.0	2719.8	
14.0	As above, matrix washed out, poor recovery. Weak HCl reaction.	18.0	2715.8	
18.0	Continues brown CONGLOMERATE, matrix dominant, clasts are gravel to cobbles and consist of schist, quartz, gneiss, tuff, no HCl reaction.	23.0	2710.8	
23.0	As above.	28.0	2705.8	
28.0	As above.	32.0	2701.8	
32.0	As above.	34.0	2699.8	
34.0	As above.	39.5	2694.3	
39.5	As above.	44.0	2689.8	
44.0	As above.	49.0	2684.8	
49.0	As above.	54.0	2679.8	
54.0	As above, cobble-rich.	59.0	2674.8	
59.0	Becomes no cobbles.			

Log continued on next page



CORE INFO

RUN NO.	Depth interval (ft)	CORE RECOVERY %
1	0 – 4	38
2	4 – 8	60
3	8 – 12	3
4	12 – 14	5
5	14 – 18	43
6	18 – 23	90
7	23 – 28	100
6	28 – 32	78
7	32 – 34	90
8	34 – 39.5	100
9	39.5 – 40	100
10	40 – 44	100
11	44 – 49	100
12	49 – 54	100
13	54 – 59	100
14	59 – 60	100

NOTES

0 - 28: Hydro test #1 FHT

29 - 59: Hydro test #2 SI

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

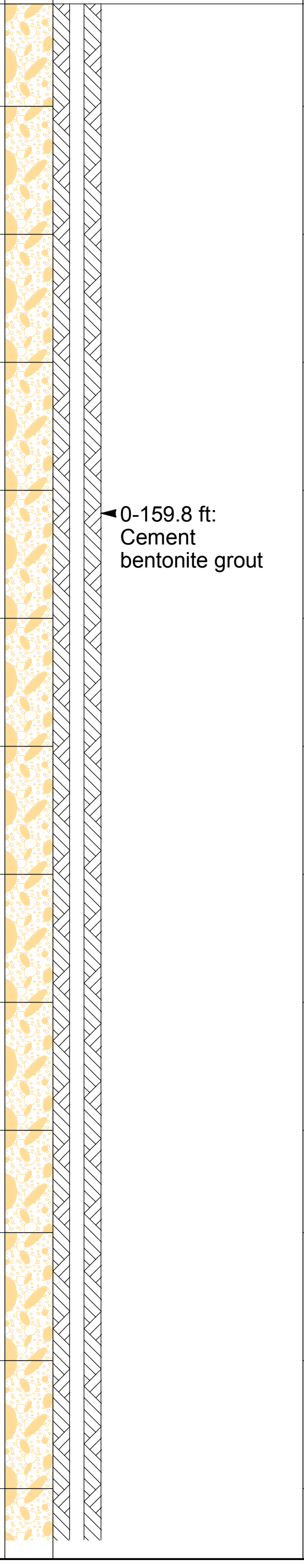
RECORD OF BOREHOLE DH16-13 (GT-17)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 28, 2016 12:12
DRILLING END: November 28, 2016 12:12
COORDINATES: N: 849,357 E: 921,449

SHEET: 2 of 5
GS ELEV.: 2733.8
TOC ELEV.: na
DATUM:

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes	Additional Lab Testing
60.0	Becomes no cobbles. *(continued)*	2673.8		14	100		
64.0	As above.	2669.8		15	100	64 - 154: Hydro test #3 SI	
69.0	As above.	2664.8		16	100		
74.0	Continues brown, CONGLOMERATE, matrix dominated some gravel, clasts consist of schist, quartz, gneiss, tuff, weak HCl reaction.	2659.8		17	100		
79.0	Becomes clast dominant.	2654.8		18	100		
84.0	Continues brown, CONGLOMERATE, matrix dominated some gravel, clasts consist of schist, quartz, gneiss, tuff, weak HCl reaction.	2649.8		19	100		
89.0	As above.	2644.8		20	100		
94.0	As above.	2639.8		21	100		
99.0	As above.	2634.8		22	100		
104.0	As above.	2629.8		23	100		
108.0	As above.	2625.8		24	100		
113.0	As above.	2620.8		25	100		
118.0	As above.	2615.8		26	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-13 (GT-17)

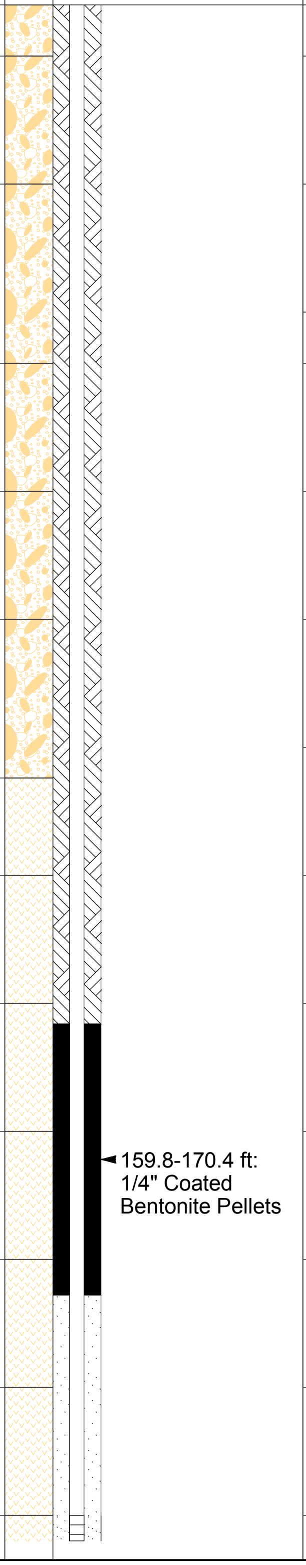
PROJECT:	RCML Near West TSF	DRILLING START:	November 28, 2016 12:12	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	November 28, 2016 12:12	GS ELEV.:	2733.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 849,357 E: 921,449	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
120.0		2613.8	
	As above. *(continued)*		
122.0		2611.8	
	As above.		
127.0		2606.8	
	As above.		
134.0		2599.8	
	Continues brown, CONGLOMERATE, matrix dominated some gravel, clasts consist of schist, quartz, gneiss, tuff, weak HCl reaction.		
139.0		2594.8	
	CONGLOMERATE consists primarily of underlying tuff material, gray matrix, clasts consist of tuff, quartz, feldspars, competent. Beginning of transition to tuff unit below.		
144.0		2589.8	
	Continues gradational contact with Apache Leap Tuff, possible rip-up chips. Contact is closed.		
150.2		2583.6	
	Becomes Apache Leap Tuff (Talg): moderately to strongly welded TUFF, gray, with some small black phenocrysts, competent and unjointed.		
154.0		2579.8	
	As above.		
159.0		2574.8	
	As above, gray to white.		
164.0		2569.8	
	As above.		
169.0		2564.8	
	As above.		
174.0		2559.8	
	As above.		
179.0		2554.8	
	As above.		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



159.8-170.4 ft:
1/4" Coated
Bentonite Pellets

CORE INFO

DEPTH (ft)	RUN NO.	CORE RECOVERY %
120–122	26	100
122–127	27	100
127–132	28	100
132–134	29	100
134–139	30	100
139–144	31	100
144–149	32	100
149–154	33	100
154–159	34	100
159–164	35	100
164–169	36	100
169–174	37	100
174–179	38	100
179–	39	100

NOTES

164 - 249: Hydro test #4 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-13 (GT-17)

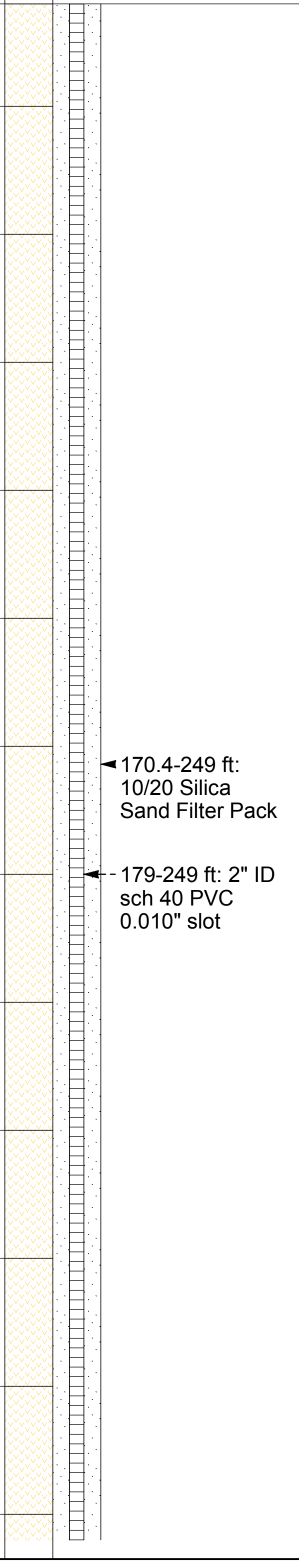
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 28, 2016 12:12
DRILLING END: November 28, 2016 12:12
COORDINATES: N: 849,357 E: 921,449

SHEET: 4 of 5
GS ELEV.: 2733.8
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	As above. *(continued)*	2553.8		39	100		
185		184.0	Continues TUFF moderately to strongly welded, gray to white, with some small black phenocrysts, few lithic clasts, competent and unjointed.	2549.8		40	100		
190		189.0	As above.	2544.8		41	100		
195		194.0	As above.	2539.8		42	100		
200		199.0	As above.	2534.8		43	100		
205		204.0	As above, no lithic clasts.	2529.8		44	100		
210		209.0	Continues TUFF, moderately to strongly welded, gray to white, with some small black phenocrysts, competent. Subhorizontal jointing may be mechanical.	2524.8		45	100		
215		214.0	As above.	2519.8		46	100		
220		219.0	As above.	2514.8		47	100		
225		224.0	As above.	2509.8		48	100		
230		229.0	As above.	2504.8		49	100		
235		234.0	As above.	2499.8		50	100		
240		239.0	As above.	2494.8		51	100		

GRAPHIC LOG / WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

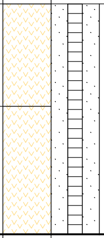
RECORD OF BOREHOLE DH16-13 (GT-17)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 28, 2016 12:12
DRILLING END: November 28, 2016 12:12
COORDINATES: N: 849,357 E: 921,449

SHEET: 5 of 5
GS ELEV.: 2733.8
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2493.8							
			As above. *(continued)*					51	100		
		244.0		2489.8							
245			As above.					52	100		
		249.0		2484.8							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											



01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

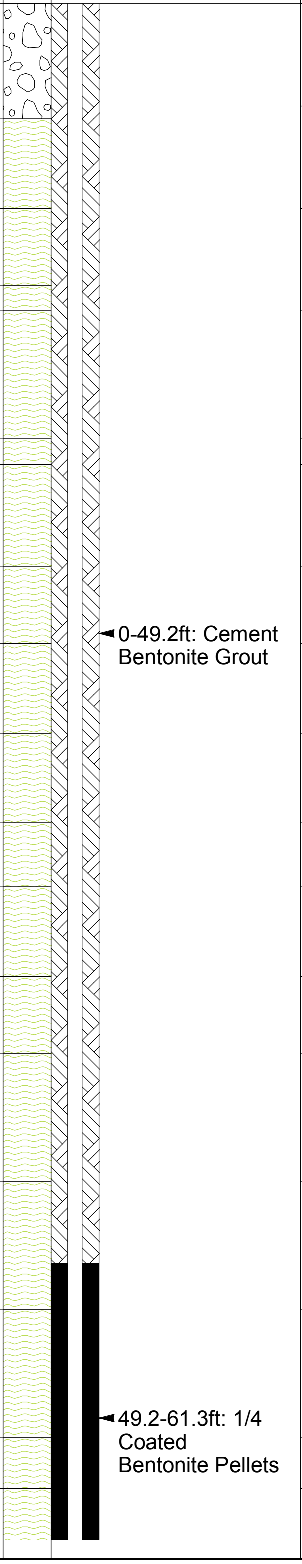
RECORD OF BOREHOLE DH16-14-(GT-1)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 29, 2016 13:23
DRILLING END: November 29, 2016 13:23
COORDINATES: N: 845,266 E: 910,365

SHEET: 1 of 4
GS ELEV.: 2316.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
0	HQ3	0.0	(GP), GRAVEL, fine to coarse, poorly graded, subangular to angular, some fine subangular to angular sand, trace non plastic fines, very dark gray-brown, weathered; schist gravel; very loose to loose, moist to wet, 6-50/2 (3 intervals) Surficial soils, no recovery.	2316.0	GP	1	0	0 - 38: Hydro test #1 FHT
		4.5	Pinal schist (pCpi): dark green to gray, METASANDSTONE, fine-grained, foliated, brecciated with heavy oxidization.	2311.5		2	88	
		8.0	As above, very poor recovery.	2308.0		3	25	
		11.0	As above.	2305.0				
		12.0	As above.	2304.0		4	30	
		17.0	No recovery.	2299.0		5	0	
		18.0	No recovery.	2298.0		6	0	
		22.0	Continues METASANDSTONE dark green to gray, fine-grained, rock fragments with quartz and quartz veining, foliated and brecciated, heavy oxidation, very poor recovery.	2294.0		7	33	
		25.0	As above.	2291.0		8	43	
		28.5	As above.	2287.5		9	100	
		32.0	As above.	2284.0		10	60	
		34.5	As above.	2281.5		11	71	
		38.0	As above, many unopened/healed fractures between discontinuities.	2278.0		12	100	38: set casing to 30 ft
		41.0	As above, poor recovery.	2275.0		13	60	
		46.0	No recovery.	2270.0		14	0	
		51.0	Continues METASANDSTONE, dark red to gray, fine-grained, heavy oxidation, many unopened/healed fractures between discontinuities, poor recovery.	2265.0		15	50	
		56.0	As above.	2260.0		16	100	
		58.0	As above.	2258.0		17	100	



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-14-(GT-1)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 29, 2016 13:23
DRILLING END: November 29, 2016 13:23
COORDINATES: N: 845,266 E: 910,365

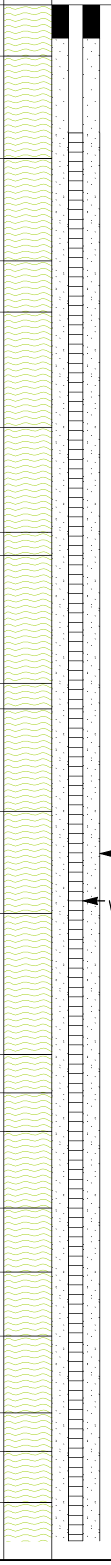
SHEET: 2 of 4
GS ELEV.: 2316.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
60.0		2256.0	
62.0	As above. *(continued)*	2254.0	
66.0	As above.	2250.0	
70.0	As above.	2246.0	
72.0	As above.	2244.0	
76.5	As above.	2239.5	
80.6	As above.	2235.4	
81.5	Becomes brecciated METASANDSTONE, dark gray green with some reddish brown, schist fragments with gouge and clay, some oxidation.	2234.5	
86.5	As above.	2229.5	
87.5	No recovery.	2228.5	
91.5	As above.	2224.5	
95.5	As above.	2220.5	
101.0	Continues METASANDSTONE, dark greenish gray, fine-grained, foliated, highly jointed, some oxidation.	2215.0	
102.5	No recovery.	2213.5	
104.0	Continues METASANDSTONE, dark greenish gray, fine-grained, foliated, highly jointed, some oxidation.	2212.0	
107.0	As above, discontinuous fractures.	2209.0	
109.5	As above.	2206.5	
112.0	As above.	2204.0	
115.0	Continues METASANDSTONE, dark greenish gray, fine-grained, foliated, highly jointed, some oxidation.	2201.0	
116.5	As above.	2199.5	
118.5	As above, interval of breccia and washed out gouge.	2197.5	
	As above.		

Log continued on next page



WELL DIAGRAM

61.3-126.7ft: 10/20 Silica Sand Filter Pack
65-125ft: 2 ID sch 40 PVC 0.010 slot

CORE INFO

RUN NO.	CORE RECOVERY %
17	100
18	75
19	88
20	100
21	67
22	100
23	80
24	80
25	88
26	100
27	50
28	100
29	100
30	80
31	83
32	100
33	75
34	100

NOTES

77.5 - 91.5: Hydro test #2 SI
77.6 - 238.5: Hydro test #3 SI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH16-14-(GT-1)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

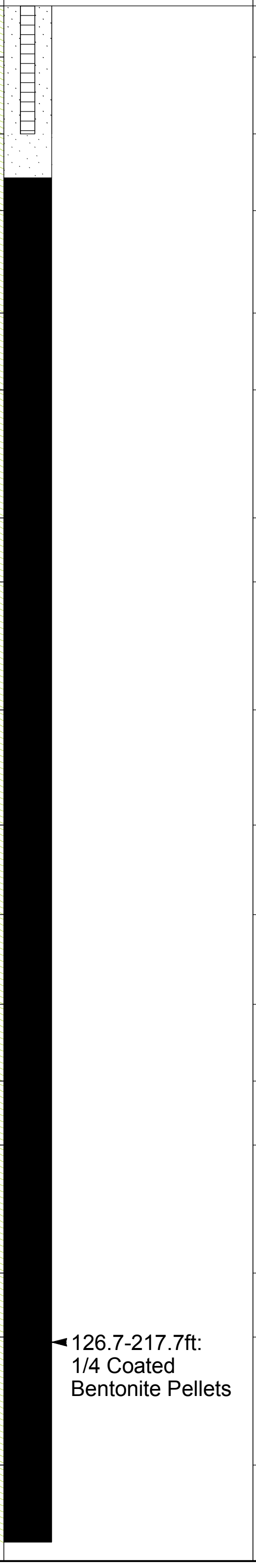
DRILLING START: November 29, 2016 13:23
DRILLING END: November 29, 2016 13:23
COORDINATES: N: 845,266 E: 910,365

SHEET: 3 of 4
GS ELEV.: 2316.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0		2196.0						
		122.0	As above. *(continued)*	2194.0			34	100		
125		125.0	As above.	2191.0			35	100		
		128.0	As above.	2188.0			36	100		
130		132.0	Continues METASANDSTONE, dark greenish gray, foliated and highly fractured, some quartz veining with chloritic alteration.	2184.0			37	100		
135		135.0	As above.	2181.0			38	100		
140		140.0	As above.	2176.0			39	100		
		142.5	As above.	2173.5			40	100		
145		147.5	As above.	2168.5			41	100		
150		152.0	As above.	2164.0			42	89		
155		155.5	Continues METASANDSTONE, dark greenish gray, fine-grained, foliated and higly fractured with moderate oxidation.	2160.5			43	100		
		159.0	As above, quartz veining, highly fractured.	2157.0			44	86		
160		162.0	As above.	2154.0			45	100		
		164.5	As above, very weathered, poor recovery.	2151.5			46	60		
165		169.5	As above.	2146.5			47	100		
170		172.0	As above.	2144.0			48	100		
175		177.0	As above.	2139.0			49	70		
180							50	100		

Log continued on next page

WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

RECORD OF BOREHOLE DH16-14-(GT-1)

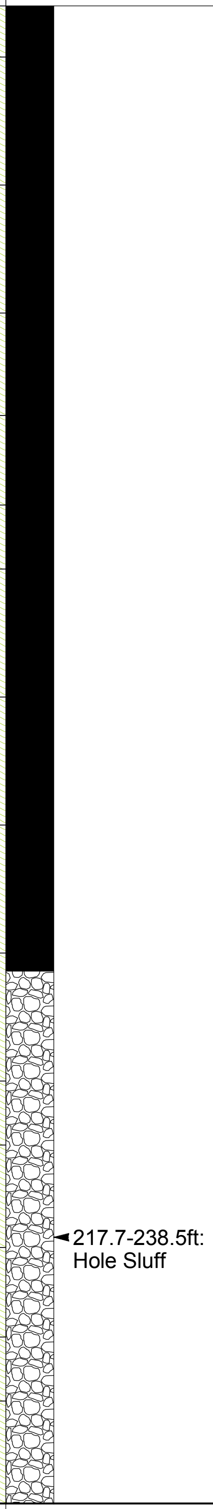
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: November 29, 2016 13:23
DRILLING END: November 29, 2016 13:23
COORDINATES: N: 845,266 E: 910,365

SHEET: 4 of 4
GS ELEV.: 2316.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	Continues METASANDSTONE, dark greenish gray, quartz veining, fine-grained, foliated, lightly to moderately fractured, moderate oxidation. *(continued)*	2136.0		50	100		
		182.0	As above.	2134.0		51	100		
		187.0	As above.	2129.0		52	100		
		192.0	As above.	2124.0		53	100		
		196.0	As above.	2120.0		54	100		
		199.5	As above.	2116.5		55	100		
		202.0	As above.	2114.0		56	100		
		207.0	As above.	2109.0		57	100		
		212.0	As above.	2104.0		58	100		
		217.0	Becomes METASANDSTONE, dark greenish gray, quartz veining, fine-grained, foliated, moderately fractured, moderate oxidation, fault gouge consists of rock fragments and clay, poor recovery.	2099.0		59	70		
		222.0	As above, no gouge.	2094.0		60	100		
		224.5	Becomes METASANDSTONE, dark greenish gray, quartz veining, fine-grained, foliated, moderately fractured, moderate oxidation, fault gouge consists of rock fragments and clay, poor recovery.	2091.5		61	88		
		228.5	As above, no gouge, oxidized	2087.5		62	86		
		232.0	As above.	2084.0		63	100		
		234.5	As above.	2081.5		64	100		
240		238.5	Bottom of borehole at 238.5 ft. Completed as well. Refer to diagram.	2077.5				238.5: TD	

WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

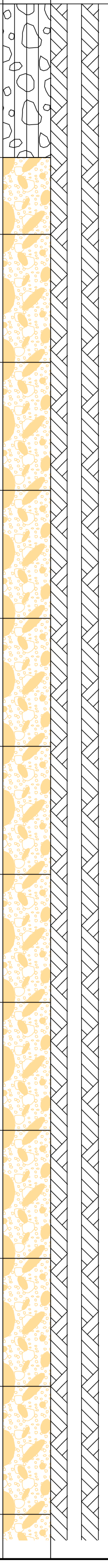
DRAFT

RECORD OF BOREHOLE DH16-15-(GT-16)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 2, 2016 11:52
DRILLING END: December 2, 2016 11:52
COORDINATES: N: 845,116 E: 920,176

SHEET: 1 of 5
GS ELEV.: 2667.7
TOC ELEV.: na
DATUM:



DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0		0.0		2667.7				0 - 29: Hydro test #1 FHT	
5		6.0	Gila conglomerate (Tcg): completely weathered, CONGLOMERATE, recovered only gravel and matrix fragments, clasts consist of schist, gneiss, quartz.	2661.7		1	37		
10		9.0	As above, recovered some intact matrix.	2658.7		2	40		
15		14.0	Continues CONGLOMERATE, matrix dominated, some gravel, clasts consist of diabase, gniess, schist, quartz, weak HCl reaction, matrix poorly cemented sand, very friable, moderately weathered,	2653.7		3	96		
20		19.0	As above.	2648.7		4	98		
25		24.0	As above.	2643.7		5	96	25 - 74: Hydro test #2 SI	
30		29.0	As above.	2638.7		6	96		
35		34.0	As above, weak HCl reaction.	2633.7		7	100		
40		39.0	As above.	2628.7		8	96		
45		44.0	Continues CONGLOMERATE, slightly weathered, matrix dominated, some gravel with cobbles, brown, clasts consist of schist, gneiss, diabase, quartz, few calcite veins, moderate HCl reaction.	2623.7		9	100		
50		49.0	As above.	2618.7		10	100		
55		54.0	As above.	2613.7		11	100		
60		59.0	As above.	2608.7		12	100		

Log continued on next page

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

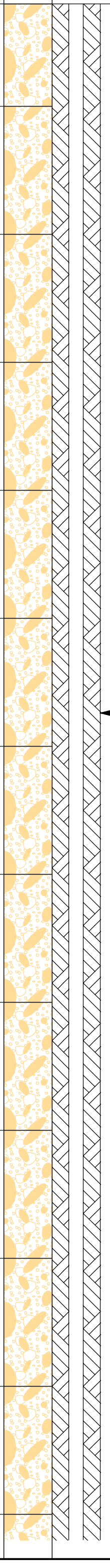
RECORD OF BOREHOLE DH16-15-(GT-16)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 2, 2016 11:52
DRILLING END: December 2, 2016 11:52
COORDINATES: N: 845,116 E: 920,176

SHEET: 2 of 5
GS ELEV.: 2667.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60		60.0		2607.7					
			As above. *(continued)*			12	100		
65		64.0	As above.	2603.7		13	100		
70		69.0	As above, moderate HCl reaction.	2598.7		14	100		
75		74.0	Continues CONGLOMERATE, fresh, matrix dominated, some gravel, brown, clasts consist of schist, gneiss, quartz, weak HCl reaction, competent.	2593.7		15	100		
80		79.0	As above.	2588.7		16	100	80 - 124: Hydro test #3 SI	
85		84.0	As above.	2583.7		17	100		
90		89.0	As above.	2578.7		18	100		
95		94.0	As above.	2573.7		19	100		
100		99.0	As above.	2568.7		20	100		
105		104.0	As above.	2563.7		21	100		
110		109.0	As above.	2558.7		22	100		
115		114.0	As above.	2553.7		23	100		
120		119.0	As above.	2548.7		24	100		



0-175.4 ft: Cement Bentonite Grout

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

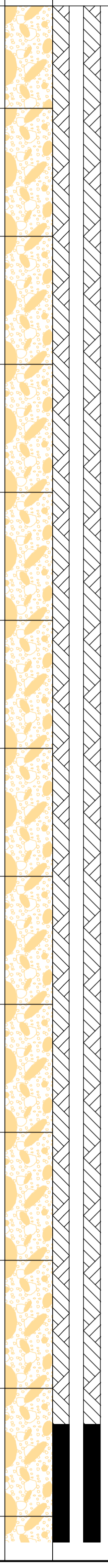
Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-15-(GT-16)

PROJECT:	RCML Near West TSF	DRILLING START:	December 2, 2016 11:52	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	December 2, 2016 11:52	GS ELEV.:	2667.7
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 845,116 E: 920,176	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0	As above. *(continued)*	2547.7		24	100		
125		124.0	As above.	2543.7		25	100		
130		129.0	As above.	2538.7		26	100		
135		134.0	As above.	2533.7		27	100	135 - 250: Hydro test #4 SI	
140		139.0	As above, weak friable matrix.	2528.7		28	100		
145		144.0	As above, weak matrix.	2523.7		29	100		
150		149.0	Continues CONGLOMERATE, slightly to moderately weathered, clast dominated, gravel with few cobbles, matrix is fine grained, poorly cemented clasts consist of schist, gneiss, quartz, tuff, weak HCl reaction.	2518.7		39	100		
155		154.0	As above.	2513.7		40	100		
160		159.0	As above.	2508.7		41	100		
165		164.0	As above.	2503.7		42	100		
170		169.0	As above, moderate HCl reaction.	2498.7		43	100		
175		174.0	As above, few mechanical breaks on ends.	2493.7		44	100		
180		179.0	As above.	2488.7		45	100		



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:46
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

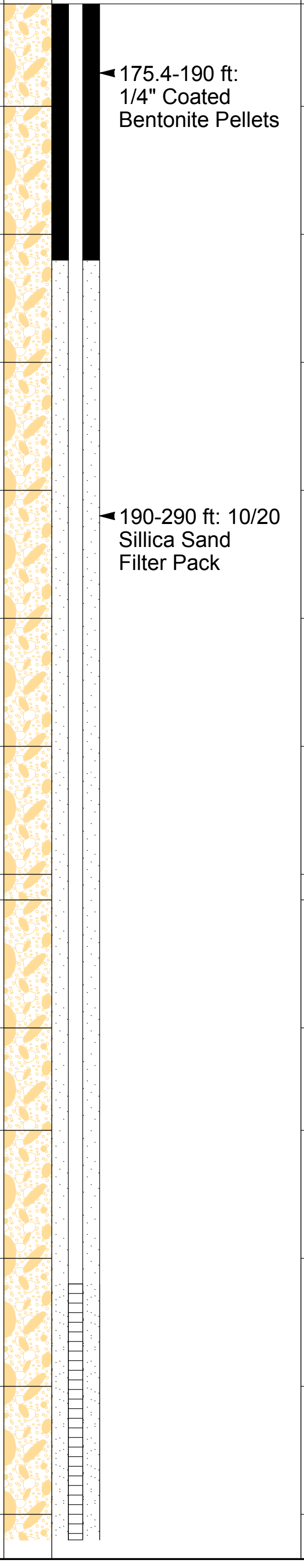
RECORD OF BOREHOLE DH16-15-(GT-16)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 2, 2016 11:52
DRILLING END: December 2, 2016 11:52
COORDINATES: N: 845,116 E: 920,176

SHEET: 4 of 5
GS ELEV.: 2667.7
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	As above. *(continued)*	2487.7		45	100		
185		184.0	Continues CONGLOMERATE fresh, matrix dominated some gravel, brown, clasts consist of schist, gneiss, quartz, tuff, diabase, weak HCl reaction.	2483.7		46	100		
190		189.0	As above.	2478.7		47	100		
195		194.0	As above.	2473.7		48	100		
200		199.0	As above.	2468.7		49	100		
205		204.0	As above.	2463.7		50	100		
210		209.0	As above.	2458.7		51	60		
		214.0	As above.	2453.7		52	100		
215		215.0	As above.	2452.7		53	100		
220		220.0	As above.	2447.7		53	100		
225		224.0	Becomes CONGLOMERATE, fresh, clast dominated, some gravel, brown, clasts consist of schist, gneiss, quartz, tuff, diabase, weak HCl reaction, competent.	2443.7		54	100		
230		229.0	Becomes CONGLOMERATE fresh, matrix dominated, some gravel and few cobbles, brown, clasts consist of schist, gneiss, quartz, tuff, diabase, moderate HCl reaction, competent.	2438.7		55	100		
235		234.0	As above.	2433.7		56	100		
240		239.0	As above.	2428.7		57	100		



Log continued on next page

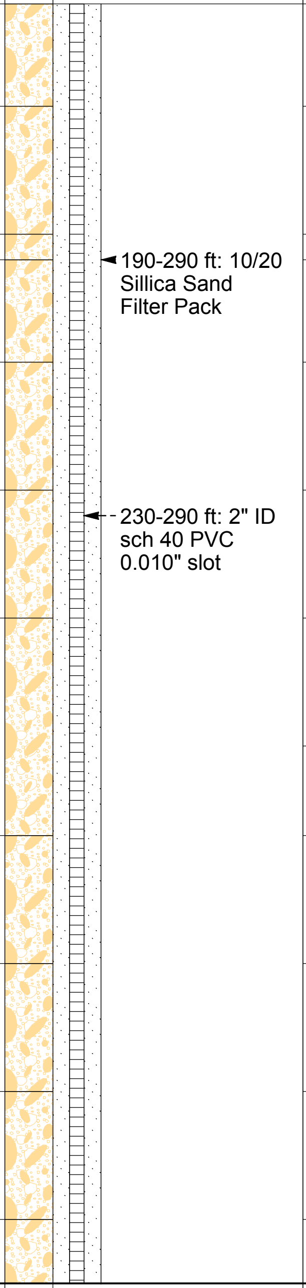
DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

RECORD OF BOREHOLE DH16-15-(GT-16)

PROJECT:	RCML Near West TSF	DRILLING START:	December 2, 2016 11:52	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	December 2, 2016 11:52	GS ELEV.:	2667.7
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 845,116 E: 920,176	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240		240.0		2427.7					
			As above. *(continued)*			57	100		
245		244.0		2423.7					
			As above.			58	50		
		249.0		2418.7					
250		250.0	As above.	2417.7		59	100	250 - 290: Hydro test #5 SI	
			As above.			60	100		
255		254.0		2413.7					
			As above.			61	100		
260		259.0		2408.7					
			As above.			62	100		
265		264.0		2403.7					
			As above.			63	100		
270						64	100		
		272.5		2395.2					
275			Becomes CONGLOMERATE, fresh, clast dominated, some gravel, brown, clasts consist of schist, gneiss, quartz, tuff, diabase, weak HCl reaction, competent.			65	100		
		277.5		2390.2					
280			Becomes CONGLOMERATE fresh, matrix dominated, some gravel and few cobbles, brown, clasts consist of schist, gneiss, quartz, tuff, diabase, moderate HCl reaction, competent.			66	100		
		282.5		2385.2					
285			As above.			67	100		
		287.5		2380.2					
			As above.			68	100		
290		290.0		2377.7					
295			Bottom of borehole at 290.0 ft. Completed as well. Refer to diagram.						
300									



DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-16 (GT-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 14:45
DRILLING END: December 6, 2016 14:45
COORDINATES: N: 845,081 E: 912,658

SHEET: 1 of 5
GS ELEV.: 2284.5
TOC ELEV.: na
DATUM:

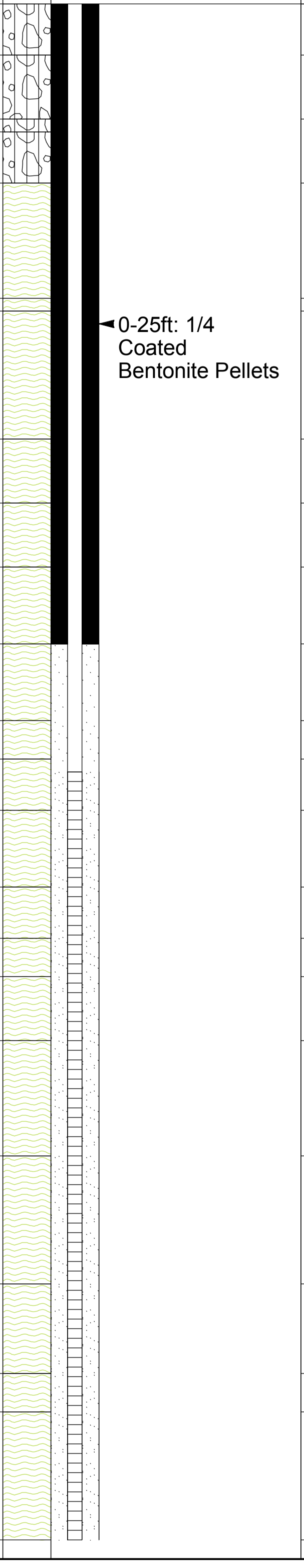
BORING METHOD: HQ3

SOIL PROFILE

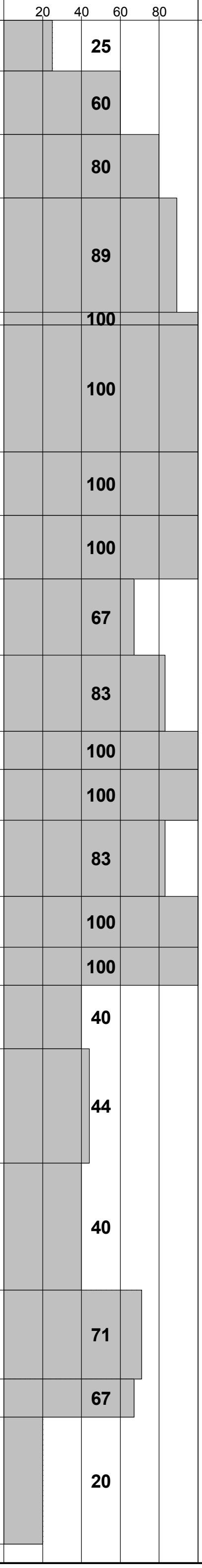
Depth	DESCRIPTION	Elev	USCS
0.0		2284.5	
2.0	Washed gravel, alluvium, pieces of sandstone and quartz	2282.5	
4.5	Unconsolidated alluvium rubble. sandstone, tuff, quartz, schist rubble	2280.0	
5.0		2279.5	
7.0	Surficial alluvium, clasts of tuff and quartz	2277.5	
11.5	Pinal schist (pCpi): dark green to gray, METASANDSTONE, fine-grained, foliated and brecciated, light oxidation.	2273.0	
12.0	As above, rubble.	2272.5	
17.0	As above.	2267.5	
19.5	As above.	2265.0	
22.0	As above.	2262.5	
25.0	As above.	2259.5	
28.0	As above.	2256.5	
29.5	As above.	2255.0	
31.5	As above.	2253.0	
34.5	Continues dark green to gray, METASANDSTONE, fault zone with rubble and plastic clay, foliated, fractured, light oxidation.	2250.0	
36.5	As above, oxidized.	2248.0	
38.0	As above.	2246.5	
40.5	As above.	2244.0	
45.0	As above.	2239.5	
50.0	As above.	2234.5	
53.5	As above.	2231.0	
55.0	As above.	2229.5	
60.0	Continues dark green to gray, METASANDSTONE with quartz veining, fine grained, fault zone continues, fractured and foliated, infill washed out.	2224.5	

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO



RUN NO.	CORE RECOVERY %
1	25
2	60
3	80
4	89
5	100
6	100
7	100
8	100
9	67
10	83
11	100
12	100
13	83
14	100
15	100
16	40
17	44
18	40
19	71
20	67
21	20

NOTES

0 - 17: Hydro test #1
FHT

17 - 77: Hydro test #2
SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

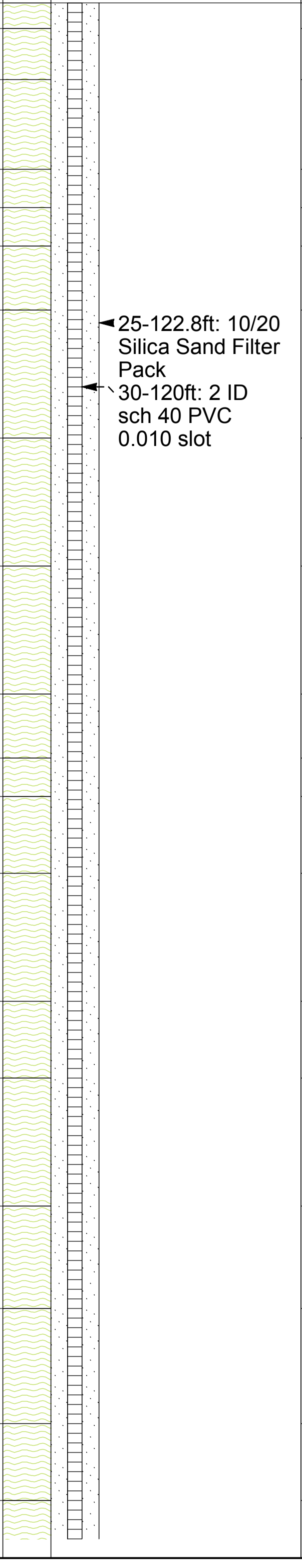
Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-16 (GT-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona
DRILLING START: December 6, 2016 14:45
DRILLING END: December 6, 2016 14:45
COORDINATES: N: 845,081 E: 912,658
SHEET: 2 of 5
GS ELEV.: 2284.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	HQ3	60.0		2224.5					
		61.0	As above.	2223.5		22	100		
65		63.0	As above.	2221.5		23	100		
		66.5	As above.	2218.0		24	57		
		68.0	As above.	2216.5		25	100		
70		69.5	Continues METASANDSTONE, dark green to gray, fine-grained, foliated, some oxidation, highly fractured.	2215.0		26	100		
		72.0	As above.	2212.5		27	100		
75		77.0	As above.	2207.5		28	100		
80		82.0	As above.	2202.5		29	100		
85		87.0	As above.	2197.5		30	90		
		89.5	As above.	2195.0		31	100		
90		91.0	As above.	2193.5		32	100		
		94.0	As above.	2190.5		33	100		
95		99.0	As above.	2185.5		34	100		
100		102.0	Continues METASANDSTONE, dark green to gray, fine-grained, foliated, jointed, little to no oxidation.	2182.5		35	100		
105		107.0	As above.	2177.5		36	100		
110		111.0	As above.	2173.5		37	100		
115		115.5	As above.	2169.0		38	100	113 - 142: Hydro test #3 SI & CRI	
		118.5	As above foliated, highly fractured.	2166.0		39	67		
120			As above, quartz veins.			40	80		



25-122.8ft: 10/20 Silica Sand Filter Pack
30-120ft: 2 ID sch 40 PVC 0.010 slot

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60
LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-16 (GT-2)

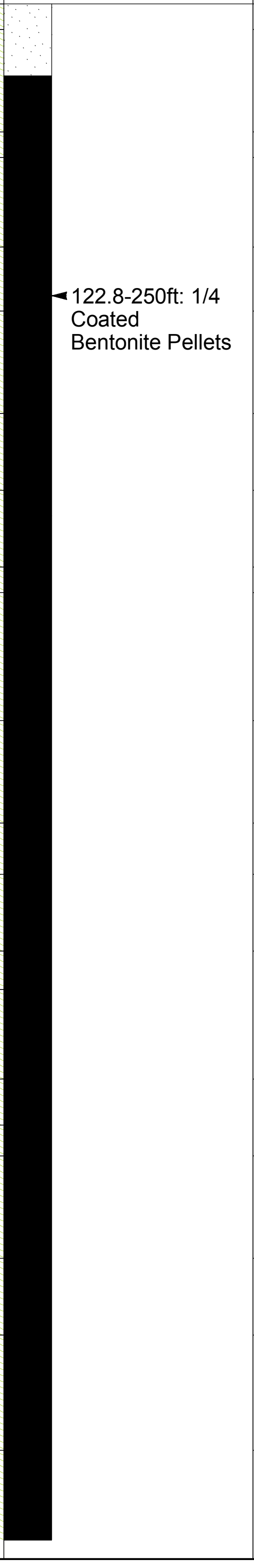
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 14:45
DRILLING END: December 6, 2016 14:45
COORDINATES: N: 845,081 E: 912,658

SHEET: 3 of 5
GS ELEV.: 2284.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0		2164.5					
	HQ3	121.0	As above, quartz veins. *(continued)*	2163.5		40	80		
125		125.0	As above, quartz veins.	2159.5		41	75		
		126.0	As above.	2158.5		42	100		
130		129.5	As above.	2155.0		43	100		
		132.0	As above.	2152.5		44	100		
135		136.0	Continues METASANDSTONE, dark green to gray, fine-grained, foliated, highly fractured, lost and broken core, possibly fault zone with infill washed out.	2148.5		45	50		
		139.0	As above, highly fractured.	2145.5		46	100		
140		142.0	As above.	2142.5		47	100		
		143.0	As above, quartz veins.	2141.5		48	100		
145		148.0	As above, some oxidation.	2136.5		49	100		
150		152.0	As above.	2132.5		50	50		
		154.0	As above.	2130.5		51	100		
155		157.0	As above.	2127.5		52	100		
		158.5	As above.	2126.0		53	40		
160		162.0	Continues METASANDSTONE, dark green to gray, fine-grained, foliated, fractured, gouge, little to no oxidation.	2122.5					
		163.8	As above.	2120.7		54	100		
165		165.0	As above, becomes fault breccia and gouge, crushed rock in clay matrix.	2119.5					
		169.0	As above.	2115.5		55	63		
170		172.0	Becomes METASANDSTONE, dark green to gray, fine-grained, foliated, little to no oxidation, crushed zones.	2112.5		56	100		
175		176.5	As above.	2108.0		57	78		
180			As above.			58	100		

WELL DIAGRAM


122.8-250ft: 1/4 Coated Bentonite Pellets

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-16 (GT-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 14:45
DRILLING END: December 6, 2016 14:45
COORDINATES: N: 845,081 E: 912,658

SHEET: 4 of 5
GS ELEV.: 2284.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2104.5						
		181.0	As above. *(continued)*	2103.5			58	100		
185		185.0	Becomes contact with DIABASE, highly oxidized, dark green to gray with dark red, drillers note improvement with fluid circulation.	2099.5			59	100	183 - 250: Hydro test #4 SI	
190		190.0	Becomes DIABASE (Yd): dark brownish red, highly oxidized, fine to medium grained, jointed.	2094.5			60	100		
195		195.0	As above.	2089.5			61	100		
		196.0	As above.	2088.5		122.8-250ft: 1/4 Coated Bentonite Pellets	62	100		
200		201.0	As above.	2083.5			63	100		
205		206.0	As above.	2078.5			64	100		
210	HQ3	211.0	As above.	2073.5			65	100		
215		216.0	As above.	2068.5			66	100		
220		221.0	Continues DIABASE, dark brownish red, highly oxidized, fine to medium grained, jointed, competent.	2063.5			67	100		
225		226.0	As above.	2058.5			68	100		
230		231.0	As above.	2053.5			69	100		
235		236.0	As above.	2048.5			70	100		
		239.0	Becomes some calcite veining.	2045.5			71	100		
240							72	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-16 (GT-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 14:45
DRILLING END: December 6, 2016 14:45
COORDINATES: N: 845,081 E: 912,658

SHEET: 5 of 5
GS ELEV.: 2284.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0		2044.5							
		242.0	Continues DIABASE, dark brownish red, highly oxidized, fine to medium grained, jointed. *(continued)*	2042.5				72	100		
245		247.0	As above.	2037.5				73	100		
250		250.0	As above.	2034.5				74	100		
255 260 265 270 275 280 285 290 295 300			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

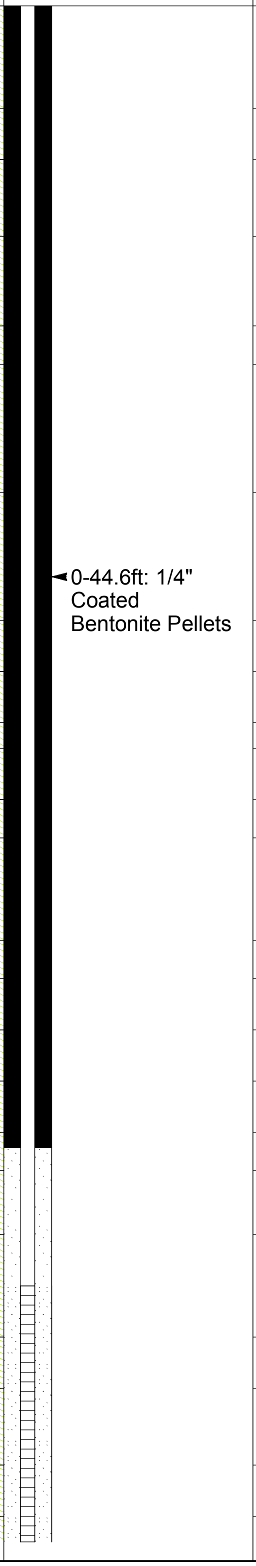
RECORD OF BOREHOLE DH16-17-(GT36)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 13:50
DRILLING END: December 6, 2016 13:50
COORDINATES: N: 851,184 E: 924,180

SHEET: 1 of 4
GS ELEV.: 2671.9
TOC ELEV.: na
DATUM:

Description	Depth	Elev	USCS	Run No.	Core Recovery %	Notes
	0.0	2671.9				0 - 38: Hydro test #1 FHT
Pinal schist (pCpi): grayish orange, SCHIST, foliated, completely weathered, very highly fractured and argillized, some iron staining.	4.0	2667.9				
As above, clayey.	6.0	2665.9		1	75	
As above.	9.0	2662.9		2	100	
As above, rubbly.	12.5	2659.4		3	77	
As above.	14.0	2657.9		4	100	
As above, rubble.	19.0	2652.9		5	34	18 - 18.5: bag sample
As above, rubble.	24.0	2647.9		6	20	
Continues SCHIST, fault zone, reddish gray, highly weathered, foliated, some oxidation, gougey zones, few calcite veins.	26.0	2645.9		7	65	
As above, rubble.	28.0	2643.9		8	25	
As above.	29.0	2642.9		9	30	
As above.	31.0	2640.9		10	75	
As above.	32.5	2639.4		11	100	
As above.	36.5	2635.4		12	95	
As above.	38.0	2633.9		13	67	
Continues SCHIST, green to greenish gray, foliated, rubbly with corestones, calcified, weak HCl reaction, large quartz vein, poor recovery.	40.0	2631.9		14	50	39 - 70: Hydro test #2 SI
As above.	42.0	2629.9		15	75	
As above.	44.0	2627.9		16	85	
As above.	45.5	2626.4		17	87	
As above.	48.0	2623.9		18	92	
As above.	52.0	2619.9		19	33	
As above, rubble.	54.0	2617.9		20	25	
As above.	57.0	2614.9		21	77	
Continues SCHIST green to greenish gray, foliated, moderate iron staining, weak HCl reaction, rubble throughout.	59.0	2612.9		22	100	
				23	100	



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-17-(GT36)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

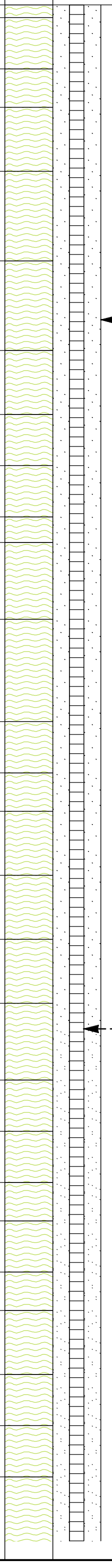
DRILLING START: December 6, 2016 13:50
DRILLING END: December 6, 2016 13:50
COORDINATES: N: 851,184 E: 924,180

SHEET: 2 of 4
GS ELEV.: 2671.9
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	RUN NO.	CORE RECOVERY %	NOTES
60.0		2611.9			
60.5	As above. *(continued)*	2611.4			
62.5	As above.	2609.4	24	90	
64.0	As above.	2607.9	25	100	
66.5	As above.	2605.4	26	60	
70.0	As above.	2601.9	27	63	
73.5	Continues SCHIST, green to greenish gray, foliated and fractured throughout, some oxidation, some calcite/quartz veins, moderate HCl reaction, rubbly and broken, poor recovery.	2598.4	28	57	70 - 139.5: Hydro test #3 SI
76.0	As above.	2595.9	29	100	
78.0	As above.	2593.9	30	30	
80.0	As above.	2591.9	31	90	
81.0	As above, some broken core.	2590.9	32	100	
84.0	As above, rubble zones.	2587.9	33	67	
88.0	As above.	2583.9	34	90	
90.0	As above.	2581.9	35	80	
91.5	As above.	2580.4	36	100	
94.0	As above.	2577.9	37	88	
96.5	As above.	2575.4	38	92	
99.0	Continues SCHIST, greenish gray to brown, foliated and brecciated texture, moderately fractured, veining, calcified, some iron staining, moderate HCl reaction.	2572.9	39	80	
102.0	As above.	2569.9	40	87	
104.0	As above.	2567.9	41	60	
106.0	As above.	2565.9	42	65	
107.5	As above.	2564.4	43	87	
109.5	As above, folded.	2562.4	44	75	
111.0	As above.	2560.9	45	87	
113.5	As above.	2558.4	46	100	
115.5	As above.	2556.4	47	85	
117.5	As above.	2554.4	48	100	
	As above.		49	73	

Log continued on next page

WELL DIAGRAM



44.6-100ft: 10/20 Silica Sand Filter Pack

50-150ft: 2" ID sch 40 PVC 0.010" slot

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

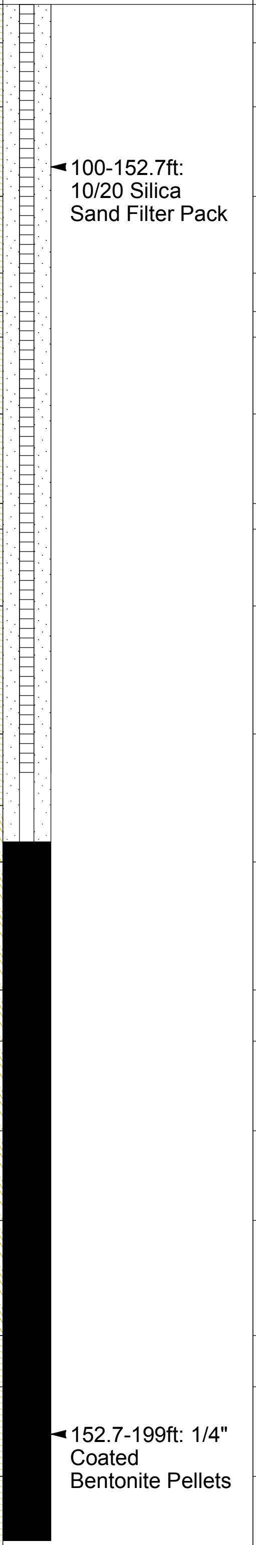
RECORD OF BOREHOLE DH16-17-(GT36)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 13:50
DRILLING END: December 6, 2016 13:50
COORDINATES: N: 851,184 E: 924,180

SHEET: 3 of 4
GS ELEV.: 2671.9
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120.0		2551.9					
121.5	As above. *(continued)*	2550.4		49	73		
124.0	Continues SCHIST, dark green to greenish gray, foliation is subvertical and curving, fractured, light oxidation, weak HCl reaction.	2547.9		50	52		
127.5	As above.	2544.4		51	91		
130.5	As above, brecciated and crushed.	2541.4		52	90		
132.0	As above.	2539.9		53	100		
133.0	As above, broken core.	2538.9		54	50		
136.0	As above, brecciated.	2535.9		55	87		
139.5	As above, moderately fractured.	2532.4		56	91		
140.5	As above, highly fractured.	2531.4		57	100	140 - 199: Hydro test #4 SI	
143.5	As above, moderately fractured.	2528.4		58	77		
148.5	As above, no iron staining.	2523.4		59	90		
151.3	As above.	2520.6		60	100		
153.5	FAULT ZONE, crushed rock with clayey gouge, moderate iron staining, extremely weak.	2518.4					
158.5	As above.	2513.4		61	24		
160.5	As above, becomes greenish gray.	2511.4		62	100		
164.0	Becomes faulted SCHIST, dark gray to greenish gray, foliated, crushed, and brecciated, weak HCl reaction.	2507.9		63	57		
167.5	As above.	2504.4		64	86		
172.0	As above.	2499.9		65	67		
174.0	Becomes SCHIST, corestones with breccia and crushed rock, foliated, brecciated texture, weak HCl reaction, quartz veining.	2497.9		66	100		
177.5	As above.	2494.4		67	66		
	As above.			68	83		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH16-17-(GT36)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 6, 2016 13:50
DRILLING END: December 6, 2016 13:50
COORDINATES: N: 851,184 E: 924,180

SHEET: 4 of 4
GS ELEV.: 2671.9
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev
180.0		2491.9
181.5	As above. *(continued)*	2490.4
183.0	Continues SCHIST, dark gray to greenish gray, foliated, crushed and brecciated throughout, gouge zones, weak HCl reaction, few large pieces of quartz.	2488.9
184.5	As above, massive quartz vein.	2487.4
188.0	As above, crenulated, small zones of breccia.	2483.9
192.0	As above.	2479.9
194.0	As above.	2477.9
199.0	As above.	2472.9

Bottom of borehole at 199.0 ft.
Completed as well. Refer to diagram.

CORE INFO

RUN NO.	CORE RECOVERY %
68	83
69	100
70	92
71	78
72	100
73	100

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-18 (GT-35)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

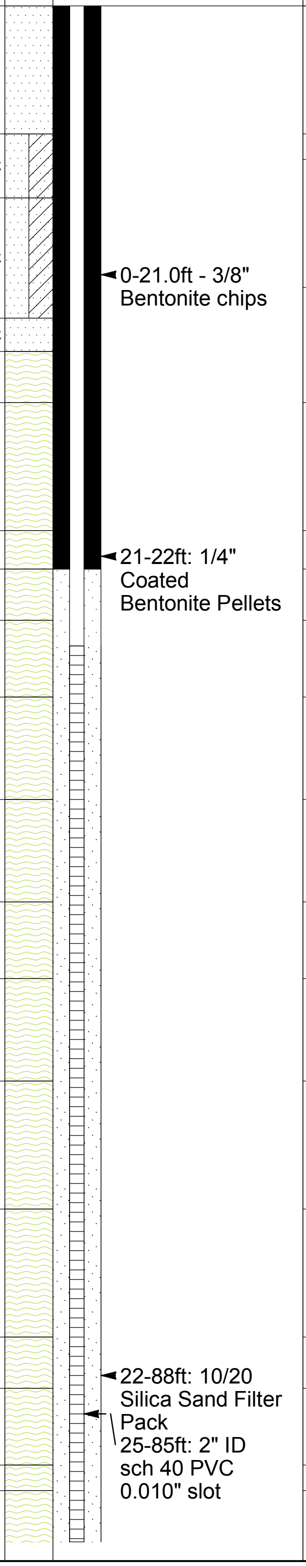
DRILLING START: December 8, 2016 09:14
DRILLING END: December 11, 2016 14:26
COORDINATES: N: 842,319 E: 909,644

SHEET: 1 of 5
GS ELEV.: 2222.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2222.0	
	(SW), SAND, well graded, fine to coarse; quartz, schist gravel; unconsolidated alluvium, washed gravel,		SW
5.0		2217.0	
	(SW-SC), SAND, well graded, fine to coarse subrounded to subangular gravel, some medium plasticity fines, dark brown-red, weathered; loose, moist		SW-SC
7.5		2214.5	
	(SW-SC), SAND, well graded, some medium plasticity fines, trace fine rounded to subrounded gravel, dark brown, weathered; compact, moist, 5-11-16-41-50/2" (3" spacing)		SW-SC
12.2		2209.8	
13.5	(SW-SC), SAND, well graded, fine to coarse subrounded to subangular gravel, some plasticity fines; washed gravel. estimated from S-2	2208.5	SW-SC
15.5		2206.5	
	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, foliated, highly weathered, some oxidation. As above.		
20.5		2201.5	
	As above.		
22.0		2200.0	
	As above.		
24.0		2198.0	
	As above.		
27.0		2195.0	
	As above.		
31.0		2191.0	
	As above.		
35.0		2187.0	
	As above.		
38.0		2184.0	
	As above.		
42.0		2180.0	
	As above.		
47.0		2175.0	
	As above.		
52.0		2170.0	
	As above.		
54.0		2168.0	
	As above.		
57.0		2165.0	
58.0	Pinal Schist (pCpi): quartz vein with some oxidation.	2164.0	

Log continued on next page



CORE INFO

RUN NO.	CORE RECOVERY %
1	20
2	70
3	20
4	67
5	80
6	100
7	50
8	83
9	88
10	75
11	33
12	100
13	100
14	72
15	50
16	100
17	100
18	100

NOTES

0 - 24: Hydro test #1 FHT

27 - 80.5: Hydro test #2 SI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

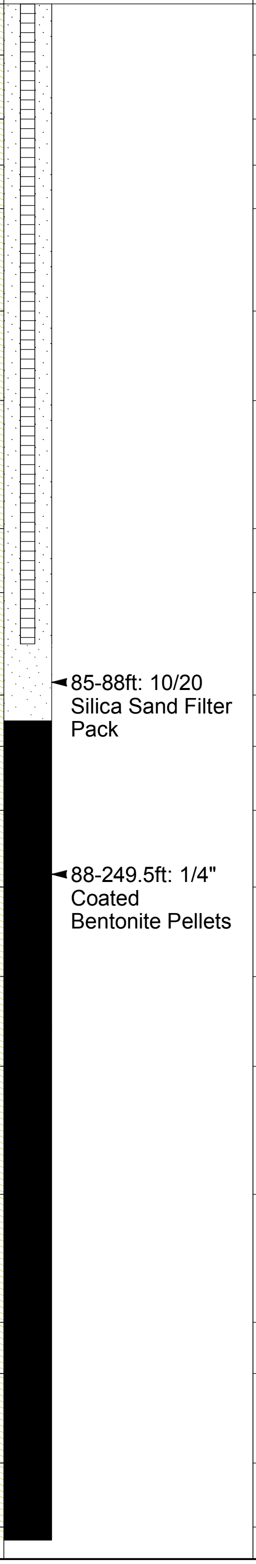
RECORD OF BOREHOLE DH16-18 (GT-35)

PROJECT:	RCML Near West TSF	DRILLING START:	December 8, 2016 09:14
PROJECT NO.:	1531436	DRILLING END:	December 11, 2016 14:26
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 842,319 E: 909,644
SHEET:	2 of 5	GS ELEV.:	2222.0
TOC ELEV.:	na	DATUM:	

Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60.0		2162.0					
62.0	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, with quartz, foliated, some oxidation. *(continued)*	2160.0		18	100		
64.5	As above.	2157.5		19	100		
66.3	As above.	2155.7		20	100		
68.0	As above, becomes brecciated.	2154.0		20	100		
72.0	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, foliated, minor oxidation.	2150.0		21	100		
75.5	As above.	2146.5		22	100		
80.5	As above, some oxidation.	2141.5		23	100		
83.0	As above.	2139.0		24	100		
87.0	As above.	2135.0		25	100	83 - 184.5: Hydro test #3 SI	
89.0	As above.	2133.0		26	100		
91.5	As above, high angle joints sub-parallel to core axis.	2130.5		27	100		
94.5	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, fine grained, highly foliated, some oxidation.	2127.5		28	100		
98.0	As above.	2124.0		29	86		
101.5	As above.	2120.5		30	100		
106.5	As above.	2115.5		31	100		
111.5	As above.	2110.5		32	30		
113.5	As above.	2108.5		33	50		
117.0	As above, becomes less foliated.	2105.0		34	100		
119.5	As above.	2102.5		35	100		

Log continued on next page

WELL DIAGRAM



DRILLING CO.:	Boart Longyear	LOGGED:	Erik Novak
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-18 (GT-35)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 8, 2016 09:14
DRILLING END: December 11, 2016 14:26
COORDINATES: N: 842,319 E: 909,644

SHEET: 3 of 5
GS ELEV.: 2222.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %
120	120.0		2102.0			
	122.0	As above. *(continued)*	2100.0		36	100 100
	124.0	As above.	2098.0		37	100
125	126.0	As above.	2096.0		38	100
130	130.0	As above.	2092.0		39	100
	133.0	As above.	2089.0		40	100
135	135.5	As above, becomes faulted.	2086.5		41	100
140	140.0	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, fine grained, foliated, some oxidation.	2082.0		42	100
	143.5	As above.	2078.5		43	100
145	148.5	As above.	2073.5		44	80
150	151.5	As above.	2070.5		45	100
155	155.0	As above.	2067.0		46	86
160	160.0	As above.	2062.0		47	100
	163.0	As above.	2059.0		48	100
165	166.5	As above.	2055.5		49	100
170	170.5	As above.	2051.5		50	100
175	175.5	As above.	2046.5		51	100
180	179.5	As above, slight weathering.	2042.5		52	100

WELL DIAGRAM: 88-249.5ft: 1/4" Coated Bentonite Pellets

NOTES

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH16-18 (GT-35)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 8, 2016 09:14
DRILLING END: December 11, 2016 14:26
COORDINATES: N: 842,319 E: 909,644

SHEET: 4 of 5
GS ELEV.: 2222.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE: DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2042.0					
			As above. *(continued)*				100		
		184.5		2037.5		53	100	183 - 249.5: Hydro test #4 SI	
185		189.0	As above.	2033.0		54	100		
190		192.0	As above.	2030.0		55	100		
195		197.0	As above.	2025.0		56	100		
200		201.5	As above, some oxidation.	2020.5		57	78		
		204.5	As above, no oxidation.	2017.5		58	100		
205		208.0	As above, some oxidation.	2014.0		59	100		
210		211.5	As above.	2010.5		60	77		
		214.0	As above.	2008.0		61	100		
215		218.0	As above.	2004.0		62	100		
		218.7	As above.	2003.3		63	67		
220		221.0	Fault gouge.	2001.0					
		222.5	Pinal Schist (pCpi): dark greenish grey with dark red, METASANDSTONE, fine grained, with some quartz, foliated, highly oxidatized.	1999.5		64	100		
225		227.0	As above, becomes slightly brecciated.	1995.0		65	100		
230		230.5	Pinal Schist (pCpi): dark greenish grey, METASANDSTONE, fine grained, foliated, oxidized.	1991.5		66	100		
		233.0	As above.	1989.0		67	100		
235		235.0	As above.	1987.0		68	100		
		237.5	Fault gouge, intervals of competent rock within zone of clayey gouge.	1984.5		69	100		
240			As above.			70	78		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Erik Novak
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH16-18 (GT-35)

PROJECT:	RCML Near West TSF	DRILLING START:	December 8, 2016 09:14	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	December 11, 2016 14:26	GS ELEV.:	2222.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 842,319 E: 909,644	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240		240.0		1982.0							
		242.0	As above. *(continued)*	1980.0				70	78		
245		245.0	Pinal Schist (pCpi): dark greenish grey with dark red, METASANDSTONE, fine grained, foliated, intervals of gouge, highly fractured, oxidatized.	1977.0				71	83		
		247.0	As above, becomes highly oxidized.	1975.0				72	100		
250		249.5	As above, highly foliated and broken.	1972.5				73	80		
			Refusal at 12.2 ft. Bottom of borehole at 249.5 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

CORE RECOVERY % scale: 20 40 60 80

DRILLING CO.:	Boart Longyear	LOGGED:	Erik Novak
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

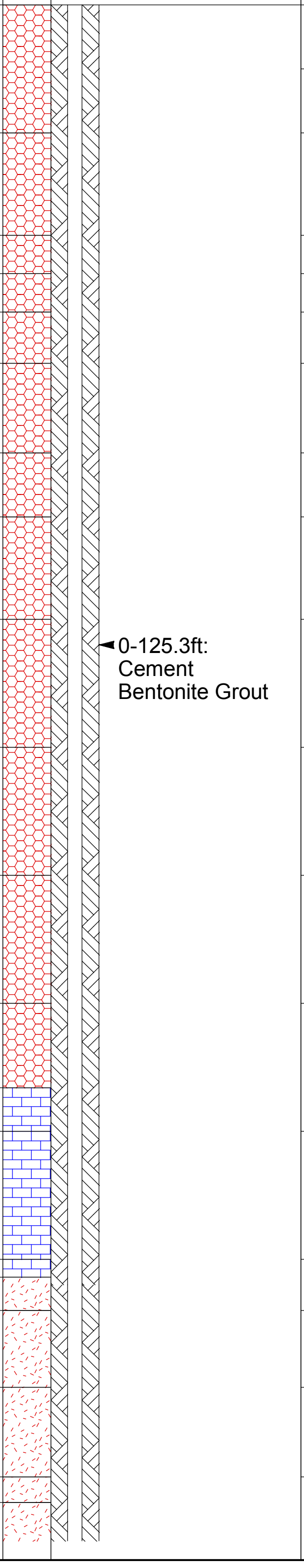
RECORD OF BOREHOLE DH16-19-(GT-4)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 11, 2016 12:43
DRILLING END: December 15, 2015 12:15
COORDINATES: N: 846,101 E: 916,859

SHEET: 1 of 5
GS ELEV.: 2443.4
TOC ELEV.: na
DATUM:

Depth	Elev	DESCRIPTION	RUN NO.	CORE RECOVERY %
0.0	2443.4	BASALT (TB): dark green to black, aphanitic groundmass with epidote filled amygdules, olivine phenocrysts, oxidation on discontinuity surfaces.	1	100
5.0	2438.4	As above, calcite veins, moderatly fractured, strong HCl reaction.	2	95
9.0	2434.4	As above.	3	67
10.5	2432.9	BASALT (TB): dark green to green, phaneritic ground mass with pyroxene phenocrysts, discontinuities surfaces are oxidized, weak HCl reaction.	4	80
12.0	2431.4	As above, mostly rubble highly fractured	5	65
14.0	2429.4	As above, groundmass becomes aphanitic, highly fractured, minor breccia with calcite infill.	6	86
17.5	2425.9	As above, highly oxidized.	7	88
20.0	2423.4	As above, moderately fractured and brecciated.	8	95
24.0	2419.4	As above.	9	78
29.0	2414.4	As above.	10	80
34.0	2409.4	As above.	11	94
39.0	2404.4	As above, breccia	12	98
42.3	2401.1	Mescal Limestone (pCmls): LIMESTONE, light gray to pink, very fine grained, light iron staining, few healed fractures infilled with calcite.		
44.0	2399.4	As above	13	100
49.0	2394.4	As above	14	100
49.7	2393.7	DIABASE (pCdiab): dark gray to black, fine grained, moderatly fractured, few calcite veins, layer of clay and breccia at contact 1" thick.		
51.0	2392.4	As above, becciated.	15	100
54.0	2389.4	As above, brecciated.	16	94
57.5	2385.9	As above, broken core.	17	60
58.5	2384.9	As above.		



NOTES

0 - 39: Hydro test #1 FHT
9 - 10.5: Drill blocked resulted in broken core.
40 - 57.5: Hydro test #2 SI & CRI
55 - 139: Hydro test #3 SI
57.5 - 58.5: Drill blocked, broken core.
58.5 - 63: Misslatch-replacing landing

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

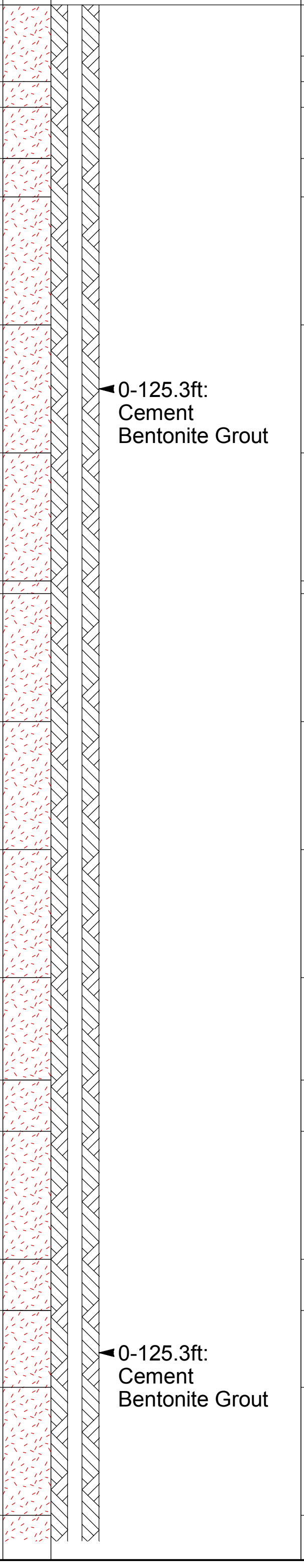
RECORD OF BOREHOLE DH16-19-(GT-4)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 11, 2016 12:43
DRILLING END: December 15, 2015 12:15
COORDINATES: N: 846,101 E: 916,859

SHEET: 2 of 5
GS ELEV.: 2443.4
TOC ELEV.: na
DATUM:

Depth	SOIL PROFILE – DESCRIPTION	Elev
60.0	As above. *(continued)*	2383.4
63.0	DIABASE (pCdiab): dark gray to black, fine grained, highly fractured, few calcite veins, brecciated texture, some fractures infilled with calcite, moderate oxidation around fractures.	2380.4
64.0	As above.	2379.4
66.0	As above.	2377.4
67.5	As above.	2375.9
72.5	As above, healed fractures with calcite.	2370.9
77.5	As above.	2365.9
82.5	As above.	2360.9
83.0	As above.	2360.4
88.0	As above.	2355.4
93.0	DIABASE (pCdiab): red to brownish black, coarse grained, calcite veining, fractured with breccia zones, partially oxidized, oxidation on discontinuities.	2350.4
98.0	As above, less fractured	2345.4
102.0	DIABASE (pCdiab): pinkish brown to dark brown, coarse to pegmatitic, minor calcite stockwork, abundant oxidation.	2341.4
104.0	As above, pegmatitic vein, breccia and rubble.	2339.4
109.0	DIABASE (pCdiab): red to brownish black, medium grained, few calcite veins, highly fractured, minor oxidation, brecciated.	2334.4
111.0	As above, becomes coarser grained.	2332.4
114.0	As above, no oxidation.	2329.4
119.0		2324.4



RUN NO.	CORE RECOVERY %
17	60
18	80
19	100
20	100
21	100
22	96
23	94
24	100
25	60
26	100
27	90
28	100
29	100
30	100
31	96
32	100
33	90
34	100
35	96

NOTES: shoulder and springs.

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

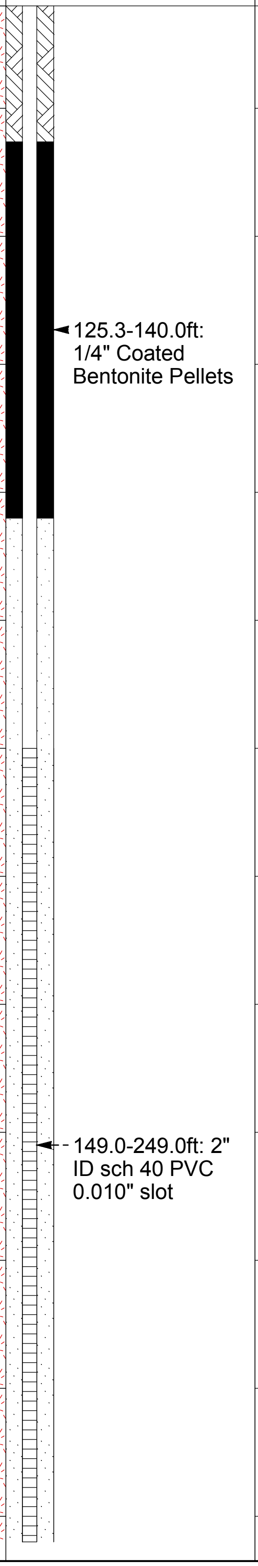
DRAFT

RECORD OF BOREHOLE DH16-19-(GT-4)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 11, 2016 12:43
DRILLING END: December 15, 2015 12:15
COORDINATES: N: 846,101 E: 916,859

SHEET: 3 of 5
GS ELEV.: 2443.4
TOC ELEV.: na
DATUM:



125.3-140.0ft: 1/4" Coated Bentonite Pellets

149.0-249.0ft: 2" ID sch 40 PVC 0.010" slot

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes	Additional Lab Testing
120.0	As above, dark grey to black, slight oxidation. *(continued)*	2323.4		35	96		
124.0	As above.	2319.4		36	100		
129.0	As above.	2314.4		37	100		
134.0	As above, very broken.	2309.4		38	56	134 - 139: Drill misslatch, broken.	
139.0	DIABASE (pCdiab): dark gray to black, coarse grained, few calcite veins, no oxidation.	2304.4		39	100	139 - 189: Hydro test #4 SI	
144.0	As above, moderately fractured.	2299.4		40	100		
149.0	As above.	2294.4		41	100		
154.0	As above, minor oxidation on discontinuties.	2289.4		42	100		
159.0	As above.	2284.4		43	100		
164.0	As above.	2279.4		44	100		
169.0	As above, becomes brecciated with quartz and calcite infill.	2274.4		45	100		
174.0	DIABASE (pCdiab): dark gray to black, medium grained, few calcite veins, slight iron staining in joints, few joints, brecciated texture.	2269.4		46	100		
179.0	As above.	2264.4		47	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-19-(GT-4)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

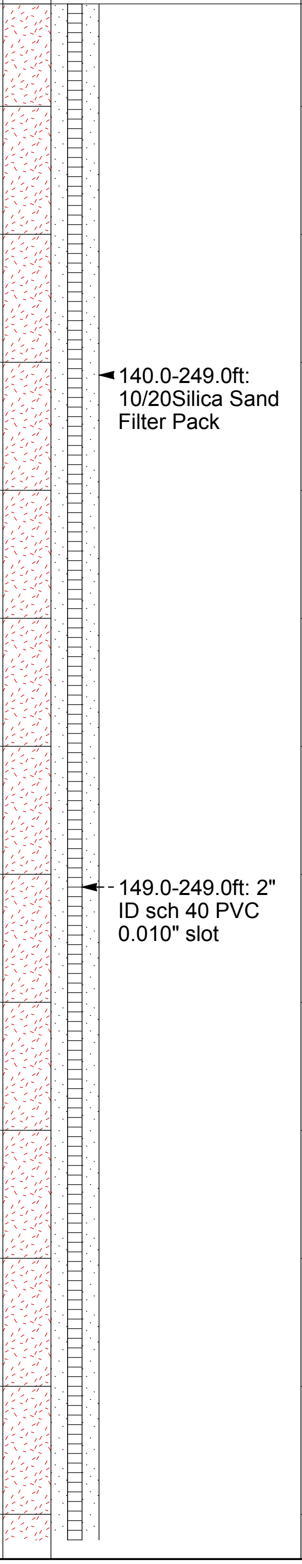
DRILLING START: December 11, 2016 12:43
DRILLING END: December 15, 2015 12:15
COORDINATES: N: 846,101 E: 916,859

SHEET: 4 of 5
GS ELEV.: 2443.4
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	As above. *(continued)*	2263.4		47	100		
185		184.0	As above, becomes coarse grained.	2259.4		48	100		
190		189.0	As above, becomes red brown to black, medium grained.	2254.4		49	96	190 - 249: Hydro test #5 SI	
195		194.0	As above.	2249.4		50	100		
200		199.0	As above.	2244.4		51	100		
205		204.0	As above.	2239.4		52	100		
210		209.0	As above, becomes coarse with calcite filled voids.	2234.4		53	100		
215		214.0	As above.	2229.4		54	100		
220		219.0	As above	2224.4		55	100		
225		224.0	As above.	2219.4		56	100		
230		229.0	As above.	2214.4		57	100		
235		234.0	As above, 2 joint sets.	2209.4		58	100		
240		239.0	As above	2204.4		59	100		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

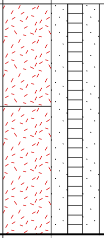
LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-19-(GT-4)

PROJECT:	RCML Near West TSF	DRILLING START:	December 11, 2016 12:43	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	December 15, 2015 12:15	GS ELEV.:	2443.4
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 846,101 E: 916,859	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2203.4							
			As above *(continued)*					59	**100**		
245		244.0		2199.4							
			As above					60	**100**		
		249.0		2194.4							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

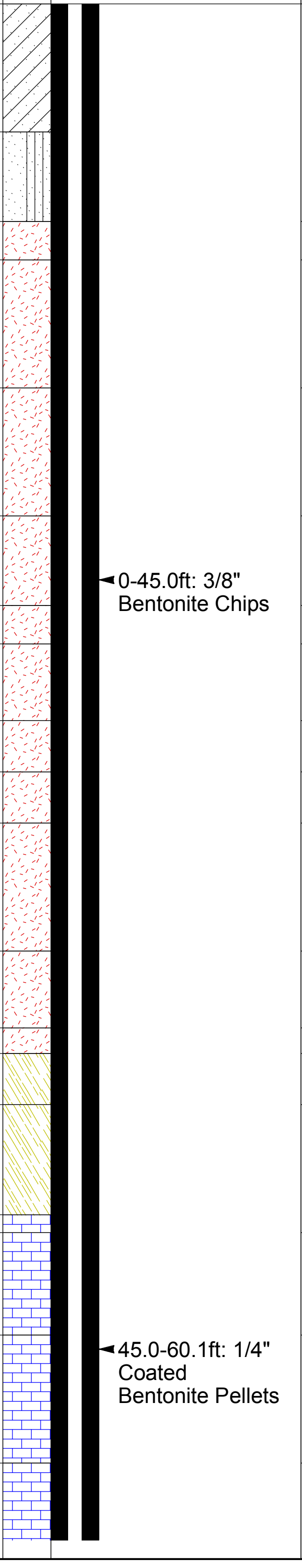
RECORD OF BOREHOLE DH16-20 (GT-03)

PROJECT:	RCML Near West TSF	DRILLING START:	December 13, 2016 07:40	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	December 17, 2016 11:00	GS ELEV.:	2369.5
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 844,754 E: 915,215	TOC ELEV.:	na
				DATUM:	

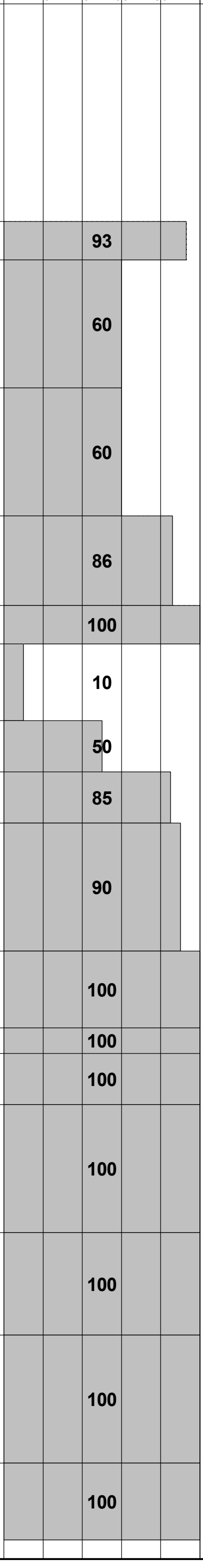
SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0	(CH), CLAY, medium plasticity, coarse subangular gravel, fine to coarse subangular to angular sand, red-brown, stratified, moderate HCL reaction; diabase gravel; wet	2369.5	CH
5.0	(SP-SC), SAND, fine to medium, poorly graded, angular, some non plastic fines, trace gravel, dark red-brown, weathered, iron oxide staining, moderate HCL reaction; moist, diabase regolith, SPT (3" int): 9-38-50/2"	2364.5	SP-SC
8.5		2361.0	
10.0	DIABASE (pCdiab): red brown, completely to moderately weathered, friable and weak, weathered to sand, oxidized. As above.	2359.5	
15.0	As above, rubble.	2354.5	
20.0	DIABASE (pCdiab): red-brown, completely to highly weathered, brecciated, oxidized, calcite veins present.	2349.5	
23.5	As above.	2346.0	
25.0	As above.	2344.5	
28.0	As above, mislatch, recovered rubble, oxidized with thin calcite veining.	2341.5	
30.0	DIABASE (pCdiab): red brown, completely to highly weathered, strong oxidation, brecciated, moderate reaction to HCl, calcite cementation, rubble.	2339.5	
32.0	As above.	2337.5	
37.0	As above.	2332.5	
40.0		2329.5	
41.0	As above, becomes faulted, brecciated and crushed with sandy gouge, highly oxidized.	2328.5	
43.0	FAULT: contact with limestone is brecciated with gouge zones, mixed diabase and limestone clasts. As above.	2326.5	
47.3		2322.2	
48.0	Mescal Limestone (pCmls): pink LIMESTONE calcite veining, strong rock, faulted zones. As above.	2321.5	
52.0	As above, fault gouge 56.5-57ft.	2317.5	
57.0	As above, moderately weathered sections of gouge.	2312.5	

Log continued on next page



CORE INFO



RUN NO.	CORE RECOVERY %
2	93
3	60
4	60
5	86
6	100
7	10
8	50
9	85
10	90
11	100
12	100
13	100
14	100
15	100
16	100
17	100

NOTES

0 - 23.5: Hydro test #1 FHT

25 - 28: Rock in bit causes mis-latch, poor recovery.

36 - 57: Hydro test #2 SI

52 - 131: Hydro test #3 SI

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Cara Shonsey
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-20 (GT-03)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

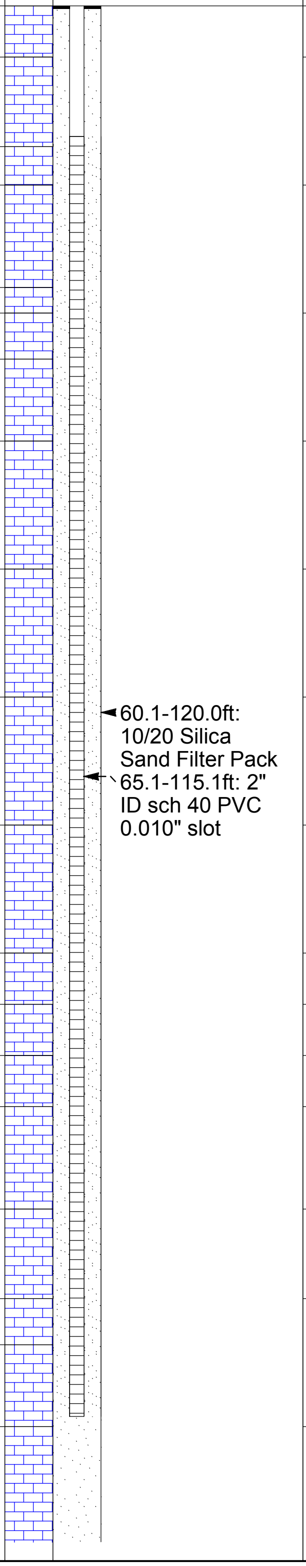
DRILLING START: December 13, 2016 07:40
DRILLING END: December 17, 2016 11:00
COORDINATES: N: 844,754 E: 915,215

SHEET: 2 of 5
GS ELEV.: 2369.5
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth (ft)	Description	Elev	USCS
60.0		2309.5	
62.0	As above, moderately weathered sections of gouge. *(continued)*	2307.5	
65.5	Becomes GOUGE, light pink sandy clay with gravel sized clasts.	2304.0	
67.0	Mescal Limestone (pCmls)): dark pink LIMESTONE moderately weathered, very strong to strong.	2302.5	
71.0	As above, fractures coated with gouge.	2298.5	
72.0	As above, becomes highly weathered, brecciated.	2297.5	
73.8	As above, gouge.	2295.7	
77.0	Mescalero Limestone (pCmls): light gray LIMESTONE, highly weathered, oxidized.	2292.5	
82.0	As above, highly weathered.	2287.5	
87.0	Mescalero Limestone (pCmls): pink LIMESTONE, highly weathered, oxidized.	2282.5	
92.0	As above, highly fractured, chlorite infill.	2277.5	
97.0	Becomes light pink, and dark gray LIMESTONE, foliated and folded, sheared, altered, and boudined.	2272.5	
99.0	As above, fault zone, breccia, crushed rock and sand and little clay, some oxidation and silicification.	2270.5	
101.0	As above, transitions out of fault zone.	2268.5	
103.0	Becomes brown LIMESTONE, highly weathered, highly fractured, oxidized.	2266.5	
107.0	As above.	2262.5	
110.5	Becomes pink LIMESTONE, black stratified chert inclusions, cemented gouge at bottom 1 ft of run.	2259.0	
112.3	Continues cemented GOUGE, highly weathered.	2257.2	
115.5	Becomes pink LIMESTONE, moderately weathered, highly fractured.	2254.0	
	Becomes orange gray to dark gray LIMESTONE, foliated and boudined, broken with rubbly zones, highy oxidized.		

Log continued on next page



60.1-120.0ft: 10/20 Silica Sand Filter Pack
65.1-115.1ft: 2" ID sch 40 PVC 0.010" slot

CORE INFO

RUN NO.	CORE RECOVERY %
17	100
18	100
19	100
20	100
21	100
22	100
23	100
24	50
25	100
26	100
27	100
28	75
29	80
30	100
31	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-20 (GT-03)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 13, 2016 07:40
DRILLING END: December 17, 2016 11:00
COORDINATES: N: 844,754 E: 915,215

SHEET: 3 of 5
GS ELEV.: 2369.5
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG
120.0		2249.5		
120.5	As above, brecciated.	2249.0		Limestone
125.5	As above, highly oxidized with MnOx dendrites.	2244.0		Limestone
131.0	Becomes light pink LIMESTONE, moderately weathered, highly fractured, partially brecciated.	2238.5		Limestone
133.5	Dripping Springs Quartzite (pCds): gray pink QUARTZITE, fine grained, many fractures near contact, moderately weathered, moderate HCl reaction.	2236.0		Quartzite
136.0	As above, liesegang banding present.	2233.5		Quartzite
141.0	As above	2228.5		Quartzite
146.0	Becomes pinkish orange BRECCIA, weak calcite matrix, clasts are quartzite with liesegang banding.	2223.5		Quartzite
149.0	Dripping Springs Quartzite (pCds): grayish black to brown QUARTZITE medium grained to silty, bedded, fractured thoughout, minor calcite stockwork.	2220.5		Quartzite
153.3	Becomes pinkish orange, BRECCIA, weak calcite matrix, quartzite clast have liesegang banding.	2216.2		Quartzite
156.0	Becomes FAULT, matrix is extremely weak, friable, gougey, and clayey, no HCl reaction.	2213.5		Fault
159.5	As above, slightly more competent.	2210.0		Fault
162.0	Becomes orange-brown QUARTZITE, moderately weathered, zones of cemented breccia and beds of fine material.	2207.5		Quartzite
167.0	As above.	2202.5		Quartzite
172.0	As above.	2197.5		Quartzite
177.0	As above.	2192.5		Quartzite

Log continued on next page

WELL DIAGRAM

120.0-250ft: 1/4" Coated Bentonite Pellets

CORE INFO

RUN NO.	CORE RECOVERY %
33	100
34	100
35	100
36	100
37	100
38	100
39	100
40	86
41	64
42	100
43	88
44	100
45	100

NOTES

131 - 225: Hydro test #5 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-20 (GT-03)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 13, 2016 07:40
DRILLING END: December 17, 2016 11:00
COORDINATES: N: 844,754 E: 915,215

SHEET: 4 of 5
GS ELEV.: 2369.5
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2189.5							
		182.0	As above. *(continued)*	2187.5				45	100		
185		187.0	As above, intervals of cemented breccia throughout.	2182.5				46	100		
190		192.0	Becomes BRECCIA, red oxide matrix, clasts are gravel sized and oxidized.	2177.5				47	100		
195		197.0	As above with intervals of unbrecciated fine material.	2172.5				48	100		
200		202.0	Becomes orange brown QUARTZITE, moderately weathered.	2167.5			120.0-250ft: 1/4" Coated Bentonite Pellets	49	100		
205		207.0	As above.	2162.5				50	94		
		208.0	Becomes BRECCIA.	2161.5				51	80		
210		209.5	As above, completely weathered, no HCl reaction.	2160.0							
		212.0	As above.	2157.5				52	100		
215		214.5	As above.	2155.0				53	100		
		219.5	As above, more competent.	2150.0				54	100		
220		224.5	As above, brecciated quartzite, intervals of gouge.	2145.0				55	100		
225		230.0	As above.	2139.5				56	100	227 - 250: Hydro test #4 SI & CRI	
230		233.0	As above.	2136.5				57	100		
235		235.0	Becomes highly fractured dark red and orange QUARTZITE bedded, highly oxidized.	2134.5							
		238.0	As above.	2131.5				58	87		
240		239.5	As above, becomes less fractured.	2130.0				59	87		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-20 (GT-03)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona
DRILLING START: December 13, 2016 07:40
DRILLING END: December 17, 2016 11:00
COORDINATES: N: 844,754 E: 915,215
SHEET: 5 of 5
GS ELEV.: 2369.5
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240.0		2129.5					
242.0	As above. *(continued)*	2127.5		60	100 100		
244.0	As above.	2125.5		61	63		
246.0	Becomes BRECCIA, strong, well cemented, quartzite clasts are altered and oxidized.	2123.5					
247.0	As above.	2122.5		62	100		
250.0	Becomes less brecciated.	2119.5		63	100		

Bottom of borehole at 250.0 ft.
Completed as well. Refer to diagram.

DEPTH (ft): 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60
LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

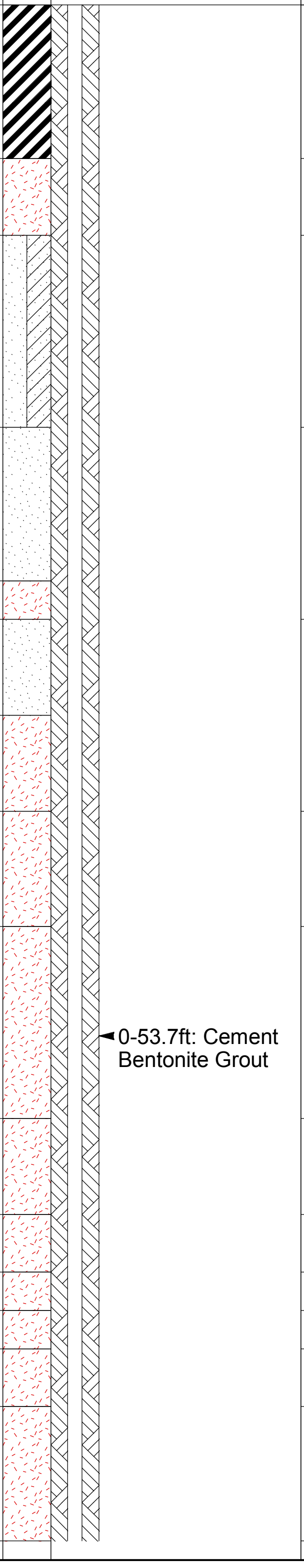
DRAFT

RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT:	RCML Near West TSF	DRILLING START:	December 16, 2016 11:31	SHEET:	1 of 7
PROJECT NO.:	1531436	DRILLING END:	December 16, 2016 11:31	GS ELEV.:	2406.9
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 845,595 E: 917,417	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS
0	0.0		2406.9	
	4.0	(CL), SILTY CLAY, medium plasticity, fine to coarse subrounded to subangular sand, trace fine to coarse subrounded to subangular gravel, brown-red, COLLUVIUM; Quartzite gravel; cohesive, stiff, w ~ PL, Bolsa quartzite colluvium, patches of mod HCl reaction	2402.9	CL
5	6.0	Poor recovery, washed gravel, mixed quartzites and diabase.	2400.9	
10	11.0	(SP-SC), SAND, medium, poorly graded, subangular to angular, some low plasticity fines, trace fine angular gravel, dark pink-brown, RESIDUUM; Diabase gravel; non-cohesive, dry to moist, Residual weathered diabase, 3" int blows: 3-6-5-11-16-22. Recovery from split spoon only, no core.	2395.9	SP-SC
15	15.0	(SP-SM), SAND, medium, poorly graded, subangular to angular, trace low plasticity fines, trace gravel, brown-black, RESIDUUM; non-cohesive, wet, 3" blows: 1-1-1-1-2-12; residual weathered diabase, moisture content from drill fluid, recovery from split spoon only.	2391.9	SP-SM
	16.0	Continues DIABASE, residual soil to completely weathered, poorly graded sand, becomes little gravel, trace calcite.	2390.9	
	18.5	(SP-SM), SAND, medium, poorly graded, subangular to angular, trace non plastic fines, trace gravel, dark brown, weak cementation, strong HCL reaction, RESIDUUM; non-cohesive, dry to moist, Weakly cemented completely weathered diabase, little FeOx staining, weathered calcite veining. 3" blows: 5-8-14-21-23-25	2388.4	SP-SM
20	21.0		2385.9	
	24.0	DIABASE: brown, completely weathered to sandy gravel with trace silt, weakly to moderately cemented, strong HCl reaction, weathered calcite veins, some FeOx staining.	2382.9	
25	29.0	Becomes dark gray brown, DIABASE, moderately weathered, medium to coarse grained, irregular calcite veining, FeOx staining, fractured, no HCl reaction in rock body, just veins. As above.	2377.9	
30	31.5	As above, becomes highly weathered and fractured.	2375.4	
	33.0	No recovery.	2373.9	
	34.0	Becomes brownish black DIABASE aphanitic, slight foliation, calcite & quartz veining, FeOx staining, returns are washed gravel only.	2372.9	
35	35.0		2371.9	
	36.5	As above.	2370.4	
40	40.0	No recovery. Mafic intrusive: dark greenish black DIABASE, aphanitic, slight foliation, calcite & quartz veining, FeOx staining, returns are washed gravel only.	2366.9	

Log continued on next page



CORE INFO

RUN NO.	CORE RECOVERY %
1	88
2	25
3	20
4	40
5	80
6	100
7	96
8	80
9	0
10	50
11	100
12	0
13	29

NOTES

0 - 31.5: Hydro test #1 FHT

31.5: stop and set surface casing to 25ft at end of shift

33: drilling difficulties next day after setting casing, hole cave and recovery problems

36.5 - 40: Drilling dfifficulties, hole washing out and producing lots of sand but no core. Drillers stop to advance surface casing.

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

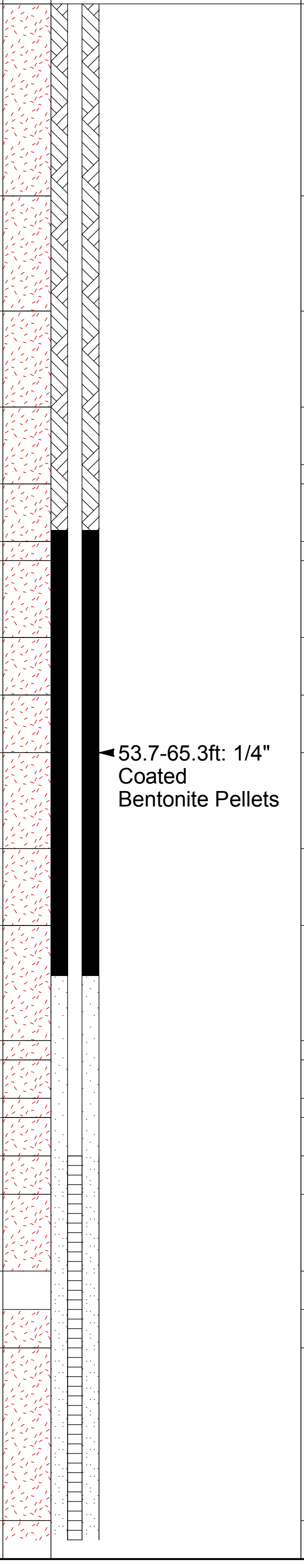
DRILLING START: December 16, 2016 11:31
DRILLING END: December 16, 2016 11:31
COORDINATES: N: 845,595 E: 917,417

SHEET: 2 of 7
GS ELEV.: 2406.9
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	Description	Elev	USCS
40.0	No recovery.	2366.9	
45.0	Continues no core recovery.	2361.9	
48.0	Continues washed gravel and redrill.	2358.9	
50.5	Mafic intrusive: dark greenish gray DIABASE, aphanitic, slight lustrous sheen, FeOx staining on discontinuities, broken core and redrill.	2356.4	
52.5	As above, becomes coarser grained. Fractured and brecciated.	2354.4	
54.0	As above.	2352.9	
54.5	As above, rubbly breccia zones.	2352.4	
56.5	As above, fractured and highly jointed, subvertical joint set, FeOx coatings on discontinuities.	2350.4	
58.0	As above.	2348.9	
59.5	As above.	2347.4	
62.0	As above.	2344.9	
64.0	No recovery.	2342.9	
67.0	No recovery, slow advancement.	2339.9	
67.5	No recovery.	2339.4	
68.5		2338.4	
69.0	Mafic intrusive: dark greenish gray DIABASE, aphanitic, some oxidation in rock body, foliated, some alteration, FeOx staining on discontinuities, only washed gravel redrill recovered.	2337.9	
70.0	As above.	2336.9	
71.0	As above with fragments of weakly cemented sandy breccia matrix and calcite veining.	2335.9	
73.0	As above with trace strong cemented breccia matrix.	2333.9	
75.0	Mafic intrusive: dark greenish gray, DIABASE, aphanitic, some oxidation in rock body, foliated, FeOx coatings, only redrill recovered (gravel), thought to be similar to above with weak breccia matrix lost in drilling process.	2331.9	
79.5	As above, with few chunks of matrix recovered - matrix is soft, silty clay, purple brown. Clasts continue mafic intrusive as above, gravel and corestones.	2327.4	

Log continued on next page



CORE INFO

Run No.	Core Recovery %
14	0
15	0
16	40
17	67
18	100
19	100
20	100
21	100
22	100
23	100
24	60
25	35
26	0
27	0
28	0
29	0
30	0
31	100
32	75
33	0
34	10
35	33
36	67

NOTES

40 - 45: Drillers advance hole with rock bit in attempt to find solid rock to set casing on. Driller notes harder material from 42-44, but soft drilling again from 44-45.

45 - 64: Hydro test #2 FHT

55 - 249: Hydro test #4 FHT

55.1 - 69: borehole walls are covered in bentonite.

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

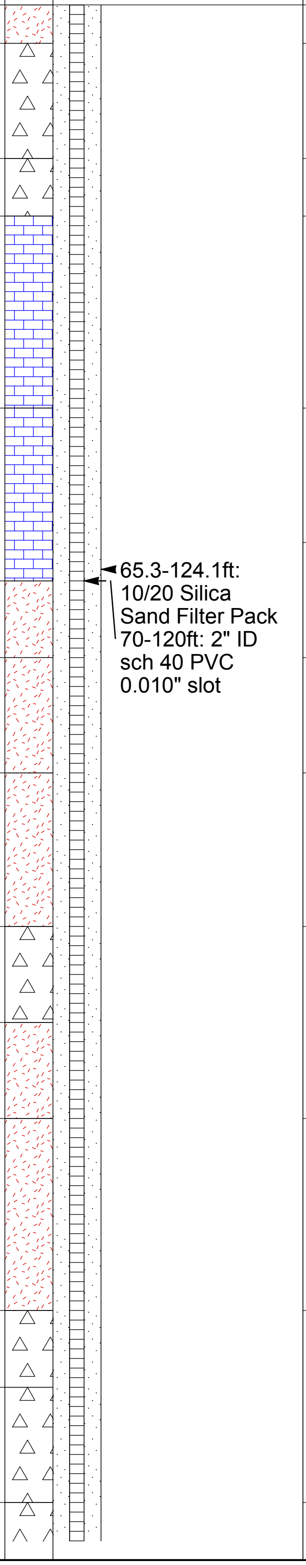
DRILLING START: December 16, 2016 11:31
DRILLING END: December 16, 2016 11:31
COORDINATES: N: 845,595 E: 917,417

SHEET: 3 of 7
GS ELEV.: 2406.9
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS
80		80.0		2326.9	
		81.0	Mafic intrusive: dark green and red, DIABASE, aphanitic, altered, epidote amygdules and oxidation. Brecciated with corestones. *(continued)*	2325.9	
		84.0	Becomes red, white, and black, BRECCIA, diabase and limestone clasts, well cemented and massive matrix, strong HCl reaction.	2322.9	
85		85.5	Continues BRECCIA, well cemented and massive, clast-supported, diabase clasts.	2321.4	
90		90.5	Becomes Mescal Limestone (pCmls): pink, gray, yellow, and white LIMESTONE BRECCIA, variably cemented with calcite and stiff clay, gougey fault zones, few mafic intrusive clasts incorporated.	2316.4	
95		95.0	Continues light gray to pinkish gray LIMESTONE, with oxidized red zones, weak, healed breccia texture, weak altered/fault zones. Brecciated at contact with diabase below.	2311.9	
		97.0	Becomes DIABASE (pCdiab) dark gray with little red mottling, coarse-grained (sub-ophitic), fractured and highly jointed, FeOx coatings, trace calcite coatings.	2309.9	
100		100.0	As above, with healed breccia and open brecciated zones.	2306.9	
		104.0	As above.	2302.9	
105		106.5	Becomes BRECCIA, matrix supported, dark gray diabase clasts in very weak, red, highly oxidized matrix, some calcification, zone of extremely weak rock.	2300.4	
		109.0	Becomes DIABASE (pCdiab): very dark gray, coarse to very coarse grained, calcite veins, little oxidation, some zones of open & irregular fractures.	2297.9	
110		114.0	Becomes reddish black with greenish black, DIABASE, chloritic and hematitic alteration, quartz/calcite veining, FeOx haloes around faults, healed (calcite and R1 rock) fractures, brecciated throughout.	2292.9	
115		116.0	Becomes reddish black DIABASE BRECCIA, clast supported, very weak matrix, clasts are coarsely crystaline/porphyritic with hematitic alteration, calcite veining, weak HCl reaction, jointed.	2290.9	
		119.0	Becomes dark reddish brown BRECCIA matrix supported, matrix is extremely weak, subvertical faulting.	2287.9	
120			As above.		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
36	67
37	100
38	100
39	100
40	100
41	100
42	93
43	95
44	100
45	96
46	100
47	70

NOTES

119 - 124: Lost core from core tube mislatch.

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

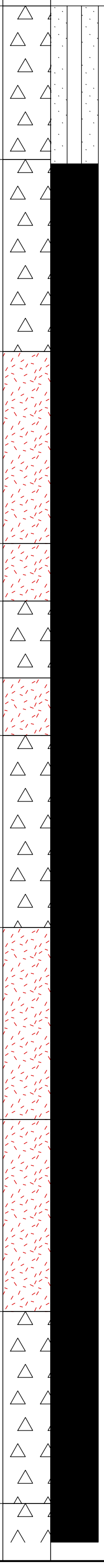
RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 16, 2016 11:31
DRILLING END: December 16, 2016 11:31
COORDINATES: N: 845,595 E: 917,417

SHEET: 4 of 7
GS ELEV.: 2406.9
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
120	120.0		2286.9				
		As above. *(continued)*			47	70	
	124.0		2282.9				
125		Continues DIABASE BRECCIA, matrix variably extremely weak to weak, oxidized throughout, jointed and sheared, some drilling damage to extremely weak rock.			48	88	
	129.0		2277.9				
130		Becomes reddish black DIABASE (pCdiab), coarse grained, healed fracture texture throughout, weak, oxidation throughout, weak HCl reaction.			49	100	
	134.0		2272.9				
135		As above.			50	98	
	135.5		2271.4				
		Becomes DIABASE BRECCIA, subrounded diabase clasts in fine matrix grades into zone of intense calcite viening and fracturing with less matrix.					
	137.5		2269.4				
		Becomes reddish gray, DIABASE (pCdiab), aphanitic, abundant calcite veining.					
	139.0		2267.9				
140		Becomes DIABASE BRECCIA, matrix dominated, subround to subangular diabase clasts up to 1.5", matrix weakly indurated, minor calcite vieing.			51	96	
	144.0		2262.9				
145		As above, intervals where veining and fractures dominate to zones of matrix dominant breccia, subround diabase clasts.			52	100	
	149.0		2257.9				
150		Becomes reddish gray DIABASE (pCdiab), fine grained, phaneritic diabase intense calcite veining and fracturing.			53	100	
	154.0		2252.9				
155		Becomes DIABASE BRECCIA, poorly cemented clay rich matrix, diabase clasts subrounded, calcite veins.			54	100	
	159.0		2247.9				
160		As above.			55	100	



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

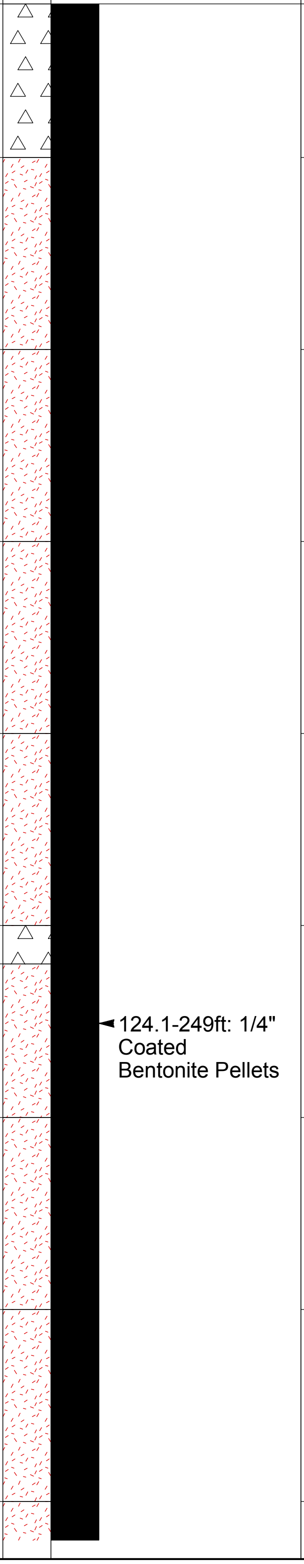
RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 16, 2016 11:31
DRILLING END: December 16, 2016 11:31
COORDINATES: N: 845,595 E: 917,417

SHEET: 5 of 7
GS ELEV.: 2406.9
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
160		160.0	As above. *(continued)*	2246.9		55	100		
165		164.0	Becomes reddish gray DIABASE (pCdiab), fine grained, phaneritic diabase euhedral phenocrysts, moderate clay and oxidation alteration.	2242.9		56	100		
170		169.0	As above, minor interval of pegmatite, coarse lathes of plagioclse.	2237.9		57	100		
175		174.0	As above, fine to medium grained, moderate clay and iron oxide alteration present.	2232.9		58	100		
180		179.0	As above, minor zone of pegmatitic diabase.	2227.9		59	100		
185		184.0	Becomes DIABASE BRECCIA, subround clasts, matrix supported, weakly cemented, clasts to 1.5".	2222.9		60	100		
		185.0	Becomes reddish gray DIABASE (pCdiab) with minor zone of pegmatite, moderate clay and oxide alteration present.	2221.9					
190		189.0	As above, intervals of stockwork calcite veining and interval of coarser grained diabase.	2217.9		61	100		
195		194.0	As above, becomes fine grained, fractured, calcite veins.	2212.9		62	100		
200		199.0	As above	2207.9		63	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 16, 2016 11:31
DRILLING END: December 16, 2016 11:31
COORDINATES: N: 845,595 E: 917,417

SHEET: 6 of 7
GS ELEV.: 2406.9
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
200	200.0	As above *(continued)*	2206.9		63	100	
	202.0	Becomes DIABASE BRECCIA, clast supported subangular to subround, matrix is clay-rich and has hematite present.	2204.9				
	204.0	Beomes reddish gray DIABASE (pCdiab), fine to medium grained, moderate clay and oxide alteration present.	2202.9		64	96	205 - 249: Hydro test #3 SI
210	209.0	As above, minor interval of breccia around calcite vein.	2197.9		65	100	
	212.0	As above, becomes medium grained, plagioclase lathes.	2194.9		66	95	
215	214.0	As above.	2192.9		67	100	
220	217.0	As above.	2189.9		68	100	
	222.0	As above, abundant iron oxide alteration.	2184.9		69	90	
225	224.0	As above.	2182.9		70	98	
230	229.0	Continues red gray DIABASE (pCdiab), medium to fine grained, competent, phaneritic, euhedral.	2177.9		71	100	
	232.0	As above.	2174.9		72	85	
235	234.0	As above.	2172.9		73	95	238 - 240: Mislatch core out of order and jumbled.
	238.0	As above.	2168.9		74	50	
240	240.0		2166.9				240 - 242: Redrill from

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-21-(GT-05)

PROJECT:	RCML Near West TSF	DRILLING START:	December 16, 2016 11:31	SHEET:	7 of 7
PROJECT NO.:	1531436	DRILLING END:	December 16, 2016 11:31	GS ELEV.:	2406.9
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 845,595 E: 917,417	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2166.9							
			As above.							mislatch.	
		241.0	Continues dark gray DIABABSE (pCdiab), fine to medium grained, iron oxide and clay alteration.	2165.9				75	88		
		244.0	As above, clay and iron oxide alteration selveges around calcite veins.	2162.9				76	98		
245											
		249.0		2157.9							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

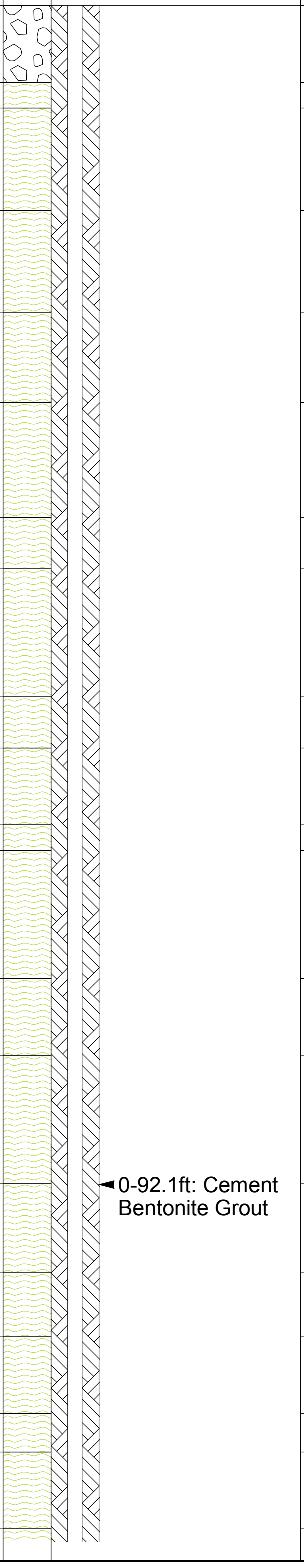
01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:47
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-22 (GT-40)

PROJECT:	RCML Near West TSF	DRILLING START:	December 18, 2016 16:14	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	December 18, 2016 16:14	GS ELEV.:	2303.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 841,495 E: 912,378	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0		0.0		2303.0					
		3.0	(GW), GRAVEL, fine to coarse, well graded, subangular, trace sand; oxidized schist and quartz gravel; washed in sampler, surface material has sand and fines.	2300.0	GW	1	33	0 - 32: Hydro test #1 FHT	
		4.0		2299.0		2	50		
5		8.0	Transitions to fractured, weathered schist in sample. Pinal Schist (pCpi): grey, micaceous fine grained SCHIST, thick pink quartz veining to 0.5 inches, highly fractured and weathered, red-brown oxidation throughout.	2295.0		3	8		
10		12.0	As above.	2291.0		4	50		
15		15.5	As above, foliated.	2287.5		5	71		
20		20.0	As above.	2283.0		6	56		
		22.0	As above, predominately quartz veins with oxidation.	2281.0		7	50		
25		27.0	Becomes gray METASANDSTONE, fine to medium grained crushed/brecciated throughout, FeOx staining on discontinuities.	2276.0		8	60		
		29.0	Becomes predominantly large quartz vein, FeOx staining, fractured and rubbly.	2274.0		9	100		
30		32.0	Pinal Schist (pCpi): grey to red, fine to medium grained, healed fracture texture, and gougey fault, oxidation selveges around fault zones, very weak HCl reaction.	2271.0		10	90	30 - 90: Hydro test #2 FHT 32: drillers advance surface casing to 25ft	
		33.0		2270.0		11	50		
35		38.0	As above: some re-drill, breccia with gouge matrix. Pinal Schist (pCpi): grey to red, fine to medium grained, healed fracture texture, and gougey fault, oxidation haloes around fault zones, very weak HCl reaction.	2265.0		12	100		
40		41.0	As above.	2262.0		13	100		
45		46.0	Pinal Schist (pCpi): gray, METASANDSTONE, fine to medium grained, crushed/brecciated throughout, some quartz, FeOx staining on discontinuities.	2257.0		14	50		
		49.5	As above.	2253.5		15	57		
50		52.0	As above.	2251.0		16	80		
55		55.0	As above.	2248.0		17	100		
		56.5	As above.	2246.5		18	100		
60		59.5	As above.	2243.5		19	100		



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Cara Shonsey
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

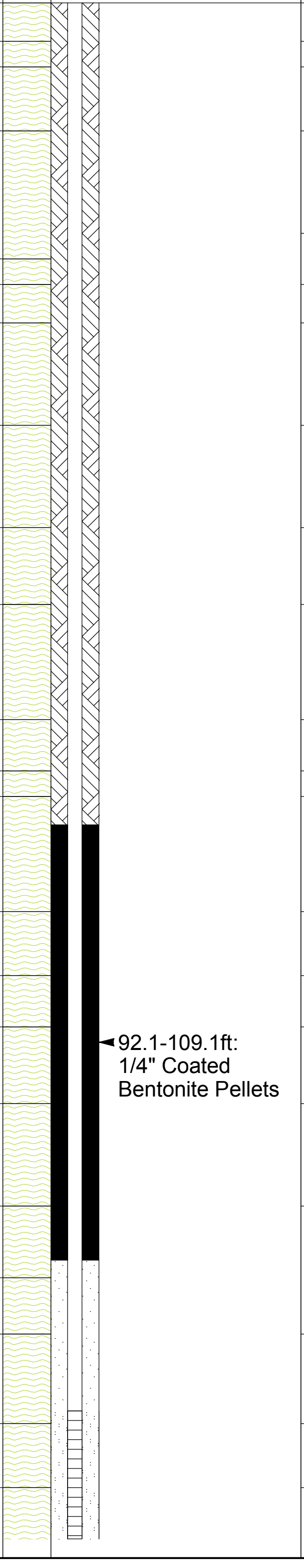
RECORD OF BOREHOLE DH16-22 (GT-40)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 18, 2016 16:14
DRILLING END: December 18, 2016 16:14
COORDINATES: N: 841,495 E: 912,378

SHEET: 2 of 5
GS ELEV.: 2303.0
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
60.0		2243.0				
61.5	As above. *(continued)*	2241.5		20	100 100	
62.5	As above.	2240.5		21	100	
65.0	Pinal Schist (pCpi): pinkish gray, METASANDSTONE, fine to medium grained, highly jointed and foliated, some crushed rock, FeOx selveges and on discontinuity surfaces.	2238.0		22	100	
70.0	Becomes foliated, crenulated.	2233.0		23	70	
71.0	As above.	2232.0		24	100	
72.5	As above.	2230.5		25	100	
76.5	As above.	2226.5		26	50	
80.5	As above..	2222.5		27	100	
83.5	As above	2219.5		28	93	
88.0	Pinal Schist (pCpi): pinkish gray, SCHIST, fine to medium grained foliated, quartz and calcite veining, fractured or crushed throughout, weak HCl reaction, FeOx staining.	2215.0		29	100	
90.0	As above, becomes more fractured and oxidized.	2213.0		30	100	
91.0	As above.	2212.0		31	100	
95.5	As above.	2207.5		32	100	92 - 150: Hydro test #3 SI
98.0	As above.	2205.0		33	100	
100.0	As above, becomes more fractured.	2203.0		34	100	100 - 103: Split was dropped, core broken.
103.0	Pinal Schist (pCpi): greenish gray, SCHIST, medium grained, foliated, crushed and gouged, no HCl reaction, FeOx staining and coatings.	2200.0		35	100	
107.0	Becomes pinkish gray, METASANDSTONE, medium grained, foliated, crushed zones, FeOx coatings, weak HCl reaction.	2196.0		36	85	
109.8	Becomes, pink and gray, METASILTSTONE, foliation follows bedding planes, faulted, very weak HCl reaction.	2193.2		37	100	
112.0	Becomes, gray METASANDSTONE, medium grained, foliated, comptent, no HCl reaction.	2191.0				
115.5	As above.	2187.5		38	100	
118.0	Pinal Schist (pCpi): dark gray to reddish gray, METASANDSTONE/METASILTSTONE, fine to medium grained, foliated, fractured, sheared, FeOx coatings and staining haloes.	2185.0		39	100	
				40	83	



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH16-22 (GT-40)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: December 18, 2016 16:14
DRILLING END: December 18, 2016 16:14
COORDINATES: N: 841,495 E: 912,378

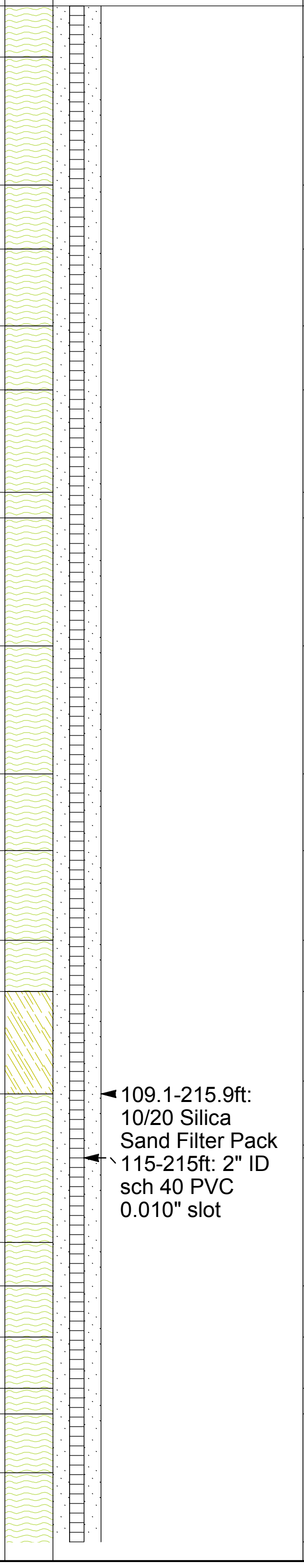
SHEET: 3 of 5
GS ELEV.: 2303.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev
120.0		2183.0
122.0	As above, zones of gouge. *(continued)*	2181.0
127.0	As above, highly foliated and crenulated.	2176.0
129.5	Becomes fault zone, gouge and rubble.	2173.5
132.5	Pinal Schist (pCpi), brownish gray, SCHIST, foliated, fractured, quartz vein with gouge, Feox staining.	2170.5
135.0	As above.	2168.0
139.0	As above.	2164.0
140.0	As above, highly jointed, broken core.	2163.0
145.0	Becomes gray to brownish gray, METASILTSTONE, fine to medium grained foliated and jointed, slightly silicified, little FeOx coatings.	2158.0
150.0	As above.	2153.0
153.0	As above, folded.	2150.0
156.5	As above, large quartz vein and poor recovery, gouge zones bracketing vein washed out in drilling, strong HCl reaction.	2146.5
158.5	As above, schistose, foliated, broken and brecciated, FeOx coatings on all discontinuities, no HCl reaction.	2144.5
162.5	Becomes FAULT GOUGE.	2140.5
168.3	As above with sand and rubble.	2134.7
170.0	Becomes Pinal Schist (pCpi): pinkish gray, SCHIST, foliated and fractured, FeOx and clay coatings.	2133.0
172.0	As above.	2131.0
174.0	As above, becomes more crushed and gougey.	2129.0
175.0	Recover only rubble/redrill.	2128.0
177.3	Pinal Schist (pCpi): grayish red, SCHIST, fault, gouge with crushed rock, FeOx staining throughout.	2125.7

Log continued on next page

WELL DIAGRAM


109.1-215.9ft: 10/20 Silica Sand Filter Pack
115-215ft: 2" ID sch 40 PVC 0.010" slot

CORE INFO

RUN NO.	CORE RECOVERY %
40	83
41	100
42	100
43	100
44	100
45	100
46	80
47	100
48	100
49	93
50	37
51	100
52	100
53	100
54	100
55	90
56	100
57	100
58	50
59	100

NOTES

127 - 129: Driller notes slight loss of drill fluid in zone.

147 - 250: Hydro test #4 SI

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

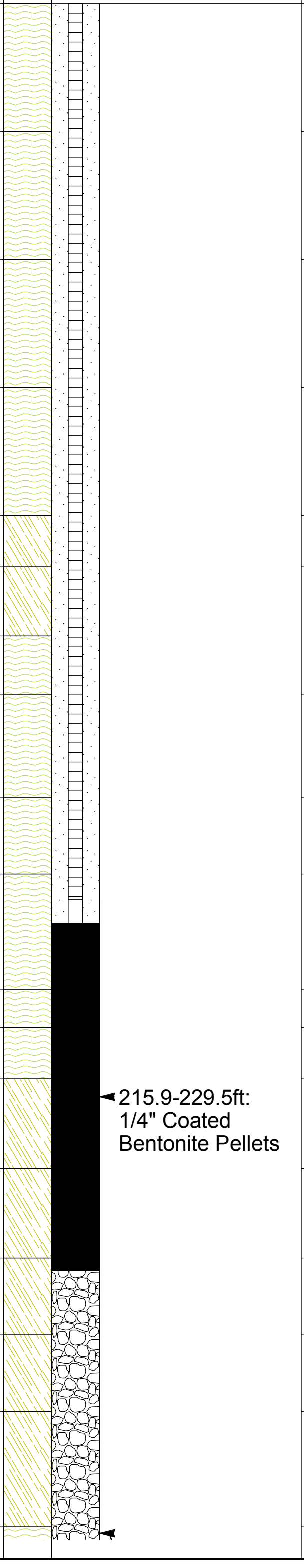
Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-22 (GT-40)

PROJECT:	RCML Near West TSF	DRILLING START:	December 18, 2016 16:14	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	December 18, 2016 16:14	GS ELEV.:	2303.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 841,495 E: 912,378	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE – DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2123.0					
185		185.0	Pinal Schist (pCpi): gray to reddish gray, METASANDSTONE, fine to medium grained, bedded, lightly foliated, fractured- both healed and open, quartz veining, moderate HCl reaction, FeOx staining and coating. *(continued)*	2118.0		60	100		
190		190.0	As above.	2113.0		61	100		
195		195.0	As above.	2108.0		62	96		
200		200.0	As above, poor recovery, gouge.	2103.0		63	50		
		202.0	Becomes FAULT GOUGE, light greenish gray, soft clay with crushed rock fragments.	2101.0		64	100		
		204.7	Continues FAULT.	2098.3		65	100		
205		207.0	Becomes Pinal Schist (pCpi): pinkish gray, SCHIST, sheared rock fabric and closed brecciated texture, clay and FeOx.	2096.0					
210		211.0	As above with gouge and rubble.	2092.0		66	100		
		214.0	As above.	2089.0		67	100		
215		218.5	As above.	2084.5		68	100		
220		220.0	Continues Pinal Schist (pCpi): light greenish gray, SCHIST, highly foliated, crenulated and sheared, clay coatings and infill.	2083.0		69	100		
		222.0	As above.	2081.0		70	65		
225		225.5	Becomes FAULT.	2077.5		71	86		
		229.0	As above, mostly gouge, sandy clay with gravel.	2074.0		72	100		
230		232.0	As above.	2071.0		73	100		
235		235.0	As above.	2068.0		74	100		
		239.5	As above.	2063.5		75	100		
240						76			



215.9-229.5ft: 1/4" Coated Bentonite Pellets

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Cara Shonsey
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH16-22 (GT-40)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

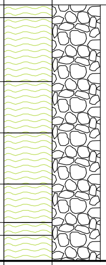
DRILLING START: December 18, 2016 16:14
DRILLING END: December 18, 2016 16:14
COORDINATES: N: 841,495 E: 912,378

SHEET: 5 of 5
GS ELEV.: 2303.0
TOC ELEV.: na
DATUM:

DEPTH (ft): 240, 245, 250, 255, 260, 265, 270, 275, 280, 285, 290, 295, 300

Depth	SOIL PROFILE – DESCRIPTION	Elev	USCS
240.0		2063.0	
240.5	Continues Pinal Schist (pCpi): light greenish gray, SCHIST, highly foliated, crenulated, brecciated and sheared, FeOx and clay coatings and infill. *(continued)*	2062.5	
243.0		2060.0	
	As above.		
245.0	As above, faulted, weak HCl reaction.	2058.0	
	As above.		
247.0		2056.0	
248.5	As above, broken core, fracture surfaces have full FeOx.	2054.5	
249.0	As above.	2054.0	
250.0	As above, highly fractured, FeOx staining on clean surfaces.	2053.0	

Bottom of borehole at 250.0 ft.
Completed as well. Refer to diagram.



CORE INFO – RUN NO.	CORE RECOVERY %
	100
77	100
78	100
79	100
80	67
81	100
82	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Cara Shonsey
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-A

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 5, 2017 00:00
DRILLING END: January 5, 2017 00:00
COORDINATES: N: 843,658 E: 916,937

SHEET: 1 of 1
GS ELEV.: 2419.8
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
0.0		2419.8				
4.0	Apache Leap Tuff (Talg): light gray to whitish pink, ash flow TUFF, biotite and feldspar phenocrysts, highly weathered.	2415.8		1	100	
6.0	As above.	2413.8		2	100	
11.0	As above, less weathered.	2408.8		3	100	
14.0	As above, horizontal discontinuities along bedding.	2405.8		4	100	
19.0	As above, becomes more competent, highly welded.	2400.8		5	100	
24.0	As above.	2395.8		6	100	
29.0	As above	2390.8		7	100	29: Hole Lost at 29'.
	Bottom of borehole at 29.0 ft. Lost hole at 29'					

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK 30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

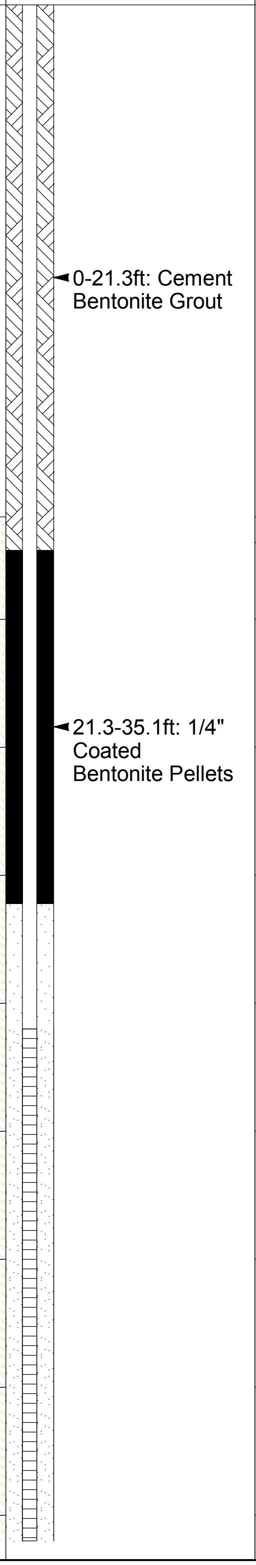
DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-B

PROJECT:	RCML Near West TSF	DRILLING START:	January 6, 2017 11:03	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	January 6, 2017 11:03	GS ELEV.:	2419.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 843,658 E: 916,937	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	Depth	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0			0.0	2419.8				0 - 32: Hydro test #1 FHT	
20		Apache Leap Tuff (Talg): light gray, ash flow TUFF, feldspar and biotite phenocrysts, highly welded, few calcite veins, few lithic fragments.	24.0	2395.8		1	100	20: Same pad as DH17-23-(GT-6)-A. Reamed down to 20', began coring.	
						2	100		
24		As above.	29.0	2390.8		3	100		
29		As above.	34.0	2385.8		4	98	30 - 90: Hydro test #2 FHT	
34		As above.	39.0	2380.8		5	100		
39		As above.	44.0	2375.8		6	100		
44		As above, becomes friable.	49.0	2370.8		7	94		
49		As above, moderately fractured.	54.0	2365.8		8	100	49 - 54: Circulation lost on this run. There are two small fracture zone around 52'.	
54		As above.	59.0	2360.8		9	100		
59						10	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK 30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-B

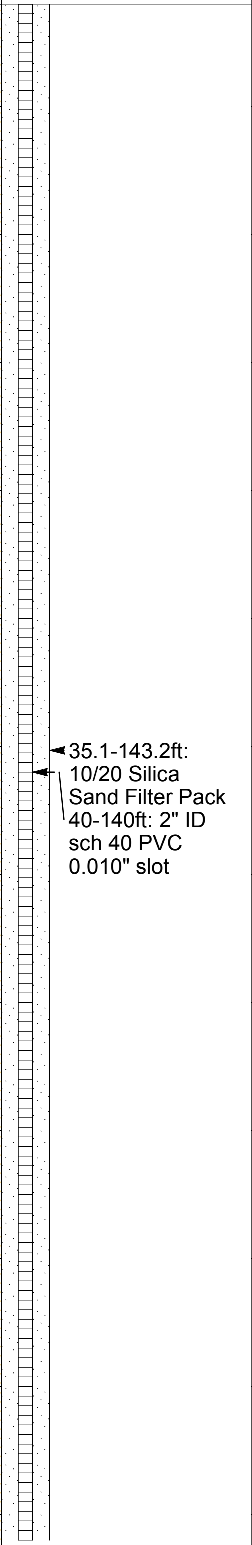
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 6, 2017 11:03
DRILLING END: January 6, 2017 11:03
COORDINATES: N: 843,658 E: 916,937

SHEET: 2 of 5
GS ELEV.: 2419.8
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	RUN NO.	CORE RECOVERY %	NOTES
60	60.0	As above, becomes massive and competent. *(continued)*	2359.8	10	100	
65	64.0	As above, becomes reddish brown.	2355.8	11	100	
70	69.0	As above, minor fractured zone. 2" lens of fine grained sandstone @ 69.8'	2350.8	12	100	
75	74.0	As above.	2345.8	13	100	
80	79.0	As above, continues massive and competent.	2340.8	14	100	
85	84.0	As above.	2335.8	15	100	
90	89.0	As above.	2330.8	16	100	92 - 150: Hydro test #3 SI
95	94.0	As above, few lithic clasts some with an iron staining halo around them.	2325.8	17	100	
100	99.0	As above.	2320.8	18	100	
105	104.0	Apache Leap Tuff (Talg): light gray, ash flow TUFF, feldspar and biotite phenocrysts, highly welded, few calcite veins, auto-breccia texture, few lithic clasts with iron staining	2315.8	19	100	
110	109.0	As above.	2310.8	20	100	
115	114.0	Apache Leap Tuff (Talg): light gray to reddish brown, ash flow TUFF, feldspar and biotite phenocrysts, highly welded, few calcite veins.	2305.8	21	100	
120	119.0		2300.8	22	100	

WELL DIAGRAM



35.1-143.2ft: 10/20 Silica Sand Filter Pack
40-140ft: 2" ID sch 40 PVC 0.010" slot

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK 30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-B

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 6, 2017 11:03
DRILLING END: January 6, 2017 11:03
COORDINATES: N: 843,658 E: 916,937

SHEET: 3 of 5
GS ELEV.: 2419.8
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0	As above, intervals of auto-breccia texture present. *(continued)*	2299.8		22	100		
125		124.0	As above.	2295.8		23	100		
130		129.0	As above.	2290.8		24	100		
135		134.0	As above.	2285.8		25	100		
140		139.0	As above.	2280.8		26	100		
145		144.0	As above.	2275.8		27	100	147 - 250: Hydro test #4 SI	
150		149.0	As above.	2270.8		28	100		
155		154.0	As above.	2265.8		29	90		
160		159.0	As above.	2260.8		30	100		
165		164.0	As above.	2255.8		31	100		
170		169.0	As above, few large 1" calcite crystals.	2250.8		32	100		
175		174.0	Apache Leap Tuff (Talg): light gray to reddish brown, ash flow TUFF, feldspar and biotite phenocrysts, highly welded, auto-breccia texture.	2245.8		33	100		
180		179.0	As above.	2240.8		34	100		

WELL DIAGRAM

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK 30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-B

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 6, 2017 11:03
DRILLING END: January 6, 2017 11:03
COORDINATES: N: 843,658 E: 916,937

SHEET: 4 of 5
GS ELEV.: 2419.8
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	As above. *(continued)*	2239.8				34	100		
185		184.0	As above.	2235.8				35	100		
190		189.0	As above, few lithic clasts some with iron staining.	2230.8				36	100		
195		194.0	As above, some open voids not inter-conected.	2225.8			143.2-250ft: 1/4" Coated Bentonite Pellets	37	100		
200		199.0	Apache Leap Tuff (Talg): light gray to reddish brown, ash flow TUFF, feldspar and biotite phenocrysts, highly welded, auto-breccia texture, most lithic clasts have iron staining.	2220.8				38	100		
205		204.0	As above.	2215.8				39	100		
210		209.0	As above.	2210.8				40	100		
215		214.0	As above, some open voids, though not inter-conected.	2205.8				41	100		
220		219.0	As above.	2200.8				42	100		
225		224.0	As above, massive.	2195.8				43	100		
230		229.0	As above, many horizontal fractures along bedding planes.	2190.8				44	100		
235		234.0	As above, fewer fractures.	2185.8				45	100		
240		239.0	As above, few lithic clasts.	2180.8				46	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK 30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-23-(GT-6)-B

PROJECT:	RCML Near West TSF	DRILLING START:	January 6, 2017 11:03	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	January 6, 2017 11:03	GS ELEV.:	2419.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 843,658 E: 916,937	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0	As above, few lithic clasts. *(continued)*	2179.8				46	100		
245		244.0	As above.	2175.8				47	100		
		249.0		2170.8							
250		250.0	As above.	2169.8				48	100		
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram. Start coring at 19'								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK 30	REVIEWED:	R Post

Golder Associates

DRAFT

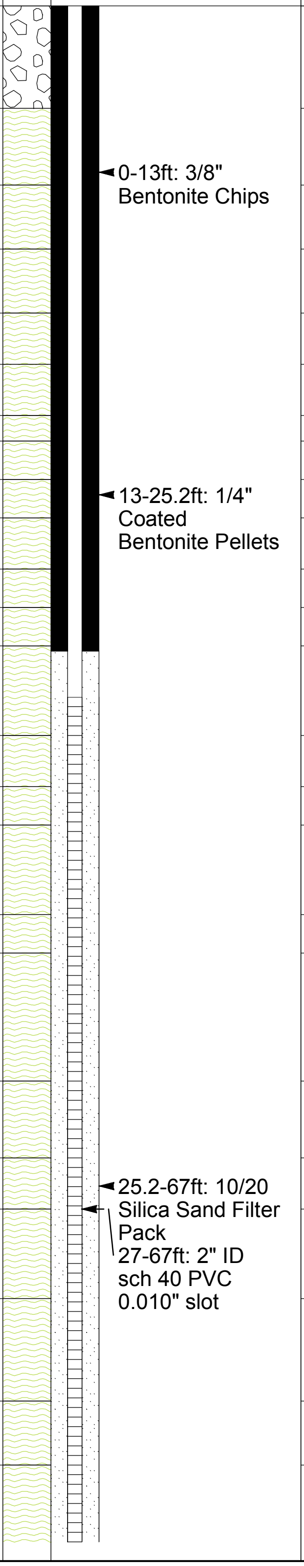
RECORD OF BOREHOLE DH17-24(GT-40-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 7, 2017 14:33
DRILLING END: January 7, 2017 14:33
COORDINATES: N: 841,495 E: 912,378

SHEET: 1 of 2
GS ELEV.: 2303.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
0		0.0		2303.0					
		4.0	Recovery is washed quartz gravel from surficial soils.	2299.0		1	13	0: Twinned hole with GT-40. Drilling optimized for hole quality and speed, not recovery. See hole DH16-22 (GT-40) for record of twinned hole.	
5		7.0	Pinal Schist (pCpi): brownish gray, SCHIST, fine to medium grained, highly foliated, quartz veining, FeOx on discontinuities, clayey infill.	2296.0		2	83		
		9.5	As above.	2293.5		3	100		
10		12.0	As above.	2291.0		4	100		
		14.0	As above.	2289.0		5	100		
15		16.0	As above.	2287.0		6	100		
		17.0	As above.	2286.0		7	50		
		18.5	As above.	2284.5		8	67		
20		20.0	No recovery.	2283.0		9	0		
		22.0	Continues SCHIST, greenish gray, highly foliated and fractured, fine to medium grained, full FeOx coatings.	2281.0		10	100		
		23.5	As above, large quartz vein.	2279.5		11	100		
25		25.0	As above.	2278.0		12	33		
		28.5	Becomes brecciated SCHIST, quartz veins, FeOx on discontinuity surfaces.	2274.5		13	29		
30		30.5	Becomes brownish gray SCHIST, highly foliated and faulted, gougey and very weak, FeOx staining.	2272.5		14	100		
		32.0	As above.	2271.0		15	100		
35		35.5	Becomes brownish gray, METASANDSTONE, fine to medium grained, jointed and lightly foliated, full FeOx coatings, weak HCl reaction.	2267.5		16	100		
		37.0	As above.	2266.0		17	100	37 - 75: Hydro test #1 FHT	
40		42.0	As above, less jointed.	2261.0		18	100		
45		45.0	As above.	2258.0		19	100		
		47.0	As above, becomes very highly jointed, broken and faulted.	2256.0		20	100		
50		50.5	As above, calcite infill in fracture.	2252.5		21	100		
		54.5	Becomes greenish gray with red SCHIST, fine grained, schistose, highly foliated, crenulations, minor FeOx coatings, no HCl reaction.	2248.5		22	100		
55		57.0	As above.	2246.0		23	100		
60			As above.			24	100		


GRAPHIC LOG / WELL DIAGRAM

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

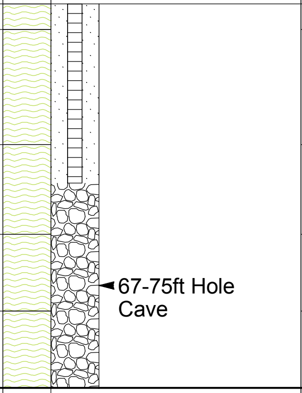
DRAFT

RECORD OF BOREHOLE DH17-24(GT-40-2)

PROJECT:	RCML Near West TSF	DRILLING START:	January 7, 2017 14:33	SHEET:	2 of 2
PROJECT NO.:	1531436	DRILLING END:	January 7, 2017 14:33	GS ELEV.:	2303.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 841,495 E: 912,378	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60		60.0		2243.0					
		61.0	As above. *(continued)*	2242.0		24	100		
65		65.5	As above.	2237.5		25	89		
		69.0	As above.	2234.0		26	100		
70		72.0	As above.	2231.0		27	100		
75		75.0	As above.	2228.0		28	100		
			Bottom of borehole at 75.0 ft. Completed as well. Refer to diagram.						

GRAPHIC LOG / WELL DIAGRAM



DEPTH (ft): 80, 85, 90, 95, 100, 105, 110, 115, 120

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-25 (GT-37)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 9, 2017 14:24
DRILLING END: January 9, 2017 14:24
COORDINATES: N: 843,072 E: 914,519

SHEET: 1 of 5
GS ELEV.: 2350.4
TOC ELEV.: na
DATUM:

DEPTH (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

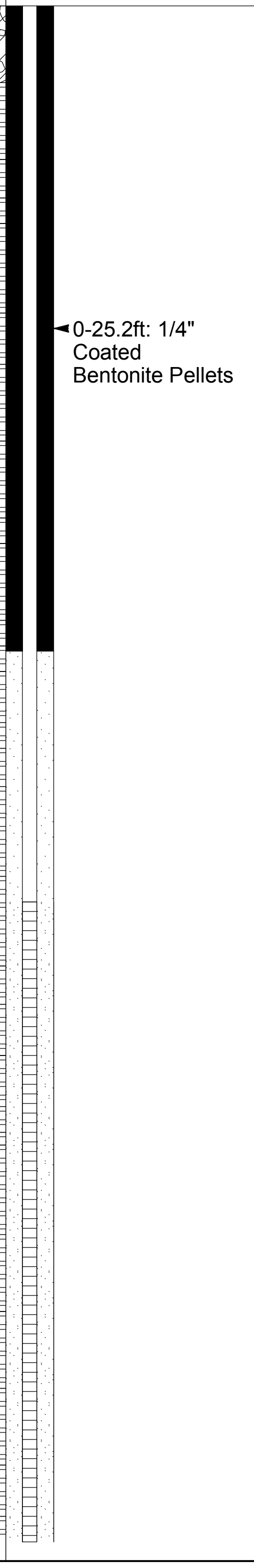
BORING METHOD

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2350.4	
3.0	Colluvium with sunangular gravel and cobbles of shale.	2347.4	
6.0	Pioneer Formation (pCp): dark gray SHALE, fine grained, thinly bedded, highly weathered, highly fractured, all surfaces complete iron staining. Rubble.	2344.4	
7.5	As above, interbeds of light siltstone.	2342.9	
8.5	As above.	2341.9	
12.0	As above, becomes less fractured, fine-grained siltstone interbeds, FeOx on fracture surfaces.	2338.4	
14.0	As above.	2336.4	
17.0	No recovery.	2333.4	
20.0	As above.	2330.4	
21.0	As above.	2329.4	
24.0	As above.	2326.4	
25.0	Continues dark reddish brown SHALE, completly weathered, very fine to fine grained, moderate iron staining, very highly fractured, siltstone interbeds. Rubble.	2325.4	
26.0		2324.4	
28.0	As above.	2322.4	
29.0	As above.	2321.4	
	As above.		
30.5	As above.	2319.9	
	As above.		
34.0		2316.4	
37.5	As above.	2312.9	
39.0	As above.	2311.4	
41.0	Continues dark reddish brown SHALE, completly weathered, very fine to fine grained, moderate iron staining, very highly fractured, siltstone interbeds. Rubble.	2309.4	
43.0	As above.	2307.4	
44.0	As above, rubble.	2306.4	
44.5	As above.	2305.9	
48.0	As above, brecciated with rubble zones, intervals of brown clay.	2302.4	
51.0	As above.	2299.4	
54.0	As above.	2296.4	
57.0	As above.	2293.4	
59.0	As above, rubble.	2291.4	

GRAPHIC LOG

WELL DIAGRAM



0-25.2ft: 1/4" Coated Bentonite Pellets

CORE INFO

RUN NO.	CORE RECOVERY % (20 40 60 80)
1	40
2	100
3	100
4	57
5	100
6	0
7	17
8	100
9	100
10	100
11	100
12	100
13	90
14	100
15	70
16	100
17	43
18	40
19	33
20	70
21	100
22	50
23	60
24	86
25	90
26	100
27	100
28	50
29	100

NOTES

0 - 31: Hydro test #1
FHT

59 - 102: Hydro test #2
SI

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-25 (GT-37)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

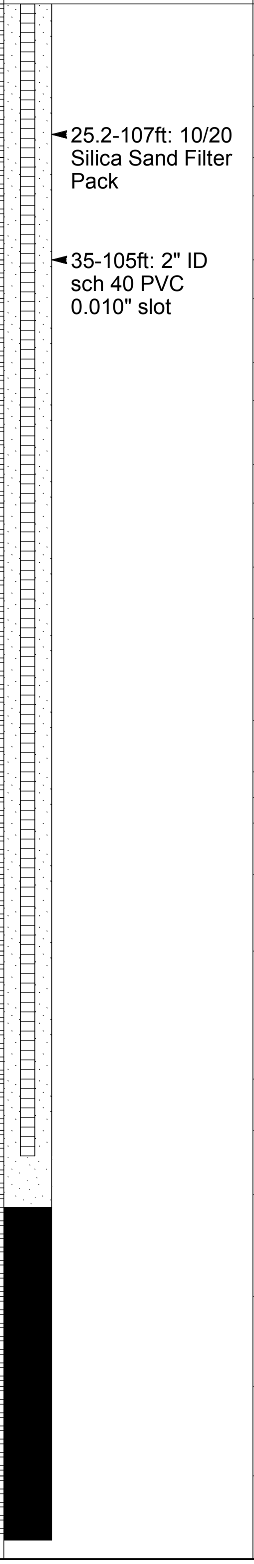
DRILLING START: January 9, 2017 14:24
DRILLING END: January 9, 2017 14:24
COORDINATES: N: 843,072 E: 914,519

SHEET: 2 of 5
GS ELEV.: 2350.4
TOC ELEV.: na
DATUM:

Depth	Elev	Description	Run No.	Core Recovery %	Notes
60.0	2290.4				
62.0	2288.4	Continues dark reddish brown to tan SHALE, moderately weathered, fine to very fine grained, light iron staining, very highly fractured, siltstone interbeds, few calcite veins, rubble zones. *(continued)*	29	100	
64.0	2286.4	As above.	30	60	
66.0	2284.4	As above.	31	60	
67.5	2282.9	As above.	32	100	
70.0	2280.4	As above.	33	60	
71.5	2278.9	As above.	34	100	
74.0	2276.4	As above.	35	100	
75.5	2274.9	As above.	36	100	
78.0	2272.4	As above.	37	80	
79.5	2270.9	As above.	38	80	
82.0	2268.4	As above.	39	80	
84.0	2266.4	As above.	40	100	
88.0	2262.4	As above.	42	100	
90.0	2260.4	As above.	43	65	
91.0	2259.4	As above.	44	100	
92.0	2258.4	As above.	45	70	
94.0	2256.4	Continues reddish brown SHALE, moderately weathered, fine to very fine grained, light iron staining, very highly fractured, siltstone interbeds, few calcite veins, rubble zones.	46	100	
97.0	2253.4	As above.	47	100	
102.0	2248.4	As above.	48	20	
104.0	2246.4	As above.	49	65	
106.5	2243.9	As above.	50	92	
110.5	2239.9	As above.	51	93	109 - 249: Hydro test #3 SI
114.0	2236.4	As above.	52	94	
117.5	2232.9	As above.	53	97	
		As above.	54	91	

Log continued on next page

WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-25 (GT-37)

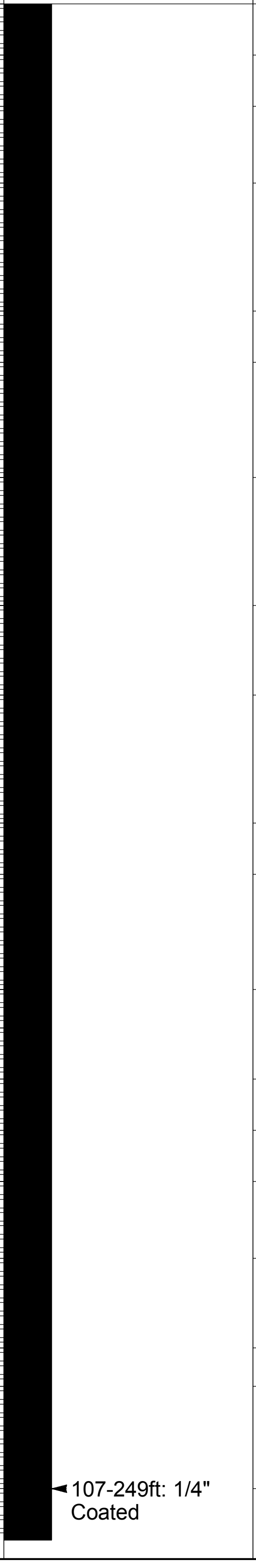
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 9, 2017 14:24
DRILLING END: January 9, 2017 14:24
COORDINATES: N: 843,072 E: 914,519

SHEET: 3 of 5
GS ELEV.: 2350.4
TOC ELEV.: na
DATUM:

Depth (ft)	Description	Elev	USCS	Run No.	Core Recovery %	Notes	Additional Lab Testing
120.0	As above. *(continued)*	2230.4		54	91		
122.0	As above.	2228.4		55	90		
124.0	As above.	2226.4		56	100		
127.0	As above.	2223.4		57	82		
132.0	As above.	2218.4		58	90		
134.0	Continues dark reddish brown to tan SHALE, slightly weathered, fine to very fine grained, light iron staining, slightly fractured, siltstone interbeds, few calcite veins, minor rubble.	2216.4		59	100		
138.5	As above.	2211.9		60	100		
143.5	As above, rubble zone.	2206.9		61	94		
147.0	As above.	2203.4		62	100		
152.0	As above.	2198.4		63	100		
154.0	As above.	2196.4		64	80		
158.5	As above, rubble.	2191.9		65	51		
160.0	As above.	2190.4					
162.0	As above.	2188.4		66	100		
164.0	As above.	2186.4		67	90		
166.0	As above.	2184.4		68	100		
169.0	As above.	2181.4		69	83		
172.5	As above.	2177.9		70	100		
174.0	As above.	2176.4		71	100		
178.0	As above.	2172.4		72	100		

Log continued on next page



DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-25 (GT-37)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 9, 2017 14:24
DRILLING END: January 9, 2017 14:24
COORDINATES: N: 843,072 E: 914,519

SHEET: 4 of 5
GS ELEV.: 2350.4
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2170.4							
		181.0	As above. *(continued)*	2169.4			Bentonite Pellets	72	100		
		184.0	As above, become brecciated.	2166.4				73	87		
185		189.0	As above, rubble.	2161.4					100		
190		193.0	As above.	2157.4				75	75		
		194.5	Continues dark reddish brown, SHALE, moderately weathered, fine to very fine grained, highly fractured, siltstone interbeds, few calcite veins. Rubble.	2155.9				76	87		
195		198.0	As above.	2152.4				77	66		
200		200.0	As above.	2150.4				78	65		
		204.0	As above.	2146.4				79	100		
205		209.0	As above.	2141.4				80	100		
210		213.0	As above.	2137.4				81	100		
215		215.0	As above.	2135.4				82	90		
		218.0	As above.	2132.4				83	73		
220		223.0	As above, becomes brecciated.	2127.4				84	100		
225		226.5	As above.	2123.9				85	71		
		230.5	As above.	2119.9				86	88		
230		234.0	As above, rubble.	2116.4				87	20		
235		239.0	As above.	2111.4				88	46		
240			As above.					89	97		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-25 (GT-37)

PROJECT:	RCML Near West TSF	DRILLING START:	January 9, 2017 14:24	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	January 9, 2017 14:24	GS ELEV.:	2350.4
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 843,072 E: 914,519	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2110.4							
			As above. *(continued)*					89	97		
		242.0		2108.4							
			As above.					90	100		
		244.0		2106.4							
245			As above.								
		249.0		2101.4							
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.:	Boart Longyear	LOGGED:	Kyle Kirtley
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-26 (GT-13)

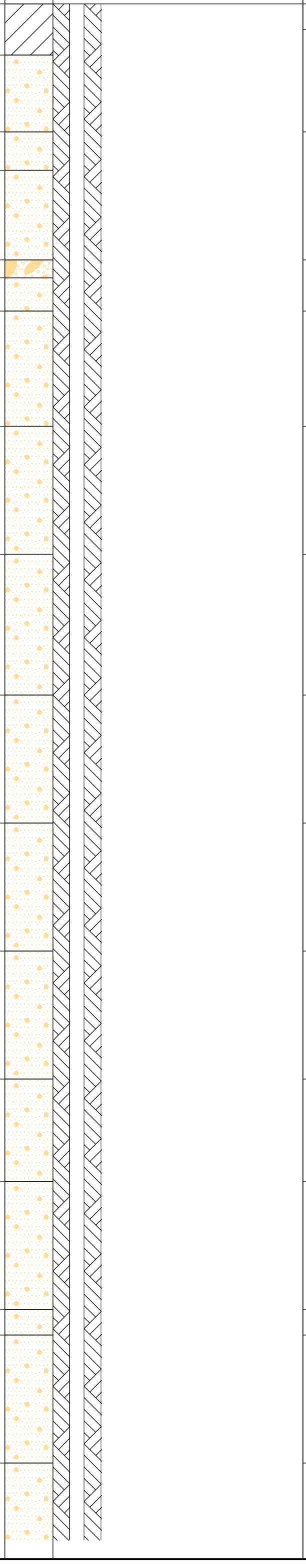
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 10, 2017 17:00
DRILLING END: January 10, 2017 17:00
COORDINATES: N: 834,203 E: 924,372

SHEET: 1 of 5
GS ELEV.: 2383.8
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2383.8	
	(CL), CLAY, low plasticity, some fine to coarse subrounded to subangular gravel, dark red and dark brown, laminated; wet		CL
2.0		2381.8	
	Gila Sandstone (Tss): Reddish to dark brown SANDSTONE, medium to coarse grained sandstone with stiff clay lenses, thinly bedded.		
5.0		2378.8	
	As above.		
6.5		2377.3	
	Becomes variably matrix supported CONGLOMERATE & thinly laminated SANDSTONE, clasts in conglomerate are subrounded-subangular.		
10.0		2373.8	
10.7		2373.1	
	Becomes reddish-brown Gila CONGLOMERATE, matrix supported, mostly gravel clasts.		
12.0		2371.8	
	Becomes thinly laminate, fine, reddish brown SANDSTONE, alternating light & dark laminations.		
	Becomes variably thinly bedded siltstone, coarse grained sandstone, and matrix supported conglomerate.		
16.5		2367.3	
	As above.		
21.5		2362.3	
	As above.		
27.0		2356.8	
	Continues interbedded CONGLOMERATE and thinly laminated medium to coarse grained SANDSTONE.		
32.0		2351.8	
	As above.		
37.0		2346.8	
	As above, intervals of clay layers.		
42.0		2341.8	
	As above.		
46.0		2337.8	
	Becomes light brown to reddish brown SANDSTONE, medium to coarse grained, with interbedded clay lenses.		
51.0		2332.8	
52.0	As above.	2331.8	
	As above, with interbeds of matrix supported conglomerate.		
57.0		2326.8	



CORE INFO

RUN NO.	CORE RECOVERY %
1	100
2	100
3	100
4	89
5	100
6	91
7	100
8	100
8	72
9	93
10	100
11	100
12	100
13	94

NOTES

0 - 12: Hydro test #1
FHT

16 - 67: Hydro test #2
SI

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

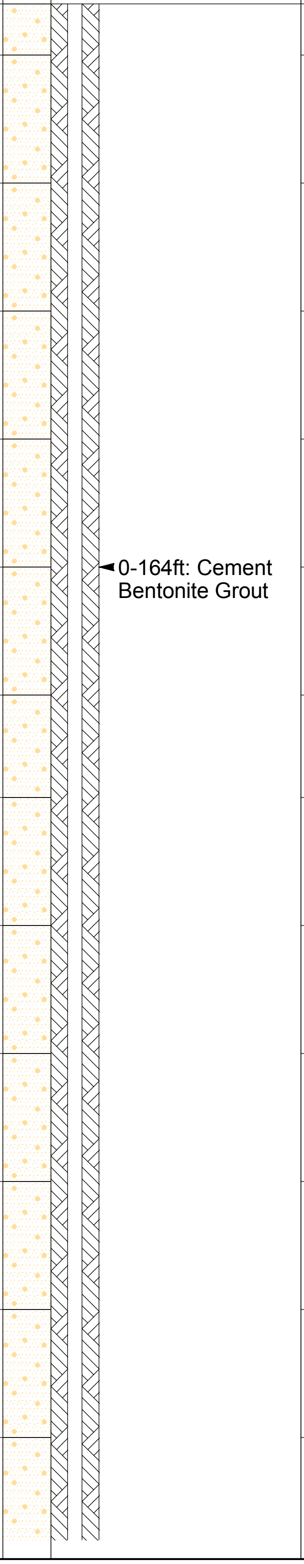
Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH17-26 (GT-13)

PROJECT:	RCML Near West TSF	DRILLING START:	January 10, 2017 17:00	SHEET:	2 of 5
PROJECT NO.:	1531436	DRILLING END:	January 10, 2017 17:00	GS ELEV.:	2383.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 834,203 E: 924,372	TOC ELEV.:	na
				DATUM:	



DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60		60.0		2323.8					
			Continues interbedded tan reddish thinly laminated SANDSTONE and matrix supprted CONGLOMERATE, gravel size clasts predominate, weak HCl reaction. *(continued)*			13	94		
		62.0		2321.8					
65			As above.			14	100	66 - 162: Hydro test #3 SI	
		67.0		2316.8					
70			As above.			15	100		
		72.0		2311.8					
75			As above.			16	100		
		77.0		2306.8					
80			As above.			17	100		
		82.0		2301.8					
85			As above.			18	100		
		87.0		2296.8					
90			As above.			19	100		
		91.0		2292.8					
95			As above.			20	100		
		96.0		2287.8					
100			As above.			21	100		
		101.0		2282.8					
105			As above.			22	100		
		106.0		2277.8					
110			As above.			23	100		
		111.0		2272.8					
115			As above.			24	100		
		116.0		2267.8					
120			As above.			25	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

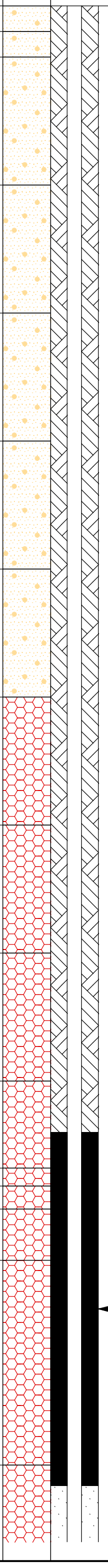
Golder Associates

RECORD OF BOREHOLE DH17-26 (GT-13)

PROJECT:	RCML Near West TSF	DRILLING START:	January 10, 2017 17:00	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	January 10, 2017 17:00	GS ELEV.:	2383.8
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 834,203 E: 924,372	TOC ELEV.:	na
				DATUM:	

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES
120.0		2263.8				
121.0	As above. *(continued)*	2262.8		25	100	
122.0	As above.	2261.8		26	100	
127.0	As above.	2256.8		27	100	
132.0	As above.	2251.8		28	100	
137.0	As above.	2246.8		29	100	
142.0	Becomes volcaniclastic SANDSTONE, highly oxidized, reddish- brown, to light brown, ash-rich, minor HCl reaction.	2241.8		30	100	
147.0	As above.	2236.8		31	100	
152.0	Becomes reddish brown to black BASALT, calcite filled amygdules, auto-breccia, pervasive oxidation.	2231.8		32 33	100 100	
157.0	As above.	2226.8		34	100	
162.0	As above.	2221.8		35	100	162 - 250: Hydro test #4 SI
165.4	As above, FeOX decreases.	2218.4		36	100	
166.1	Continues heavily oxidized, auto-brecciated BASALT with calcite amygdules.	2217.7				
167.0	As above.	2216.8				
169.0	As above.	2214.8		37	100	
177.0	Becomes aphenitic dark gray BASALT, abundant thick calcite veins.	2206.8		38	100	
	As above.			39	100	

DEPTH (ft): 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

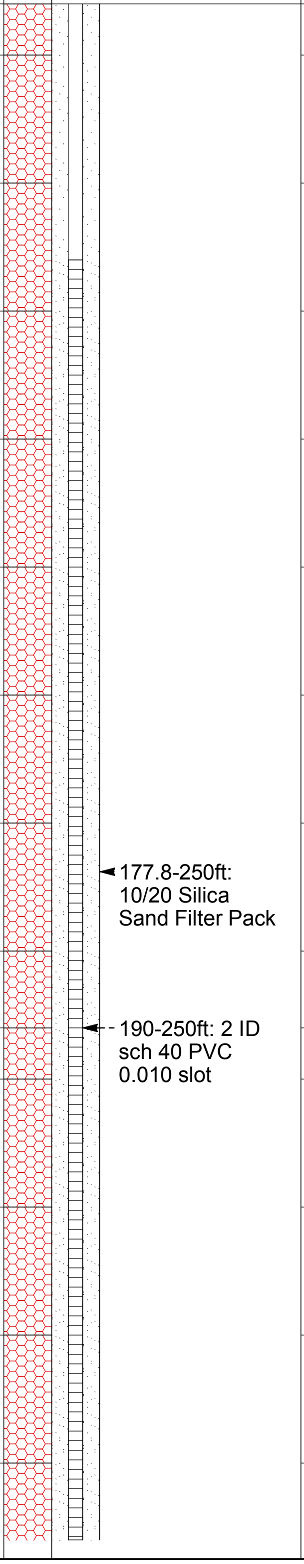
RECORD OF BOREHOLE DH17-26 (GT-13)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 10, 2017 17:00
DRILLING END: January 10, 2017 17:00
COORDINATES: N: 834,203 E: 924,372

SHEET: 4 of 5
GS ELEV.: 2383.8
TOC ELEV.: na
DATUM:

Depth (ft)	Elev	Description	USCS	Run No.	Core Recovery %
180.0	2203.8	As above. *(continued)*		39	100
182.0	2201.8	As above.		40	100
187.0	2196.8	As above.		41	100
192.0	2191.8	As above.		42	100
197.0	2186.8	As above.		43	100
202.0	2181.8	As above.		44	100
207.0	2176.8	As above.		45	100
212.0	2171.8	As above.		46	100
217.0	2166.8	As above.		47	100
220.0	2163.8	As above.		48	100
222.0	2161.8	As above.		49	100
227.0	2156.8	As above.		50	100
232.0	2151.8	As above.		51	100
237.0	2146.8	As above.		52	100



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

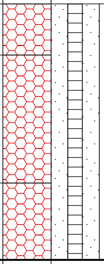
DRAFT

RECORD OF BOREHOLE DH17-26 (GT-13)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 10, 2017 17:00
DRILLING END: January 10, 2017 17:00
COORDINATES: N: 834,203 E: 924,372

SHEET: 5 of 5
GS ELEV.: 2383.8
TOC ELEV.: na
DATUM:



DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2143.8							
			As above. *(continued)*					52	100		
		242.0		2141.8							
245			As above.					53	100		
		247.0		2136.8							
			As above.					54	100		
250		250.0		2133.8							
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-27 (GT-12)

PROJECT:	RCML Near West TSF	DRILLING START:	January 14, 2017 13:05	SHEET:	1 of 5
PROJECT NO.:	1531436	DRILLING END:	January 14, 2017 13:05	GS ELEV.:	2333.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 832,977 E: 923,488	TOC ELEV.:	na
				DATUM:	

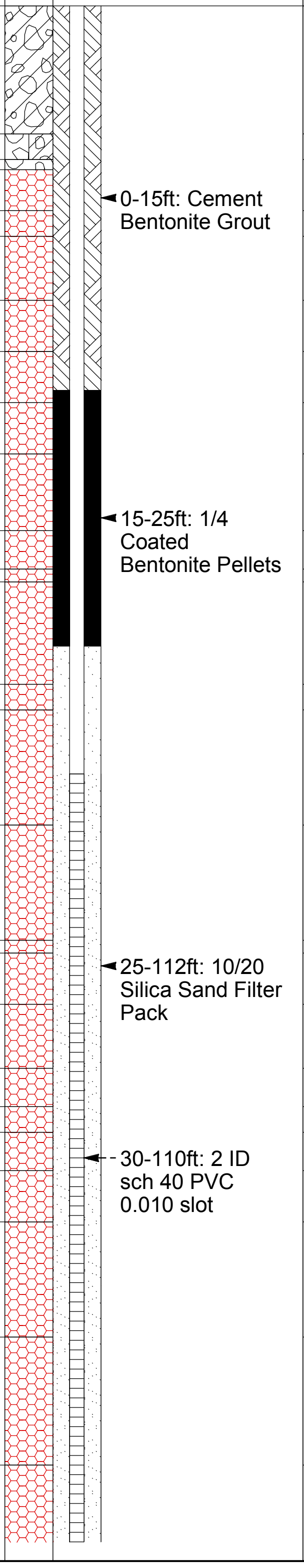
SOIL PROFILE

BORING METHOD: HQ3

Depth	DESCRIPTION	Elev	USCS
0.0		2333.0	
	Dark brown gravelly clay, fragmented basalt with tuff, quartz, & other volcanic fragments.		
5.0		2328.0	
	Rubble zone with basalt, tuff, quartz, & other volcanic fragments.		
6.0		2327.0	
6.4		2326.6	
	Fragmented pinkish-gray strongly welded tuff and basalt		
8.0		2325.0	
9.0		2324.0	
	Light-to-dark gray BASALT, fine grained with hornblende, biotite, garnet, and olivine phenocrysts that are less than ~1 to 0.5-mm in size, pervasive FeOx staining.		
11.5		2321.5	
	As above, rubble.		
13.5		2319.5	
	As above, at ~11 ft, yellowish-white staining begins to appear on fracture surfaces, no HCL reaction.		
15.5		2317.5	
	Continues light to dark gray BASALT, fine grained hornblende, olivine, garnet, and biotite phenocrysts (<~1-mm), fractures have less FeOx staining and are partially to fully-coated with a waxy, white mineral, talc.		
17.5		2315.5	
20.5		2312.5	
	As above, abundant MnOx and talc on discontinuities, becomes more factured.		
22.0		2311.0	
	As above.		
22.5		2310.5	
	As above.		
	As above, broken.		
	As above.		
	Continues fine grained BASALT, dark gray with FeOx staining,small phenocrysts (<~0.5-mm) of hornblende, garnet, fractured are often oxidized occasionally coated with chlorite.		
26.5		2306.5	
27.5		2305.5	
	As above.		
	As above, increase in FeOx staining.		
32.0		2301.0	
	As above, rubbly.		
36.5		2296.5	
37.0		2296.0	
	As above.		
	As above, joints have thick (>~5-mm) infill, white, soft, no HCL reaction, possibly chlorite or talc.		
39.0		2294.0	
	As above.		
41.5		2291.5	
	As above.		
43.0		2290.0	
	As above, rubble.		
44.0		2289.0	
	As above.		
45.5		2287.5	
	As above, rubble and gouge.		
47.5		2285.5	
	Continues fine crystalline BASALT, dark gray with low FeOx staining, small phenocrysts (<~0.5-mm) of hornblende, garnet, and biotite, fractured surfaces vary from oxidized staining to completely coated with a combination of chlorite or talc.		
52.0		2281.0	
	As above, calcite on fracture surfaces & open veins.		
57.0		2276.0	
	As above, increased calcite veining.		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
1	20
2	100
3	100
4	30
5	100
6	100
7	100
8	100
9	100
10	100
11	100
12	100
13	100
14	100
15	100
16	100
17	100
18	100
19	100
20	100
21	100
22	100
23	100
24	100
25	100

NOTES

33 - 62: Hydro test #1
SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-27 (GT-12)

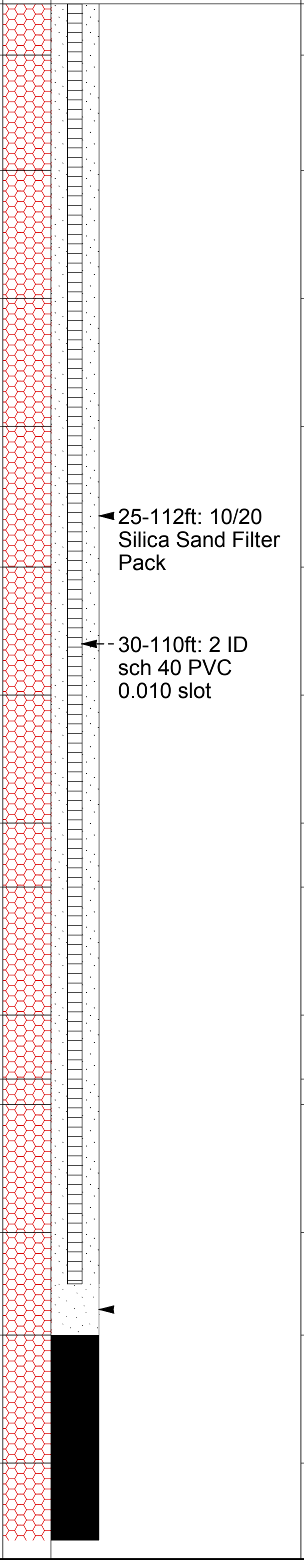
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 14, 2017 13:05
DRILLING END: January 14, 2017 13:05
COORDINATES: N: 832,977 E: 923,488

SHEET: 2 of 5
GS ELEV.: 2333.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes	Additional Lab Testing
60.0	As above, increased calcite veining. *(continued)*	2273.0		25	100		
62.0	As above.	2271.0		26	100	63 - 132: Hydro test #2 SI	
66.5	As above.	2266.5		27	100		
71.5	As above.	2261.5		28	100		
76.5	As above.	2256.5		29	100		
82.0	As above.	2251.0		30	100		
87.0	As above.	2246.0		31	100		
92.0	As above.	2241.0		32	100		
94.5	As above.	2238.5		33	100		
99.5	As above.	2233.5		34	100		
102.0	As above, mostly rubble.	2231.0		35	100		
103.0	Continues finely crystalline BASALT, dark gray to black with low FeOx staining, small phenocrysts (<~1.0-mm) of hornblende, garnet, and biotite, fractured surfaces vary from clean with Fe or Mn staining to completely coated with a combination of chlorite or talc.	2230.0		36	100		
108.0	As above.	2225.0		37	100		
112.0	As above.	2221.0		38	100		
117.0	As above.	2216.0		39	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

DRAFT

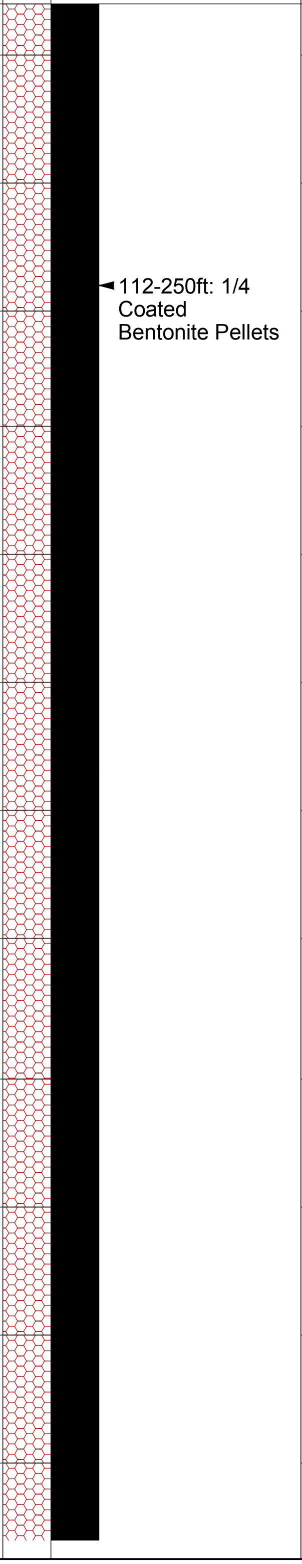
RECORD OF BOREHOLE DH17-27 (GT-12)

PROJECT:	RCML Near West TSF	DRILLING START:	January 14, 2017 13:05	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	January 14, 2017 13:05	GS ELEV.:	2333.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 832,977 E: 923,488	TOC ELEV.:	na
				DATUM:	

BORING METHOD: HQ3

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	120.0	As above. *(continued)*	2213.0		39	100		
	122.0	As above.	2211.0		40	100		
125	127.0	As above.	2206.0		41	100		
130	132.0	Becomes highly oxidized, amygdaloidal BASALT, contianing calcite amygdules and veins, bright rust to dark purple-blackish colored, phenocrysts still observed but have been completely oxidized and look like rust stains, open vein have yellow-colored staining and FeOx staining.	2201.0		42	100	133 - 250: Hydro test #3 SI & CRI	
135	136.5	As above.	2196.5		43	100		
140	141.5	As above, decreasing FeOx.	2191.5		44	100		
145	146.5	As above, with increase in FeOx.	2186.5		45	100		
150	151.5	As above.	2181.5		46	100		
155	156.5	As above, fractured surfaces are completely covered in calcite crystals and zeolite.	2176.5		47	100		
160	162.0	As above.	2171.0		48	100		
165	167.0	As above.	2166.0		49	100		
170	172.0	As above.	2161.0		50	100		
175	177.0	As above.	2156.0		51	100		
180								

GRAPHIC LOG / WELL DIAGRAM



112-250ft: 1/4 Coated Bentonite Pellets

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-27 (GT-12)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 14, 2017 13:05
DRILLING END: January 14, 2017 13:05
COORDINATES: N: 832,977 E: 923,488

SHEET: 4 of 5
GS ELEV.: 2333.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes
180.0	As above. *(continued)*	2153.0		51	100	
182.0	As above.	2151.0		52	100	
185.6	Becomes completely oxidized, red brown BASALT, few amygdules.	2147.4		53	100	
192.0	Becomes Apache Leap Tuff (Talg): moderately welded, oxidized TUFF, light brown to pinkish-reddish, has visible crystal rich; biotite, quartz phenocrysts.	2141.0		54	100	193 - 250: Hydro test # SI
197.0	As above.	2136.0		55	100	
202.0	As above.	2131.0		56	100	
207.0	As above.	2126.0		57	100	
212.0	As above, more weathered & weaker.	2121.0		58	100	
217.0	As above.	2116.0		59	100	
222.0	As above.	2111.0		60	100	
227.0	As above.	2106.0		61	100	
232.0	Becomes poorly welded TUFF, light brown to dark brown with high FeOx, clay alteration, weak.	2101.0		62	100	
237.0	As above, crystal rich, phenocryst larger than previous runs.	2096.0		63	100	

WELL DIAGRAM: 112-250ft: 1/4 Coated Bentonite Pellets

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-27 (GT-12)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 14, 2017 13:05
DRILLING END: January 14, 2017 13:05
COORDINATES: N: 832,977 E: 923,488

SHEET: 5 of 5
GS ELEV.: 2333.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0		2093.0							
		242.0	As above, crystal rich, phenocryst larger than previous runs. *(continued)*	2091.0				63	100		
245		245.9	Becomes highly weathered, heavily FeOx non-welded TUFF, crystal rich, clay altered and weak.	2087.1				64	100		
		247.0	Massive, Becomes CONGLOMERATE, schistose clasts in medium-to-coarse grained sandy clay, clast suported, clasts <~2.5", matrix has HCL moderate reaction.	2086.0							
250		250.0	As above.	2083.0				65	100		

Refusal at 5.0 ft.
Bottom of borehole at 250.0 ft.
Completed as well. Refer to diagram.

255
260
265
270
275
280
285
290
295
300

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

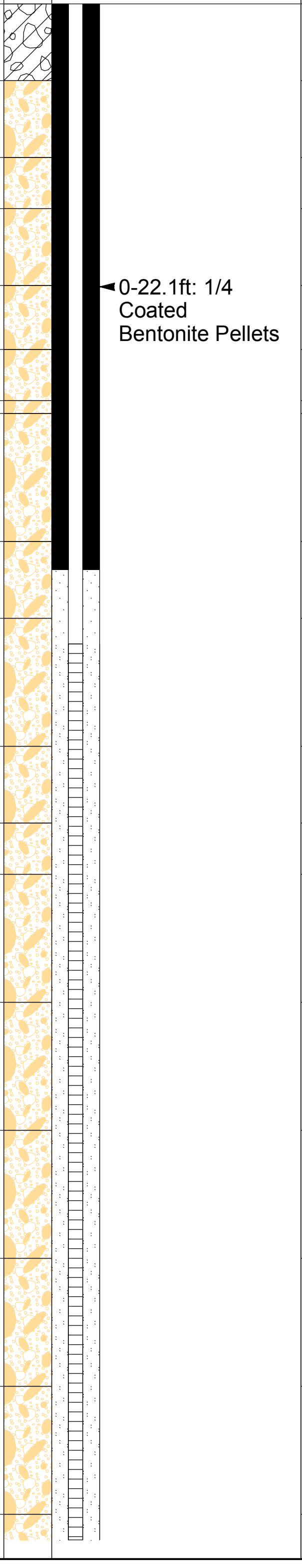
RECORD OF BOREHOLE DH17-28 (GT-23)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 17, 2017 07:13
DRILLING END: January 17, 2017 07:13
COORDINATES: N: 835,599 E: 929,090

SHEET: 1 of 5
GS ELEV.: 2516.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0	HQ3	0.0	Colluvium and weathered cnoglomerate.	2516.0				0 - 32: Hydro test #1 FHT	
		3.0	Gila CONGLOMERATE (Tcg): completely weathered, matrix washed out, clasts consist of, schist, quartz, tuff. Rubble zone.	2513.0		1	33		
5		6.0	As above.	2510.0		2	25		
		8.0	As above.	2508.0		3	33		
10		11.0	Becomes brown CONGLOMERATE, clast dominant, subangular to subround, fine sandy matrix, clasts consist of, gneiss, schist, quartz, tuff, weak HCl reaction, competent.	2505.0		4	68		
		13.5	As above.	2502.5		5	25		
15		15.5	As above.	2500.5		6	100		
		16.0	As above.	2500.0		7	100		
20		21.0	As above, moderately fractured.	2495.0		8	43		
		24.0	As above.	2492.0		9	100		
25		29.0	As above rubble.	2487.0		10	100	29 - 104: Hydro test #2 SI & CRI	
30		32.0	As above, rubble.	2484.0		11	90		
		34.0	As above.	2482.0		12	100		
35		39.0	As above.	2477.0		13	100		
40		44.0	As above.	2472.0		14	100		
45		49.0	As above.	2467.0		15	100		
50		54.0	As above.	2462.0		16	100		
55		59.0	As above.	2457.0		17	100		
60									



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH17-28 (GT-23)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

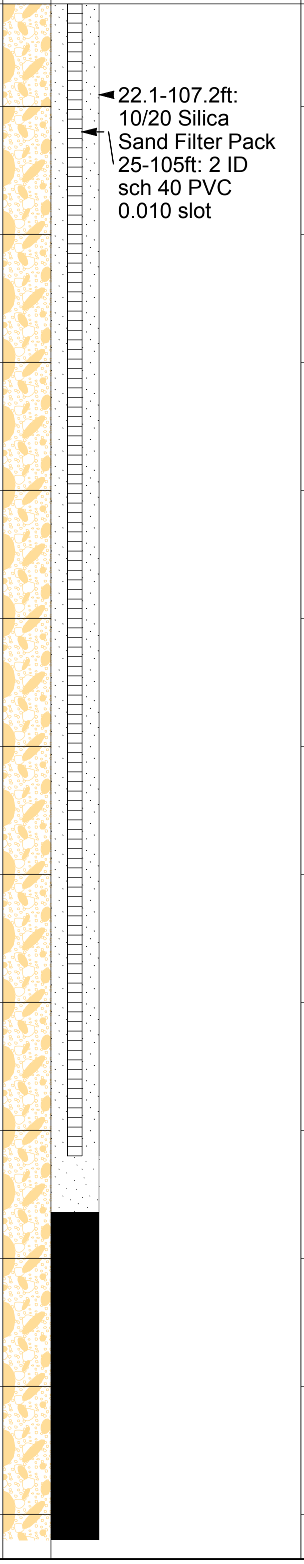
DRILLING START: January 17, 2017 07:13
DRILLING END: January 17, 2017 07:13
COORDINATES: N: 835,599 E: 929,090

SHEET: 2 of 5
GS ELEV.: 2516.0
TOC ELEV.: na
DATUM:

BORING METHOD: HQ3

DEPTH (ft)	Depth	SOIL PROFILE DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	60.0	As above. *(continued)*	2456.0		17	100		
65	64.0	As above.	2452.0		18	100		
70	69.0	As above.	2447.0		19	100		
75	74.0	As above.	2442.0		20	100		
80	79.0	As above, few cobbles.	2437.0		21	100		
85	84.0	As above.	2432.0		22	100		
90	89.0	As above.	2427.0		23	100		
95	94.0	As above.	2422.0		24	100		
100	99.0	As above.	2417.0		25	100		
105	104.0	As above.	2412.0		26	100		
110	109.0	Continues Gila CONGLOMERATE, brown, clast dominated, gavel with few cobbles, fine sandy matrix, clasts consist of, schist, quartz, tuff, diabase, weak HCl reaction, competent.	2407.0		27	100	109 - 250: Hydro test #3 SI	
115	114.0	As above.	2402.0		28	100		
120	119.0	As above.	2397.0		29	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-28 (GT-23)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 17, 2017 07:13
DRILLING END: January 17, 2017 07:13
COORDINATES: N: 835,599 E: 929,090

SHEET: 3 of 5
GS ELEV.: 2516.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120	HQ3	120.0	As above. *(continued)*	2396.0		29	100		
125		124.0	As above.	2392.0		30	100		
130		129.0	As above, one boulder.	2387.0		31	100		
135		134.0	As above.	2382.0		32	100		
140		139.0	As above.	2377.0		33	100		
145		144.0	As above.	2372.0		35	100		
150		149.0	As above.	2367.0		36	100		
155		154.0	As above.	2362.0		37	100		
160		159.0	As above.	2357.0		38	100		
165		164.0	As above.	2352.0		39	100		
170		169.0	As above.	2347.0		40	100		
175		174.0	As above.	2342.0		41	100		
180		179.0	As above.	2337.0		42	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-28 (GT-23)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 17, 2017 07:13
DRILLING END: January 17, 2017 07:13
COORDINATES: N: 835,599 E: 929,090

SHEET: 4 of 5
GS ELEV.: 2516.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180	HQ3	180.0	As above. *(continued)*	2336.0		42	100		
185		184.0	As above.	2332.0		43	100		
190		189.0	As above.	2327.0		44	100		
		191.5	As above.	2324.5		45	80	191.5: Bit went out at 191.5, lost 0.5' of core.	
195		194.0	As above.	2322.0		46	100		
200		199.0	As above.	2317.0		47	100		
205		204.0	As above.	2312.0		48	100		
210		208.0	Continues Gila CONGLOMERATE, brown, clast dominated, gavel, fine grained sandy matrix, clasts consist of, schist, quartz, tuff, diabase, basalt, weak HCl reaction, competent.	2308.0		49	100		
215		213.0	As above.	2303.0		50	100		
220		218.0	As above.	2298.0		51	100		
225		223.0	As above.	2293.0		52	100		
230		228.0	As above.	2288.0		53	100		
235		233.0	As above, few cobbles.	2283.0		54	100		
240		238.0	As above, few cobbles.	2278.0		55	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-28 (GT-23)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 17, 2017 07:13
DRILLING END: January 17, 2017 07:13
COORDINATES: N: 835,599 E: 929,090

SHEET: 5 of 5
GS ELEV.: 2516.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240	HQ3	240.0	As above, few cobbles. *(continued)*	2276.0				55	100		
		243.0	As above, few cobbles.	2273.0				56	100		
245											
		248.0	As above, few cobbles.	2268.0				56	100		
250		250.0	Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.	2266.0							
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kyle Kirtley
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-29 (GT-14-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 23, 2017 09:30
DRILLING END: January 23, 2017 09:30
COORDINATES: N: 838,433 E: 923,220

SHEET: 1 of 2
GS ELEV.: 2405.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth (ft)	Description	Elev	USCS
0.0	Gila CONGLOMERATE (Tcg): polylithic subangular to subrounded gravel clasts in well indurated silty sand matrix, weakly calcareous cement, variably clast or matrix dominant, no iron staining.	2405.0	
12.0	Becomes Gila SANDSTONE (Tss): coarse to medium grained, bedding defined by grain size changes, subrounded gravels well indurated with slightly to moderately clacareous cement.	2393.0	
22.0	Becomes Gila CONGLOMERATE (Tcg): polylithic subangular to subrounded gravel clasts in well indurated silty sand matrix, weakly calcareous cement, variably clast or matrix dominant, no iron staining.	2383.0	
27.0	Continues Gila CONGLOMERATE, massive few discontinuities, variably matrix supported, intervals of medium to coarse sandstone, immature, variably thick bedding defined by grain size changes, weak HCl reaction throughout.	2378.0	

Log continued on next page

WELL DIAGRAM

CORE INFO

RUN NO.	CORE RECOVERY %
1	80
2	100
3	100
4	100
5	100
6	90
7	96
8	100
9	100
10	100
11	100
12	100
13	100

NOTES

0 - 27: Hydro test #1 FHT

14.9: Lost circulation around this depth.

23 - 62: Hydro test #2 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-29 (GT-14-2)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 23, 2017 09:30
DRILLING END: January 23, 2017 09:30
COORDINATES: N: 838,433 E: 923,220

SHEET: 2 of 2
GS ELEV.: 2405.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
60		60.0		2345.0							
		62.0		2343.0		▨		13	100		
			Bottom of borehole at 62.0 ft. Backfilled with cement bentonite grout.								
65											
70											
75											
80											
85											
90											
95											
100											
105											
110											
115											
120											

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:48
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH17-30 (GT-25)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 24, 2017 13:45
DRILLING END: January 24, 2017 13:45
COORDINATES: N: 833,472 E: 931,659

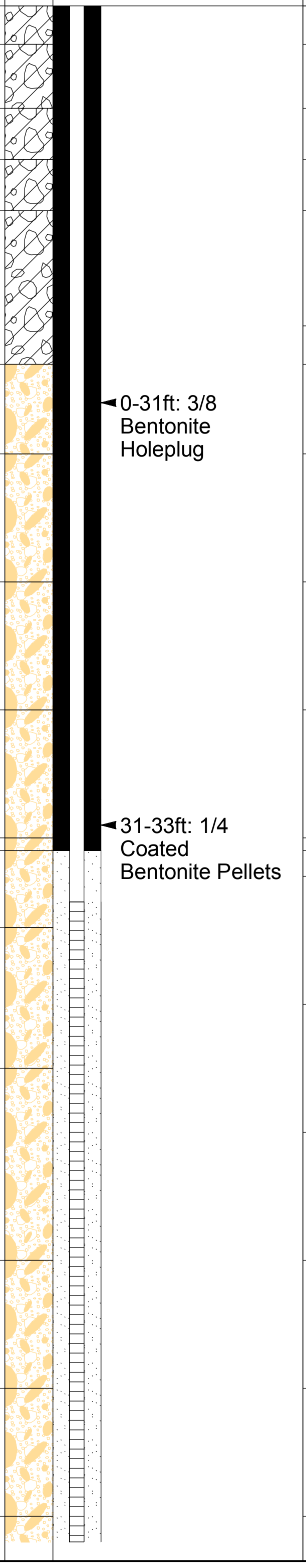
SHEET: 1 of 5
GS ELEV.: 2472.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev
0.0	Surface alluvium. Washed gravel and little clayey sand. Clasts granodiorite, pink tuff, and schist.	2472.0
1.5	Continues alluvium. Returns are washed cobbles and coarse gravel. Clasts are quartz, granodiorite, and pink tuff.	2470.5
4.0	As above, tuff and quartzite clasts.	2468.0
6.0	As above, returns are foliated chloritized fine grained diabase with epidote, granodiorite, quartz, quartzite.	2466.0
8.0	As above, clasts predominantly coarse gravel size: foliated diabase, quartzite, rhyolite, quartz	2464.0
14.0	Becomes Gila Conglomerate (Tcg): slightly weathered, clast supported, coarse sand to cobbles in silty sand matrix, clasts are subrounded to subangular, foliated diabase, quartzite, schist, pink and white tuff, schist. Moderate to weak HCl rxn.	2458.0
17.5	As above, no HCl reaction.	2454.5
22.5	As above, with few vuggy quartz veins with crystals.	2449.5
27.5	As above but no quartz veins, becomes very weak HCl reaction.	2444.5
32.5		2439.5
33.0	Continues CONGLOMERATE, slightly weathered, matrix supported, coarse sand to fine gravel in sandy clay matrix, subrounded to angular clasts are quartzite, schist, tuff, and diabase. Weak HCl reaction, competent.	2439.0
36.0	As above, trace vugs with quartz crystals, strong HCl reaction.	2436.0
41.5	Becomes matrix supported, brown CONGLOMERATE, moderate to strong HCl reaction, gravel and cobbles in sandy clay matrix, clasts are: tuff, schist, quartzite, subophitic diabase. Vuggy zones with quartz crystals.	2430.5
49.0	As above.	2423.0
54.0	As above, zones of slightly more friable matrix, becomes clast supported.	2418.0
59.0	As above.	2413.0

Log continued on next page

WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY %
1	100
2	40
3	25
4	75
5	33
6	67
6	100
7	100
8	100
9	100
10	100
11	100
12	100
13	100
14	100
15	100
16	100
17	100

NOTES

0 - 32: Hydro test #1 FHT

32.5: 1st run after setting casing, recover washed gravel.
33 - 94: Hydro test #2 SI

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

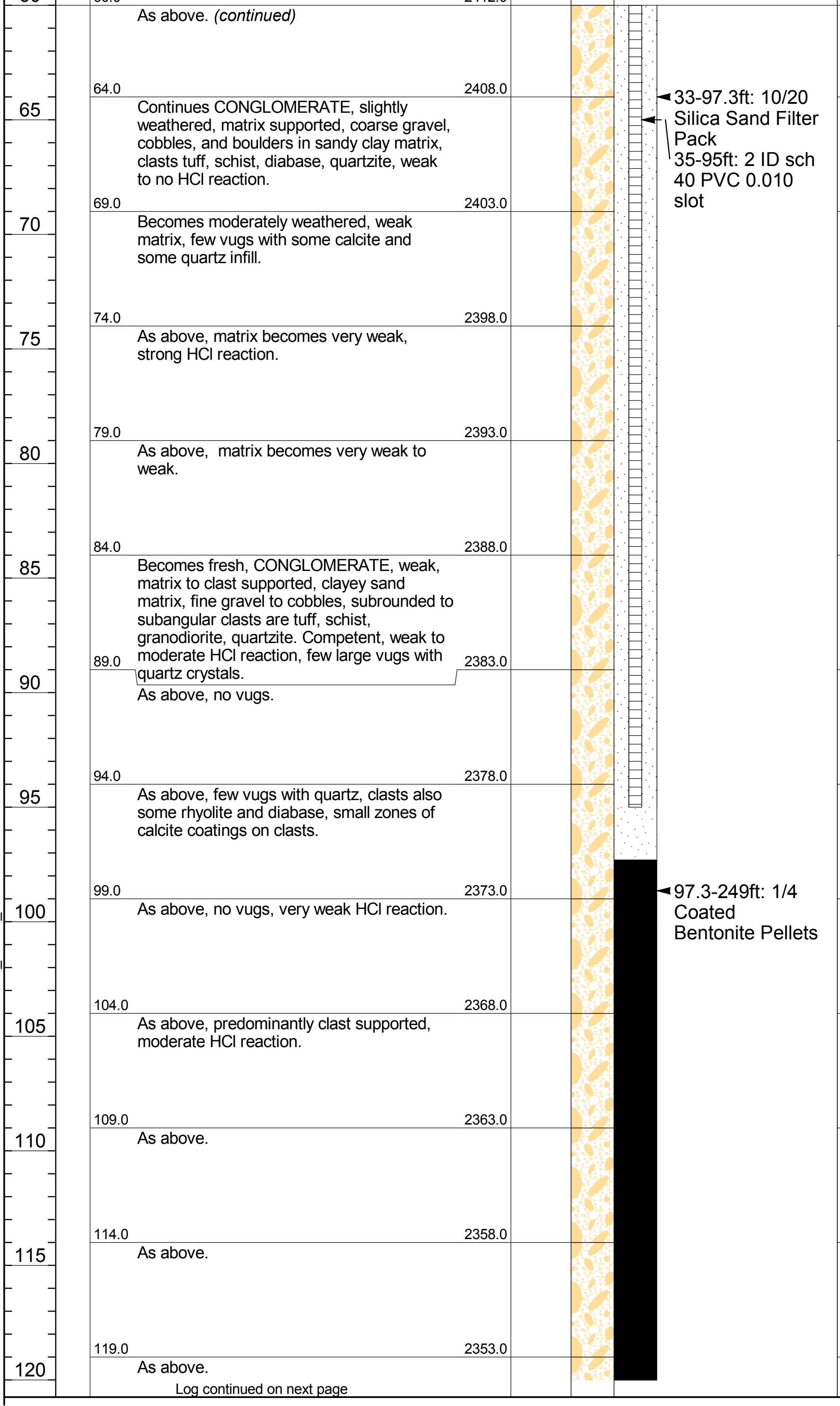
RECORD OF BOREHOLE DH17-30 (GT-25)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 24, 2017 13:45
DRILLING END: January 24, 2017 13:45
COORDINATES: N: 833,472 E: 931,659

SHEET: 2 of 5
GS ELEV.: 2472.0
TOC ELEV.: na
DATUM:

Depth	Description	Elev	USCS	Run No.	Core Recovery %	Notes	Additional Lab Testing
60.0	As above. *(continued)*	2412.0		17	100		
64.0	Continues CONGLOMERATE, slightly weathered, matrix supported, coarse gravel, cobbles, and boulders in sandy clay matrix, clasts tuff, schist, diabase, quartzite, weak to no HCl reaction.	2408.0		18	100		
69.0	Becomes moderately weathered, weak matrix, few vugs with some calcite and some quartz infill.	2403.0		19	100		
74.0	As above, matrix becomes very weak, strong HCl reaction.	2398.0		20	100		
79.0	As above, matrix becomes very weak to weak.	2393.0		21	100		
84.0	Becomes fresh, CONGLOMERATE, weak, matrix to clast supported, clayey sand matrix, fine gravel to cobbles, subrounded to subangular clasts are tuff, schist, granodiorite, quartzite. Competent, weak to moderate HCl reaction, few large vugs with quartz crystals.	2388.0		22	100		
89.0	As above, no vugs.	2383.0		23	100		
94.0	As above, few vugs with quartz, clasts also some rhyolite and diabase, small zones of calcite coatings on clasts.	2378.0		24	100	94 - 249: Hydro test #3 SI	
99.0	As above, no vugs, very weak HCl reaction.	2373.0		25	100		
104.0	As above, predominantly clast supported, moderate HCl reaction.	2368.0		26	100		
109.0	As above.	2363.0		27	100	109: Damage from overdrilling.	
114.0	As above.	2358.0		28	100		
119.0	As above.	2353.0		29	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

RECORD OF BOREHOLE DH17-30 (GT-25)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 24, 2017 13:45
DRILLING END: January 24, 2017 13:45
COORDINATES: N: 833,472 E: 931,659

SHEET: 3 of 5
GS ELEV.: 2472.0
TOC ELEV.: na
DATUM:

97.3-249ft: 1/4 Coated Bentonite Pellets

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0	As above. *(continued)*	2352.0		29	100		
125		124.0	As above, becomes matrix supported, weak HCl reaction, with a silty interbed.	2348.0		30	100		
130		129.0	As above.	2343.0		31	100		
135		134.0	As above, becomes clast supported, coarse gravel and tuff boulder, moderate HCl reaction.	2338.0		32	100		
140		139.0	As above.	2333.0		33	100		
145		144.0	As above.	2328.0		34	100		
150		149.0	As above.	2323.0		35	100		
155		154.0	As above.	2318.0		36	100		
160		159.0	Continues CONGLOMERATE, fresh, matrix to clast supported, fine to medium gravel with cobbles in clayey sand matrix, subrounded to angular clasts are diabase, quartzite, schist, tuff, quartz. Competent and massive, moderate HCl reaction.	2313.0		37	100		
165		164.0	Becomes slightly weathered CONGLOMERATE, matrix is very weak to weak, continues massive but more easily drilling damaged.	2308.0		38	100		
170		169.0	As above, becomes slightly weathered to fresh.	2303.0		39	100		
175		174.0	As above, becomes matrix supported.	2298.0		40	100		
180		179.0	As above.	2293.0		41	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-30 (GT-25)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 24, 2017 13:45
DRILLING END: January 24, 2017 13:45
COORDINATES: N: 833,472 E: 931,659

SHEET: 4 of 5
GS ELEV.: 2472.0
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %
180.0		2292.0			
	As above. *(continued)*			41	100
184.0		2288.0			
	As above.			42	100
189.0		2283.0			
	As above.			43	100
194.0		2278.0			
	As above.			44	100
199.0		2273.0			
	As above.			45	100
204.0		2268.0			
	As above, becomes weak HCl reaction.			46	100
207.0		2265.0			
	As above, moderate HCl reaction.			47	100
212.0		2260.0			
	As above.			48	100
214.0		2258.0			
	As above, with bed of slightly weathered, very weak to weak rock.			49	100
219.0		2253.0			
	Becomes Gila SANDSTONE, fresh, weak, fine to coarse clayey sand with little fine to coarse subangular gravel, few fine sand interbeds, massive, weak to moderate HCl reaction. Gradational contact.			50	100
224.0		2248.0			
	As above, bedded.			51	100
229.0		2243.0			
	Becomes Gila CONGLOMERATE, fresh, weak, clast supported, fine to coarse gravel with cobbles, little sandy matrix, subrounded to angular clasts are schist, tuff, rhyolite, quartzite, diabase. Massive, strong HCl reaction.			52	100
234.0		2238.0			
	As above, becomes matrix supported, with tuff boulder.			53	100
239.0		2233.0			
	As above.			54	100

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-30 (GT-25)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 24, 2017 13:45
DRILLING END: January 24, 2017 13:45
COORDINATES: N: 833,472 E: 931,659

SHEET: 5 of 5
GS ELEV.: 2472.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE: Depth	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO: RUN NO.	CORE INFO: CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0 244.0	As above. *(continued)*	2232.0 2228.0				54	100		
245		249.0	As above.	2223.0				55	90	244: Bit wears out at 248ft, last 0.5ft not recovered.	
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:49
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

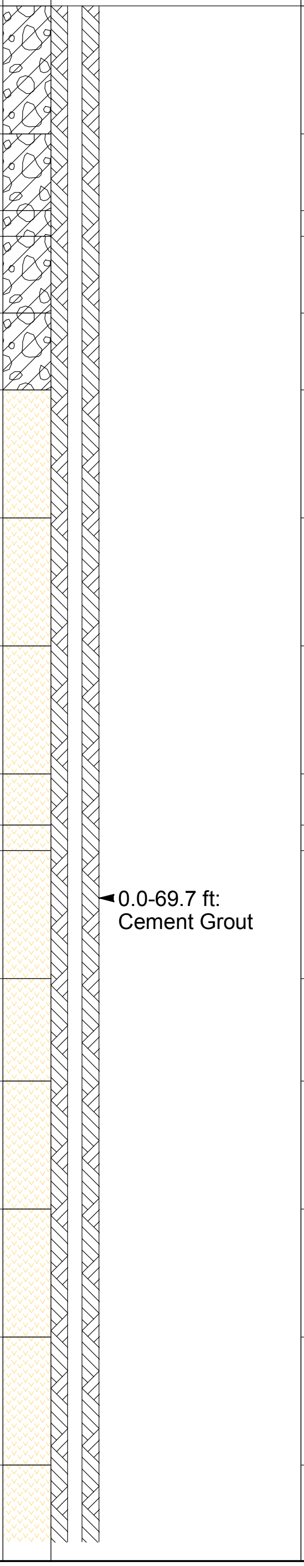
RECORD OF BOREHOLE DH17-31 (GT-34)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 25, 2017 00:00
DRILLING END: January 28, 2017 00:00
COORDINATES: N: 845,356 E: 939,790

SHEET: 1 of 5
GS ELEV.: 2877.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	RUN NO.	CORE RECOVERY %	NOTES
0	0.0		2877.0			
0–5		Overburden. gravel to cobbles limestone and volcanics, fines have been washed out.		1	30	0 - 30: Hydro test #1 FHT
5	5.0	Colluvium. limestone cobbles to 3 inches, fines are clayey sand.	2872.0	2	57	
	8.0	As above fines washed out.	2869.0	3	80	
	9.0	As above, at 10' becomes weakly cemented colluvium, gravel to cobble clasts of limestone with clayey fines, vigorous HCl reaction.	2868.0	4	83	
	12.0	Colluvium limestone clasts up to 3 in fines are gravelly clay vigorous HCl reaction.	2865.0	5	50	
15	15.0	Becomes Apache Leap Tuff (Talg): reddish brown to grey TUFF crystal rich, few lithics, phenocrysts include feldspars and euhedral biotite weak HCl reaction.	2862.0	6	100	
20	20.0	As above.	2857.0	7	100	22 - 67: Hydro test #2 SI & CRI
25	25.0	As above, less weathered.	2852.0	8	100	
30	30.0	No recovery.	2847.0	9	0	
	32.0	Continues slightly weathered, red brown crystal rich TUFF, few lithics, minor silica veining.	2845.0	10	100	
	33.0	As above.	2844.0	11	100	
	38.0	As above, becomes more fractured.	2839.0	12	100	
40	42.0	As above.	2835.0	13	100	
45	47.0	As above.	2830.0	14	100	
50	52.0	As above, becomes gouge 52.5' to 55.5'.	2825.0	15	100	
55	57.0	As above, becomes massive, very competent.	2820.0	16	100	
60						



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-31 (GT-34)

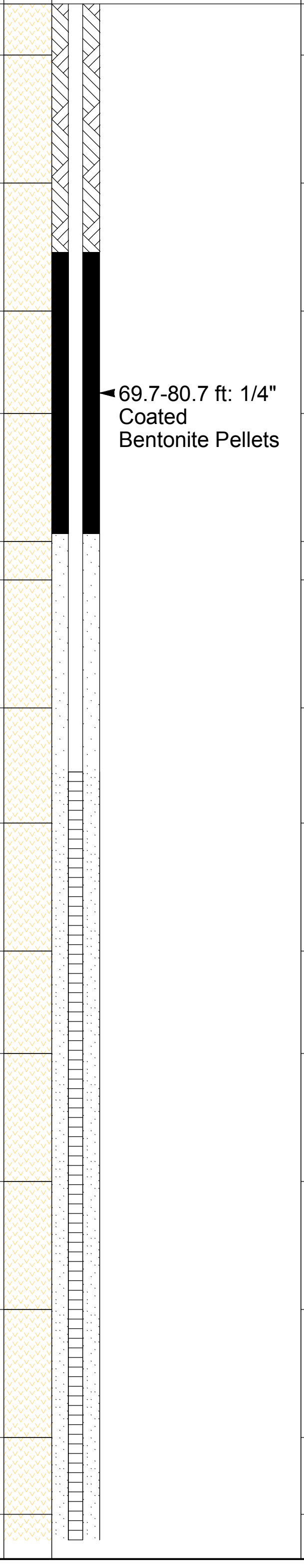
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 25, 2017 00:00
DRILLING END: January 28, 2017 00:00
COORDINATES: N: 845,356 E: 939,790

SHEET: 2 of 5
GS ELEV.: 2877.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Description	Depth	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60			60.0	2817.0					
		As above, becomes massive, very competent. *(continued)*	62.0	2815.0		16	100		
65		As above.	67.0	2810.0		17	100	62 - 111: Hydro test #3 SI & GF	
70		As above.	72.0	2805.0		18	100		
75		As above, interval of intense fracturing.	76.0	2801.0		19	100		
80		As above.	81.0	2796.0		20	100		
		As above.	82.5	2794.5		21	100		
85		As above.	87.5	2789.5		22	100		
90		As above.	92.0	2785.0		23	100		
95		Continues fresh to slightly weathered, red brown crystal rich TUFF, few lithics, weak fabric defined by phenocryst orientation, weathering increases around joints often manganese oxide coating.	97.0	2780.0		24	100		
100		As above.	101.0	2776.0		25	100		
105		As above, becomes more jointed and weathered along selveges of joints.	106.0	2771.0		26	80	104.5: lost circulation	
110		As above, fine veins with some open voids, silica and calcite infill, not interconnected.	111.0	2766.0		27	100	107 - 157: Hydro test #4 SI & GF	
115		Continues light brown red,massive TUFF with ocassional vug with calcite infill.	116.0	2761.0		28	100		
		As above.	119.0	2758.0		29	100		
120		As above.				30	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-31 (GT-34)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 25, 2017 00:00
DRILLING END: January 28, 2017 00:00
COORDINATES: N: 845,356 E: 939,790

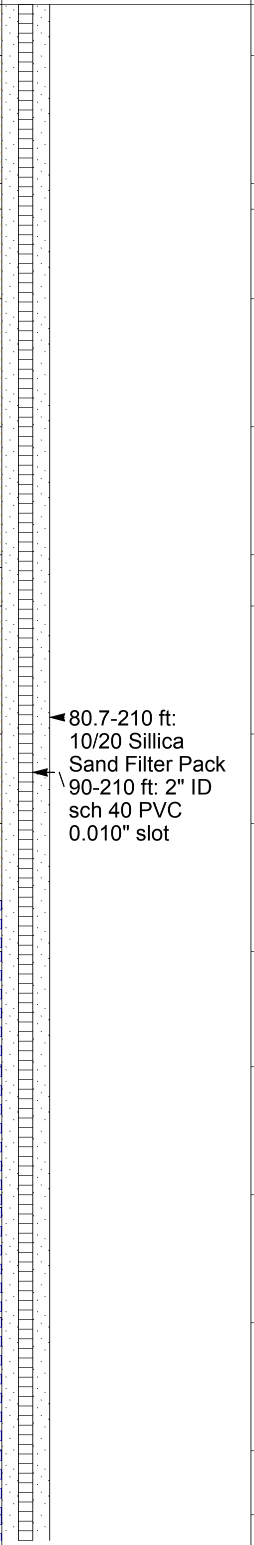
SHEET: 3 of 5
GS ELEV.: 2877.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth (ft)	Elev	DESCRIPTION	USCS	GRAPHIC LOG
120.0	2757.0	As above. *(continued)*		
122.0	2755.0	As above.		
127.0	2750.0	As above.		
128.0	2749.0	As above with zones of highly weathered rock in broken zones, also subtle hydrothermal breccia.		
131.5	2745.5	As above.		
136.5	2740.5	As above.		
141.5	2735.5	As above.		
142.0	2735.0	Becomes white to orange TUFF, highly altered, groundmass is oxidized, fresh euhedral biotite, weathered feldspars.		
143.5	2733.5	As above.		
148.5	2728.5	As above.		
152.0	2725.0	As above.		
155.0	2722.0	Becomes Mescal Limestone (pCmls): fine grained, yellow gray, thinly to moderately bedded fine grained LIMESTONE silica and calcite veining.		
157.0	2720.0	As above with abundant silica and calcite veins crosscutting bedding.		
161.5	2715.5	Continues varicolored red and yellow gray, bedded LIMESTONE zones of stockwork calcite veining and hydrothermal breccia intense silica & calcite veining throughout.		
166.5	2710.5	As above.		
167.0	2710.0	Becomes red and black silica flooded brecciated LIMESTONE iron stained strata of silica and carbonate, bands of hematite.		
171.3	2705.7	Becomes white gray with red and buff LIMESTONE, medium bedded, abundant silica and calcite veining as well as hydrothermal breccia.		
176.5	2700.5	As above.		
179.0	2698.0	As above.		

Log continued on next page

WELL DIAGRAM



CORE INFO

Depth (ft)	RUN NO.	CORE RECOVERY %
120.0 - 122.0	30	100
122.0 - 127.0	31	100
127.0 - 128.0	32	100
128.0 - 131.5	33	86
131.5 - 136.5	34	100
136.5 - 141.5	36	100
141.5 - 143.5	37	100
143.5 - 148.5		100
148.5 - 152.0		100
152.0 - 157.0		96
157.0 - 161.5		96
161.5 - 166.5		100
166.5 - 171.5		100
171.5 - 176.5		100
176.5 - 179.0		92
179.0 -		100

NOTES

141.5 - 142: Drilled without water creating a clay mush out of the core.

156 - 231: Hydro test #5 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

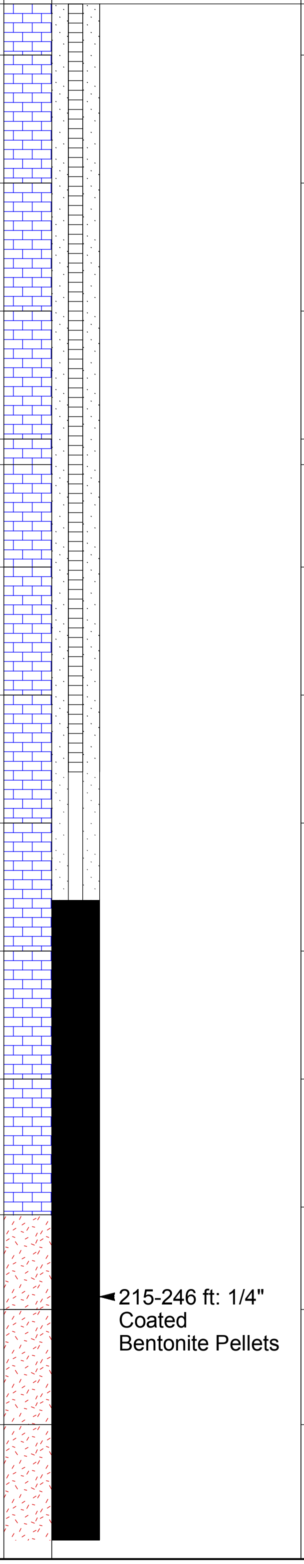
DRAFT

RECORD OF BOREHOLE DH17-31 (GT-34)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 25, 2017 00:00
DRILLING END: January 28, 2017 00:00
COORDINATES: N: 845,356 E: 939,790

SHEET: 4 of 5
GS ELEV.: 2877.0
TOC ELEV.: na
DATUM:



215-246 ft: 1/4" Coated Bentonite Pellets

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2697.0					
			As above. *(continued)*				100		
		182.0		2695.0					
185			As above, becomes very thinly bedded, interval of oxidized hydrothermal breccia.				100		
		187.0		2690.0					
190			As above.				100		
		192.0		2685.0					
195			As above, becomes iron rich red brown, calcareous, weak to no bedding, stockwork calcite veins.				100		
		197.0		2680.0					
		198.0	As above.	2679.0			100		
200			As above.				100		
		202.0		2675.0					
205			Continues LIMESTONE mottled light red and black, irregular, wavey banding becomes fine, regularly banded.				100		
		207.0		2670.0					
210			Continues varicolored white and red LIMESTONE, competent, medium bedded defined by color change (iron staining), intense calcite veining throughout.				100		
		212.0		2665.0					
215			As above.				100		
		217.0		2660.0					
220			As above.				100		
		222.0		2655.0					
225			Becomes finer bedded LIMESTONE, predominantly iron rich red beds, highly fractured and highly weathered, calcite veining.				100		
		227.3		2649.7					
230			Becomes dark gray brown DIABASE, fine grained, highly fractured and veined calcite and talc infill pervasive iron staining on discontinuities.				75		
		231.0		2646.0				231 - 249: Hydro test #6 SI	
235			As above, pervasive oxidation, highly fractured and veined.				96		
		235.5		2641.5					
240			Continues DIABASE, groundmass is pervasively oxidized, becomes coarser grained mm-scale plagioclase lathes.				100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-31 (GT-34)

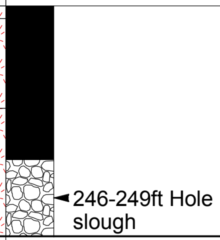
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 25, 2017 00:00
DRILLING END: January 28, 2017 00:00
COORDINATES: N: 845,356 E: 939,790

SHEET: 5 of 5
GS ELEV.: 2877.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2637.0						
		240.5	As above.	2636.5				100		
245		244.0	As above.	2633.0				100	246 - 249: Hole caved-in prior to well installation	
		249.0		2628.0						
250			Bottom of borehole at 249.0 ft. Completed as well. Refer to diagram.							
255										
260										
265										
270										
275										
280										
285										
290										
295										
300										

WELL DIAGRAM



01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:49
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH17-32 (GT-42)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 28, 2017 13:20
DRILLING END: February 1, 2017 10:00
COORDINATES: N: 837,520 E: 915,556

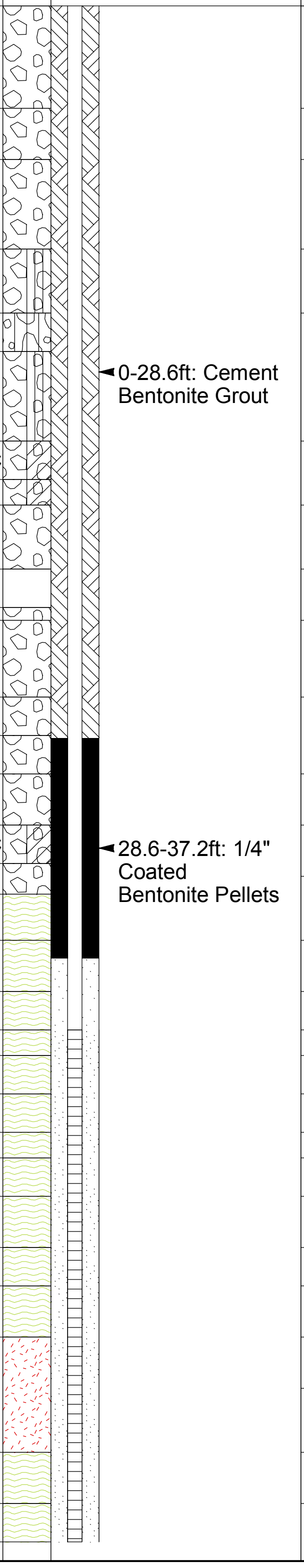
SHEET: 1 of 5
GS ELEV.: 2234.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

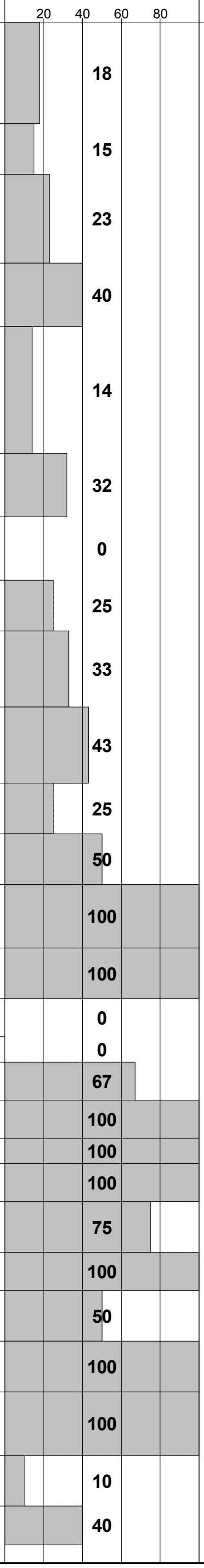
Depth	DESCRIPTION	Elev	USCS
0.0		2234.0	
4.0	Surface alluvium, silty sandy gravel, recover only washed gravel.	2230.0	
6.0	As above.	2228.0	
9.5	(GW), GRAVEL, brown, moderate HCL reaction, ALLUVIUM; Multi-lithic gravel; non-cohesive, compact, N(3"): 1-1-1-2-4-5	2224.5	GW
12.0	Surface alluvium, silty sandy gravel, recover only washed gravel.	2222.0	
13.5	(GM), SILTY GRAVEL, brown, weak HCL reaction, ALLUVIUM; Multi-lithic gravel; non-cohesive, moist, N(3"): 2-3-6-6-5-5	2220.5	GM
17.0	As above.	2217.0	
18.5	(GW-GC), GRAVEL, gray-brown, ALLUVIUM; Multi-lithic gravel; non-cohesive, compact, moist to wet, N(3"): 3-7-6-4-5-5	2215.5	GW-GC
19.5	No recovery after SPT.	2214.5	
22.0	No recovery.	2212.0	
23.5	Recover only 1/2" of sand. N(3"): 2-2-2-2-9-10	2210.5	
24.0	Recover washed gravels, quartz, schist, quartzite, diabase.	2210.0	
27.0	As above.	2207.0	
28.5	(GW), GRAVEL, gray-brown, ALLUVIUM; Multi-lithic gravel; compact, wet, Rock in shoe. N(3"): 4-8-8-6-5-6	2205.5	GW
30.0	Recover washed gravels, quartz, schist, quartzite, diabase.	2204.0	
32.0	As above.	2202.0	
33.5	(GW-GC), GRAVEL, gray-brown, ALLUVIUM; Multi-lithic gravel; non-cohesive, wet, N(3"): 1-3-6-4-9-32	2200.5	GW-GC
34.7	Cobbles: schist and quartzite.	2199.3	
36.5	Becomes Pinal schist (pCpi); brownish gray, moderately weathered, fine to medium grained, highly foliated, rubbly, no HCl reaction.	2197.5	
38.5		2195.5	
40.0	As above.	2194.0	
41.0	No recovery.	2193.0	
42.5	No recovery.	2191.5	
44.0	Continues SCHIST, greenish brownish gray, slightly weathered, fine to medium grained, foliated along bedding, jointed.	2190.0	
45.0	As above, rubble zone.	2189.0	
46.5	As above.	2187.5	
48.5	As above, with quartz veining. As above.	2185.5	
50.0	As above, slightly oxidized.	2184.0	
52.0	As above, slightly silicified, rubble, contact zone.	2182.0	
56.5	Becomes DIABASE, brownish orange, aphanitic groundmass with olivine phenocrysts, schist xenoliths, calcite stockwork veins, completely oxidized, massive, weak.	2177.5	
58.5	Becomes SCHIST, contact, almost no recovery, recovered material is gray, soft, sandy clay.	2175.5	
60.0	No recovery.	2174.0	

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



CORE INFO



RUN NO.	CORE RECOVERY %
1	18
2	15
3	23
4	40
5	14
6	32
7	0
8	25
9	33
10	43
11	25
12	50
13	100
14	100
15	0
16	0
17	67
18	100
19	100
20	100
21	75
22	100
23	50
24	100
25	100
25	10
26	40

NOTES

0 - 33.5: Hydro test #1 FHT

38 - 58: Hydro test #2 FHT
38.1: Drillers set casing. Backfill with holeplug, ream with rockbit, then wash down with casing shoe to 35ft.
38.5 - 40: First run after setting casing, no recovery.

54 - 145: Hydro test #3 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-32 (GT-42)

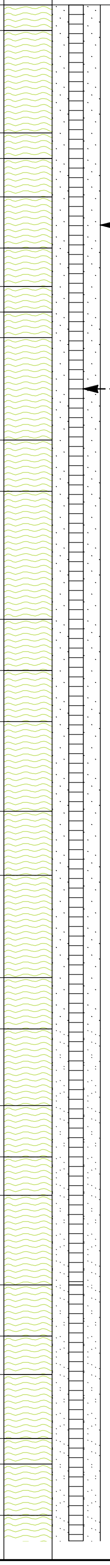
PROJECT:	RCML Near West TSF	DRILLING START:	January 28, 2017 13:20	SHEET:	2 of 5
PROJECT NO.:	1531436	DRILLING END:	February 1, 2017 10:00	GS ELEV.:	2234.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 837,520 E: 915,556	TOC ELEV.:	na
				DATUM:	

SOIL PROFILE

Depth	DESCRIPTION	Elev
60.0		2174.0
61.0	Continues SCHIST, greenish gray to grayish pink, quartz veins, all rubble.	2173.0
	No recovery.	
65.0		2169.0
66.0	Continues SCHIST, gray, foliated, some quartz, rubble.	2168.0
67.5	As above.	2166.5
	No recovery.	
69.5		2164.5
71.0	Continues SCHIST, greenish to brownish gray, schistose, fine to med grained, fractured and sheared, rubble.	2163.0
72.0		2162.0
73.0	As above.	2161.0
	As above, more brownish gray.	
	As above, oxidized discontinuities, very weak HCl reaction.	
77.0		2157.0
	As above, quartz veins, rubble.	
79.0		2155.0
	Becomes chloritized metasiltstone, slightly weathered, green, lightly foliated with quartz/calcite veining, fine grained, jointed, full oxide coatings on all discontinuities.	
84.0		2150.0
	Continues SCHIST, slightly weathered, grayish pink, fine to med grained, metasandstone, some silica veining along bedding, slightly silicified, foliated along bedding, fractured and jointed.	
86.0		2148.0
88.0		2146.0
	As above.	
	As above.	
91.5		2142.5
	As above, becomes completely silicified, very strong.	
94.0		2140.0
	As above.	
98.0		2136.0
	As above, with manganese oxide and crystalline calcite coatings on all discontinuities.	
100.0		2134.0
	As above.	
103.0		2131.0
	As above.	
105.0		2129.0
	As above.	
106.5		2127.5
	No recovery.	
110.0		2124.0
	Continues grayish pink, silicified SCHIST, very strong, all rubble and poor recovery.	
112.0		2122.0
	As above, rubble.	
113.5		2120.5
	No recovery.	
116.0		2118.0
117.0	As above, rubble and redrill.	2117.0
	As above.	
119.0		2115.0

Log continued on next page

WELL DIAGRAM



37.2-202.2ft: 10/20 Silica Sand Filter Pack

40-200ft: 2" ID sch 40 PVC 0.010" slot

CORE INFO

RUN NO.	CORE RECOVERY %
26	40
27	0
28	50
29	100
30	0
31	100
32	100
33	100
34	88
35	50
36	70
37	50
38	50
39	100
40	100
41	100
42	100
43	100
44	100
45	100
45	0
46	50
47	33
48	0
49	50
50	25
51	100

NOTES

106.5 - 110: Driller notes that it drills very soft.

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-32 (GT-42)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 28, 2017 13:20
DRILLING END: February 1, 2017 10:00
COORDINATES: N: 837,520 E: 915,556

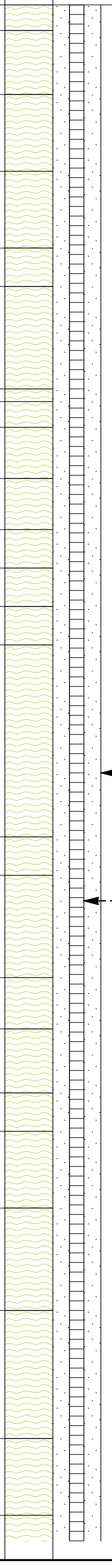
SHEET: 3 of 5
GS ELEV.: 2234.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
120.0		2114.0	
121.0	Continues SCHIST, grayish pink to pink, fine grained, silicified, silica veins, foliated and sheared, iron staining and calcite on discontinuities, brecciated and rubbly. *(continued)*	2113.0	
123.5		2110.5	
	As above, staining primarily MnOx.		
	As above.		
126.5		2107.5	
	As above, rubble and redrill.		
129.5		2104.5	
131.0	As above, continues pink silicified SCHIST, brecciated, calcite and MnOx coatings.	2103.0	
	No recovery.		
135.0		2099.0	
135.5	Rubble and corestone.	2098.5	
136.5	Becomes fresh, pinkish brownish gray, highly silicified, METASANDSTONE and quartz vein, competent and unjointed, weak reaction HCl.	2097.5	
138.5		2095.5	
	As above, no HCl reaction.		
140.5		2093.5	
	No recovery.		
142.0	Continues pink, silicified SCHIST with boudinaged silica veins, only rubble.	2092.0	
143.5	As above.	2090.5	
	As above.		
145.0		2089.0	
	Becomes brecciated SCHIST, matrix supported, sand to gravel sized clasts with calcite cementation, and soft gougey fault zone.		
152.5		2081.5	
	As above, rubbly.		
154.0		2080.0	
	As above, gouge washed out.		
158.0		2076.0	
	As above.		
160.0		2074.0	
	As above.		
162.5		2071.5	
164.0	Becomes massive BRECCIA, matrix is reddish brown clayey gouge.	2070.0	
	As above.		
167.0		2067.0	
	Banded, Becomes gray SCHIST, competent, fractured, rubble with some gouge.		
171.0		2063.0	
	As above.		
176.0		2058.0	
	As above.		
179.0		2055.0	
	As above.		

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



37.2-202.2ft: 10/20 Silica Sand Filter Pack

40-200ft: 2" ID sch 40 PVC 0.010" slot

CORE INFO

RUN NO.	CORE RECOVERY %
51	100
52	80
53	50
54	33
55	100
56	0
57	0
58	100
59	100
60	100
60	0
61	33
62	33
63	33
64	100
65	50
65	100
66	100
67	38
66	100
67	40
68	100
69	100
70	38
71	67
72	100
73	100
74	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-32 (GT-42)

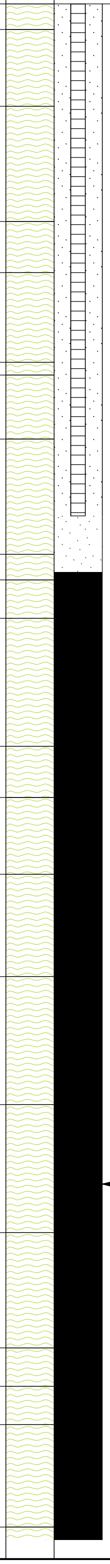
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 28, 2017 13:20
DRILLING END: February 1, 2017 10:00
COORDINATES: N: 837,520 E: 915,556

SHEET: 4 of 5
GS ELEV.: 2234.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2054.0					
		181.0	As above. *(continued)*	2053.0		74	100		
		184.0	As above.	2050.0		75	100		
185		188.5	Becomes greyish brown METASANDSTONE, fine scale banding, very competent.	2045.5		76	100		
190		190.5	As above.	2043.5		77	100		
		194.0	As above, rubble.	2040.0		78	100		
195		194.5	As above.	2039.5		79	100		
		197.0	As above.	2037.0		80	100		
200		201.5	As above.	2032.5		81 82	75 80		
		202.5	As above.	2031.5		83	100		
		204.0	As above.	2030.0		84	33		
205		209.0	Becomes grey to brown SCHIST rubble.	2025.0		85	20		
210		211.0	BECOMES gray METASANDSTONE, calcite veins, fractured.	2023.0		86	100		
		214.0	As above.	2020.0		87	100		
215		218.0	As above.	2016.0		88	100		
220		223.0	As above.	2011.0		89	80		
225		228.0	As above.	2006.0		90	100	225 - 250: Hydro test #4 SI	
230		232.5	As above.	2001.5		91	100		
		234.0	As above.	2000.0		92	100		
235		235.5	As above.	1998.5					
		239.5	As above.	1994.5		93	100		
240									

WELL DIAGRAM



202.2-250ft: 1/4" Coated Bentonite Pellets

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-32 (GT-42)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 28, 2017 13:20
DRILLING END: February 1, 2017 10:00
COORDINATES: N: 837,520 E: 915,556

SHEET: 5 of 5
GS ELEV.: 2234.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
240		240.0	As above. *(continued)*	1994.0		94	100 100		
		244.0		1990.0					
245		245.0	As above.	1989.0		95	100		
			As above, grey to pink, silica banded.			96	75		
250		250.0		1984.0					
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.						

DEPTH (ft) scale: 255, 260, 265, 270, 275, 280, 285, 290, 295, 300

WELL DIAGRAM

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH17-33 (GT-29)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

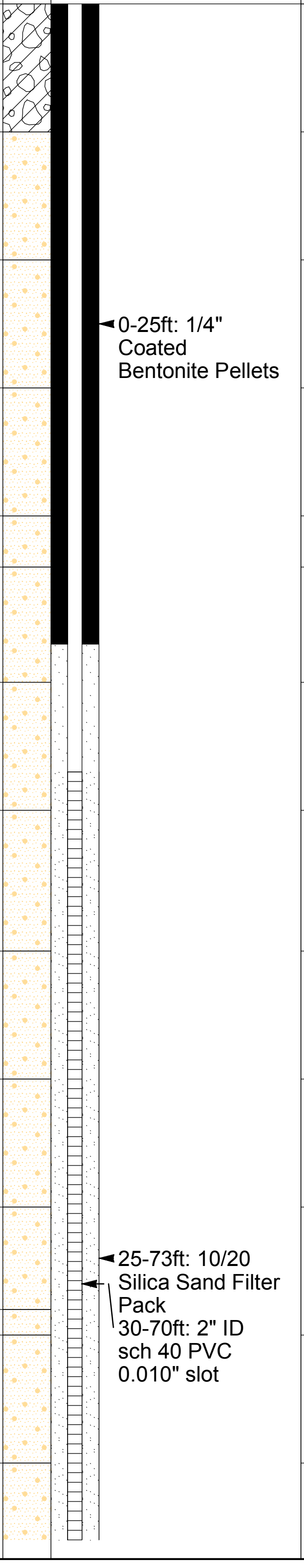
DRILLING START: January 30, 2017 10:31
DRILLING END: January 30, 2017 10:31
COORDINATES: N: 842,391 E: 937,371

SHEET: 1 of 5
GS ELEV.: 2709.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0		0.0	Polylithic gravel to cobbles alluvium, fines are washed out	2709.0			50	0 - 22: Hydro test #1 FHT	
5		5.0	Gila Sandstone (Tss): red-brown, coarse, immature SANDSTONE abundant diabase coarse sand to gravel ,subangular, massive no bedding, some iron straining on joints, weakly cemented, no HCl reaction.	2704.0			100		
10		10.0	As above, occasional cobble.	2699.0			100		
15		15.0	As above, interval of calcite cement.	2694.0			100	18 - 87: Hydro test #3 SI & GF	
20		20.0	Continues very immatured coarse SANDSTONE, angular gravel, abundant diabase clasts, moderate hcl reaction, calcite cement.	2689.0			100		
		22.0	As above.	2687.0			93		
25		26.5	As above, occasional cobbles, dominately diabase, weak hcl reaction.	2682.5			100		
30		31.5	As above.	2677.5			100		
35		37.0	As above, becoming more cobble rich.	2672.0			100		
40		42.0	As above, cobbley with many broken zones due to weathering.	2667.0			66		
45		47.0	As above, very weathered, oxidized.	2662.0			40	47 - 52: lost circulation this run	
50		51.0	As above, large cobble of tuff.	2658.0					
		52.0	Continues SANDSTONE, very coarse, immature, competent, calcite cemented, massive.	2657.0			100		
55		57.0	As above.	2652.0			100	57 - 87: Hydro test #2 SI & CRI	
60									

Log continued on next page

GRAPHIC LOG / WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-33 (GT-29)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 30, 2017 10:31
DRILLING END: January 30, 2017 10:31
COORDINATES: N: 842,391 E: 937,371

SHEET: 2 of 5
GS ELEV.: 2709.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS	CORE RECOVERY %	NOTES
60	60.0	As above. *(continued)*	2649.0			
	62.0		2647.0		100	
	62.0	As above, poorly to moderately indurated.				
65	67.0		2642.0		100	
	67.0	Becomes very poorly indurated weathered and weak resulting in broken zones.				
70	72.0		2637.0		100	
	72.0	Continues SANDSTONE alternating between coarser and finer grained intervals, highly fractured, weak to moderately cemented.				
75	77.0		2632.0		100	
	77.0	As above.				
80	82.0		2627.0		80	
	82.0	Becomes Apache Leap Tuff (Talg): mottled white and light brown TUFF intensely altered to clay, fine grained, few lithics, euhedral biotite pheoncrysts.				82 - 152: Hydro test #4a, b SI & CRI
85	87.0		2622.0		100	
	87.0	Continues extremely weathered TUFF mottled white and buff altrered to clay very few lithics.				
90	92.0		2617.0		72	
	92.0	Continues intensely weathered masive crystal rich, light pink, TUFF, lithic poor, fine euhedral, unweathered biotite all feldspars altered to clay, no oxidation no hcl reaction.				
95	97.0		2612.0		100	
	97.0	As above.				
100	102.0		2607.0		100	
	102.0	As above, mottled with rounded blebs of white tuff.				
105	107.0		2602.0		100	
	107.0	As above, slightly more lithics.				
110	112.0		2597.0		100	
	112.0	Continues mottled white and grey TUFF highly weathered few lithics clay alteration, groundmass, fairly fresh euhedral fine boitite.				
115	117.0		2592.0		100	
	117.0	As above.				
120					100	

WELL DIAGRAM

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:49
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

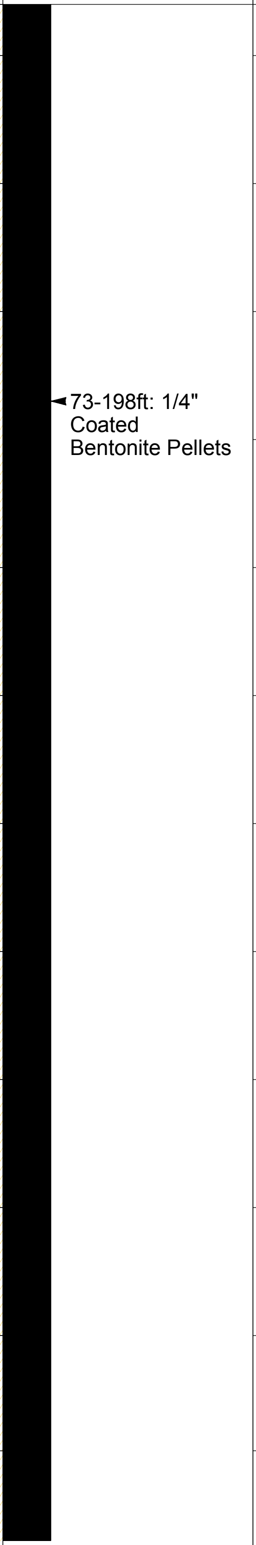
RECORD OF BOREHOLE DH17-33 (GT-29)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 30, 2017 10:31
DRILLING END: January 30, 2017 10:31
COORDINATES: N: 842,391 E: 937,371

SHEET: 3 of 5
GS ELEV.: 2709.0
TOC ELEV.: na
DATUM:

Depth (ft)	Description	Elev	USCS	Run No.	Core Recovery %	Notes
120.0 – 122.0	As above. *(continued)*	2589.0 – 2587.0			100	
122.0 – 127.0	As above.	2587.0 – 2582.0			100	
127.0 – 132.0	As above.	2582.0 – 2577.0			100	
132.0 – 142.0	As above.	2577.0 – 2567.0			100 100	
142.0 – 147.0	Becomes pink, crystal rich TUFF, competent, less weathered but more fractured than above, also more lithics, no oxidation.	2567.0 – 2562.0			100	
147.0 – 152.0	As above.	2562.0 – 2557.0			100	151 - 250: Hydro test #5 SI
152.0 – 157.0	As above.	2557.0 – 2552.0			94	
157.0 – 162.0	Becomes completely weathered gray TUFF, massive, crystal rich, fedspars and groundmass altered to clay, no oxidaton.	2552.0 – 2547.0			100	
162.0 – 167.0	As above.	2547.0 – 2542.0			100	
167.0 – 172.0	As above, mottled white and gray TUFF.	2542.0 – 2537.0			80	
172.0 – 176.5	As above.	2537.0 – 2532.5			100	
176.5 –	As above.	2532.5 –			92	



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

RECORD OF BOREHOLE DH17-33 (GT-29)

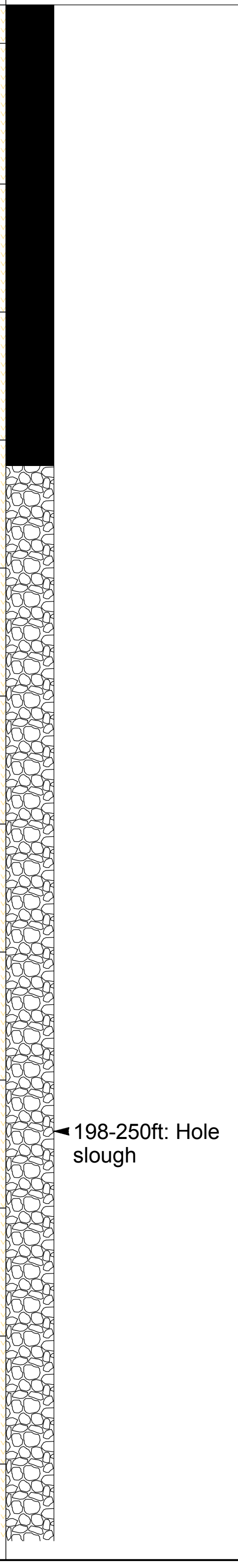
PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: January 30, 2017 10:31
DRILLING END: January 30, 2017 10:31
COORDINATES: N: 842,391 E: 937,371

SHEET: 4 of 5
GS ELEV.: 2709.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %
180		180.0		2529.0			
		181.5	As above. *(continued)*	2527.5			92
185		187.0	As above.	2522.0			96
190		192.0	Becomes less weathered gray crystal rich TUFF no lithics, weak fabric defined by phenocryst alignment, no oxidation, highly clay altered.	2517.0			100
195		197.0	As above.	2512.0			100
200		202.0	As above.	2507.0			100
205		207.0	Continues gray crystal rich TUFF, moderately weathered, moderate eutaxitic texture defined by flatted aligned inclusions of white tuff (possibly welded pumice).	2502.0			100
210		212.0	As above.	2497.0			100
215		217.0	As above, becomes slightly weathered.	2492.0			100
220		222.0	As above, more jointed.	2487.0			100
225		227.0	As above.	2482.0			100
230		232.0	Continues massive fresh crystal rich, buff, TUFF, more lithic rich.	2477.0			100
235		237.0	As above.	2472.0			100
240			As above.				100

WELL DIAGRAM



NOTES

ADDITIONAL LAB TESTING

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

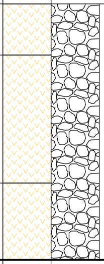
LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH17-33 (GT-29)

PROJECT:	RCML Near West TSF	DRILLING START:	January 30, 2017 10:31	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	January 30, 2017 10:31	GS ELEV.:	2709.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 842,391 E: 937,371	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2469.0							
			As above. *(continued)*						100		
		242.0		2467.0							
245			As above.						100		
		247.0		2462.0							
			As above.						100		
250		250.0		2459.0							
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											



DRILLING CO.:	Boart Longyear	LOGGED:	Jesse Silverman
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-34 (GT-27)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 17:00
DRILLING END: February 3, 2017 17:00
COORDINATES: N: 837,367 E: 937,530

SHEET: 1 of 5
GS ELEV.: 2648.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	Depth	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO: RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0			0.0	2648.0							
		Alluvium: loose, coarse sand to cobbles, including: schist, quartz, diabase, subrounded.	6.0	2642.0				1 2	0 75	0 - 19: Hydro test #1 FHT	
5, 10		Gila Conglomerate (Tcg): tan, polylithic, CONGLOMERATE, clast supported, subrounded to subangular sand to gravel, clast lithologies include: diabase, vein quartz, schist, sandstone, quartzite, sandy matrix, weak HCl reaction, competent, well indurated.	11.0	2637.0				3	100		
		Poor recovery, redrill.	14.0	2634.0				4	33	11 - 14: Drill mislatch; lost core, redrill.	
15		Gila Conglomerate (Tcg): tan, polylithic, CONGLOMERATE, clast supported, subrounded to subangular sand to gravel, clast lithologies include: diabase, vein quartz, schist, sandstone, quartzite, sandy matrix, weak HCl reaction, competent, well indurated.	19.0	2629.0				5	100		
20		As above.	23.0	2625.0				6	100		
25		As above.	28.0	2620.0				7	100	25 - 47: Hydro test #2 SI & GF	
30		As above.	33.0	2615.0				8	100		
35		As above.	37.0	2611.0				9	100		
40		As above, becomes weak HCl reaction.	42.0	2606.0				10	60		
		As above.	44.0	2604.0				11	100		
45		As above.	47.0	2601.0				13	100	45 - 104: Hydro test #3 SI & GF	
50		As above, becomes no HCl reaction.	52.0	2596.0				14	100		
55		As above.	57.0	2591.0				15	100		
60		As above.						16	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kerry Paul
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

RECORD OF BOREHOLE DH17-34 (GT-27)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 17:00
DRILLING END: February 3, 2017 17:00
COORDINATES: N: 837,367 E: 937,530

SHEET: 2 of 5
GS ELEV.: 2648.0
TOC ELEV.: na
DATUM:

Depth	SOIL PROFILE – DESCRIPTION	Elev	USCS	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60.0		2588.0						
62.0	As above. *(continued)*	2586.0			16	100		
64.0	As above.	2584.0			17	100		
69.0	As above.	2579.0			18	100		
74.0	As above.	2574.0			19	100		
79.0	As above.	2569.0			20	100		
80.0	As above.	2568.0			21	100		
84.0	As above, becomes weak HCl reaction.	2564.0			22	100	80 - 189: Hydro test #4 SI & CRI	
89.0	As above.	2559.0			23	100		
94.0	As above.	2554.0			34	100		
96.0	As above.	2552.0			36	100		
97.0	As above.	2551.0			37	80		
102.0	As above.	2546.0			38	100		
104.0	As above.	2544.0			39	100		
109.0	Continues tan, polylithic, CONGLOMERATE, gravel to boulder clasts of diabase, vein quartz, schist, sandstone, quartzite in sandy matrix, weak HCl reaction.	2539.0			40	100		
114.0	As above.	2534.0			41	100		
119.0	As above.	2529.0			43	100		
	As above.				44	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kerry Paul
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-34 (GT-27)

PROJECT:	RCML Near West TSF	DRILLING START:	February 3, 2017 17:00	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	February 3, 2017 17:00	GS ELEV.:	2648.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 837,367 E: 937,530	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0		2528.0							
			As above. *(continued)*					44	100		
		124.0		2524.0							
125			As above.					45	100		
		129.0		2519.0							
130			As above.					46	100		
		134.0		2514.0							
135			As above.					47	100		
		139.0		2509.0							
140			As above.					48	100		
		144.0		2504.0							
145			As above.					49	100		
		149.0		2499.0							
150			As above, becomes strong HCl reaction, some discontinuous, coarse sand-sized voids with calcite infill.					50	100		
		154.0		2494.0							
155			As above, becomes fewer micro-voids, moderate HCl reaction, with few thin, fine sand interbeds.					51	100		
		159.0		2489.0							
160			As above, moderate to strong HCl reaction.					52	100		
		163.0		2485.0							
165			As above.					53	100		
		168.0		2480.0							
170			As Above.					54	100		
		173.0		2475.0							
		174.0	As above.	2474.0				55	100		
175			As above.					56	100		
		179.0		2469.0							
180								57	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Kerry Paul
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-34 (GT-27)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 17:00
DRILLING END: February 3, 2017 17:00
COORDINATES: N: 837,367 E: 937,530

SHEET: 4 of 5
GS ELEV.: 2648.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2468.0							
		184.0	Continues Gila CONGLOMERATE, fresh, medium strong, clast supported in coarse sandy matrix, gravel is fine to coarse, subangular to subrounded, in coarse subangular sandy matrix, clasts are: quartzite, schist, diabase, quartz, rhyolite, limestone, moderate to strong HCl reaction, competent and massive. *(continued)*	2464.0				57	100		
185		189.0	As above, few cobbles.	2459.0				58	100	185 - 250: Hydro test #5 SI	
190		194.0	As above, some cobbles, few small voids with calcite crystals.	2454.0				59	100		
195		199.0	As above, massive and competent.	2449.0				60	100		
200		204.0	As above, few voids with calcite, pink tuff boulder.	2444.0				61	100		
205		209.0	As above.	2439.0				62	100		
210		214.0	As above.	2434.0				63	100		
215		219.0	As above.	2429.0				64	100		
220		224.0	As above.	2424.0				65	100		
225		229.0	As above.	2419.0				66	100		
230		234.0	As above, schist clasts predominate.	2414.0				67	100		
235		239.0	As above, returns to polylithic, clasts are: schist, tuff, diabase, rhyolite, quartzite, and limestone, interbed of matrix supported cobbles.	2409.0				68	100		
240			As above.					69	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kerry Paul
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-34 (GT-27)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 17:00
DRILLING END: February 3, 2017 17:00
COORDINATES: N: 837,367 E: 937,530

SHEET: 5 of 5
GS ELEV.: 2648.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	SOIL PROFILE: Depth	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO: RUN NO.	CORE INFO: CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2408.0							
			As above. *(continued)*					69	**100**		
		244.0		2404.0							
245			As above, with tuff boulder.					70	**100**		
		249.0		2399.0							
250								71	**100**		
			Bottom of borehole at 250.0 ft. Backfilled with cement grout.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Kerry Paul
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:49
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

DRAFT

RECORD OF BOREHOLE DH17-35 (GT-30)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 09:32
DRILLING END: February 3, 2017 09:32
COORDINATES: N: 842,900 E: 933,749

SHEET: 1 of 5
GS ELEV.: 2710.0
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES
0.0		2710.0				
2.0	Colluvium, angular diabase gravel to cobbles, no fines.	2708.0		1	50	0 - 22: Hydro test #1 FHT
3.0	Continues diabase colluvium, fines washed out.	2707.0		2	100	
6.5	DIABASE (pCdiab): dark gray, fine grained, fractured with abundant iron staining and calcite veins.	2703.5		3	94	
9.0	Becomes brecciated DIABASE calcite cemented, hydrothermal breccia, highly fractured and oxidized.	2701.0		4	100	
10.0	As above, broken zone.	2700.0		5	50	
11.5	As above, broken zone continues in highly oxidized rock.	2698.5		6	100	
15.0	Poor recovery, continues fracture zone in oxidized DIABASE.	2695.0	0-29ft: Cement Bentonite Grout	7	43	11.5 - 15: poor recovery core escaped core barrel into rods
20.0	Continues brecciated DIABASE, clast supported hydrothermal breccia, calcite infill, heavily oxidized.	2690.0		8	100	15 - 57: Hydro test #2 FHT
22.0	As above, with calcite cemented oxidized gouge matrix.	2688.0		9	100	
27.0	As above.	2683.0		10	100	
32.0	As above, with open voids containing crystallized calcite.	2678.0		11	100	
37.0	As above.	2673.0	29-40.5ft: 1/4" Coated Bentonite Pellets	12	100	
42.0	Becomes matrix dominant brecciated DIABASE clasts are angular to subangular, heavily oxidized matrix.	2668.0		13	100	
47.0	Becomes FAULT breccia, matrix supported, clasts are subround matrix is poorly cemented gouge, heavily oxidized.	2663.0		14	84	
52.0	Becomes coarse grained, brown, ophitic DIABASE with plagiolase lathes heavily oxidized groundmass.	2658.0		15	90	50 - 141: Hydro test #3 SI
57.0	Becomes brecciated, fine grained DIABASE, oxidized calcite cemented matrix.	2653.0		16	100	
	Becomes coarse grained, ophitic DIABASE, minor brecciation and calcite veining.			17	100	

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

DRAFT

RECORD OF BOREHOLE DH17-35 (GT-30)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

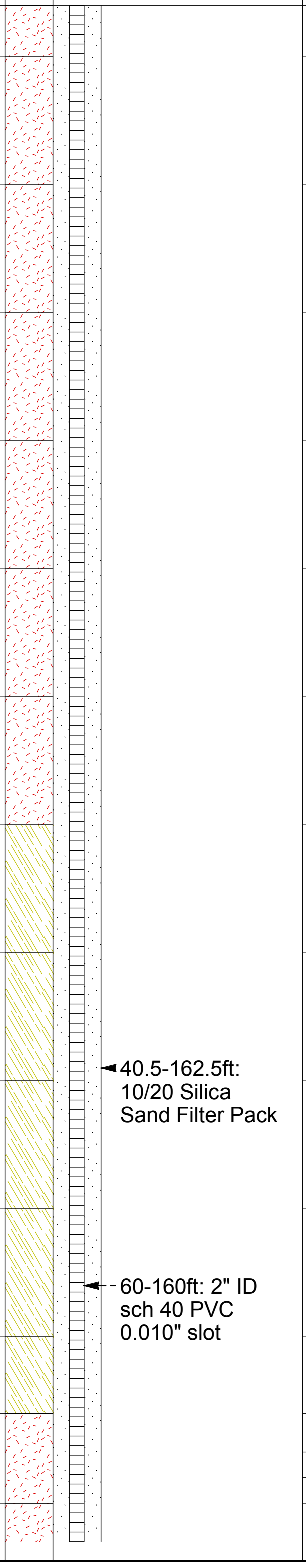
DRILLING START: February 3, 2017 09:32
DRILLING END: February 3, 2017 09:32
COORDINATES: N: 842,900 E: 933,749

SHEET: 2 of 5
GS ELEV.: 2710.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60	60.0		2650.0					
	62.0	Becomes coarse grained, ophitic DIABASE, minor brecciation and calcite veining. *(continued)*	2648.0		17	100		
65	67.0	As above.	2643.0		18	100		
70	72.0	Becomes brecciated DIABASE, fine grained matrix, heavily oxidized with calcite veining.	2638.0		19	100		
75	77.0	As above.	2633.0		20	100		
80	82.0	As above, coarse calcite cemented matrix.	2628.0		21	100		
85	87.0	As above.	2623.0		22	100		
90	92.0	Becomes coarse grained, ophitic DIABASE with euhedral plagioclase lathes, pervasive oxidation in groundmass.	2618.0		23	100		
95	97.0	Becomes FAULT breccia, matrix dominant, sub rounded diabase clasts, heavily oxidized.	2613.0		24	100		
100	102.0	As above.	2608.0		25	100		
105	107.0	As above.	2603.0		26	100		
110	112.0	Continues intermittant breccia clayey oxidized matrix, clast dominant.	2598.0		27	100		
115	115.0	Becomes FAULT dark gray clay gouge, uncemented with fragments of solid diabase very weak completely weathered.	2595.0		28	100		
	118.5	Becomes fine grained aphanitic dark green DIABASE with oxidized discontinuity surfaces highly fractured.	2591.5		29 30 31	100 100 100		
120		As above, highly fractured.			32	100		

Log continued on next page

WELL DIAGRAM



40.5-162.5ft: 10/20 Silica Sand Filter Pack

60-160ft: 2" ID sch 40 PVC 0.010" slot

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

DRAFT

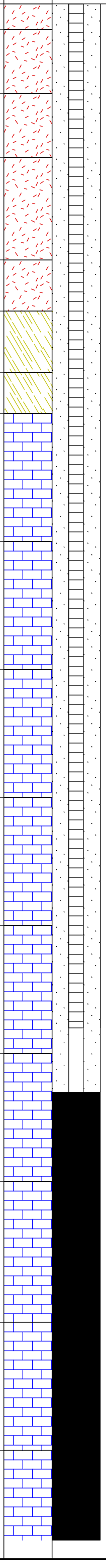
RECORD OF BOREHOLE DH17-35 (GT-30)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 09:32
DRILLING END: February 3, 2017 09:32
COORDINATES: N: 842,900 E: 933,749

SHEET: 3 of 5
GS ELEV.: 2710.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0		2590.0					
		121.0	As above, highly fractured. *(continued)*	2589.0		32	100		
		123.5	As above.	2586.5		33	100		
125		126.0	As above.	2584.0		34	80		
			As above.			35	100		
130		130.0		2580.0		36	100		
		132.0	As above, less fractured.	2578.0		37	100		
		134.4	Becomes FAULT gouge and breccia, matrix dominant, weakly cemented, clay rich, rounded clasts of diabase.	2575.6		38	100		
135		136.0	As above, includes clasts of limestone as well as fractured and weathered limestone.	2574.0					
140		141.0	Becomes Mescal Limestone (pCmls): rosey buff, fine grained LIMESTONE with zones of breccia and intense calcite veining.	2569.0		39	100	137 - 250: Hydro test #4 SI	
145		146.0	As above.	2564.0		40	100		
150		151.0	As above, contains intervals of breccia some silicification.	2559.0		41	100		
155		156.0	Continues buff to pale green LIMESTONE, very competent, silty interbeds, bedding is variable from medium to massive defined by color change.	2554.0		42	100		
160		161.0	As above.	2549.0		43	100		
165		166.0	Continues fine grained LIMESTONSE with lenses of gray chert interbeds along bedding planes.	2544.0		44	100		
170		171.5	As above.	2538.5		45	91		
175		176.5	Continues buff thinly bedded LIMESTONE with chert nodules and interbeds.	2533.5		46	100		
180			As above.			47	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-35 (GT-30)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 3, 2017 09:32
DRILLING END: February 3, 2017 09:32
COORDINATES: N: 842,900 E: 933,749

SHEET: 4 of 5
GS ELEV.: 2710.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev
180.0		2530.0
181.5	As above. *(continued)*	2528.5
187.0	As above.	2523.0
192.0	As above.	2518.0
197.0	Continues buff, fine grained LIMESTONE, heavily micro fractured, with very hard siliceous interbeds.	2513.0
202.0	As above.	2508.0
207.0	Becomes brecciated LIMESTONE with limestone and siliceous clasts and siliceous cement, competent, variably oxidized.	2503.0
213.0	Continues silicified LIMESTONE and fault breccia, clasts are subrounded limestone and silica matrix is heavily oxidized, fine grained and moderately indurated.	2497.0
217.0	Becomes pink-gray, fine grained LIMESTONE medium to finely bedded, with siliceous interbeds.	2493.0
222.0	As above.	2488.0
227.0	As above.	2483.0
232.0	As above.	2478.0
237.0	As above.	2473.0
	As above.	

Log continued on next page

WELL DIAGRAM

162.5-250ft: 1/4" Coated Bentonite Pellets

CORE INFO

RUN NO.	CORE RECOVERY %
47	100
48	100
49	100
50	100
51	100
52	100
53	100
54	100
55	100
56	86
57	100
58	100
59	100

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Jesse Silverman
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-35 (GT-30)

PROJECT: RCML Near West TSF	DRILLING START: February 3, 2017 09:32	SHEET: 5 of 5	
PROJECT NO.: 1531436	DRILLING END: February 3, 2017 09:32	GS ELEV.: 2710.0	
LOCATION: Near West TSF, Superior, Arizona	COORDINATES: N: 842,900 E: 933,749	TOC ELEV.: na	
		DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0	As above. *(continued)*	2470.0				59	100		
		242.0	As above.	2468.0				60	100		
245		247.0	As above.	2463.0				61	100		
250		250.0	Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.	2460.0							
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.: Boart Longyear	LOGGED: Jesse Silverman
DRILLER: Royal Johnson	CHECKED: G Smith
DRILL RIG: BK60	REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-36 (GT-14-3)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

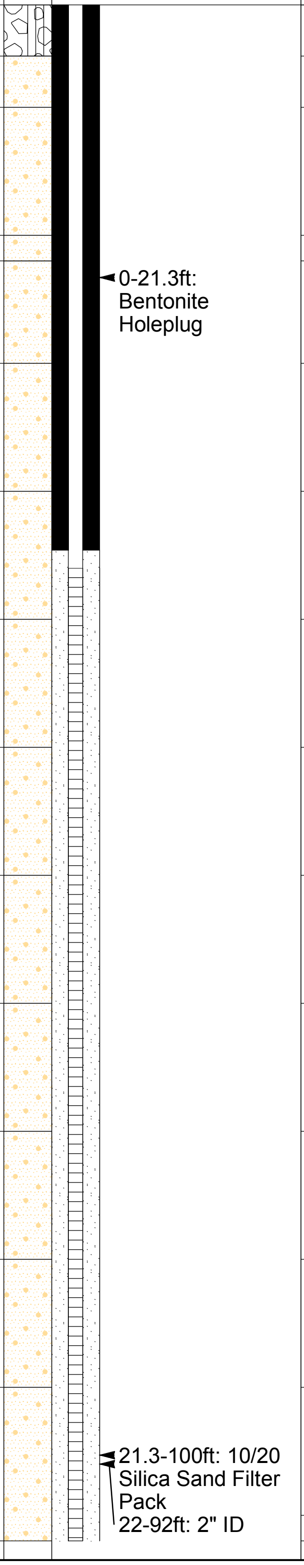
DRILLING START: February 7, 2017 11:31
DRILLING END: February 7, 2017 15:59
COORDINATES: N: 838,433 E: 923,220

SHEET: 1 of 2
GS ELEV.: 2410.0
TOC ELEV.: na
DATUM:

Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0.0		2410.0					
2.0	Surficial alluvium, silty sandy gravel, no recovery	2408.0		1	0	0 - 10: Hydro test #1 FHT	
4.0	Gila Sandstone (Tss): brown, moderately weathered, medium to coarse grained sand, subangular to angular, with little fine to coarse gravel, clasts are quartzite, schist, quartz, diabase, rhyolite, beding defined by grain size changes, few small roots, strong HCl reaction.	2406.0		1	100		
9.0	As above, clayey interbeds.	2401.0		2	100		
10.0	As above.	2400.0		3	100		
14.0	As above.	2396.0		4	100		
19.0	As above.	2391.0		5	100	15 - 100: Hydro test #2 SI	
24.0	As above.	2386.0		6	100		
29.0	As above.	2381.0		7	100		
34.0	As above.	2376.0		8	100		
39.0	As above.	2371.0		9	100		
44.0	As above.	2366.0		10	100		
49.0	As above.	2361.0		11	100		
54.0	As above.	2356.0		12	100		
60.0	As above.	2350.0		13	100		
				14	100		

Log continued on next page

WELL DIAGRAM



DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-36 (GT-14-3)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

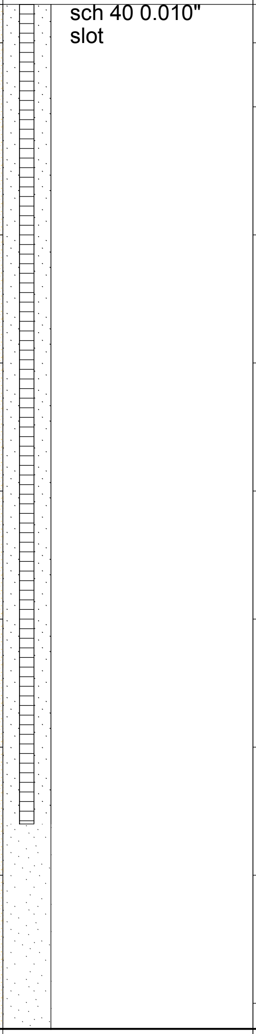
DRILLING START: February 7, 2017 11:31
DRILLING END: February 7, 2017 15:59
COORDINATES: N: 838,433 E: 923,220

SHEET: 2 of 2
GS ELEV.: 2410.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG
60		60.0		2350.0		
		61.5	Becomes highly weathered, extremely weak, fine sand to fine gravel with silty interbeds.	2348.5		
65		69.0	As above.	2341.0		
70		74.0	Becomes slightly weathered to fresh, zones of fine to coarse gravel, clasts are rhyolite, diabase, schist, quartzite, gneiss.	2336.0		
75		79.0	As above.	2331.0		
80		84.0	As above.	2326.0		
85		89.0	As above.	2321.0		
90		94.0	As above.	2316.0		
95		100.0	As above.	2310.0		
100			Bottom of borehole at 100.0 ft. Completed as well. Refer to diagram.			
105						
110						
115						
120						

WELL DIAGRAM



CORE INFO

RUN NO.	CORE RECOVERY % (20 40 60 80)
14	100
14	100
15	100
16	100
17	100
18	100
19	100
20	100
21	100
22	100

NOTES

ADDITIONAL LAB TESTING

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-37 (GT-28)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

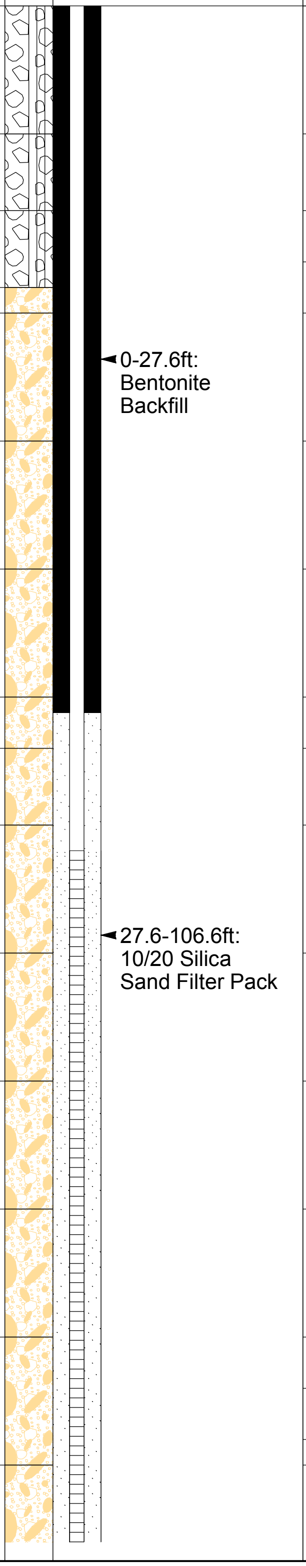
DRILLING START: February 7, 2017 13:41
DRILLING END: February 7, 2017 13:41
COORDINATES: N: 839,358 E: 936,278

SHEET: 1 of 5
GS ELEV.: 2644.0
TOC ELEV.: na
DATUM:

SOIL PROFILE

Depth	DESCRIPTION	Elev	USCS
0.0		2644.0	
	Colluvium, fines washed out, subangular to subrounded gravel to cobbles, multilithic but dominantly felsic volcanics, some quartz vein material.		
5.0	Colluvium unconsolidated subangular gravel to cobbles fine are light brown silt with some sand, non plastic, moderate HCl reaction.	2639.0	
8.0	Colluvium unconsolidated multilithic subangular to subround cobbles and gravel some fines which are coarse silty sands, vigorous HCl reaction.	2636.0	
11.0		2633.0	
12.0	Becomes Gila Conglomerate (Tcg): polylithic clasts, gravel to cobble sized, composed of schist, tuff, and, rhyolite, matrix is light brown fine grained sand, well indurated, no hcl reaction. As above.	2632.0	
17.0	As above, becomes more cobble rich, weak HCl reaction.	2627.0	
22.0	As above, matrix becomes coarser sand, no HCl reaction.	2622.0	
27.0	As above, very clast dominante, weak matrix.	2617.0	
29.0	Continues Gila conglomerate (Tcg): slightly weathered, weak, clast supported in sandy brown matrix, subrounded to subangular, clasts diabase, tuff, schist, quartzite, breaks easily along clasts, weak HCl reaction.	2615.0	
32.0	As above, moderate HCl reaction.	2612.0	
37.0	As above, weathered, weakly matrix cemented matrix.	2607.0	
42.0	As above.	2602.0	
47.0	As above.	2597.0	
52.0	As above.	2592.0	
57.0	Becomes slightly weathered, weak, mostly massive, matrix supported, moderate HCl reaction.	2587.0	

Log continued on next page



CORE INFO

DEPTH (ft)	RUN NO.	CORE RECOVERY %
0–5	1	10
5–8	2	17
8–10	3	25
10–12	4	100
12–17	5	60
17–22	6	100
22–27	7	100
27–29	8	100
29–32	9	100
32–37	10	100
37–42	11	100
42–47	12	100
47–52	13	100
52–54	14	100
54–56	14	100
56–57	14	100
57–60	15	100

NOTES

0 - 27: Hydro test #1 FHT

33 - 121: Hydro test #2 SI & CRI

ADDITIONAL LAB TESTING

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/27/17 15:56
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\FINAL GINT PROJECTS\NWTSF_FINAL_WELLS.GPJ

DRAFT

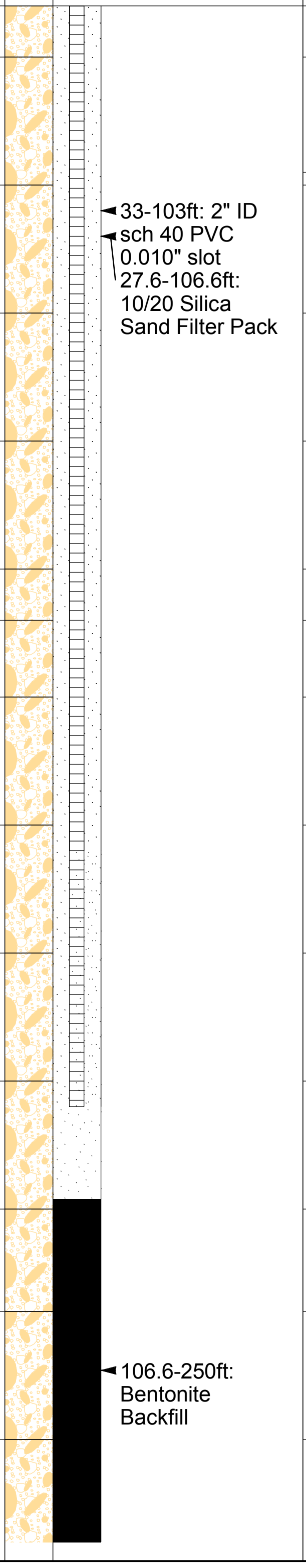
RECORD OF BOREHOLE DH17-37 (GT-28)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 7, 2017 13:41
DRILLING END: February 7, 2017 13:41
COORDINATES: N: 839,358 E: 936,278

SHEET: 2 of 5
GS ELEV.: 2644.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60		60.0		2584.0		15	100		
		62.0	As above, with zone of extremely weak, poorly indurated, friable matrix.	2582.0		16	100		
65						16	100		
		67.0	As above.	2577.0		17	100	67: driller notes reduction in fluid returns	
70									
		72.0	Gila conglomerate (Tcg): gray-brown, slightly weathered, weak, matrix supported, coarse gravel and cobbles in sandy matrix, clasts are diabase, schist, quartzite, tuff. Moderate HCl reaction.	2572.0		18	100		
75									
		77.0	As above, becomes highly weathered.	2567.0		19	100		
80									
		82.0	Continues slightly weathered.	2562.0		20	100	82: driller loses circulation	
		84.0	Becomes extremely to very weak, highly weathered, friable, with some rubble.	2560.0		20	100		
85									
		87.0	Becomes slightly weathered, weak, strong HCl reaction.	2557.0		21	100		
90									
		92.0	As above.	2552.0		22	100		
95									
		97.0	As above.	2547.0		23	100		
100									
		102.0	Gila Conglomerate (Tcg): matrix poor, predominantly gravel, matrix is very brittle with few fines, breaks easily at clast contacts, vigorous HCl reaction, some FeOx staining.	2542.0		24	100	102 - 107: Drillers report loss of fluids.	
105									
		107.0	As above.	2537.0		25	100		
110									
		111.0	Becomes slightly weathered, weak to medium strong, matrix supported, silty sandy matrix. strong HCl reaction.	2533.0		26	100	113 - 250: Hydro test #3 SI	
115									
		116.0	As above.	2528.0		27	100		
120									



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Royal Johnson
DRILL RIG: BK60

LOGGED: Gwyn Smith
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-37 (GT-28)

PROJECT:	RCML Near West TSF	DRILLING START:	February 7, 2017 13:41	SHEET:	3 of 5
PROJECT NO.:	1531436	DRILLING END:	February 7, 2017 13:41	GS ELEV.:	2644.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 839,358 E: 936,278	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0		2524.0							
		121.0	As above. *(continued)*	2523.0				27	100		
		124.0	As above, zone of moderately to highly weathered rock, very weak, with extremely weak friable zones.	2520.0				28	100		
125		126.0	Becomes slightly weathered.	2518.0				28	100		
130		131.5	As above.	2512.5				29	100		
		134.0	As above.	2510.0				30	100		
135		137.5	As above, few small voids with calcite crystals.	2506.5				31	100		
140		140.6	As above, becomes fresh, matrix supported.	2503.4				32	100		
		142.0	As above, iron staining.	2502.0				32	100		
145		147.0	Becomes clast supported, matrix is coarse sand and weakly cemented and weak, weak iron staining.	2497.0				33	100		
150		152.0	As above, medium strong, moderate HCl reaction.	2492.0				34	100		
155		157.0	Becomes red brown to brown fresh, matrix supported, strong HCl reaction.	2487.0				35	100		
160		162.0	As above.	2482.0				36	100		
165		167.0	As above.	2477.0				37	100		
170		172.0	As above.	2472.0				38	100		
175		177.0	As above, bcomes clast supported, cobbly.	2467.0				39	100		
180			As above, few small voids with calcite infill.					40	100		

Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

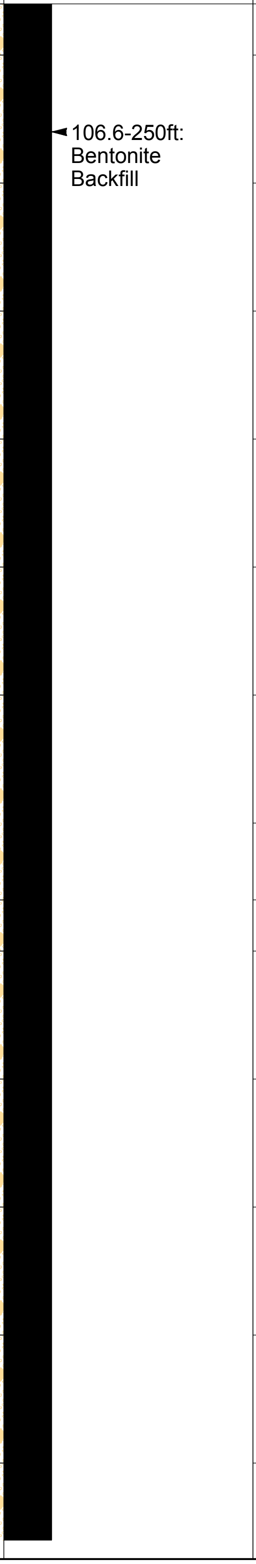
DRAFT

RECORD OF BOREHOLE DH17-37 (GT-28)

PROJECT:	RCML Near West TSF	DRILLING START:	February 7, 2017 13:41	SHEET:	4 of 5
PROJECT NO.:	1531436	DRILLING END:	February 7, 2017 13:41	GS ELEV.:	2644.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 839,358 E: 936,278	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE: Depth	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: Elev	USCS	GRAPHIC LOG	CORE INFO: RUN NO.	CORE INFO: CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0		2464.0						
		182.0	As above, few small voids with calcite infill. *(continued)*	2462.0			40	100		
185		187.0	As above.	2457.0			41	100		
190		192.0	As above.	2452.0			42	100		
195		197.0	As above.	2447.0			43	100		
200		202.0	As above.	2442.0			44	100		
205		207.0	As above.	2437.0			45	100		
210			As above, becomes matrix supported, weak HCl reaction.				46	100		
215		215.0		2429.0			47	100		
		217.0	Becomes clast supported Gila Conglomerate (Tcg): gray brown, clasts are angular to subangular, predominantely cobbles, lithologies include: limestone, schist, quartzite, tuff, diabase, matrix is fine gravel and coarse sand, vigorous HCl reaction, trace calcite crystals in small voids.	2427.0			47	100		
220		222.0	As above.	2422.0			48	100		
225		227.0	As above.	2417.0			49	100		
230		232.0	Becomes matrix supported, fresh, medium strong, weak HCl reaction.	2412.0			50	100		
235		237.0	Becomes clast supported and cobbly, strong HCl reaction.	2407.0			51	100		
240			As above.				52	100		

WELL DIAGRAM



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-37 (GT-28)

PROJECT:	RCML Near West TSF	DRILLING START:	February 7, 2017 13:41	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	February 7, 2017 13:41	GS ELEV.:	2644.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 839,358 E: 936,278	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	SOIL PROFILE DESCRIPTION	SOIL PROFILE Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE INFO CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0		2404.0							
			As above. *(continued)*					52	100		
		242.0		2402.0							
245			As above.					53	100		
		247.0		2397.0							
			As above.					54	100		
250		250.0		2394.0							
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.:	Boart Longyear	LOGGED:	Gwyn Smith
DRILLER:	Royal Johnson	CHECKED:	G Smith
DRILL RIG:	BK60	REVIEWED:	R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/27/17 15:56
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\FINAL GINT PROJECTS\NWTSF_FINAL_WELLS.GPJ

DRAFT

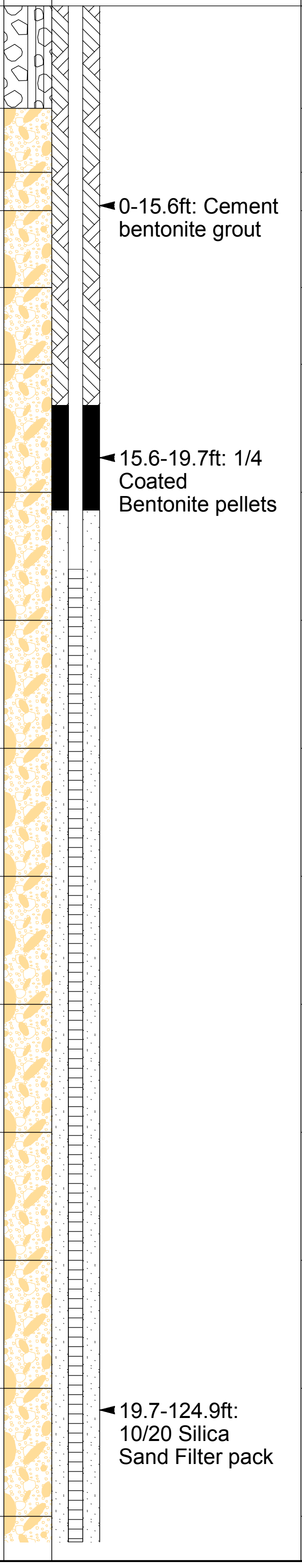
RECORD OF BOREHOLE DH17-38 (GT-22)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 14, 2017 13:30
DRILLING END: February 8, 2017 12:00
COORDINATES: N: 837,080 E: 927,269

SHEET: 1 of 5
GS ELEV.: 2406.0
TOC ELEV.: na
DATUM:

Depth	Elev	DESCRIPTION	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
0.0	2406.0	Gravel/cobbles - Quartzite with FeOX staining, bottom of run is multilithic clasts: schist, quartzite, and volcanics.		1	75	0 - 16: Hydro test #1 FHT	
4.0	2402.0	Gila Conglomerate (Tcg): polylithic CONGLOMERATE, clasts are subround, cobble sized quartzite, pinal schist, marble, no HCl reaction. Broken rubble zone.		2	80		
6.5	2399.5	As above.		3	100		
8.0	2398.0	As above.		4	33		
11.0	2395.0	Continues clast supported CONGLOMERATE, poorly sorted, polylithic clasts subangular to subrounded, including: quartzite, sandstone, schist, calcareous matrix, vigorous HCl reaction.		5	100		
14.0	2392.0	As above.		6	100		
19.0	2387.0	As above.		7	100		
24.0	2382.0	As above.		8	100	24 - 129: Hydro test #2 SI	
29.0	2377.0	As above.		9	100		
34.0	2372.0	As above.		10	100		
39.0	2367.0	As above.		11	100		
44.0	2362.0	Becomes matrix supported CONGLOMERATE, poorly sorted, sub-rounded to sub-angular clasts (~<.1-2 inches), clasts include: quartzite, arkose, poorly welded tuff, schist, FeOX volcanics, chert, sandy matrix is calcaerous cemented.		12	100		
49.0	2357.0	As above.		13	100		
54.0	2352.0	As above.		14	100		
59.0	2347.0	As above.		15	100		



Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

01 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 3/17/17 15:50
P:\2015 PROJECTS\1531436 RCML NEAR WEST TSF GEOTECH\GINT\NWTSF_FINAL_JS1.GPJ

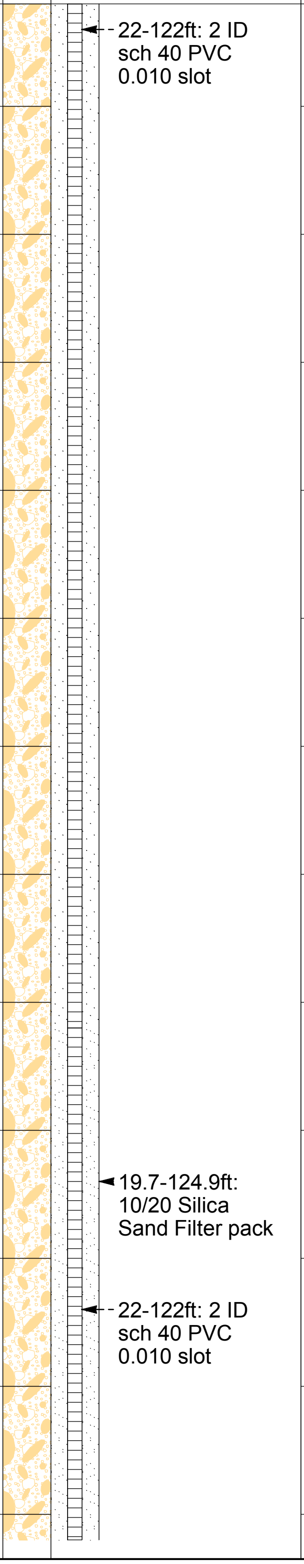
DRAFT

RECORD OF BOREHOLE DH17-38 (GT-22)

PROJECT:	RCML Near West TSF	DRILLING START:	February 14, 2017 13:30	SHEET:	2 of 5
PROJECT NO.:	1531436	DRILLING END:	February 8, 2017 12:00	GS ELEV.:	2406.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 837,080 E: 927,269	TOC ELEV.:	na
				DATUM:	

DEPTH (ft)	BORING METHOD	SOIL PROFILE: Depth	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: Elev	USCS	CORE INFO: RUN NO.	CORE INFO: CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
60		60.0	As above. *(continued)*	2346.0		15	100		
65		64.0	As above.	2342.0		16	100		
70		69.0	As above.	2337.0		17	100		
75		74.0	As above.	2332.0		18	100		
80		79.0	As above.	2327.0		19	100		
85		84.0	As above, becomes clast supported.	2322.0		20	100		
90		89.0	As above.	2317.0		21	100		
95		94.0	As above.	2312.0		22	100		
100		99.0	As above.	2307.0		23	100		
105		104.0	As above.	2302.0		24	100		
110		109.0	As above.	2297.0		25	100		
115		114.0	As above, cobble rich.	2292.0		26	100		
120		119.0	As above.	2287.0		27	100		

GRAPHIC LOG / WELL DIAGRAM



Log continued on next page

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

RECORD OF BOREHOLE DH17-38 (GT-22)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 14, 2017 13:30
DRILLING END: February 8, 2017 12:00
COORDINATES: N: 837,080 E: 927,269

SHEET: 3 of 5
GS ELEV.: 2406.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
120		120.0	As above. *(continued)*	2286.0		27	100		
125		124.0	Becomes matrix supported CONGLOMERATE, poorly sorted, sub-rounded to angular clasts, gravel to cobbles, clasts include: quartzite, tuff, schist, chert, weak HCl reation.	2282.0		28	100	124 - 250: Hydro test #3 SI	
130		129.0	As above.	2277.0		29	100		
135		134.0	As above.	2272.0		30	100		
140		139.0	As above, becomes clast supported.	2267.0		31	100		
145		144.0	As above.	2262.0		32	100		
150		149.0	As above.	2257.0		33	100		
155		154.0	As above.	2252.0		34	100		
160		159.0	As above.	2247.0		35	100		
165		164.0	As above.	2242.0		36	100		
170		169.0	As above, interbeds of coarse sandstone.	2237.0		37	100		
175		174.0	As above.	2232.0		38	100		
180		179.0	As above.	2227.0		39	100		

GRAPHIC LOG / WELL DIAGRAM

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-38 (GT-22)

PROJECT: RCML Near West TSF
PROJECT NO.: 1531436
LOCATION: Near West TSF, Superior, Arizona

DRILLING START: February 14, 2017 13:30
DRILLING END: February 8, 2017 12:00
COORDINATES: N: 837,080 E: 927,269

SHEET: 4 of 5
GS ELEV.: 2406.0
TOC ELEV.: na
DATUM:

DEPTH (ft)	BORING METHOD	Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	RUN NO.	CORE RECOVERY %	NOTES	ADDITIONAL LAB TESTING
180		180.0	As above. *(continued)*	2226.0				39	100		
185		184.0	Continues clast supported CONGLOMERATE, poorly sorted, sub-rounded to angular clasts, gravel to cobbles, clasts include: quartzite, tuff, schist, chert, weak HCl reation.	2222.0			◄ 124.9-250ft: 1/4 Coated Bentonite Pellets	40	100	184 - 250: Hydro test #4 SI	
190		189.0	As above.	2217.0				41	100		
195		194.0	As above.	2212.0				42	100		
200		199.0	As above.	2207.0				43	100		
205		204.0	As above.	2202.0				44	100		
210		209.0	As above.	2197.0				45	100		
215		214.0	As above.	2192.0				46	100		
220		219.0	As above, cobble-rich.	2187.0				47	100		
225		224.0	As above.	2182.0				48	100		
230		229.0	As above.	2177.0				49	100		
235		234.0	As above.	2172.0				50	100		
240		239.0	As above.	2167.0				51	100		

Log continued on next page

DRILLING CO.: Boart Longyear
DRILLER: Daniel Dodge
DRILL RIG: BK30

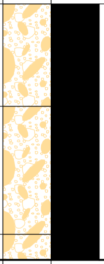
LOGGED: Adriana Garcia
CHECKED: G Smith
REVIEWED: R Post

Golder Associates

DRAFT

RECORD OF BOREHOLE DH17-38 (GT-22)

PROJECT:	RCML Near West TSF	DRILLING START:	February 14, 2017 13:30	SHEET:	5 of 5
PROJECT NO.:	1531436	DRILLING END:	February 8, 2017 12:00	GS ELEV.:	2406.0
LOCATION:	Near West TSF, Superior, Arizona	COORDINATES:	N: 837,080 E: 927,269	TOC ELEV.:	na
				DATUM:	



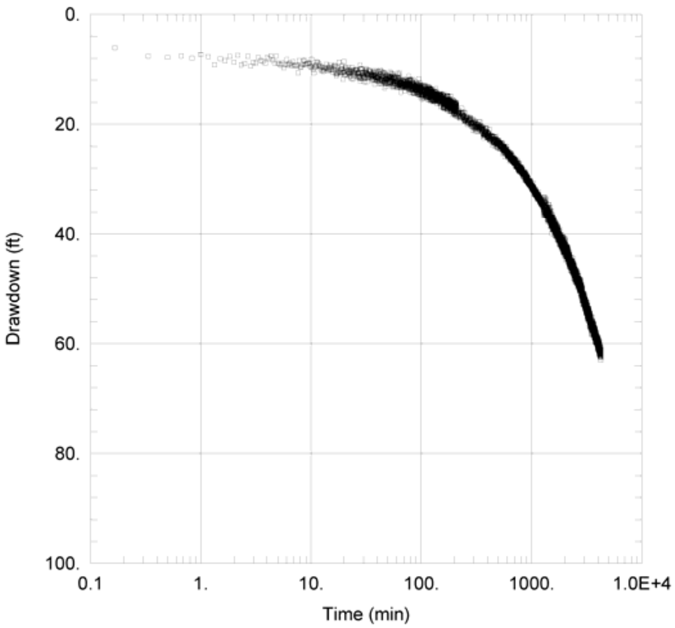
DEPTH (ft)	BORING METHOD	SOIL PROFILE Depth	DESCRIPTION	Elev	USCS	GRAPHIC LOG	WELL DIAGRAM	CORE INFO RUN NO.	CORE RECOVERY % (20 40 60 80)	NOTES	ADDITIONAL LAB TESTING
240		240.0	As above. *(continued)*	2166.0				51	100		
245		244.0	As above.	2162.0				52	100		
		249.0		2157.0							
250		250.0	As above.	2156.0				53	100		
			Bottom of borehole at 250.0 ft. Completed as well. Refer to diagram.								
255											
260											
265											
270											
275											
280											
285											
290											
295											
300											

DRILLING CO.:	Boart Longyear	LOGGED:	Adriana Garcia
DRILLER:	Daniel Dodge	CHECKED:	G Smith
DRILL RIG:	BK30	REVIEWED:	R Post

Golder Associates

Appendix K.1

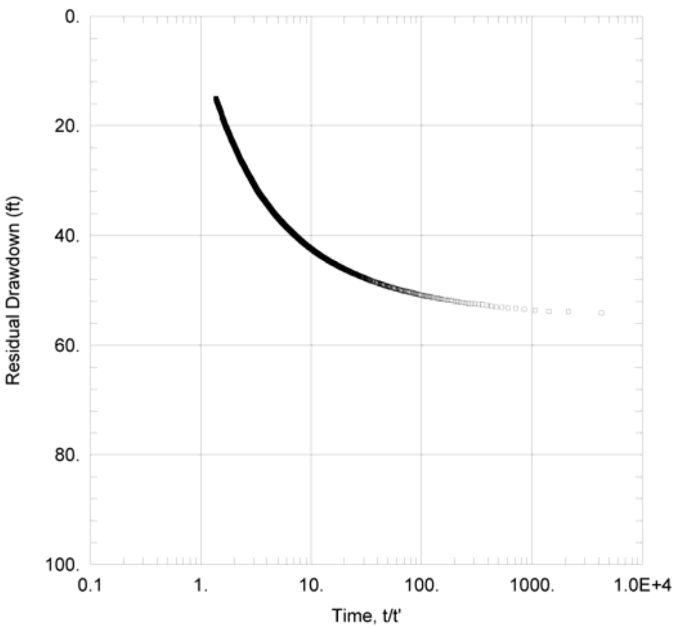
AQTESOLV Plots of Constant-rate Tests



DRAWDOWN GRAPH FOR PUMPED WELL DS16-01

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining
Project: 605.7807
Location: Near West
Test Well: DS16-01 (N)
Test Date: 11-April-2017



RECOVERY GRAPH FOR PUMPED WELL DS16-01

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper Mining
Project: 605.7807
Location: Near West
Test Well: DS16-01 (N)
Test Date: 11-April-2017

EXPLANATION

Pumping Started: 11-April-2017 09:30 hrs
Pumping Stopped: 14-April-2017 08:30 hrs
Initial Water Level: 44.08 feet below land surface
Average Pumping Rate (totalizer): 64.7 gpm

FIGURE 1. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-01

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY & ASSOCIATES

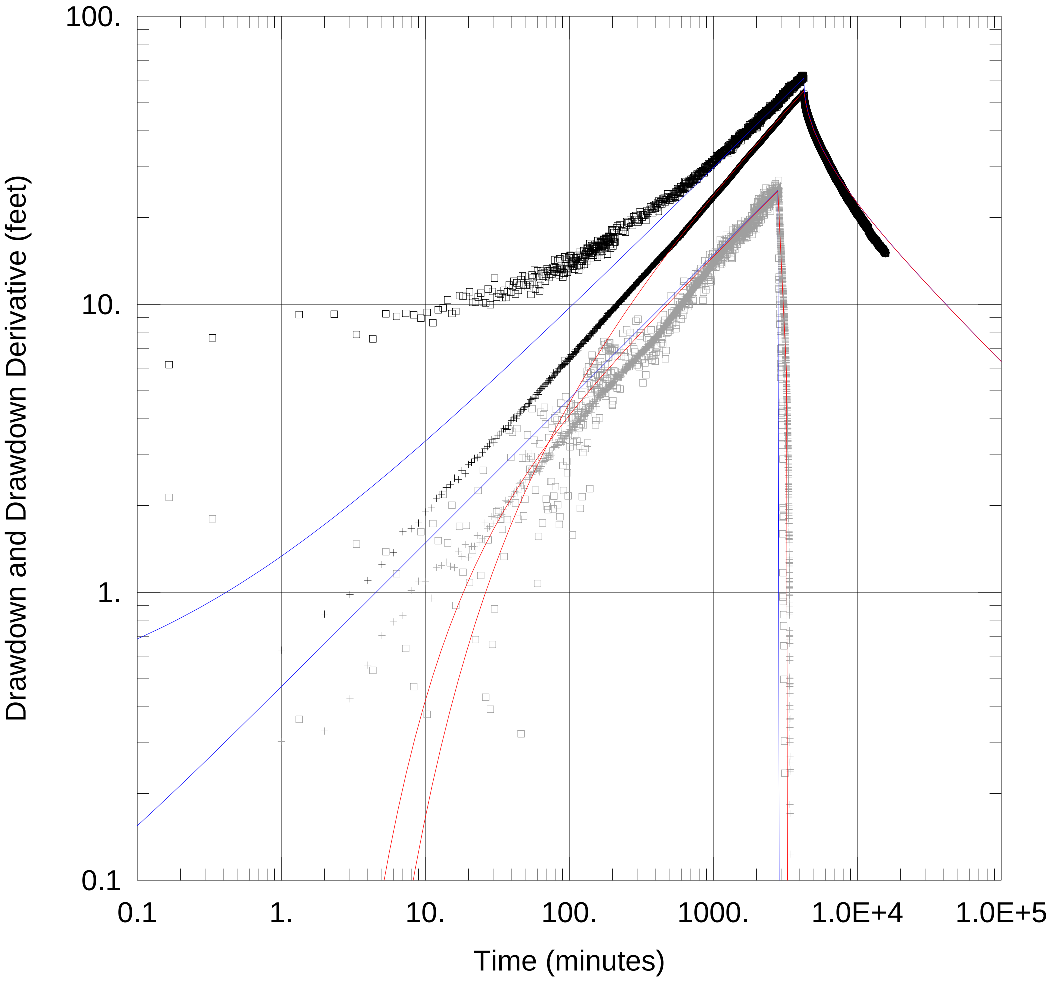


FIGURE 2. DS16-01 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-01 (N)
Test Date: 11 - 14 April 2017

AQUIFER DATA

Saturated Thickness: 88. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-01	923209.5	838446.2
DH16-01	923218.8	838455.3

Observation Wells

Well Name	X (ft)	Y (ft)
▫ DS16-01	923209.5	838446.2
+ DH16-01	923218.8	838455.3

SOLUTION

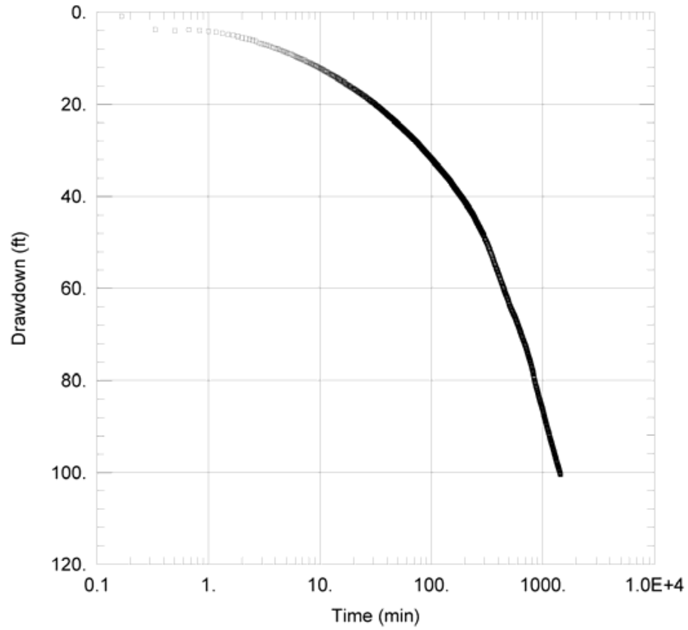
Aquifer Model: Confined
Solution Method: Barker

K = 1.7 ft/day
n = 1.
Sw = 2.
r(c) = 0.1667 ft

Ss = 0.00039
b = 88. ft
r(w) = 0.4375 ft

MONTGOMERY
& ASSOCIATES

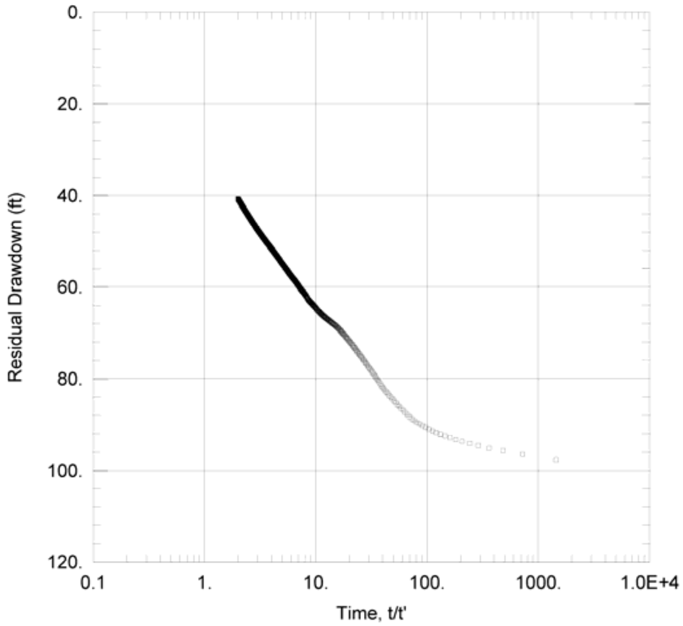
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-02\3 Analysis\aqt\DS16-02_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-02

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-02
Test Date: 3 - 4 May 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-02

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-02
Test Date: 3 - 4 May 2017

EXPLANATION

Pumping Started: 3-May-2017 13:00 hrs
Pumping Stopped: 4-May-2017 13:00 hrs
Initial Water Level: 152.15 ft
Average Pumping Rate (totalizer): 7.0 gpm

FIGURE 3. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-02

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

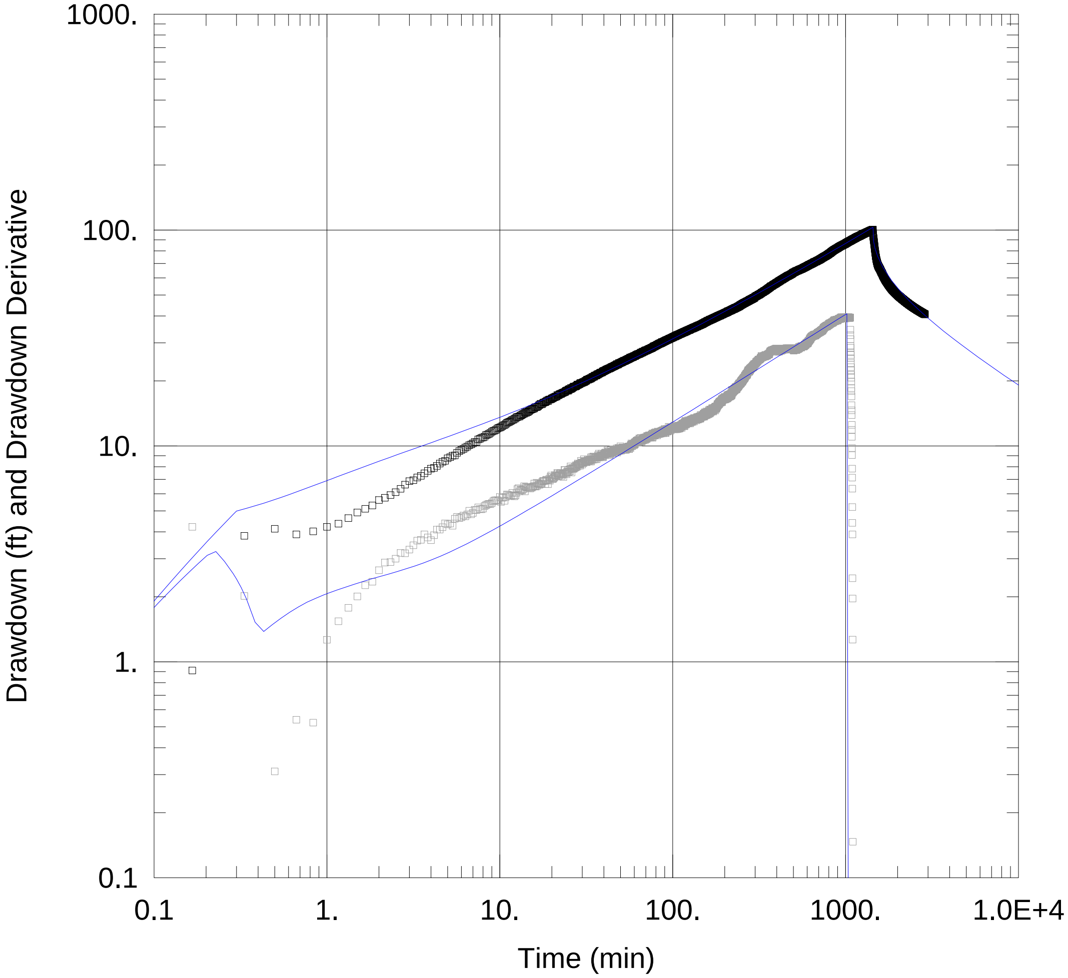


FIGURE 4. DS16-02 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-02
Test Date: 3 - 4 May 2017

AQUIFER DATA

Saturated Thickness: 186. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-02	918055.23	842613.83

Observation Wells

Well Name	X (ft)	Y (ft)
▫ DS16-02	918055.23	842613.83

SOLUTION

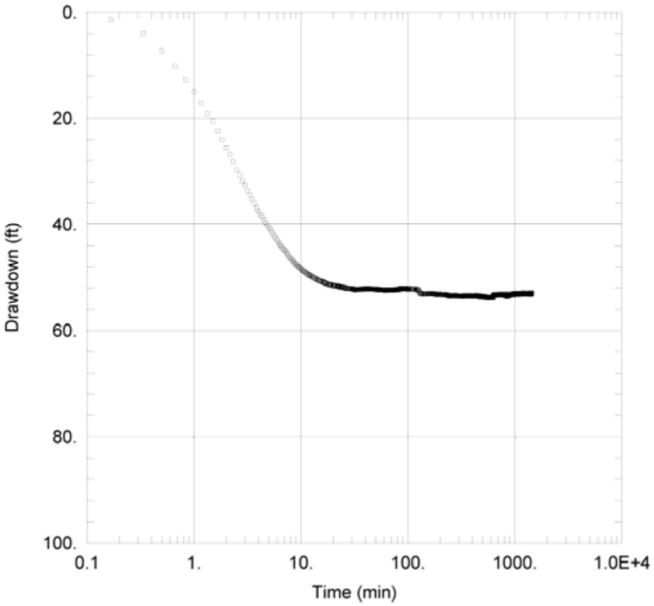
Aquifer Model: Confined
Solution Method: Barker

K = 0.0027 ft/day
n = 1.
Sw = 2.
r(c) = 0.1667 ft

Ss = 1.9E-5
b = 186. ft
r(w) = 0.4375 ft

MONTGOMERY
& ASSOCIATES

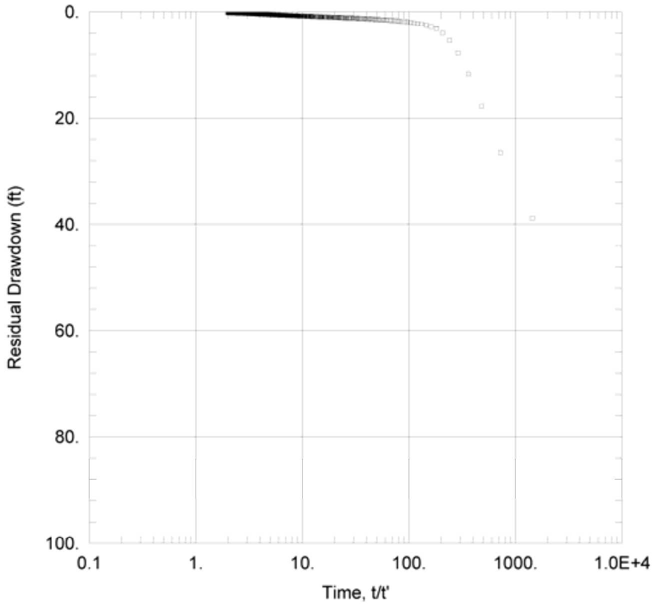
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-03\3 Analysis\aqt\DS16-03_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-03

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-03 (F)
Test Date: 5 - 6 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-03

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-03 (F)
Test Date: 5 - 6 Apr 2017

EXPLANATION

Pumping Started: 5-April-2017 17:00 hrs
Pumping Stopped: 6-April-2017 17:00 hrs
Initial Water Level: 31.82 ft bls
Average Pumping Rate (totalizer): 12.5 gpm

FIGURE 5. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-03

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

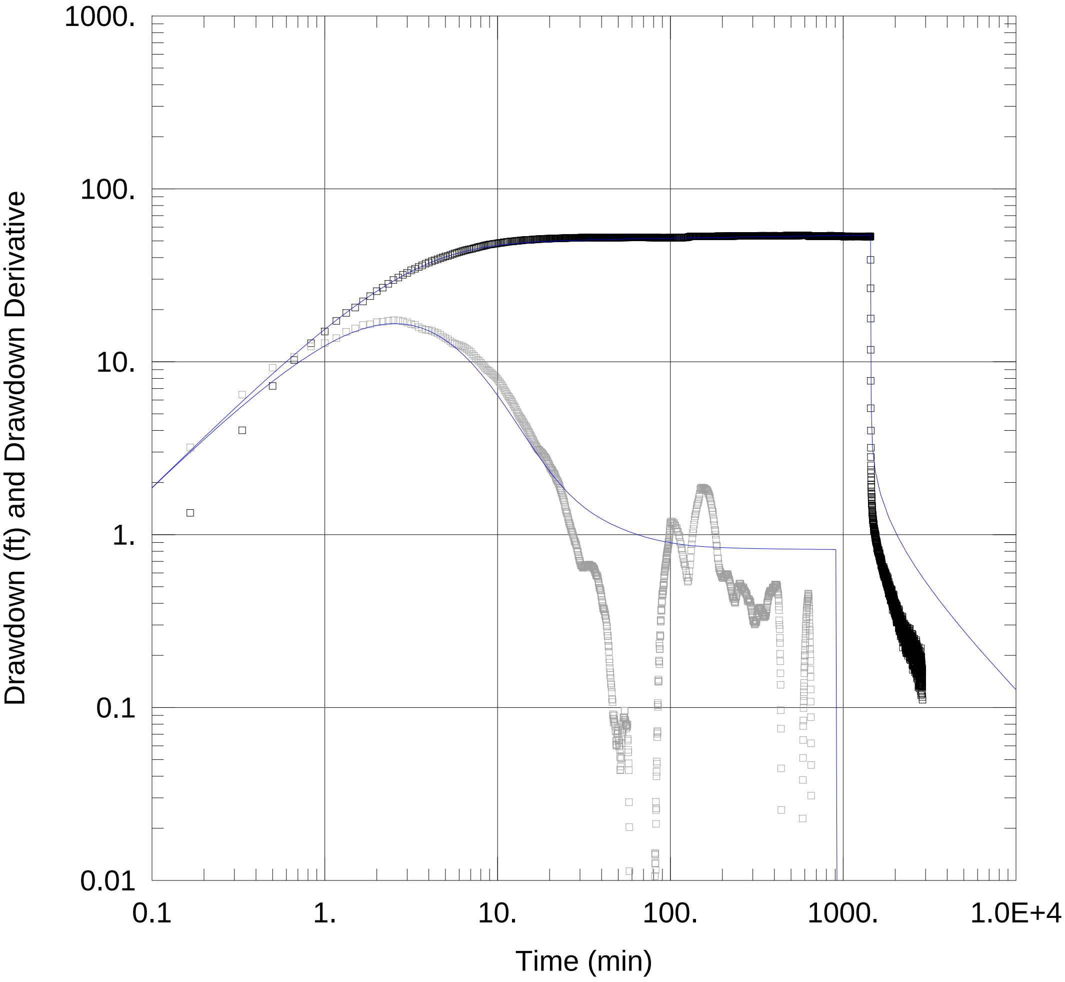


FIGURE 6. DS16-03 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-03 (F)
Test Date: 5 - 6 Apr 2017

AQUIFER DATA

Saturated Thickness: 279. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-03	926185.4	843649.1

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-03	926185.4	843649.1

SOLUTION

Aquifer Model: Confined

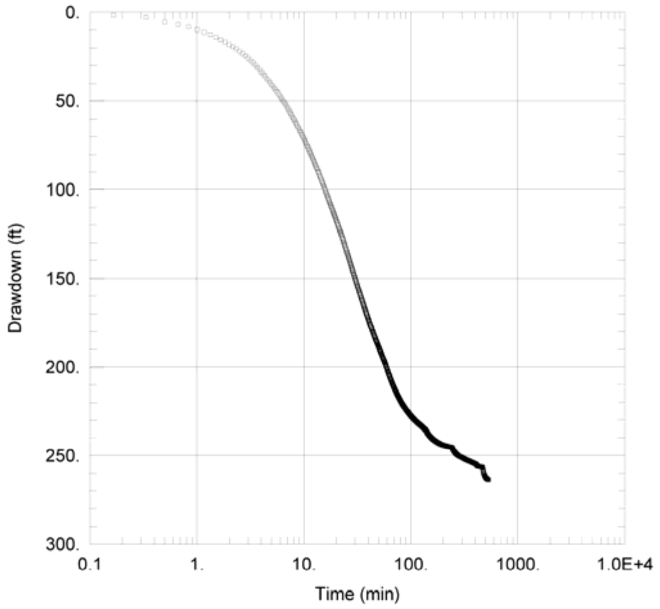
Solution Method: Dougherty-Babu

T = 235. ft^2/day
Kz/Kr = 1.
r(w) = 0.4375 ft

S = 0.0005
Sw = 5.
r(c) = 0.1667 ft

MONTGOMERY
& ASSOCIATES

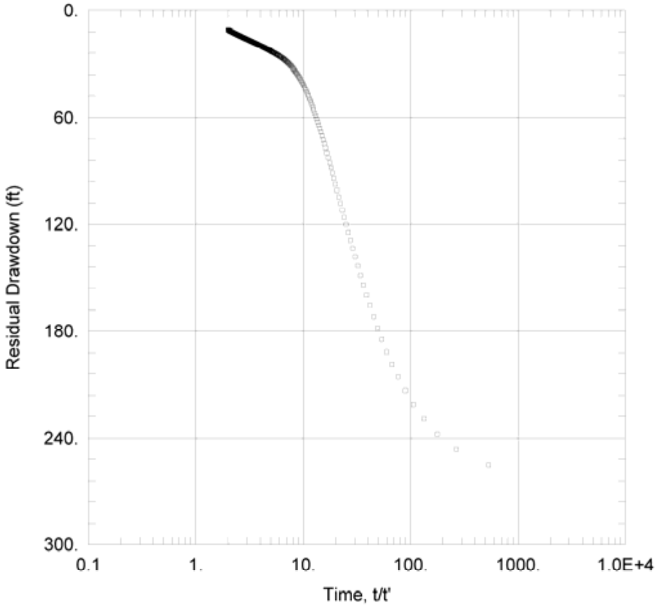
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-04\3 Analysis\aqt\DS16-04_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-04

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-04 (G)
Test Date: 21 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-04

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-04 (G)
Test Date: 21 Apr 2017

EXPLANATION

Pumping Started: 21-April-2017 10:45 hours
Pumping Stopped: 21-April-2017 19.36 hours
Initial Water Level: 9.39 feet below land surface
Average Pumping Rate (totalizer): 4.1 gpm

FIGURE 7. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-04

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

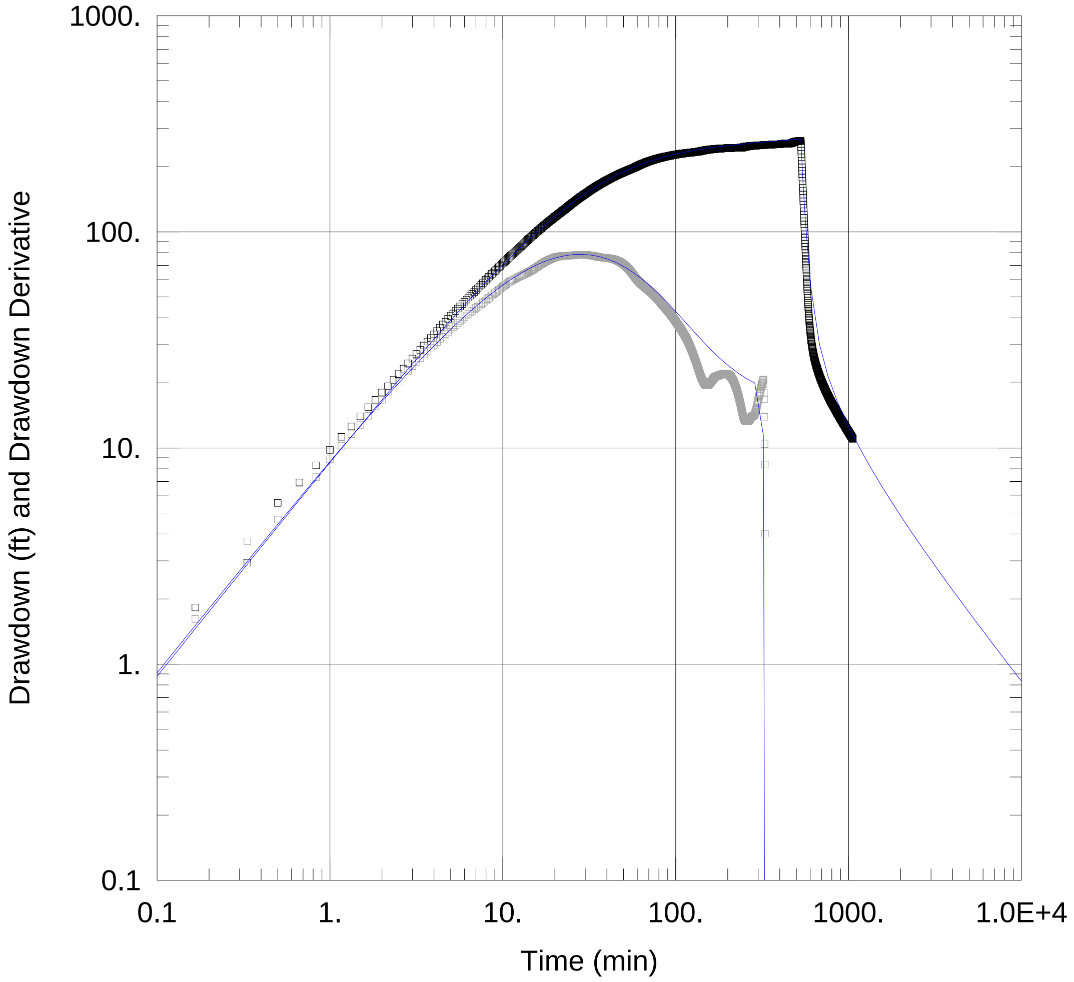


FIGURE 8. DS16-04 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-04 (G)
Test Date: 21 Apr 2017

AQUIFER DATA

Saturated Thickness: 47. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-04	922849	842227.2

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-04	922849	842227.2

SOLUTION

Aquifer Model: Confined

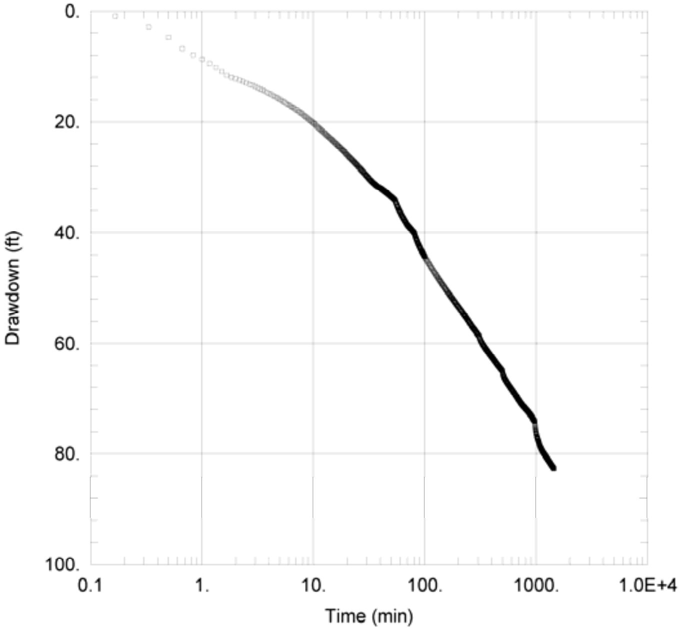
Solution Method: Dougherty-Babu

T = 4.1 ft^2/day
Kz/Kr = 1.
r(w) = 0.4375 ft

S = 4.0E-6
Sw = 1.25
r(c) = 0.1667 ft

MONTGOMERY
& ASSOCIATES

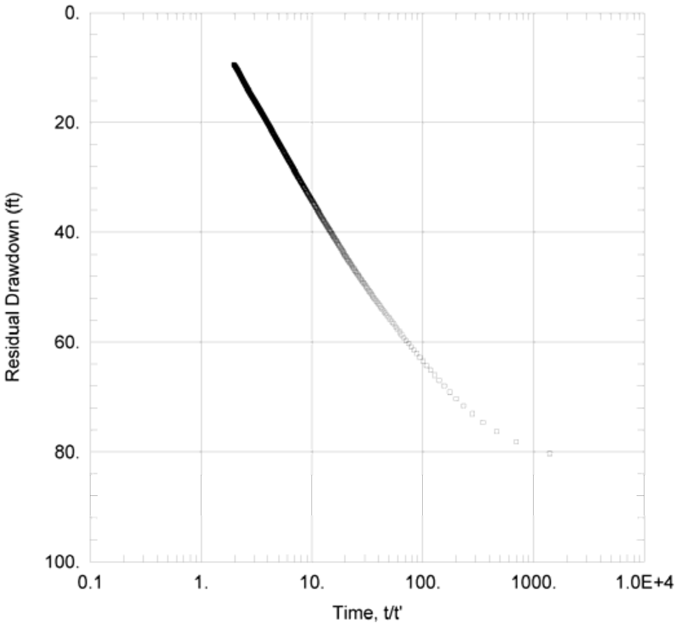
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-05\3 Analysis\aqt\DS16-05_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-05

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-05 (O)
Obs. Well: DH16-18
Test Date: 9 - 10 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-05

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-05 (O)
Obs. Well: DH16-18
Test Date: 9 - 10 Apr 2017

EXPLANATION

Pumping Started: 09-April-2017 10:00 hours
Pumping Stopped: 10-April-2017 10.00 hours
Initial Water Level: 29.08 feet below land surface
Average Pumping Rate (totalizer): 1.5 gpm

FIGURE 9. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-05

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

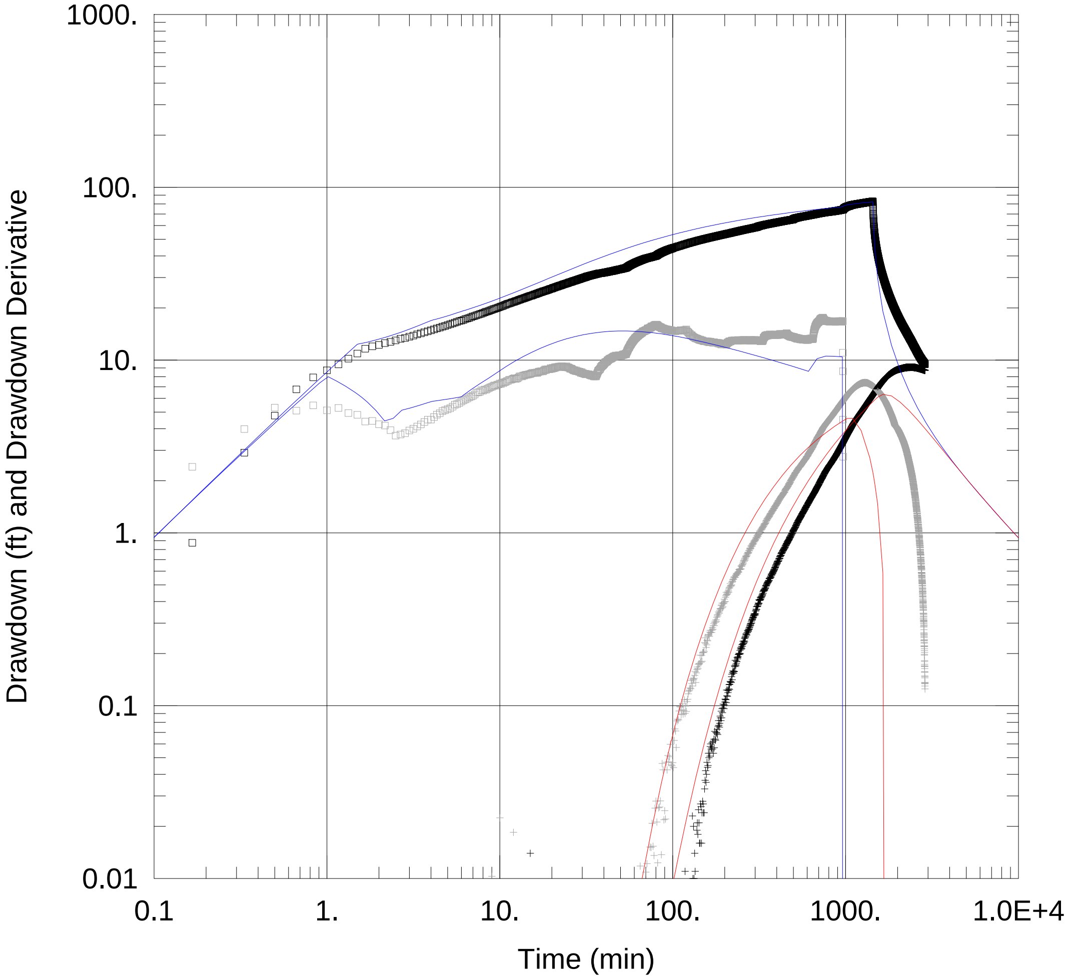


FIGURE 10. DS16-05 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-05 (O)
Test Date: 9 - 10 Apr 2017

AQUIFER DATA

Saturated Thickness: 291. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-05	909633.6	842326.5

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-05	909633.6	842326.5
+ DH16-18	909644.3	842318.9

SOLUTION

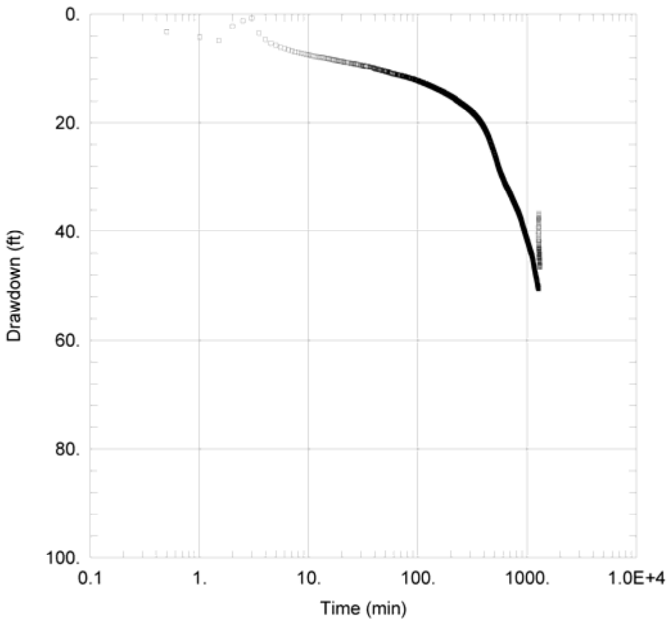
Aquifer Model: Unconfined

Solution Method: Moench

T = 3.9 ft^2/day
Sy = 0.005
Sw = -2.5
r(c) = 0.1667 ft

S = 0.00019
Kz/Kr = 1.
r(w) = 0.4375 ft
alpha = 1.0E-10 min^{-1}

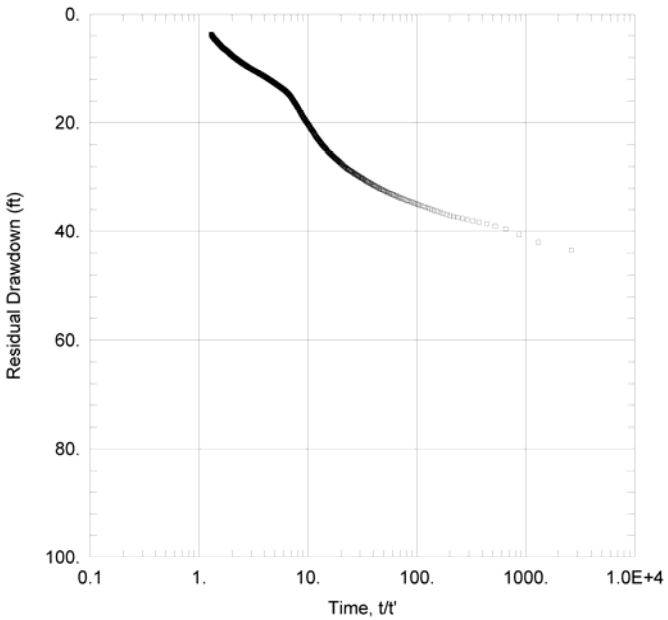
MONTGOMERY & ASSOCIATES



DRAWDOWN GRAPH FOR PUMPED WELL DS16-06

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-06 (L)
Obs. Well: DH16-16
Test Date: 18 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-06

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-06 (L)
Obs. Well: DH16-16
Test Date: 18 Apr 2017

EXPLANATION

Pumping Started: 18-April-2017 10:00 hours
Pumping Stopped: 19-April-2017 10.00 hours
Initial Water Level: 26.39 feet below land surface
Average Pumping Rate (totalizer): 24.9 gpm

FIGURE 11. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-06

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

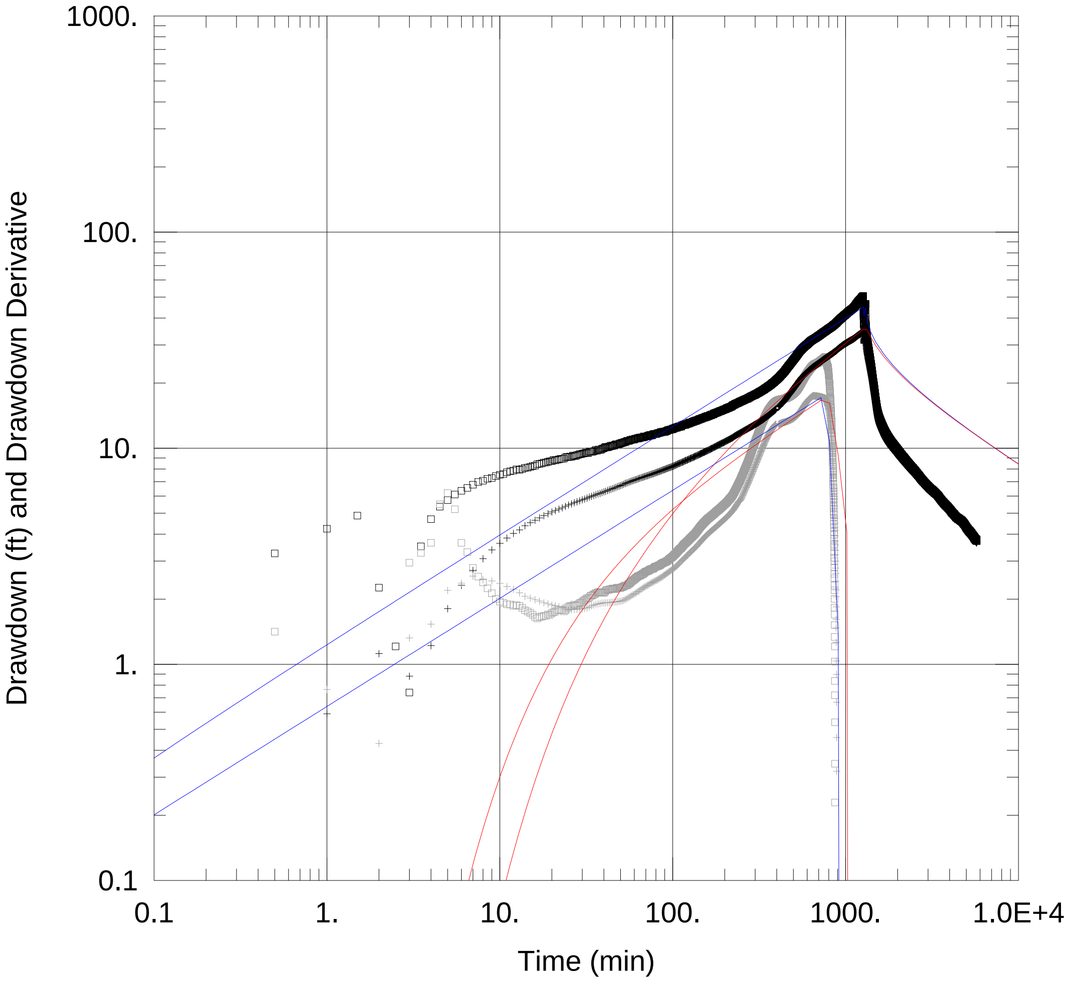


FIGURE 12. DS16-06 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-06 (L)
Test Date: 18 Apr 2017

AQUIFER DATA

Saturated Thickness: 94. ft

Anisotropy Ratio (Kz/Kr): 5.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-06	912657.7	845066.9

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-06	912657.7	845066.9
+ DH16-16	912658.1	845081.2

SOLUTION

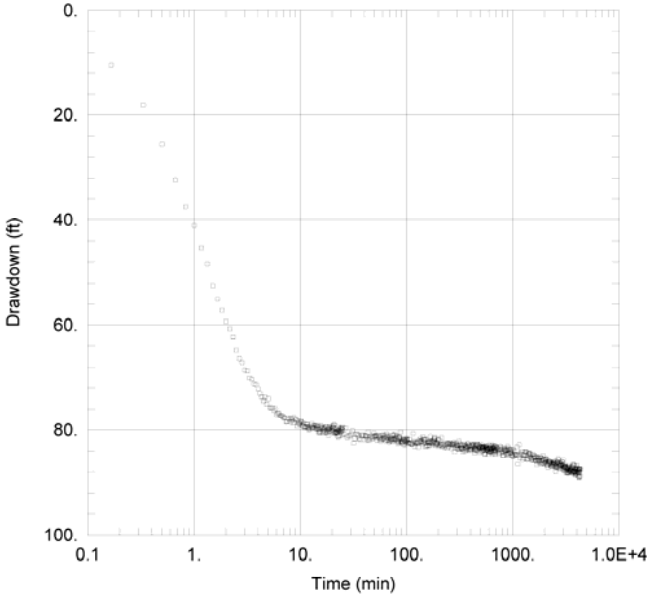
Aquifer Model: Confined

Solution Method: Barker

K = 0.37 ft/day
n = 1.
Sw = 0.
r(c) = 0.1667 ft

Ss = 0.00011
b = 94. ft
r(w) = 0.4375 ft

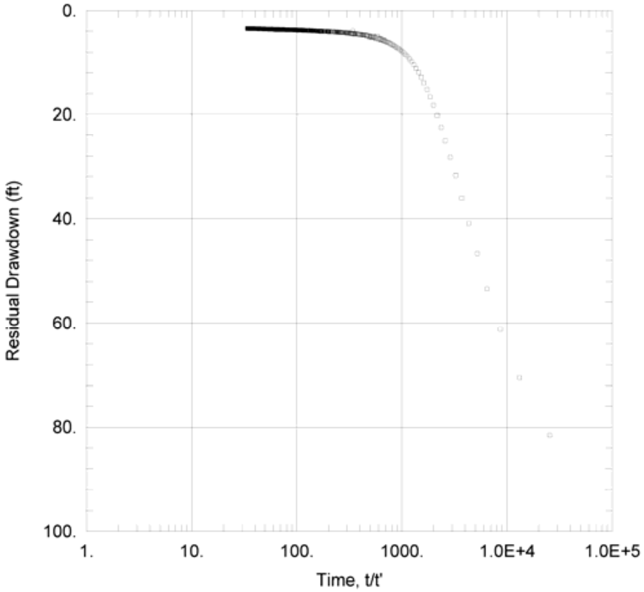
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-07\3 Analysis\aqt\DS16-07_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-07

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-07 (K)
Test Date: 1 - 4 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-07

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-07 (K)
Test Date: 1 - 4 Apr 2017

EXPLANATION

Pumping Started: 01-April-2017 10:00 hours
Pumping Stopped: 04-April-2017 10.00 hours
Initial Water Level: 67.71 feet below land surface
Average Pumping Rate (totalizer): 40.0 gpm

FIGURE 13. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-07

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

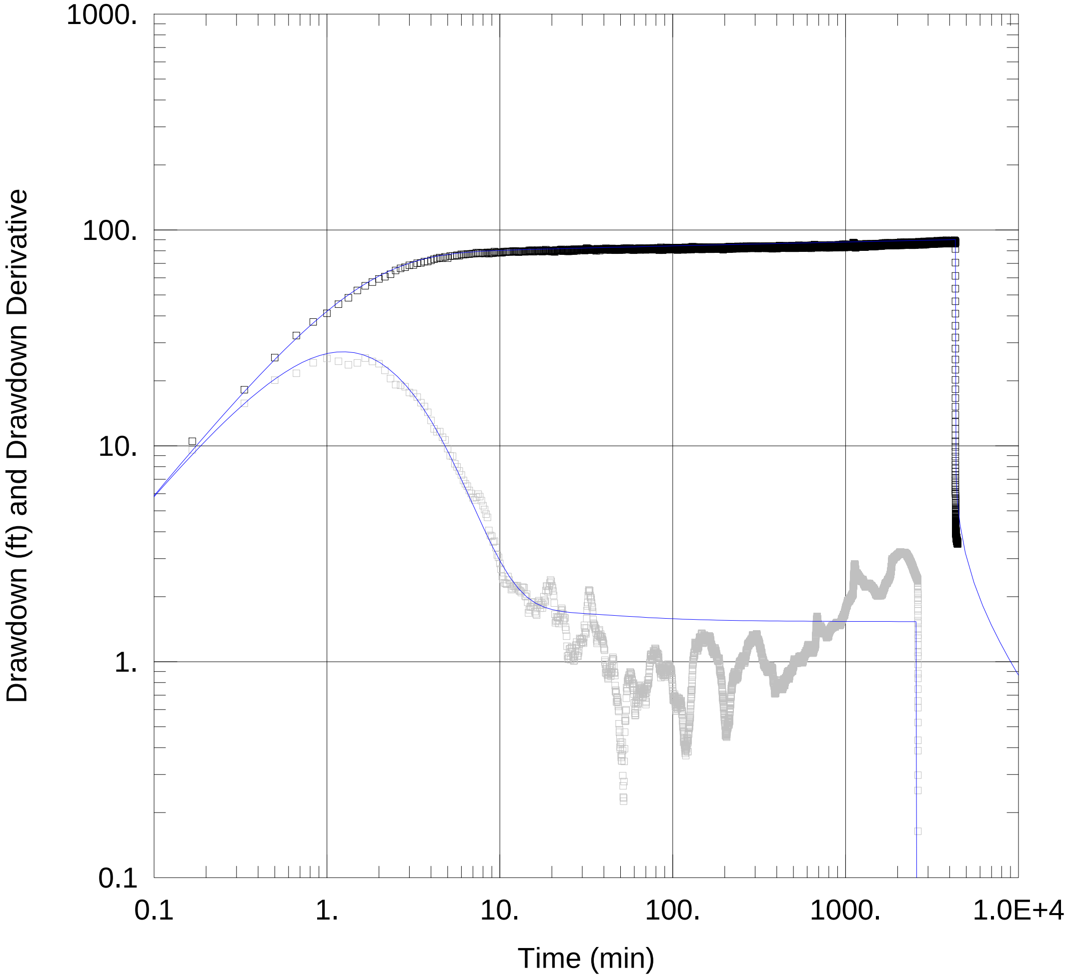


FIGURE 14. DS16-07 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-07 (K)
Test Date: 1 - 4 Apr 2017

AQUIFER DATA

Saturated Thickness: 119. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-07	915230.2	844753.7

Observation Wells

Well Name	X (ft)	Y (ft)
▫ DS16-07	915230.2	844753.7

SOLUTION

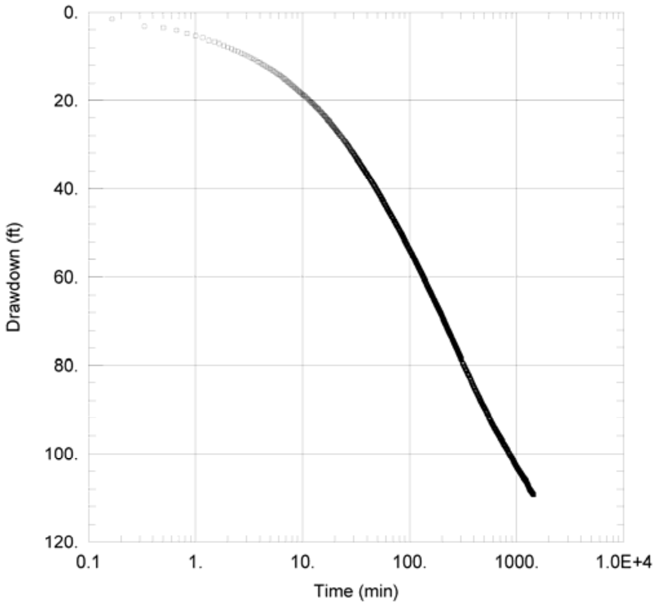
Aquifer Model: Confined
Solution Method: Dougherty-Babu

T = 400. ft^2/day
Kz/Kr = 1.
r(w) = 0.4375 ft

S = 1.01E-15
Sw = 5.
r(c) = 0.1667 ft

MONTGOMERY
& ASSOCIATES

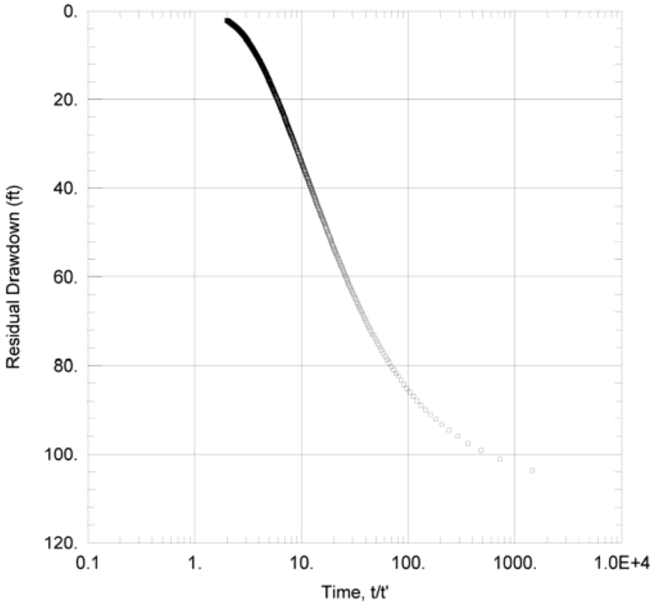
605.7807\Aquifer testing\4 Pumping Tests\3 Wells\DS16-13\3 Analysis\aqt\DS16-13_AQTESOLV_ddrc_plots.grf



DRAWDOWN GRAPH FOR PUMPED WELL DS16-13

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-13
Test Date: 29 - 30 Apr 2017



RECOVERY GRAPH FOR PUMPED WELL DS16-13

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-13
Test Date: 29 - 30 Apr 2017

EXPLANATION

Pumping Started:29-April-2017 09:00 hours
Pumping Stopped: 30-April-2017 09.00 hours
Initial Water Level: 28.68 feet below land surface
Average Pumping Rate (totalizer): 7.5 gpm

FIGURE 15. SEMI-LOG DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL DS16-13

Client: Resolution Copper
Project: Near West Hydrologic Testing
Location: Pinal County, Arizona

MONTGOMERY
& ASSOCIATES

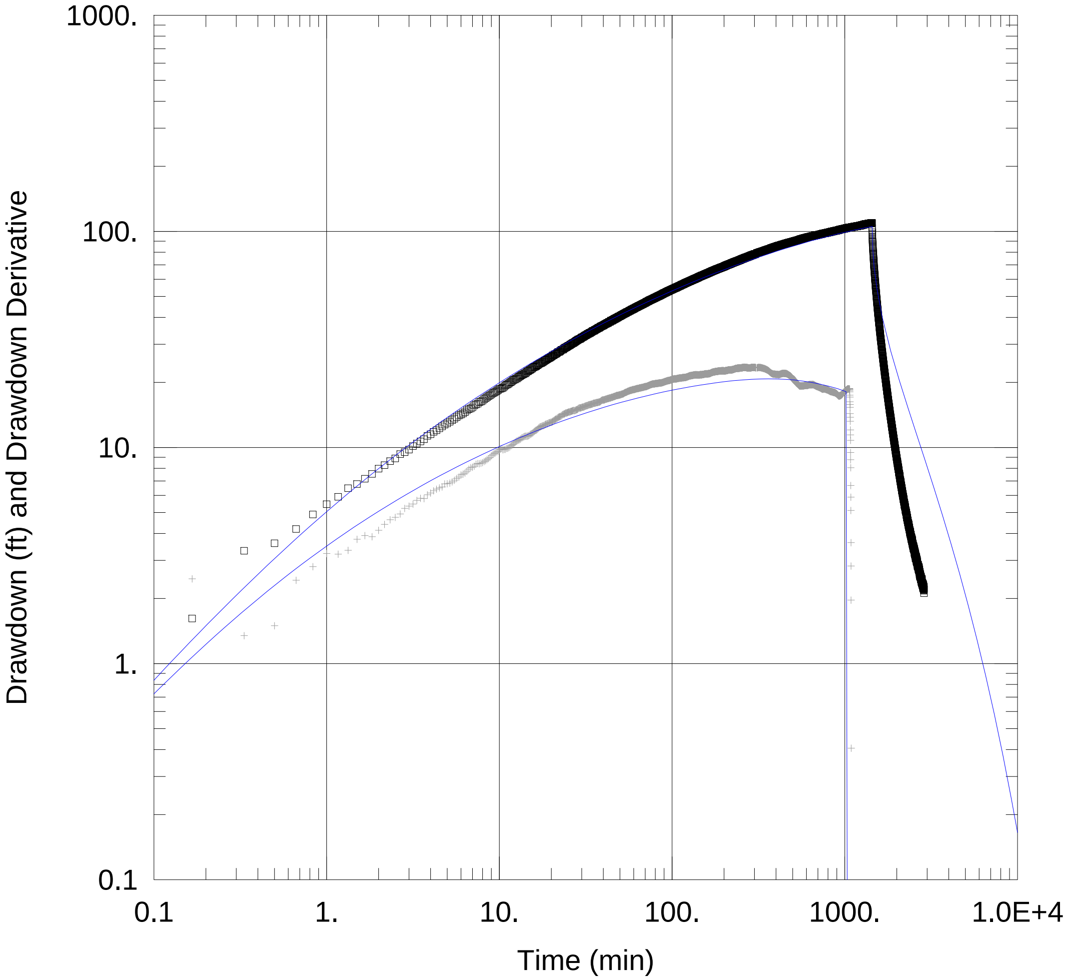


FIGURE 16. DS16-13 CONSTANT-RATE PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-13
Test Date: 29 - 30 Apr 2017

AQUIFER DATA

Saturated Thickness: 236. ft
Aquitard Thickness (b'): 300. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b"): 500. ft

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-13	937270.9	842132.7

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-13	937270.9	842132.7

SOLUTION

Aquifer Model: Leaky
Solution Method: Moench (Case 3)

T = 4. ft^2/day
r/B' = 0.15
r/B" = 0.05
Sw = -3.
r(c) = 0.1667 ft

S = 0.002
ß' = 0.022
ß" = 0.
r(w) = 0.4375 ft

MONTGOMERY
& ASSOCIATES

MONTGOMERY
& ASSOCIATES

Appendix K.2

AQTESOLV Plots of Short-duration Pumping Tests

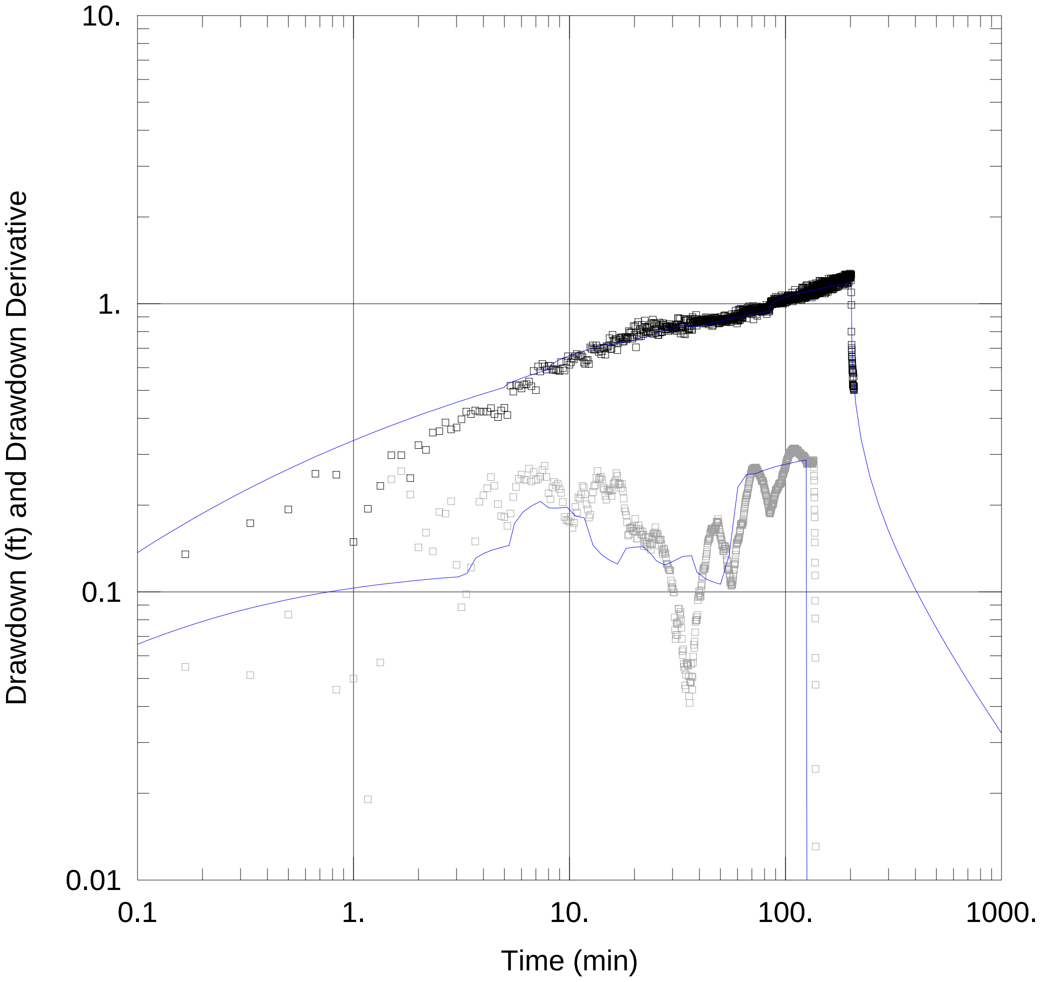


FIGURE 1. DS16-14 SHORT-DURATION PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DS16-14
Test Date: 17 May 2017

AQUIFER DATA

Saturated Thickness: 244. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DS16-14	937527.1	837284.7

Observation Wells

Well Name	X (ft)	Y (ft)
□ DS16-14	937527.1	837284.7

SOLUTION

Aquifer Model: Unconfined

Solution Method: Moench

T = 630. ft^2/day
Sy = 0.01
Sw = -3.
r(c) = 0.1667 ft

S = 0.001
ß = 3.215E-6
r(w) = 0.4375 ft
alpha = 1.0E-6 min^{-1}

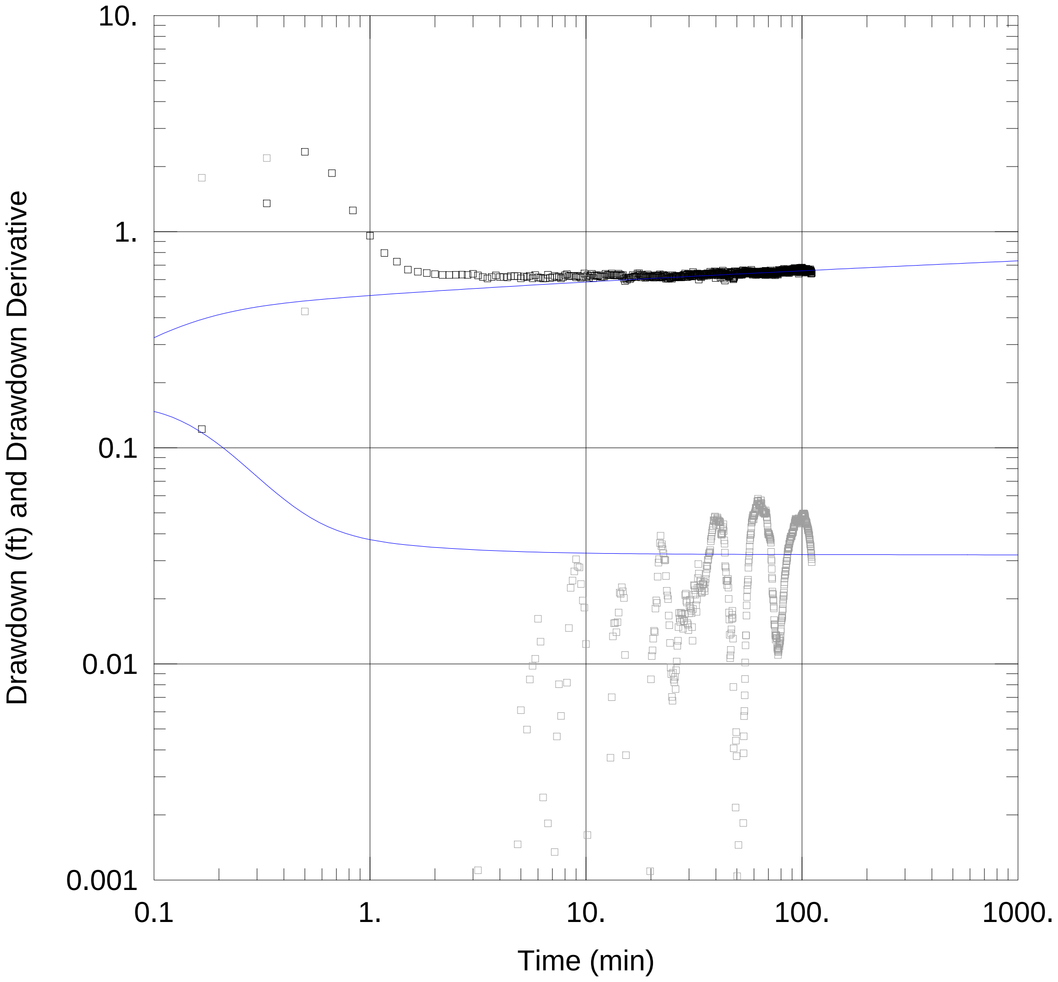


FIGURE 2. DH16-09 SHORT-DURATION PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DH16-09 (GT-32)
Test Date: 9 May 2017

AQUIFER DATA

Saturated Thickness: 100. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DH16-09	927715.4	845384.4

Observation Wells

Well Name	X (ft)	Y (ft)
□ DH16-09	927715.4	845384.4

SOLUTION

Aquifer Model: Unconfined

Solution Method: Moench

T = 560. ft^2/day
Sy = 0.01
Sw = -4.
r(c) = 0.0861 ft

S = 1.0E-5
ß = 2.468E-6
r(w) = 0.1571 ft
alpha = 3.033E-9 min^{-1}

MONTGOMERY
& ASSOCIATES

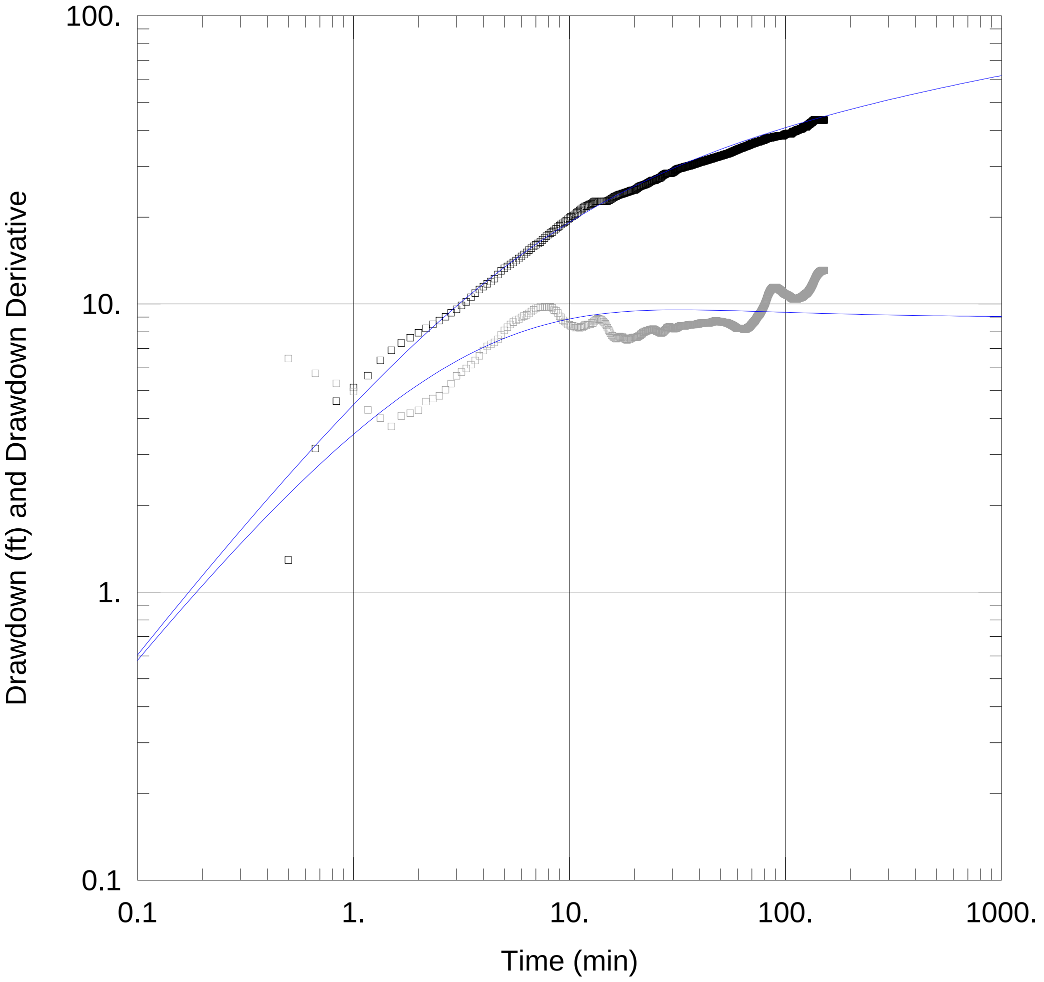


FIGURE 3. DH16-21 SHORT-DURATION PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DH16-21 (GT-5)
Test Date: 16 May 2017

AQUIFER DATA

Saturated Thickness: 9.5 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DH16-21	917417.3	845595.1

Observation Wells

Well Name	X (ft)	Y (ft)
□ DH16-21	917417.3	845595.1

SOLUTION

Aquifer Model: Confined

Solution Method: Dougherty-Babu

T = 0.7 ft^2/day
Kz/Kr = 1.
r(w) = 0.1571 ft

S = 4.0E-5
Sw = -3.5
r(c) = 0.0861 ft

MONTGOMERY
& ASSOCIATES

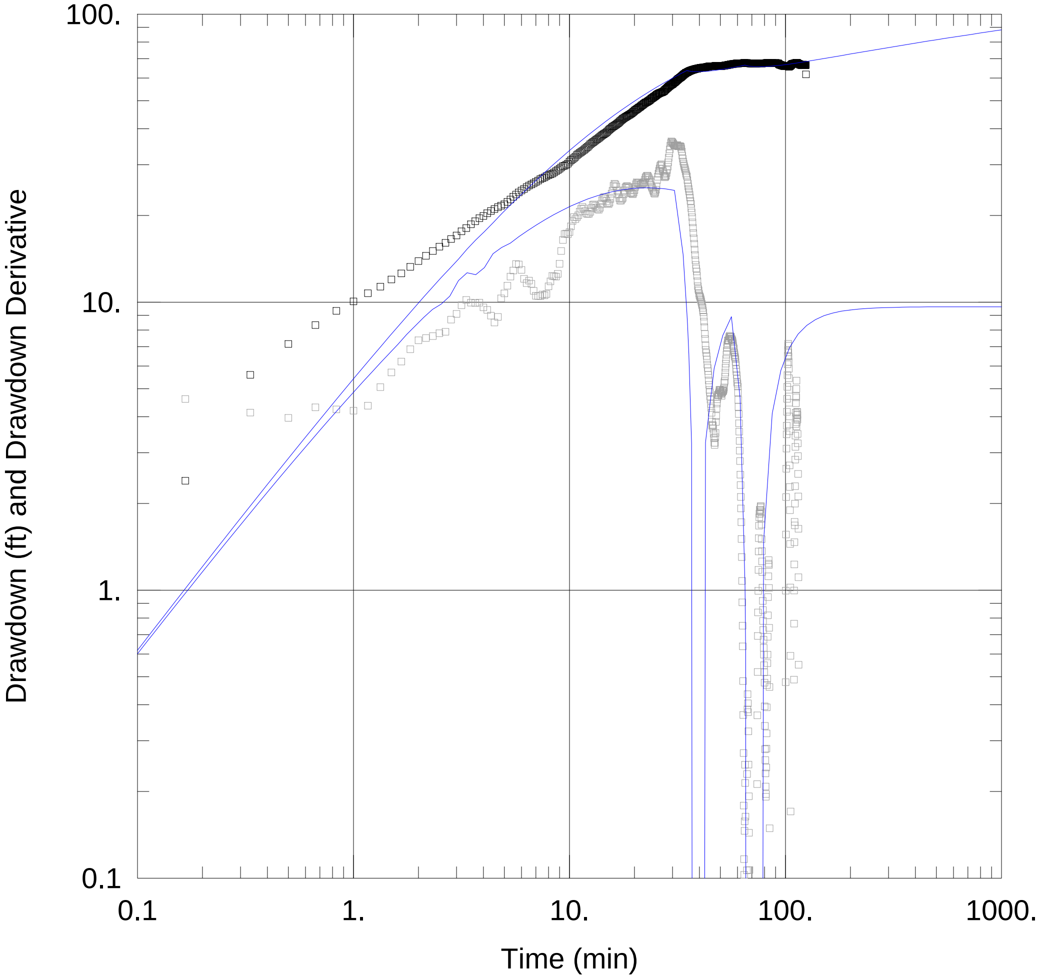


FIGURE 4. DH17-26 SHORT-DURATION PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DH17-26 (GT-13)
Test Date: 8 May 2017

AQUIFER DATA

Saturated Thickness: 155. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DH17-26	924372.3	834202.6

Observation Wells

Well Name	X (ft)	Y (ft)
□ DH17-26	924372.3	834202.6

SOLUTION

Aquifer Model: Confined

Solution Method: Dougherty-Babu

T = 1.2 ft^2/day
Kz/Kr = 1.
r(w) = 0.1571 ft

S = 1.0E-5
Sw = -4.7
r(c) = 0.0861 ft

MONTGOMERY & ASSOCIATES

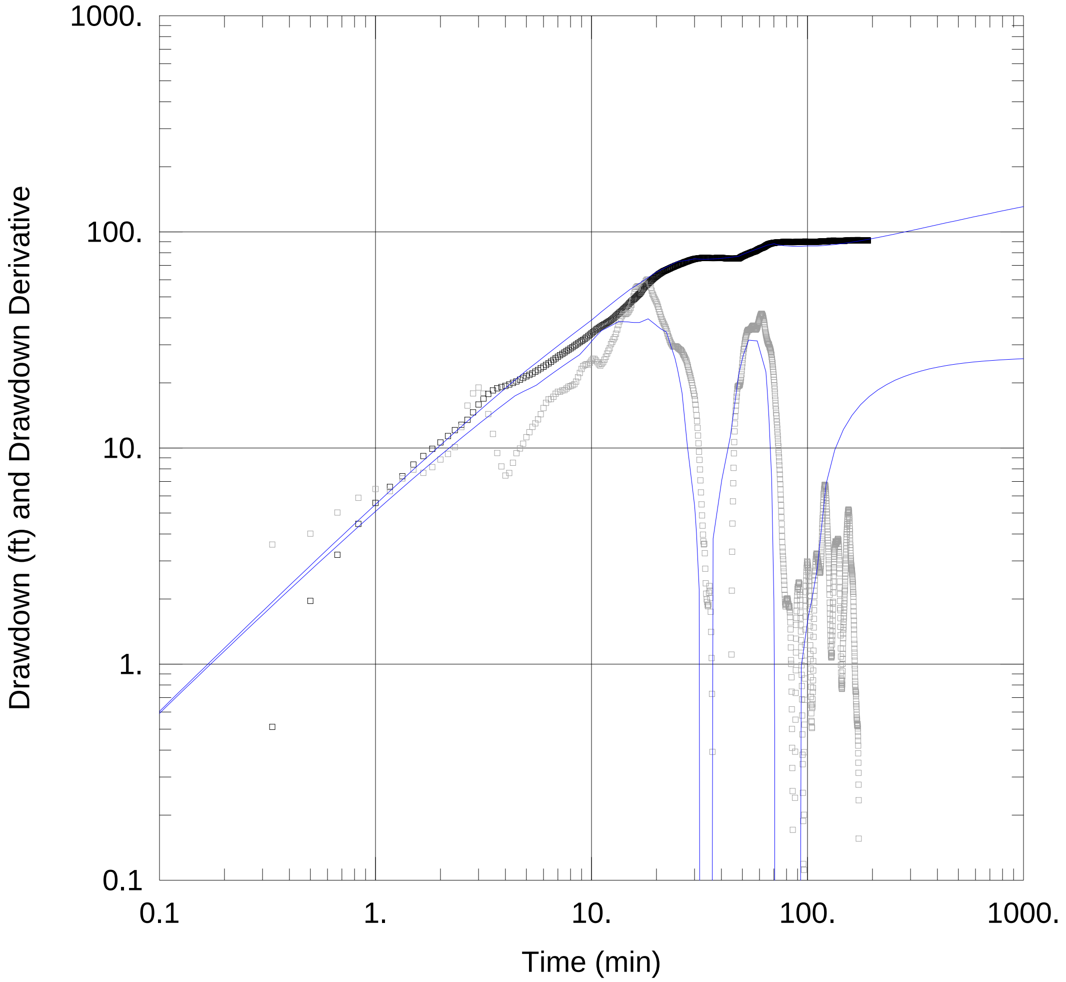


FIGURE 5. DH17-35 SHORT-DURATION PUMPING TEST

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution Copper
Project: 605.7807
Location: Near West
Test Well: DH17-35 (GT-30)
Test Date: 15 May 2017

AQUIFER DATA

Saturated Thickness: 27. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
DH17-35	933752.2	845384.4

Observation Wells

Well Name	X (ft)	Y (ft)
▫ DH17-35	933752.2	845384.4

SOLUTION

Aquifer Model: Confined

Solution Method: Dougherty-Babu

T = 0.25 ft^2/day
Kz/Kr = 1.
r(w) = 0.1571 ft

S = 0.0005
Sw = -2.7
r(c) = 0.0861 ft

MONTGOMERY
& ASSOCIATES

Appendix K.3

AQTESOLV Plots of Slug Tests

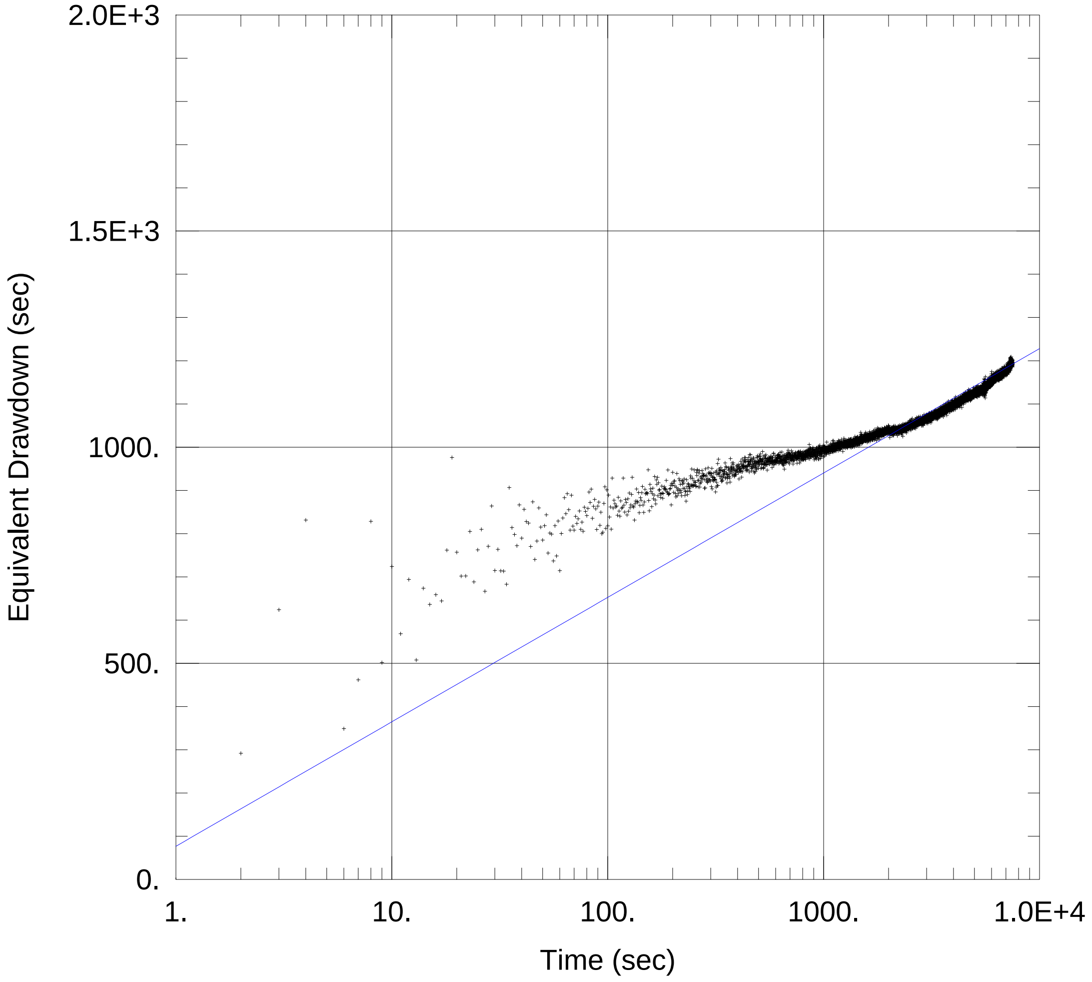


FIGURE 1. DS16-04 SLUG D FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-04
Test Date: Feb. 7, 2017

AQUIFER DATA

Saturated Thickness: 47. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-04)

Initial Displacement: 1.46 ft
Total Well Penetration Depth: 47. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 612.3 ft
Screen Length: 47. ft
Well Radius: 0.4479 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Peres-Onur-Reynolds
T = 4.8 ft^2/day
S = 0.0006

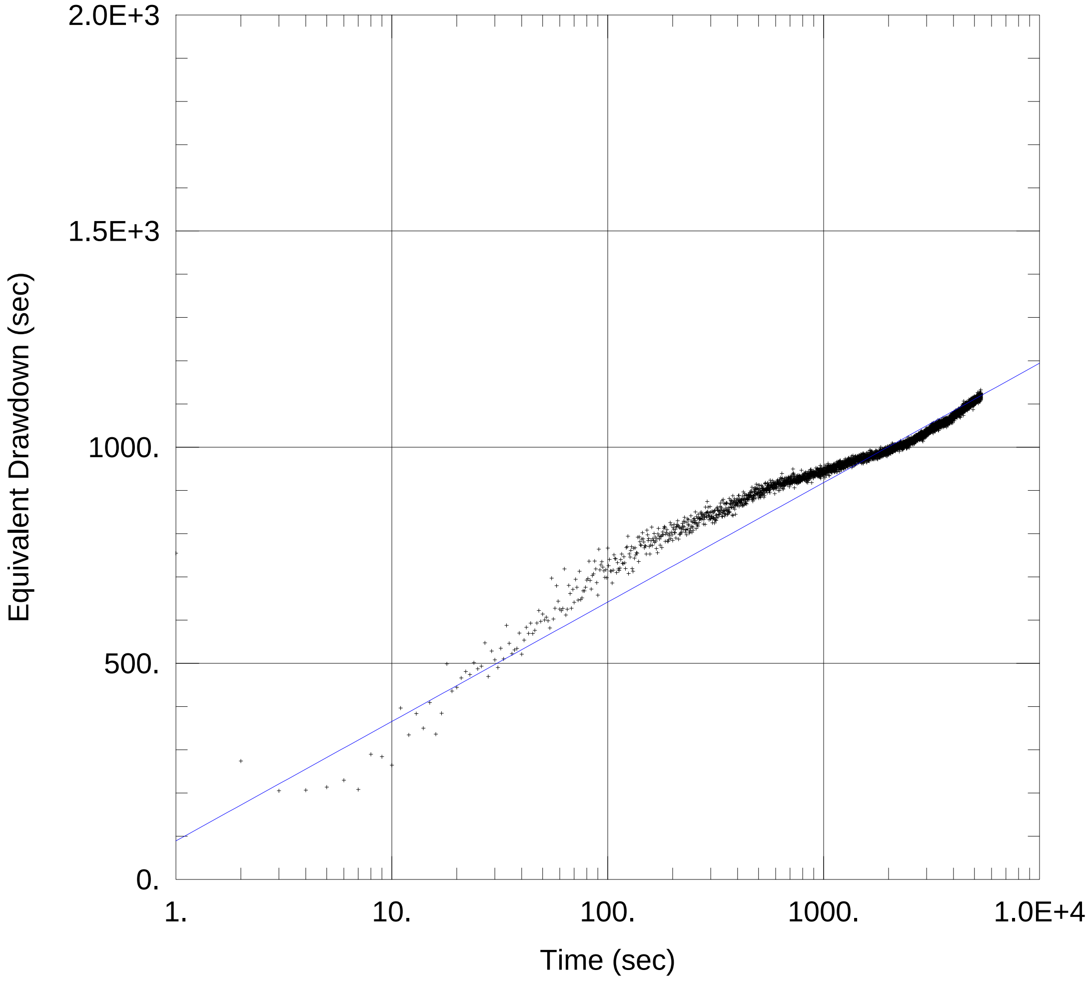


FIGURE 2. DS16-04 SLUG D RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-04
Test Date: Feb. 7, 2017

AQUIFER DATA

Saturated Thickness: 47. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-04)

Initial Displacement: 1.51 ft
Total Well Penetration Depth: 47. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 612.3 ft
Screen Length: 47. ft
Well Radius: 0.4479 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Peres-Onur-Reynolds
T = 5. ft^2/day
S = 0.00055

MONTGOMERY
& ASSOCIATES

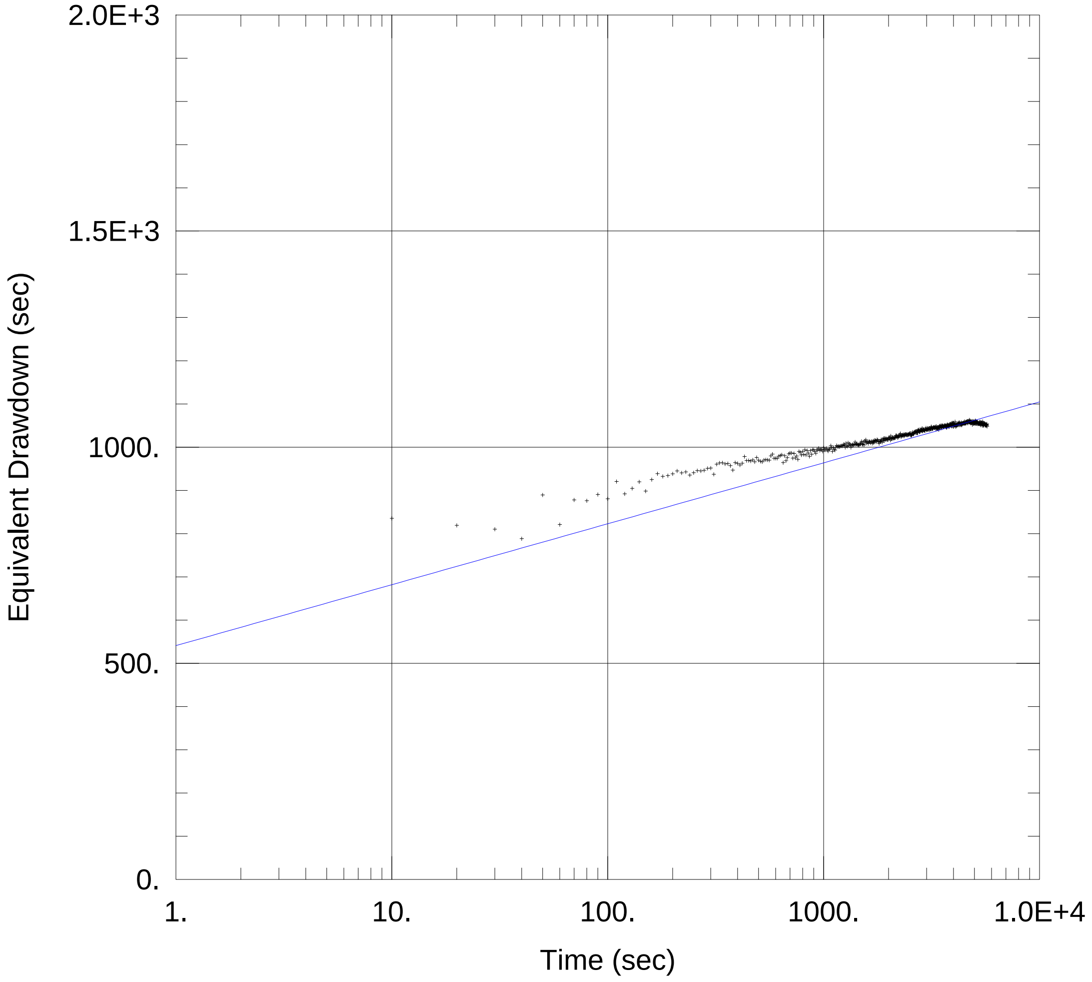


FIGURE 3. DS16-04 SLUG D-C-G FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-04
Test Date: Feb. 7, 2017

AQUIFER DATA

Saturated Thickness: 47. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-04)

Initial Displacement: 3.19 ft
Total Well Penetration Depth: 47. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 612.3 ft
Screen Length: 47. ft
Well Radius: 0.4479 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Peres-Onur-Reynolds

$T = 9.8$ ft^2/day
$S = 3.3E-7$

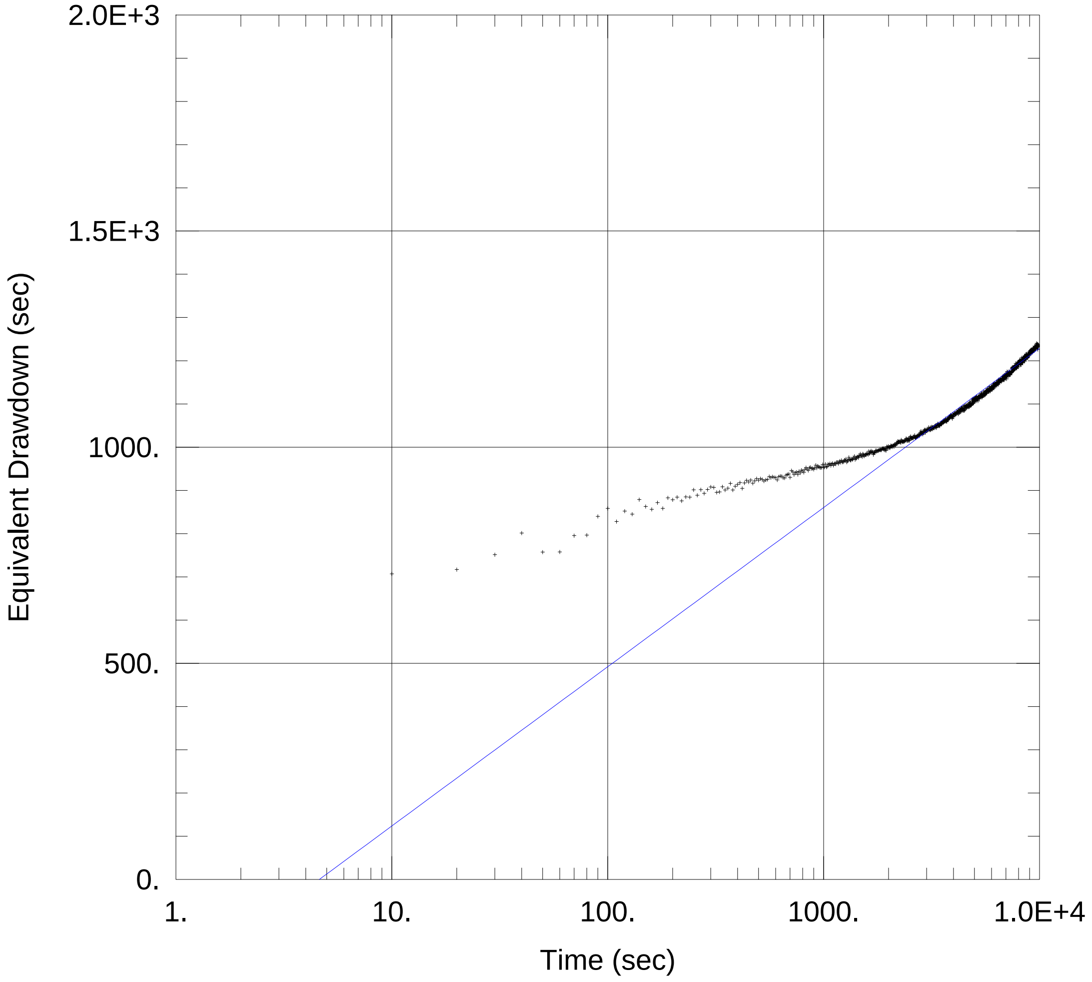


FIGURE 4. DS16-04 SLUG D-C-G RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-04
Test Date: Feb. 8, 2017

AQUIFER DATA

Saturated Thickness: 47. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-04)

Initial Displacement: 3.27 ft
Total Well Penetration Depth: 47. ft
Casing Radius: 0.1667 ft

Static Water Column Height: 612.4 ft
Screen Length: 47. ft
Well Radius: 0.4479 ft

SOLUTION

Aquifer Model: Confined

Solution Method: Peres-Onur-Reynolds

T = 3.75 ft^2/day

S = 0.004

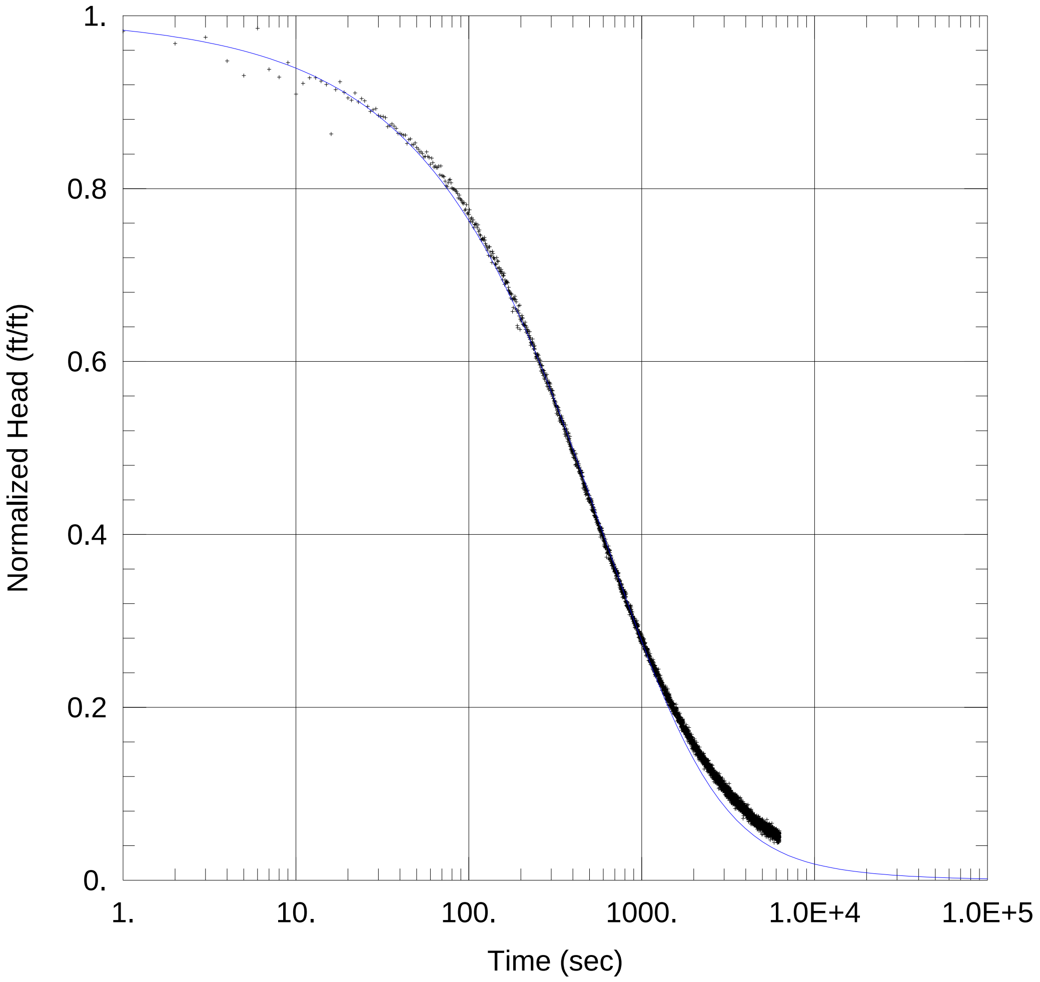


FIGURE 5. DS16-05 (DS-O) SLUG A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 1/31/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 1.54 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.2 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.911 ft^2/day
S = 0.004183

MONTGOMERY
& ASSOCIATES

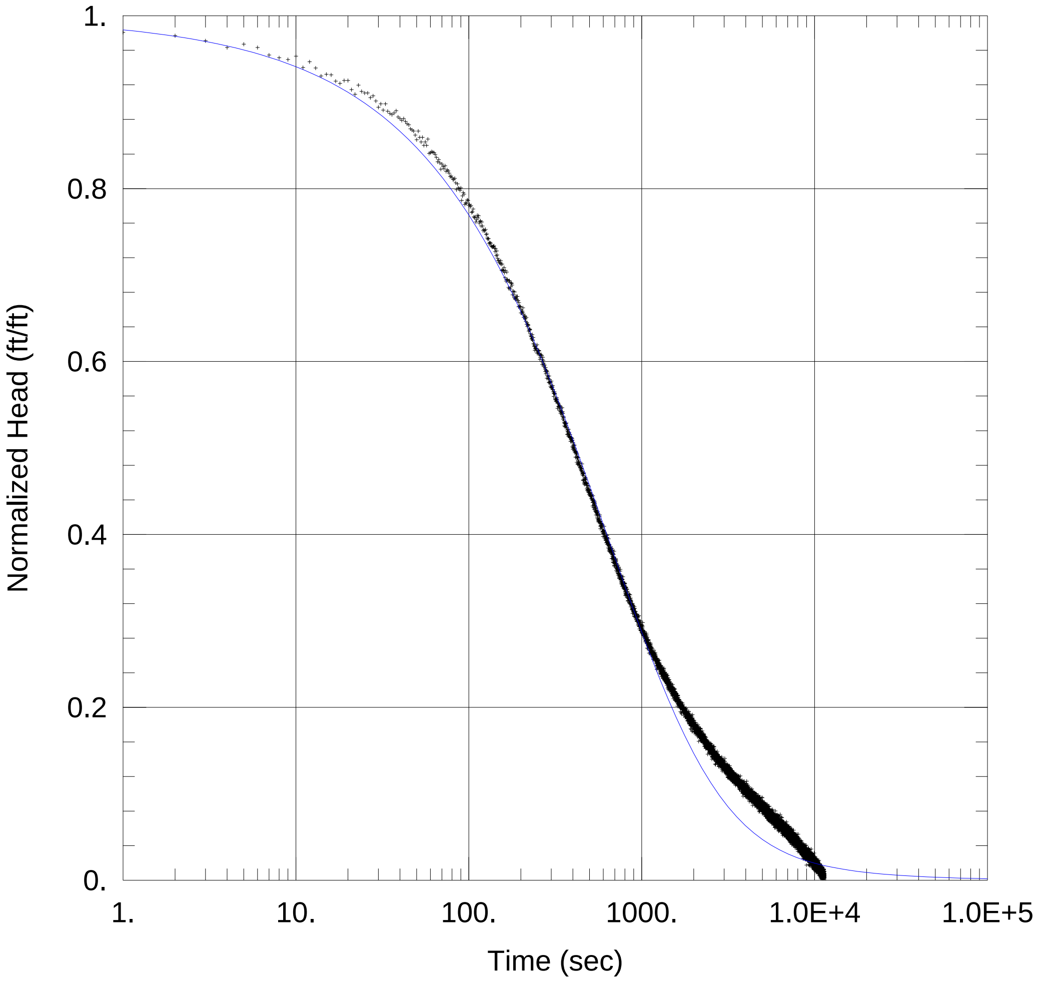


FIGURE 6. DS16-05 (DS-O) SLUG A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 1/31/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 1.52 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.3 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.748 ft^2/day
S = 0.004136

MONTGOMERY
& ASSOCIATES

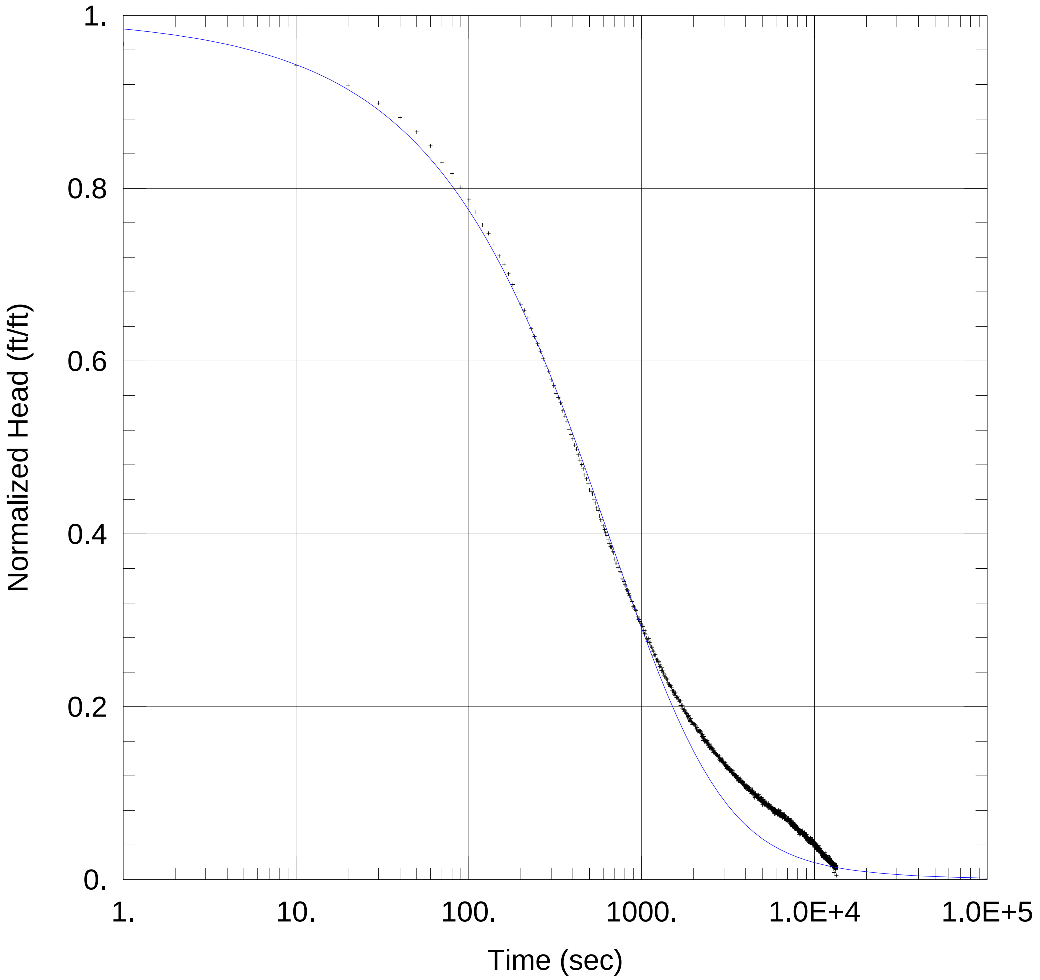


FIGURE 7. DS16-05 (DS-O) SLUG A-B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 2/1/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 2.99 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.4 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.78 ft^2/day
S = 0.0037

MONTGOMERY
& ASSOCIATES

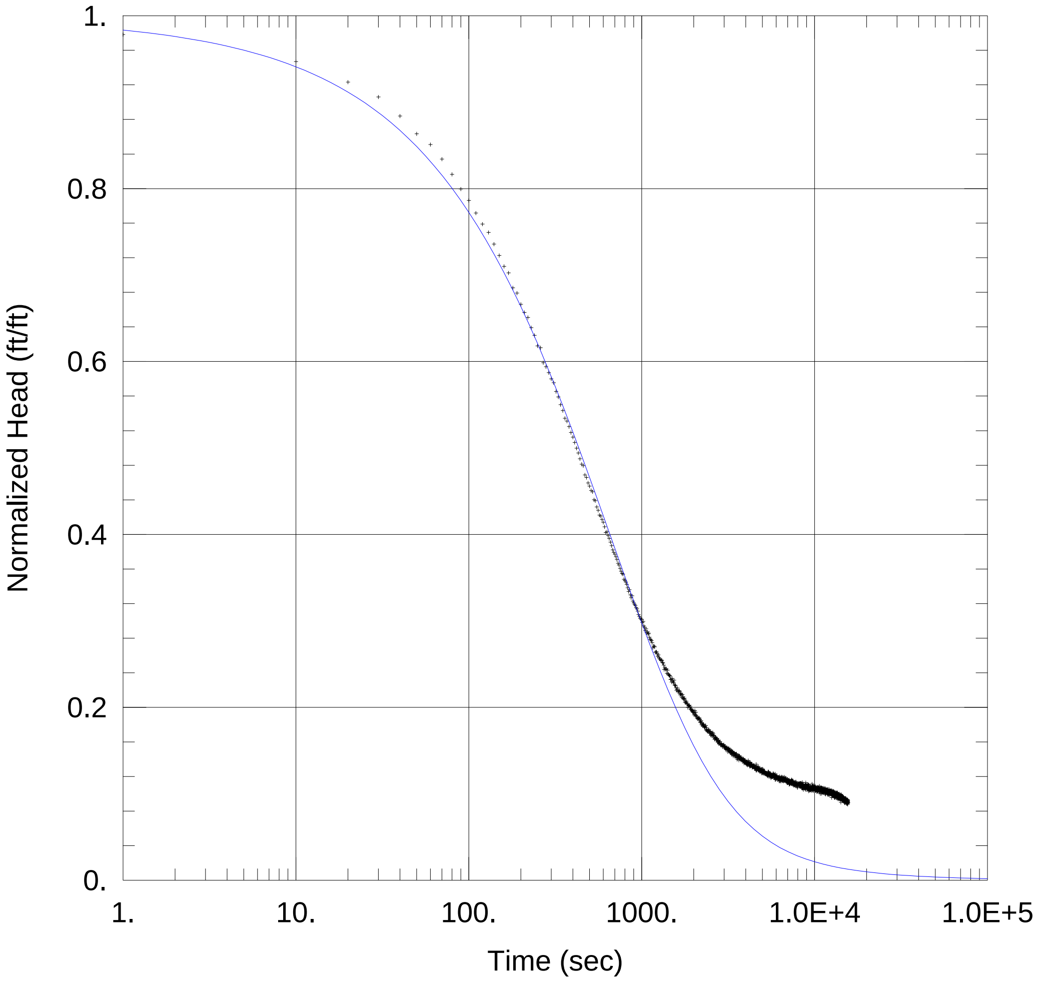


FIGURE 8. DS16-05 (DS-O) SLUG A-B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 2/1/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 3.03 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.4 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.49 ft^2/day
S = 0.004625

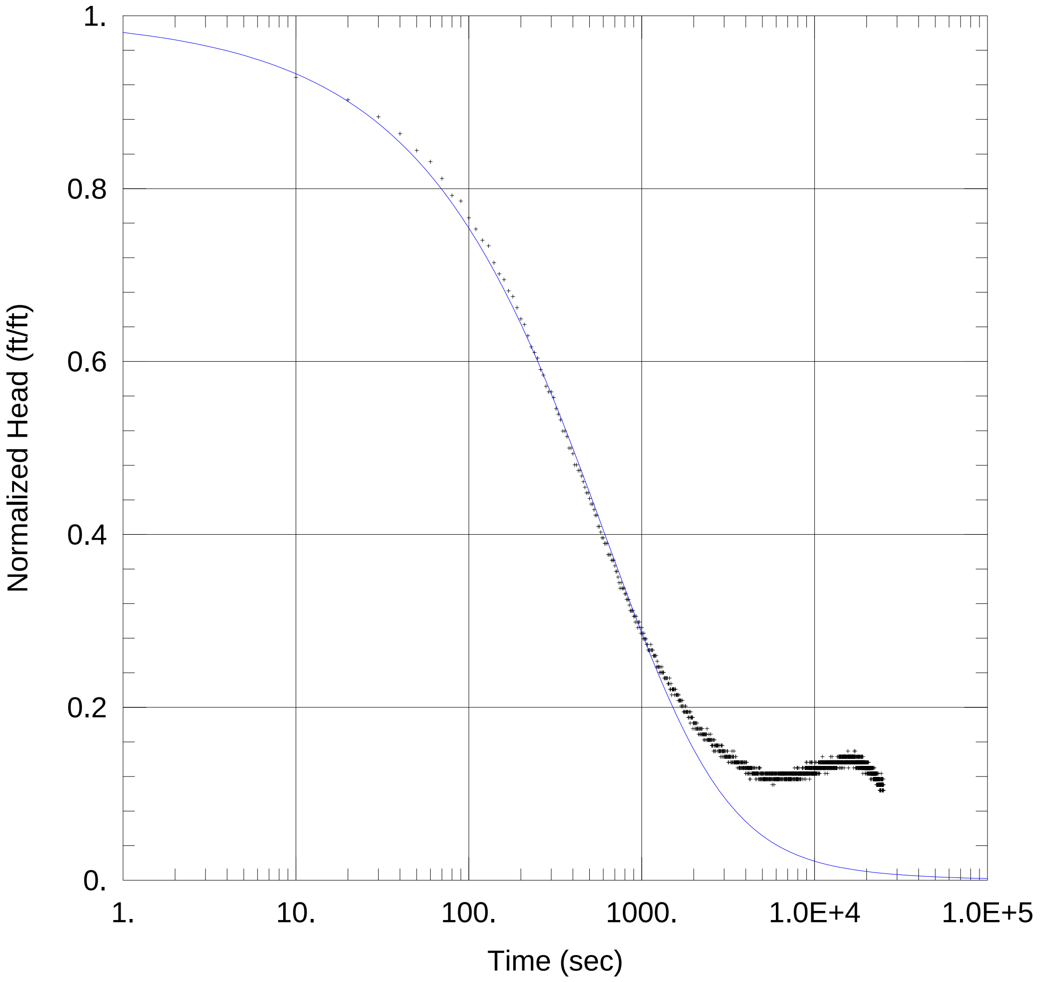


FIGURE 9. DS16-05 (DS-O) SLUG A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 2/1/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 1.54 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.1 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.329 ft^2/day
S = 0.006902

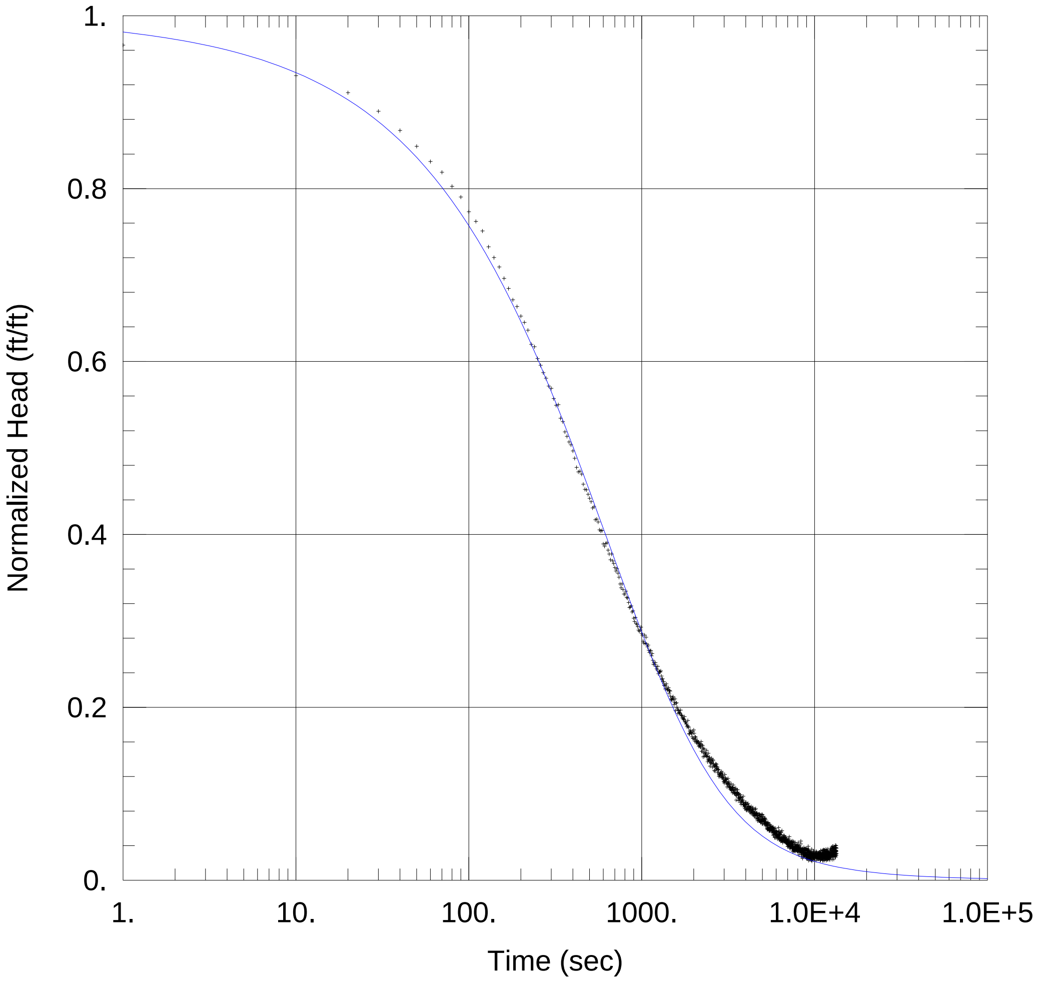


FIGURE 10. DS16-05 (DS-O) SLUG A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-05
Test Date: 2/2/2017

AQUIFER DATA

Saturated Thickness: 135. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-05)

Initial Displacement: 1.53 ft
Total Well Penetration Depth: 135. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 291.3 ft
Screen Length: 135. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.38 ft^2/day
S = 0.0064

MONTGOMERY
& ASSOCIATES

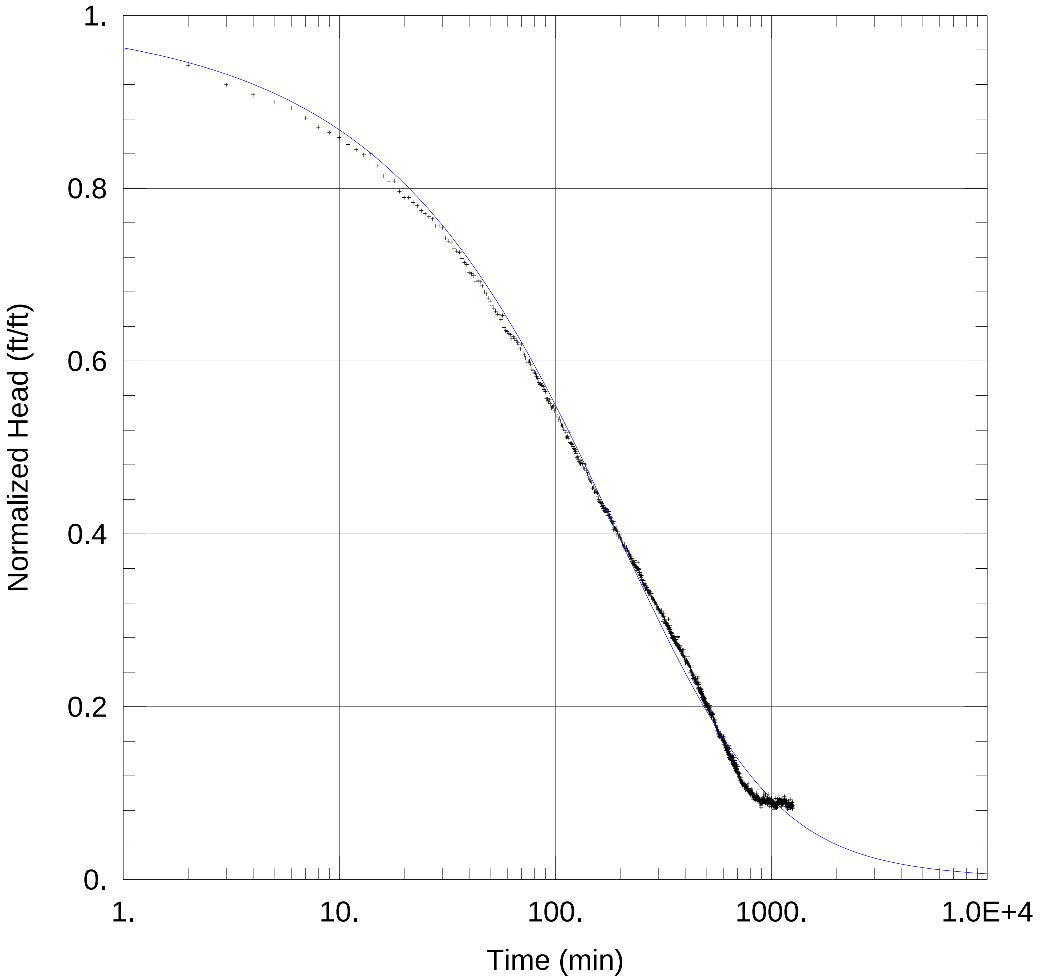


FIGURE 11. DS16-08 (DS-I) SLUG B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/1/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 0.85 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.6 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1656 ft^2/day
S = 0.008288

MONTGOMERY
& ASSOCIATES

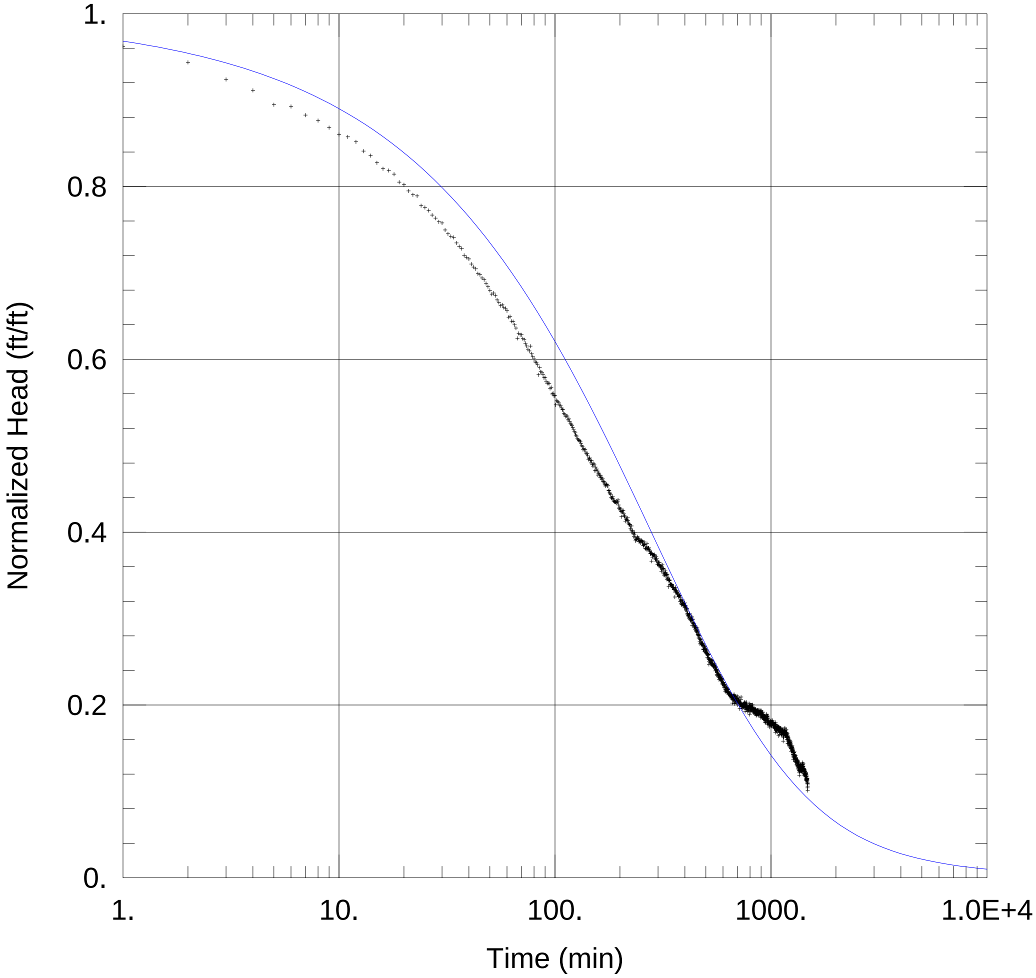


FIGURE 12. DS16-08 (DS-I) SLUG B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/2/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 0.865 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.7 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1123 ft^2/day
S = 0.009

MONTGOMERY
& ASSOCIATES

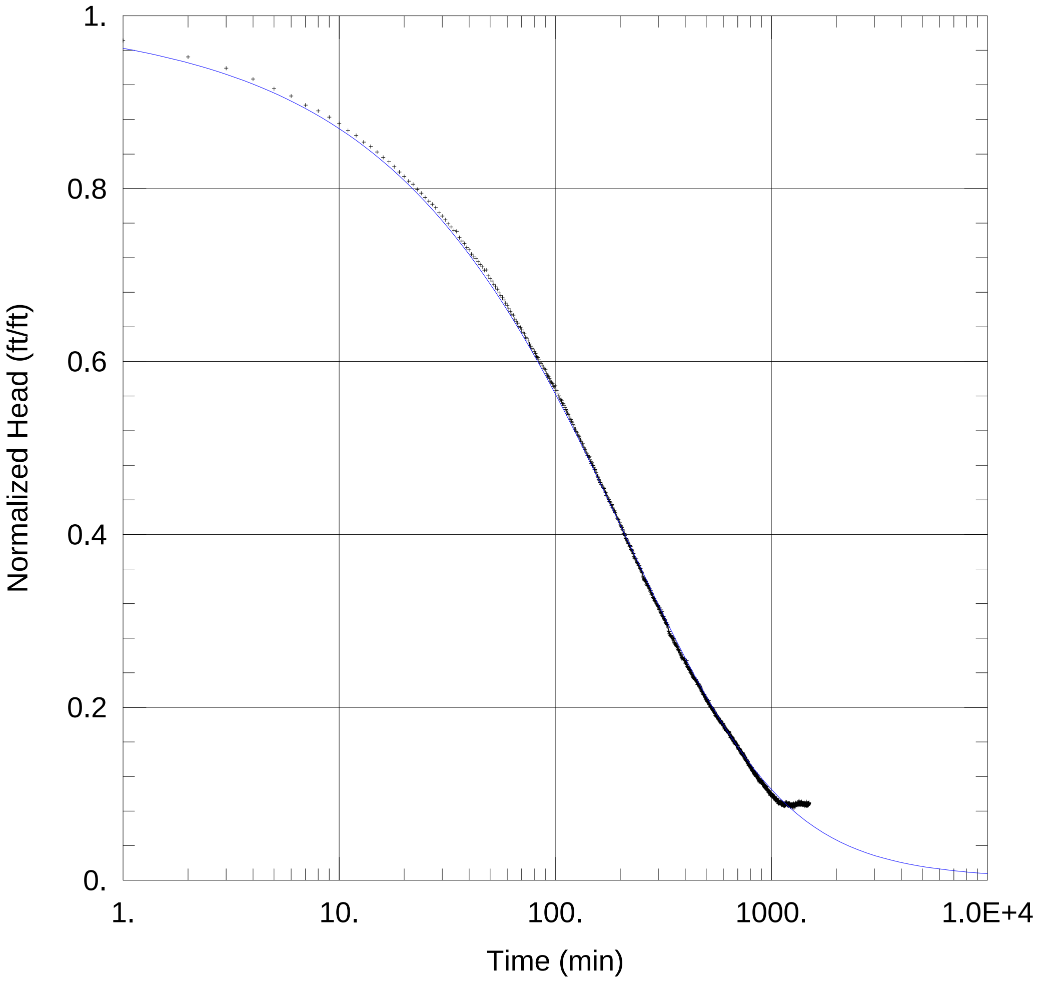


FIGURE 13. DS16-08 (DS-I) SLUG B + C FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/3/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 1.96 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.6 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1457 ft^2/day
S = 0.009785

MONTGOMERY
& ASSOCIATES

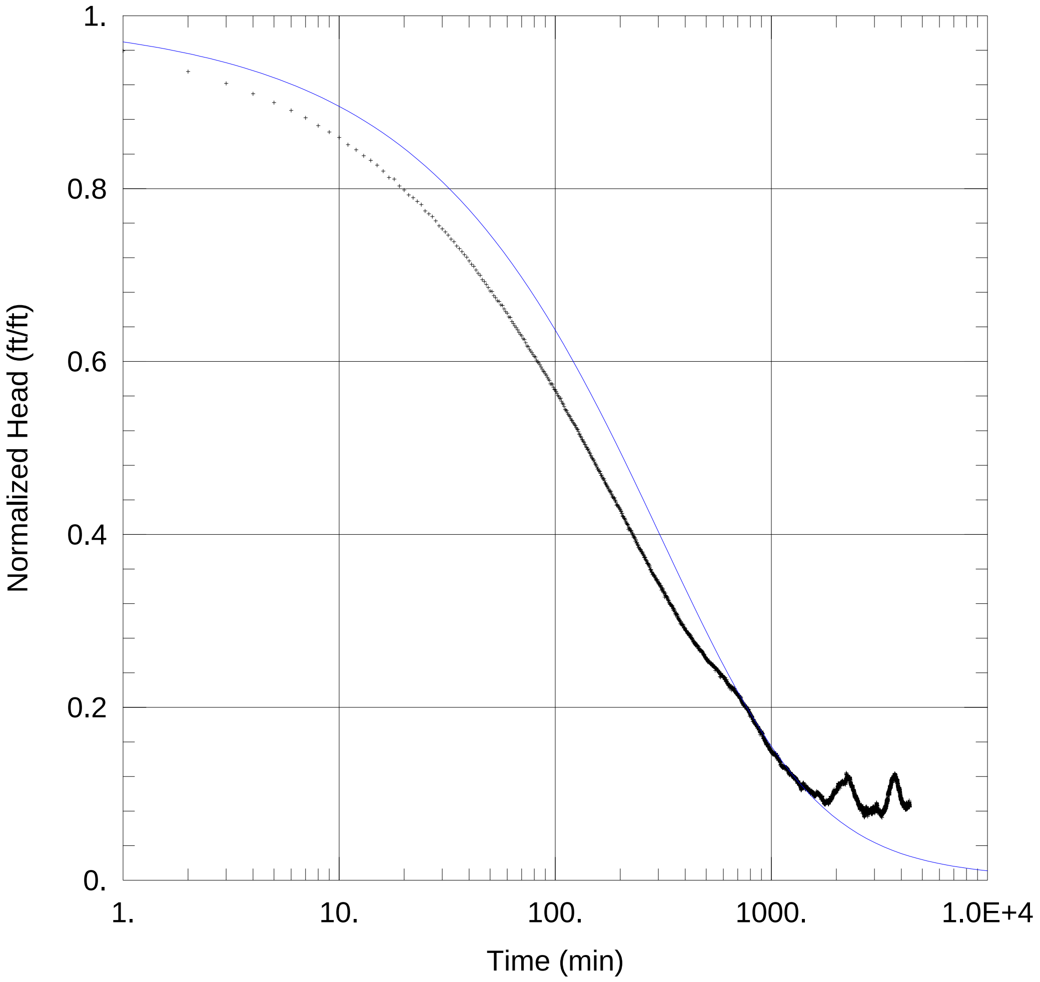


FIGURE 14. DS16-08 (DS-I) SLUG B + C RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/4/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 2.03 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.8 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1032 ft^2/day
S = 0.009

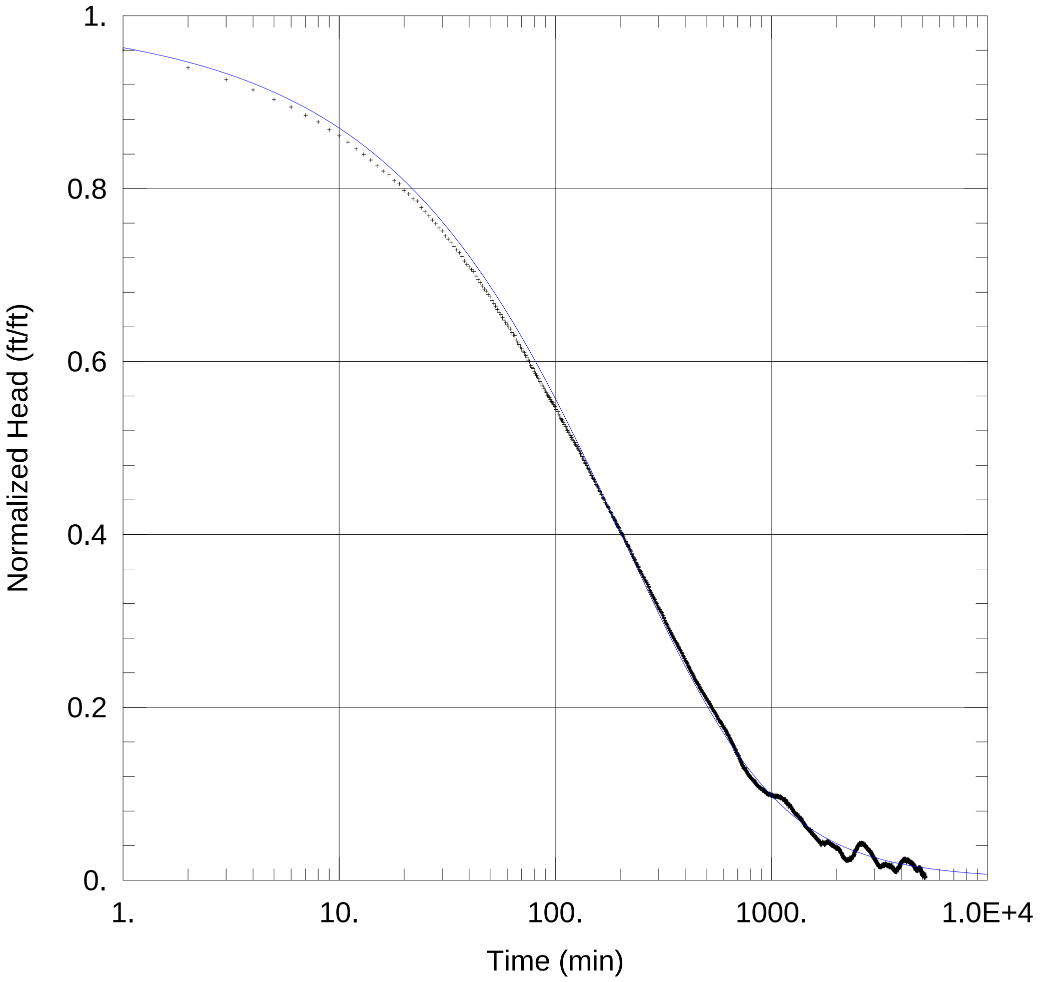


FIGURE 15. DS16-08 (DS-I) SLUG B + C + G FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/8/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 3.32 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.7 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1585 ft^2/day
S = 0.008433

MONTGOMERY
& ASSOCIATES

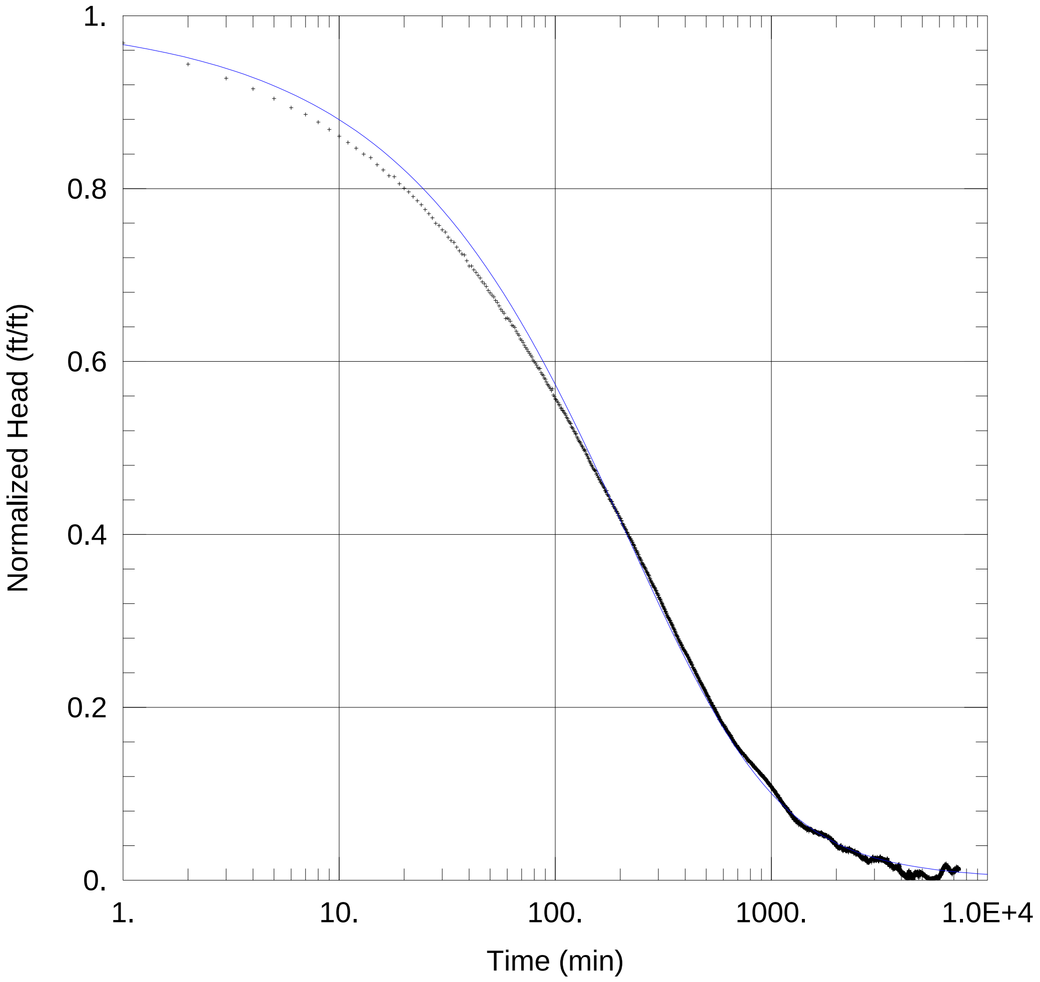


FIGURE 16. DS16-08 (DS-I) SLUG B + C + G RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-08
Test Date: 2/15/2017

AQUIFER DATA

Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-08)

Initial Displacement: 3.31 ft
Total Well Penetration Depth: 82. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 331.7 ft
Screen Length: 82. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1618 ft^2/day
S = 0.006506

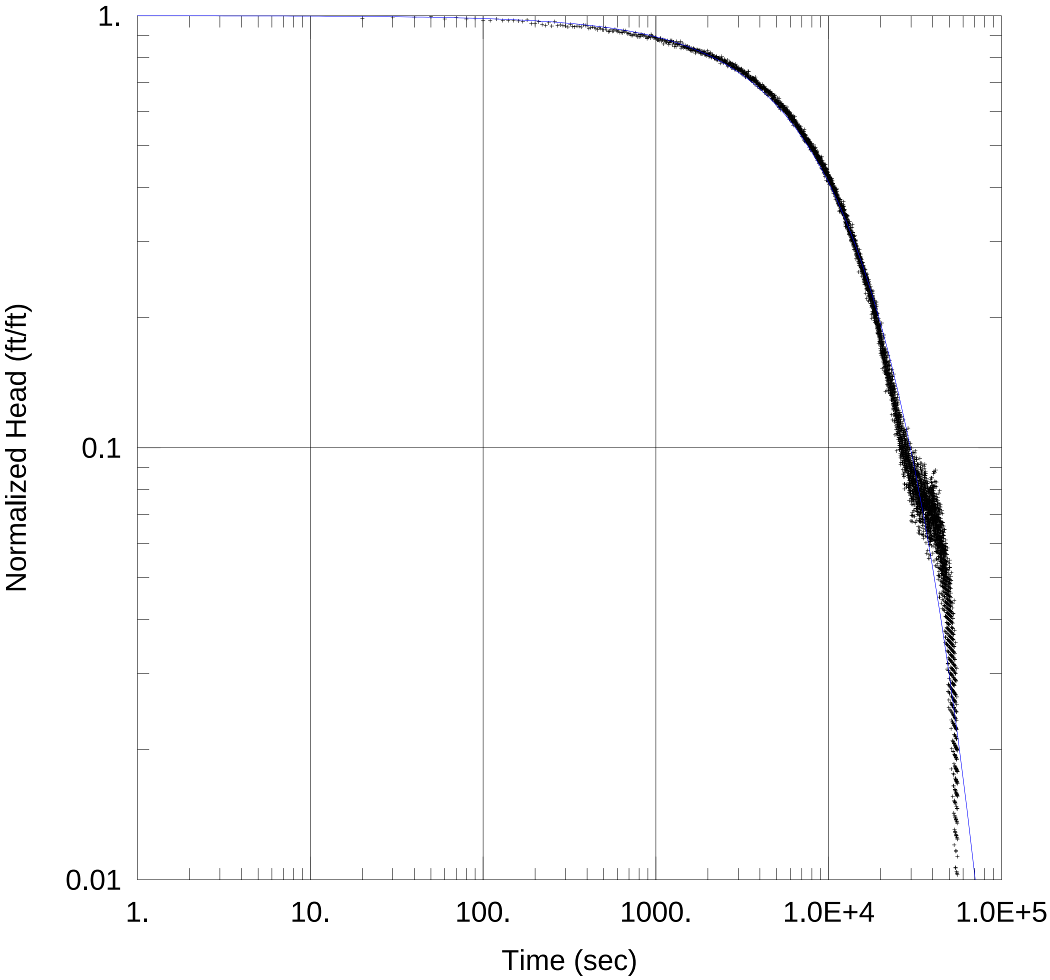


FIGURE 17. DS16-11 (DS-J) SLUG F FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-11
Test Date: 2/1/2017

AQUIFER DATA

Saturated Thickness: 433. ft

WELL DATA (DS16-11)

Initial Displacement: 0.93 ft
Total Well Penetration Depth: 433. ft
Casing Radius: 0.1667 ft

Static Water Column Height: 432.8 ft
Screen Length: 203. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.002932 ft/day
Kz/Kr = 1.

Ss = 2.08E-8 ft^{-1}

MONTGOMERY
& ASSOCIATES

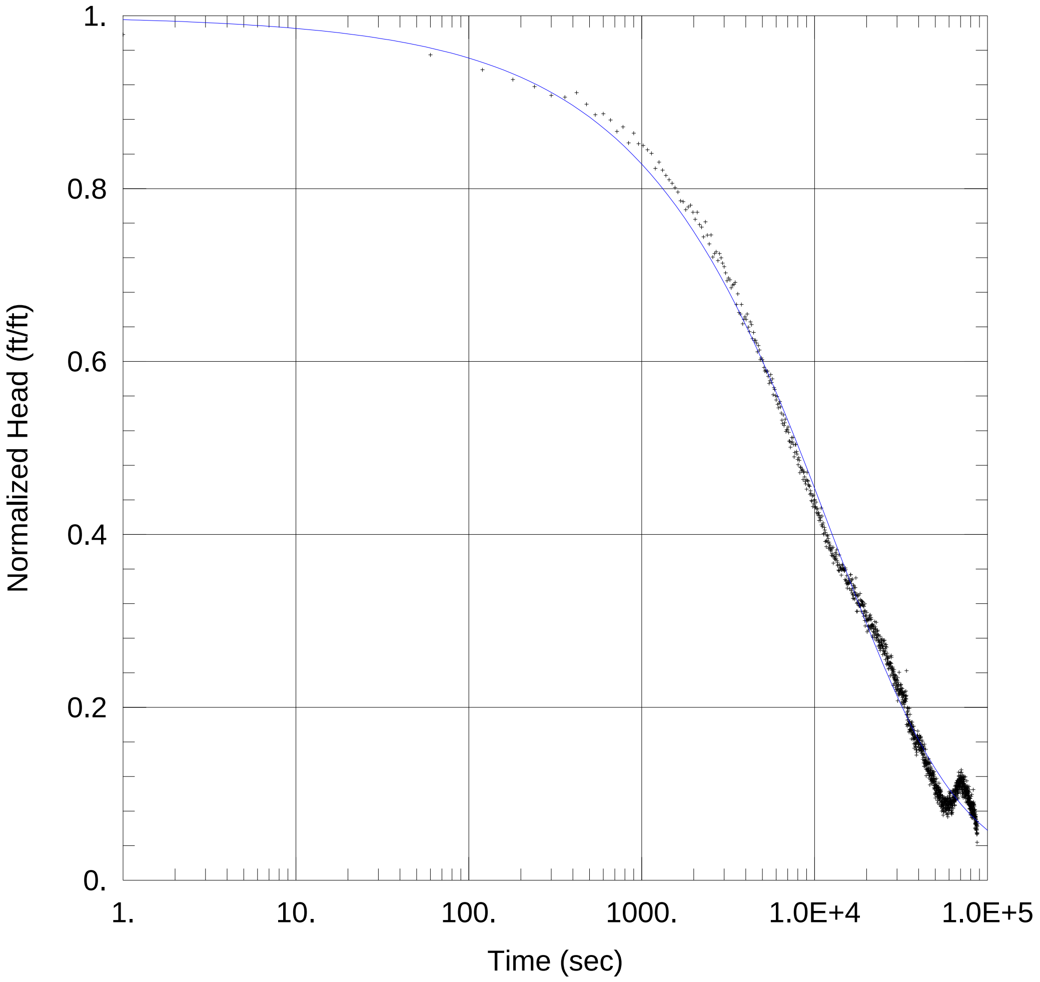


FIGURE 18. DS16-11 (DS-J) SLUG F RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-11
Test Date: 2/2/2017

AQUIFER DATA

Saturated Thickness: 203. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-11)

Initial Displacement: 0.98 ft
Total Well Penetration Depth: 203. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 432.7 ft
Screen Length: 203. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1458 ft^2/day
S = 0.009555

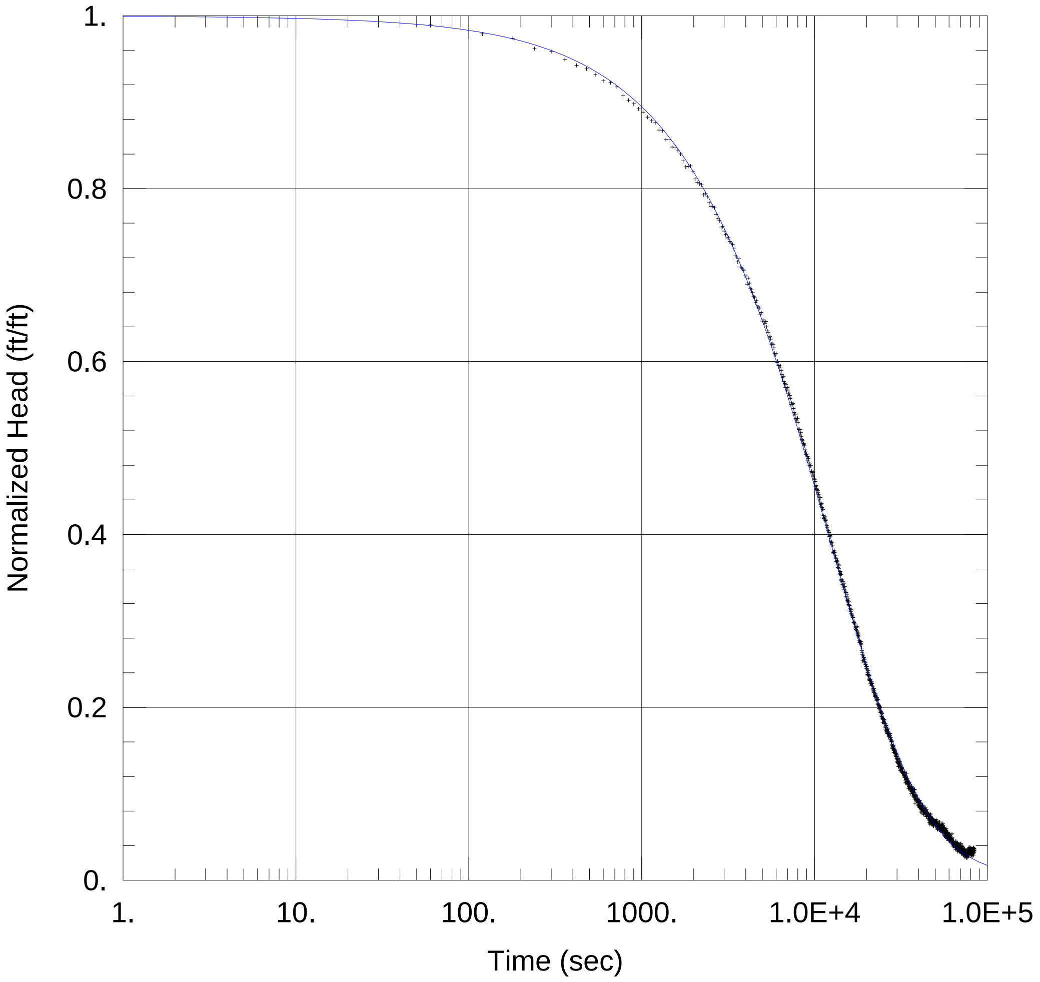


FIGURE 19. DS16-11 (DS-J) SLUG F-B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-11
Test Date: 2/3/2017

AQUIFER DATA

Saturated Thickness: 433. ft

WELL DATA (DS16-11)

Initial Displacement: 2.4 ft	Static Water Column Height: 432.7 ft
Total Well Penetration Depth: 433. ft	Screen Length: 203. ft
Casing Radius: 0.1667 ft	Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined	Solution Method: KGS Model
Kr = 0.002045 ft/day	Ss = 2.336E-7 ft^{-1}
Kz/Kr = 1.	

MONTGOMERY
& ASSOCIATES

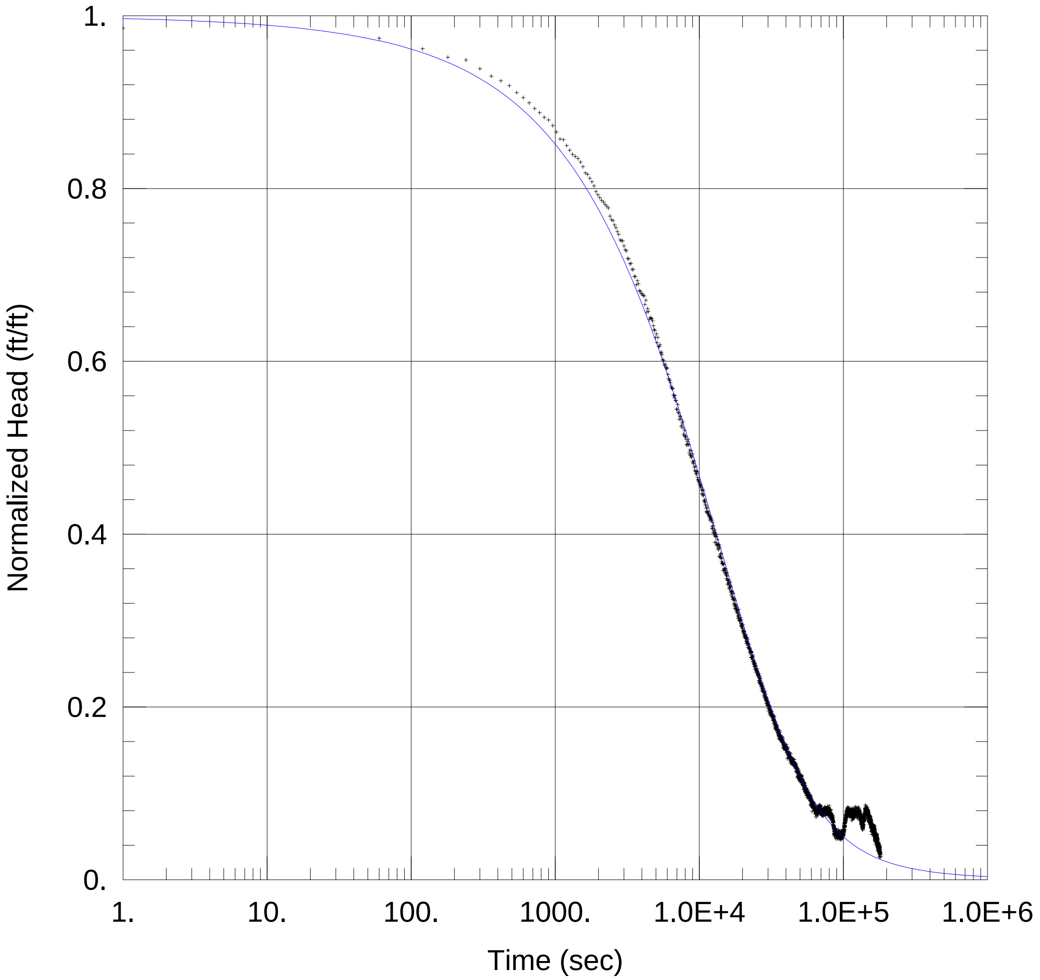


FIGURE 20. DS16-11 (DS-J) SLUG F-B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7803
Location: Superior, AZ
Test Well: DS16-11
Test Date: 2/4/2017

AQUIFER DATA

Saturated Thickness: 203. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-11)

Initial Displacement: 2.46 ft
Total Well Penetration Depth: 203. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 432.8 ft
Screen Length: 203. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1796 ft^2/day
S = 0.004104

MONTGOMERY
& ASSOCIATES

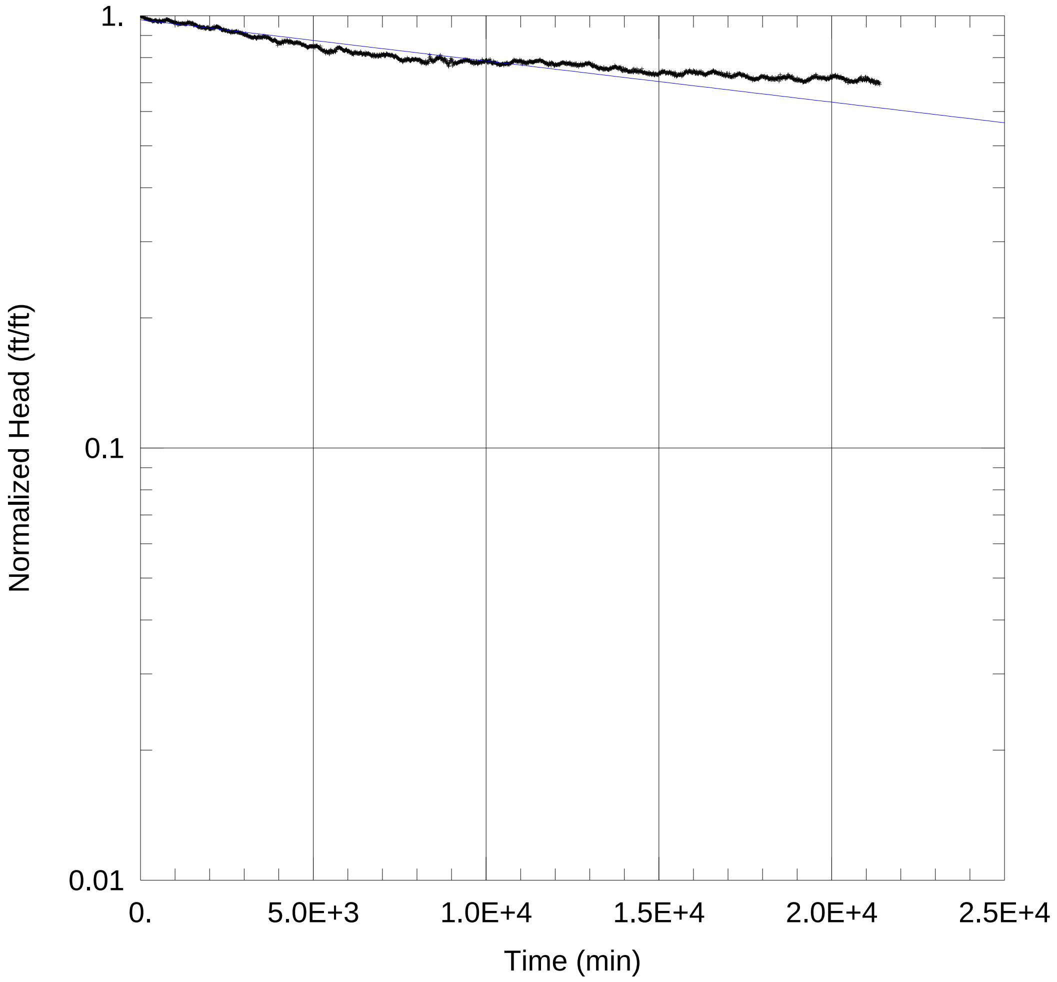


FIGURE 21. DS16-12 (DS-A) SLUG C FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS16-12
Test Date: 5/2/2017

AQUIFER DATA

Saturated Thickness: 90. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-12)

Initial Displacement: 1.07 ft
Total Well Penetration Depth: 90. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 203.3 ft
Screen Length: 90. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 2.584E-5 ft/day
y0 = 1.047 ft

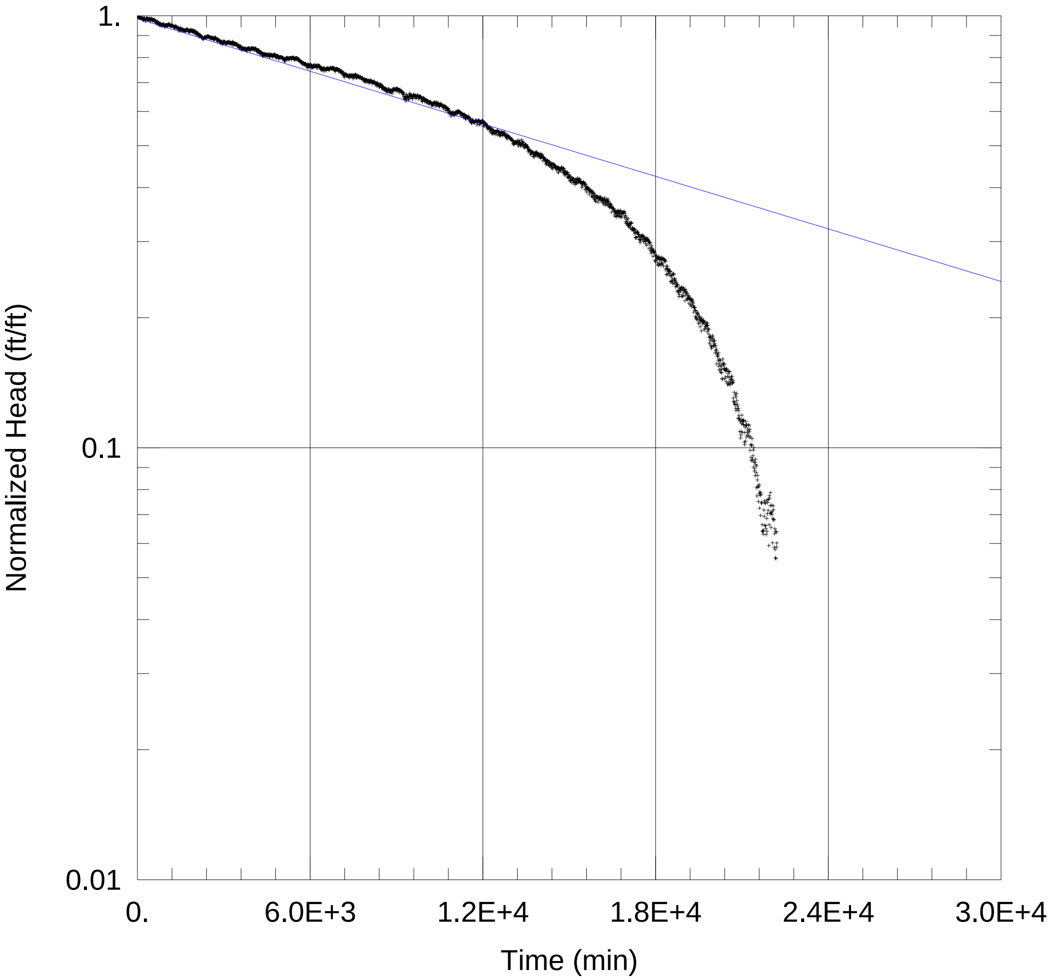


FIGURE 22. DS16-12 (DS-A) SLUG C RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS16-12 (DS-A)
Test Date: 5/24/2017

AQUIFER DATA

Saturated Thickness: 90. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS16-12)

Initial Displacement: 1.21 ft
Total Well Penetration Depth: 90. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 213.7 ft
Screen Length: 90. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 5.497E-5 ft/day
y0 = 1.191 ft

MONTGOMERY
& ASSOCIATES

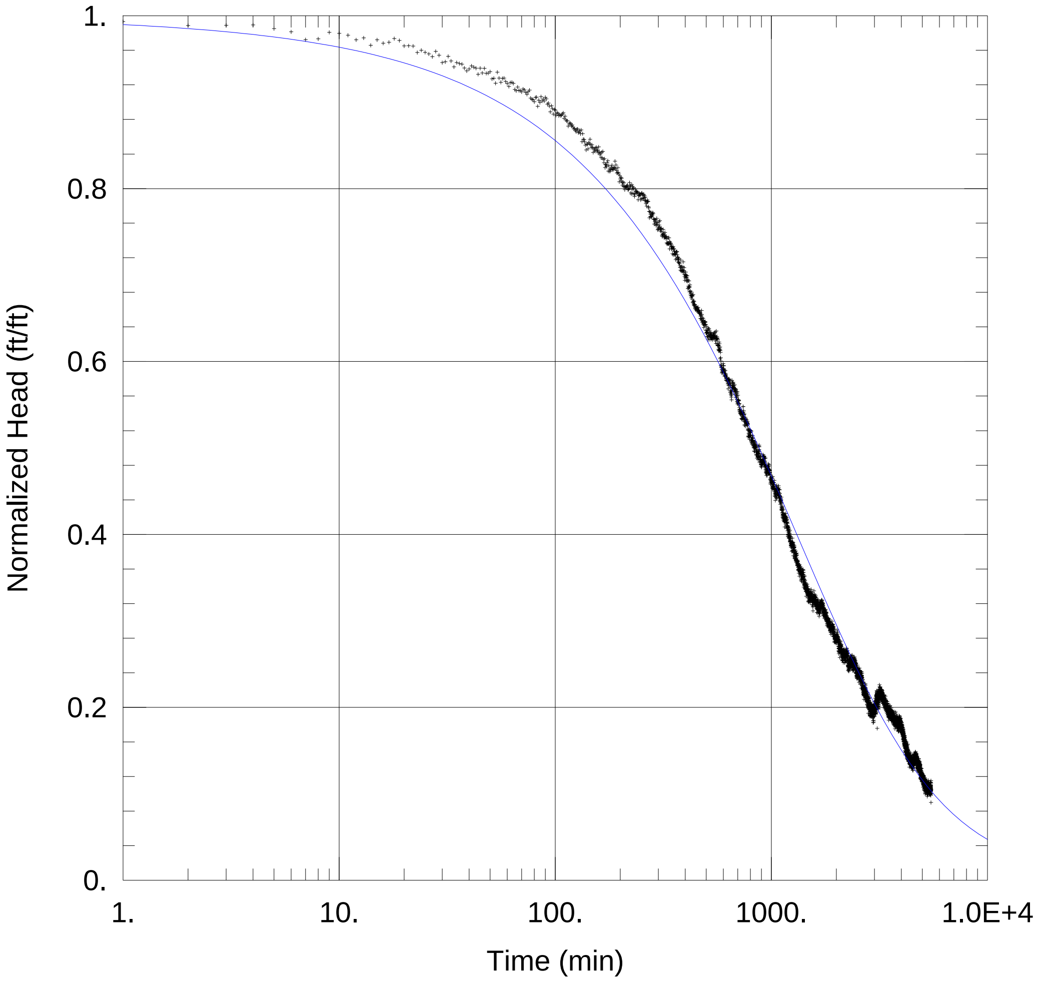


FIGURE 23. DS17-15 (DS-D) SLUG D FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-15
Test Date: 4/26/2017

AQUIFER DATA

Saturated Thickness: 178. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-15)

Initial Displacement: 1.48 ft
Total Well Penetration Depth: 178. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 386.1 ft
Screen Length: 178. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.03186 ft^2/day
S = 0.003257

MONTGOMERY
& ASSOCIATES

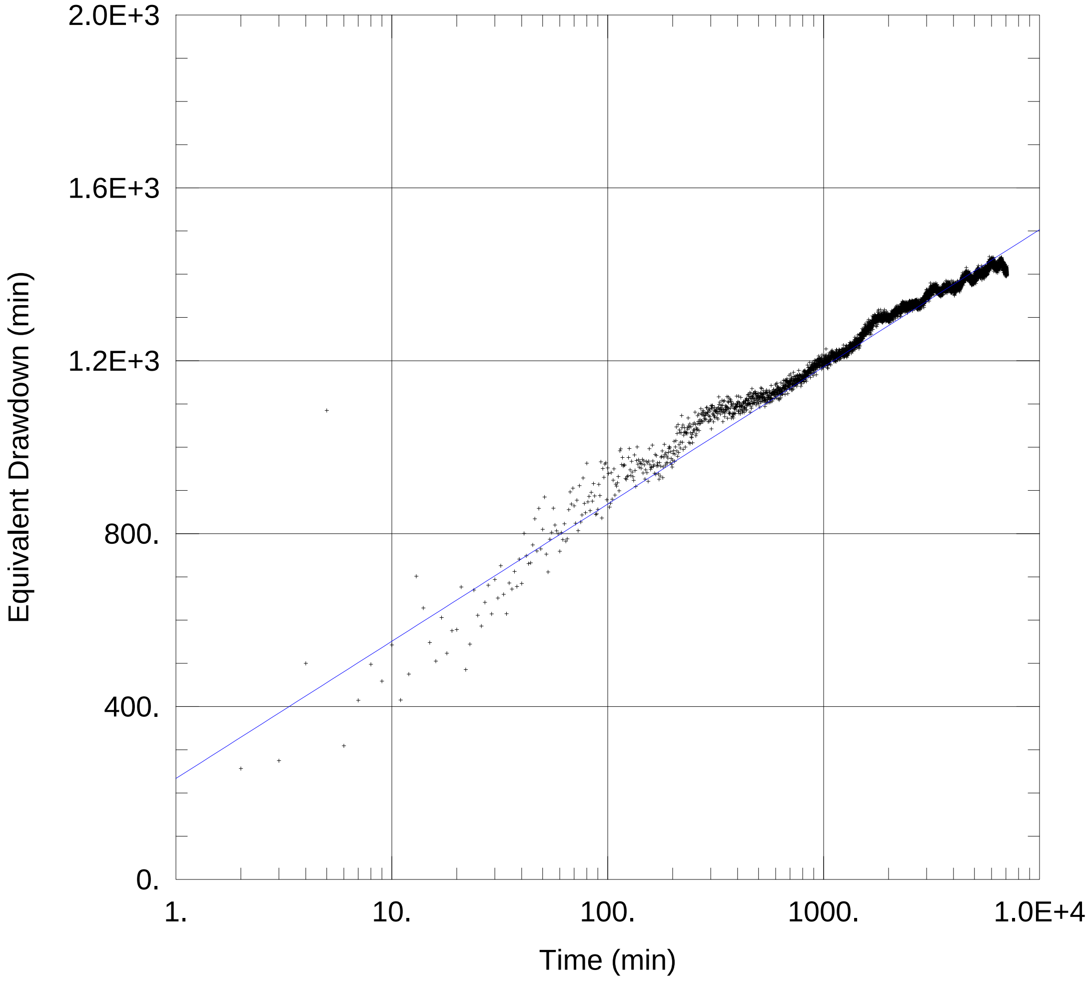


FIGURE 24. DS17-15 (DS-D) SLUG D RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-15
Test Date: 4/30/2017

AQUIFER DATA

Saturated Thickness: 178. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-15)

Initial Displacement: 1.48 ft
Total Well Penetration Depth: 178. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 386.3 ft
Screen Length: 178. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Peres-Onur-Reynolds
T = 0.07256 ft^2/day
S = 0.0001938

MONTGOMERY
& ASSOCIATES

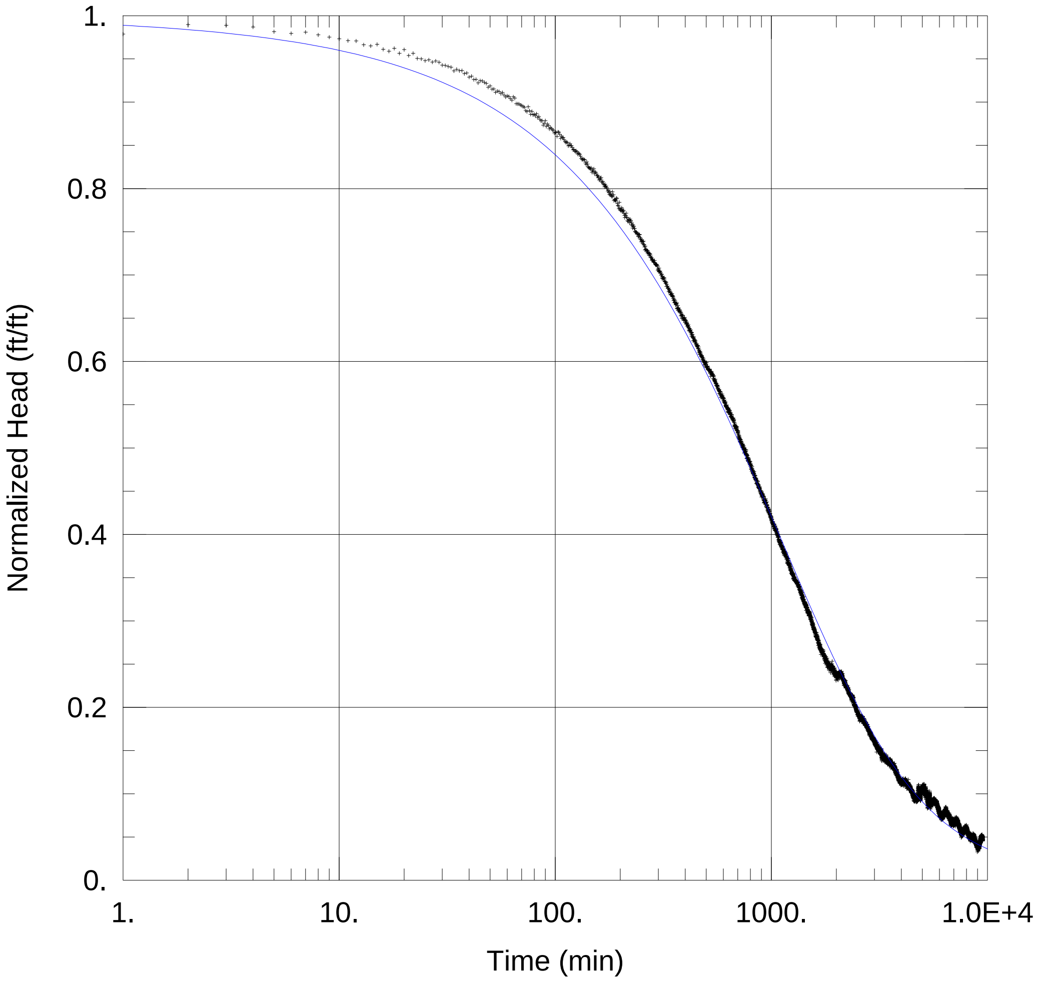


FIGURE 25. DS17-15 (DS-D) SLUG D + F + G FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-15
Test Date: 5/5/2017

AQUIFER DATA

Saturated Thickness: 178. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-15)

Initial Displacement: 3.1 ft
Total Well Penetration Depth: 178. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 386.3 ft
Screen Length: 178. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.03909 ft^2/day
S = 0.003057

MONTGOMERY
& ASSOCIATES

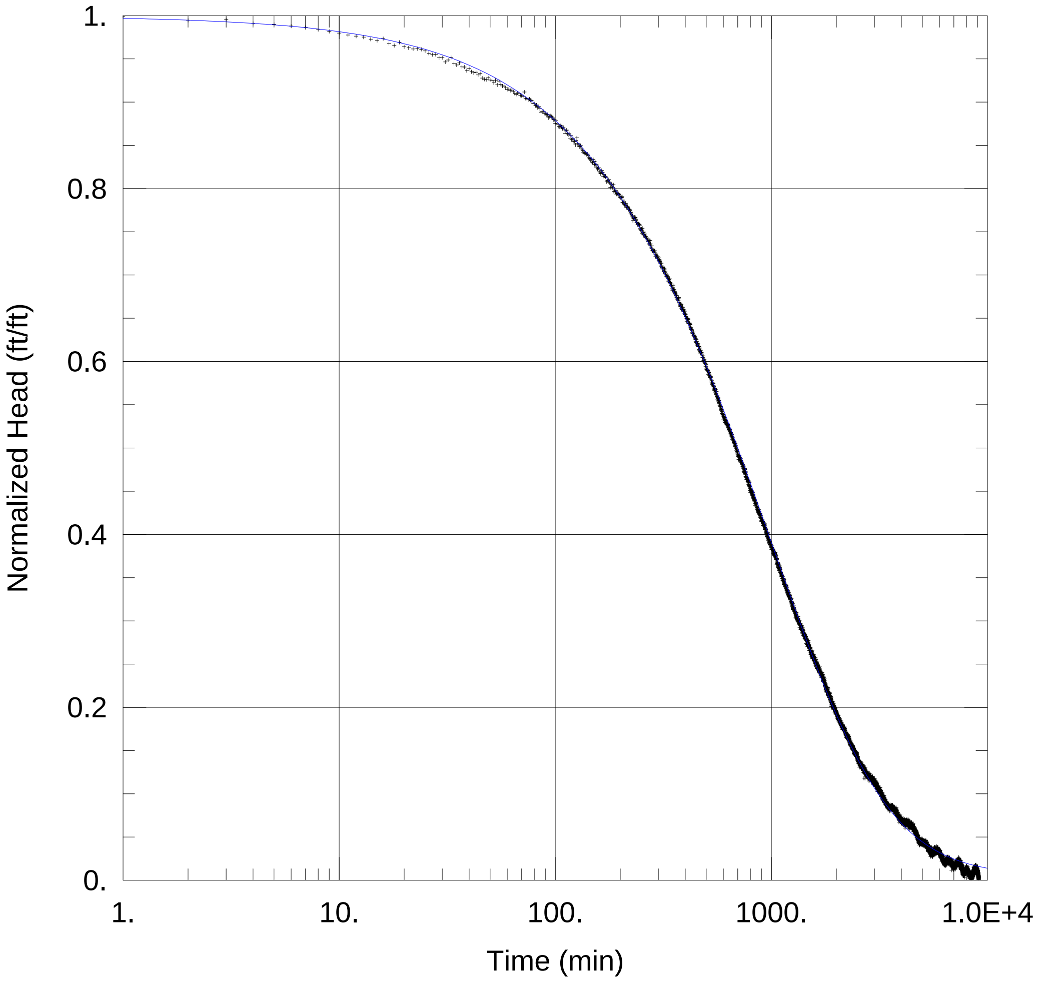


FIGURE 26. DS17-15 (DS-D) SLUG D + F + G RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-15
Test Date: 5/17/2017

AQUIFER DATA

Saturated Thickness: 178. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-15)

Initial Displacement: 3.08 ft
Total Well Penetration Depth: 178. ft
Casing Radius: 0.1667 ft
Static Water Column Height: 386.4 ft
Screen Length: 178. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.09702 ft^2/day
S = 1.909E-5

MONTGOMERY
& ASSOCIATES

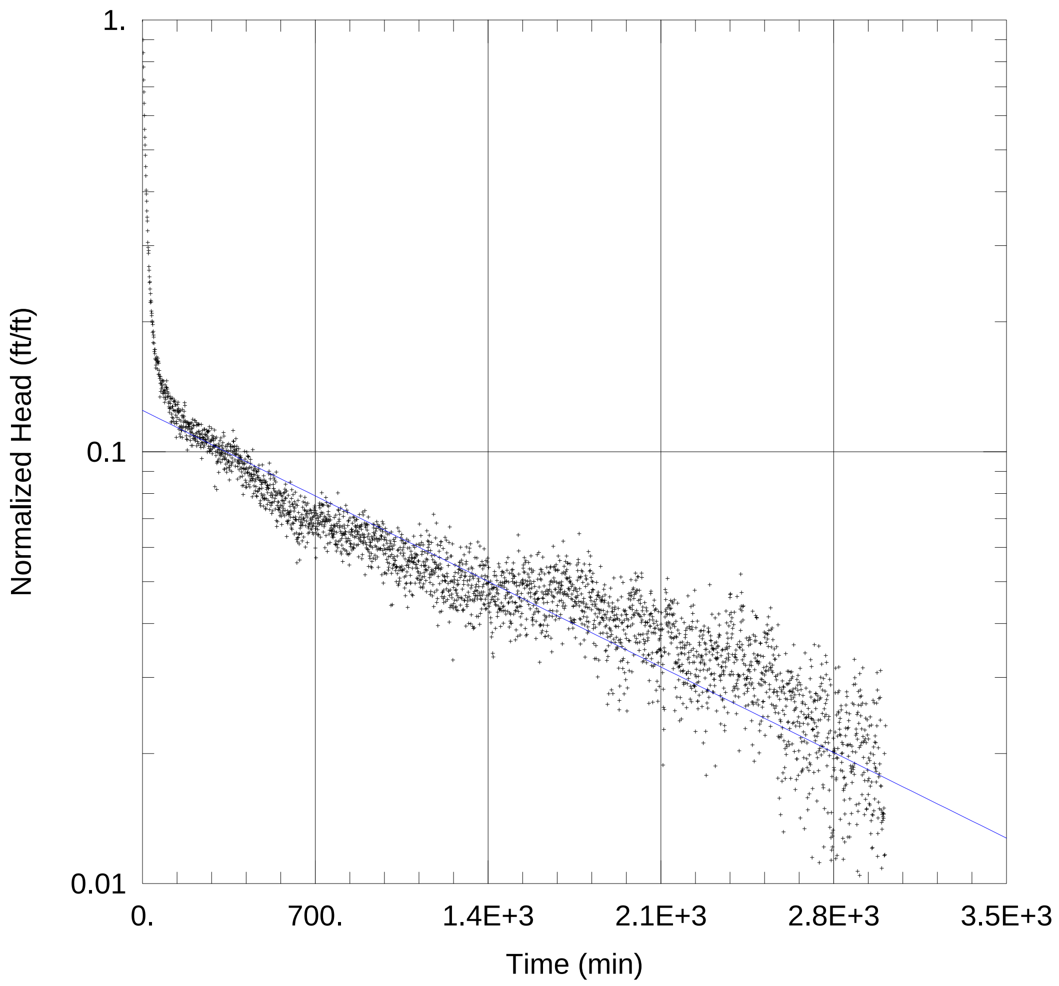


FIGURE 27. DS17-16 (DS-E) SLUG B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-16
Test Date: 4/25/2017

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-16)

Initial Displacement: 0.983 ft
Static Water Column Height: 104.1 ft
Total Well Penetration Depth: 104.1 ft
Screen Length: 73. ft
Casing Radius: 0.1667 ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0007504 ft/day
y0 = 0.1225 ft

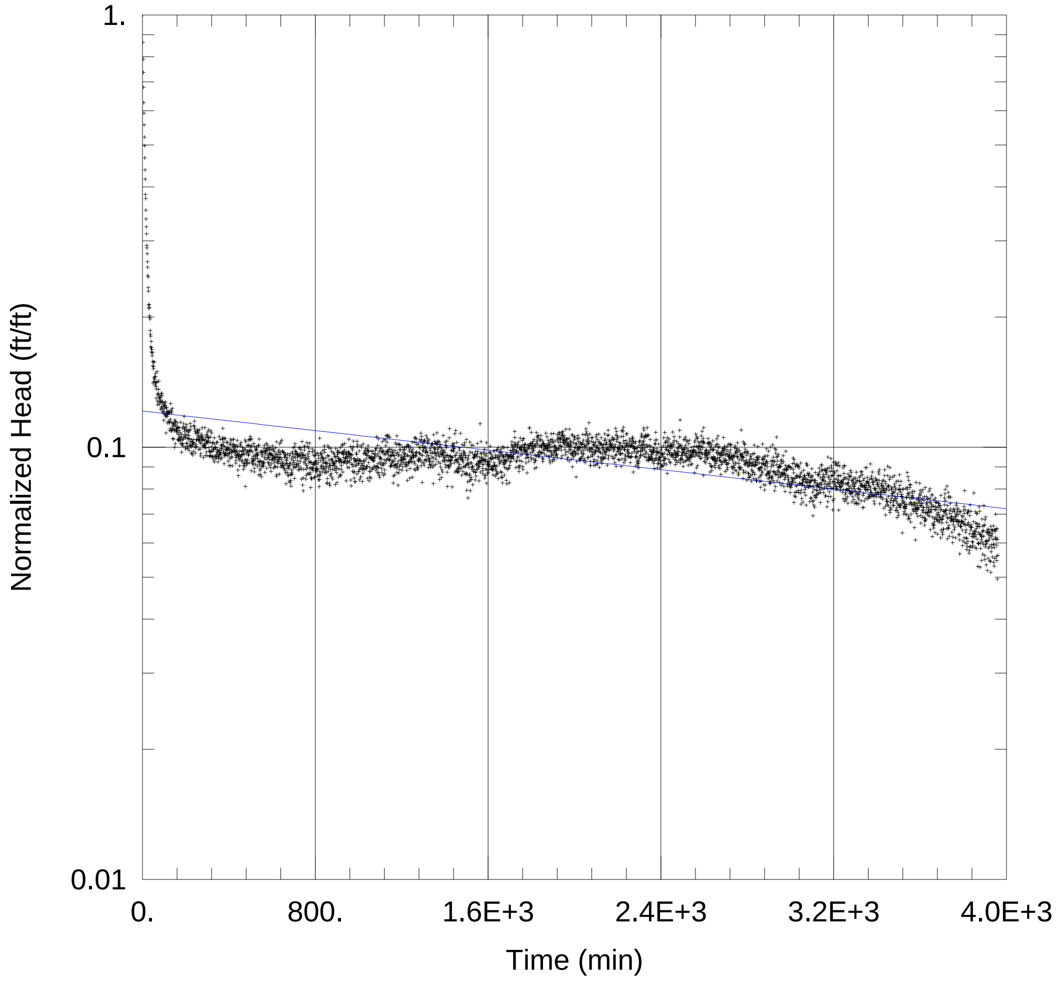


FIGURE 28. DS17-16 (DS-E) SLUG B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-16
Test Date: 4/27/2017

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-16)

Initial Displacement: 1.1 ft
Total Well Penetration Depth: 104.1 ft
Casing Radius: 0.1667 ft
Static Water Column Height: 104.1 ft
Screen Length: 73. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001497 ft/day
y0 = 0.1333 ft

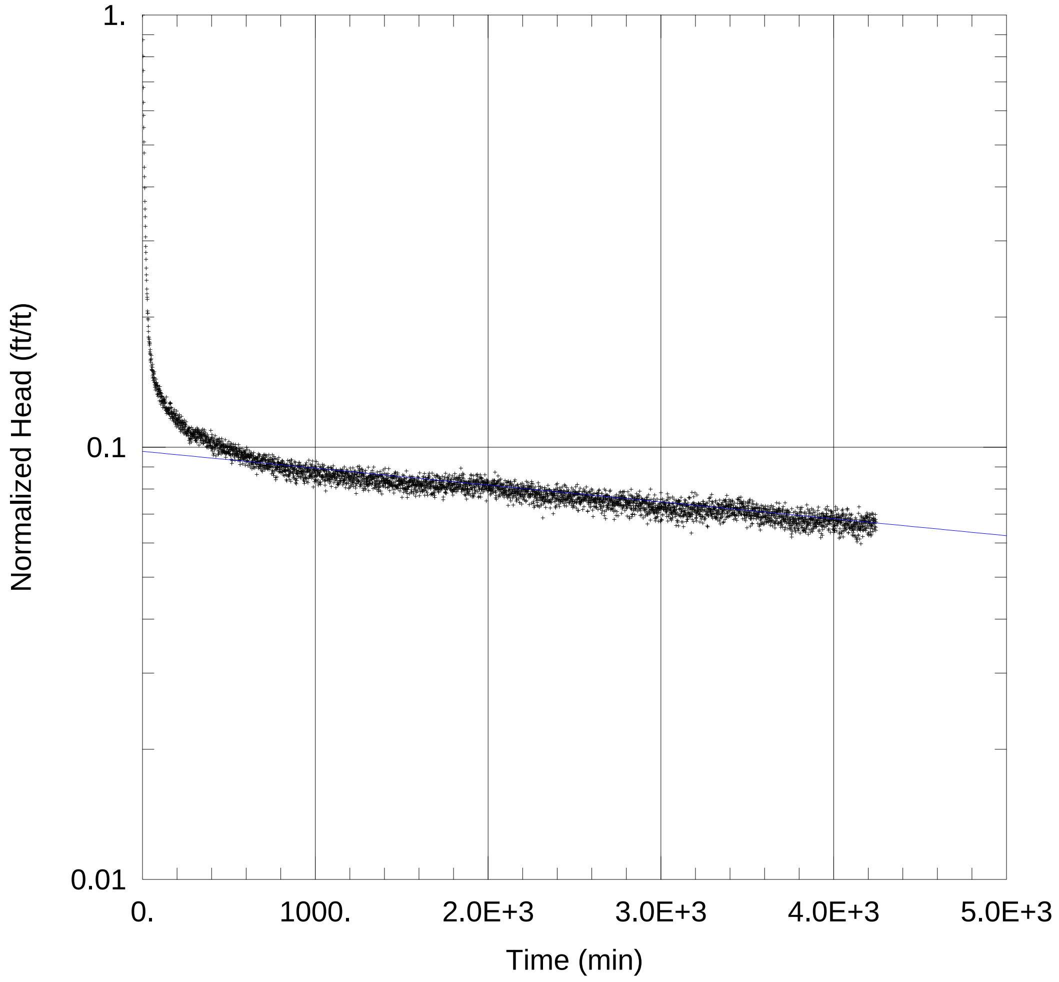


FIGURE 29. DS17-16 (DS-E) SLUG A + B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-16
Test Date: 4/30/2017

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-16)

Initial Displacement: 2.09 ft
Total Well Penetration Depth: 104.1 ft
Casing Radius: 0.1667 ft
Static Water Column Height: 104.1 ft
Screen Length: 73. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001035 ft/day
y0 = 0.2044 ft

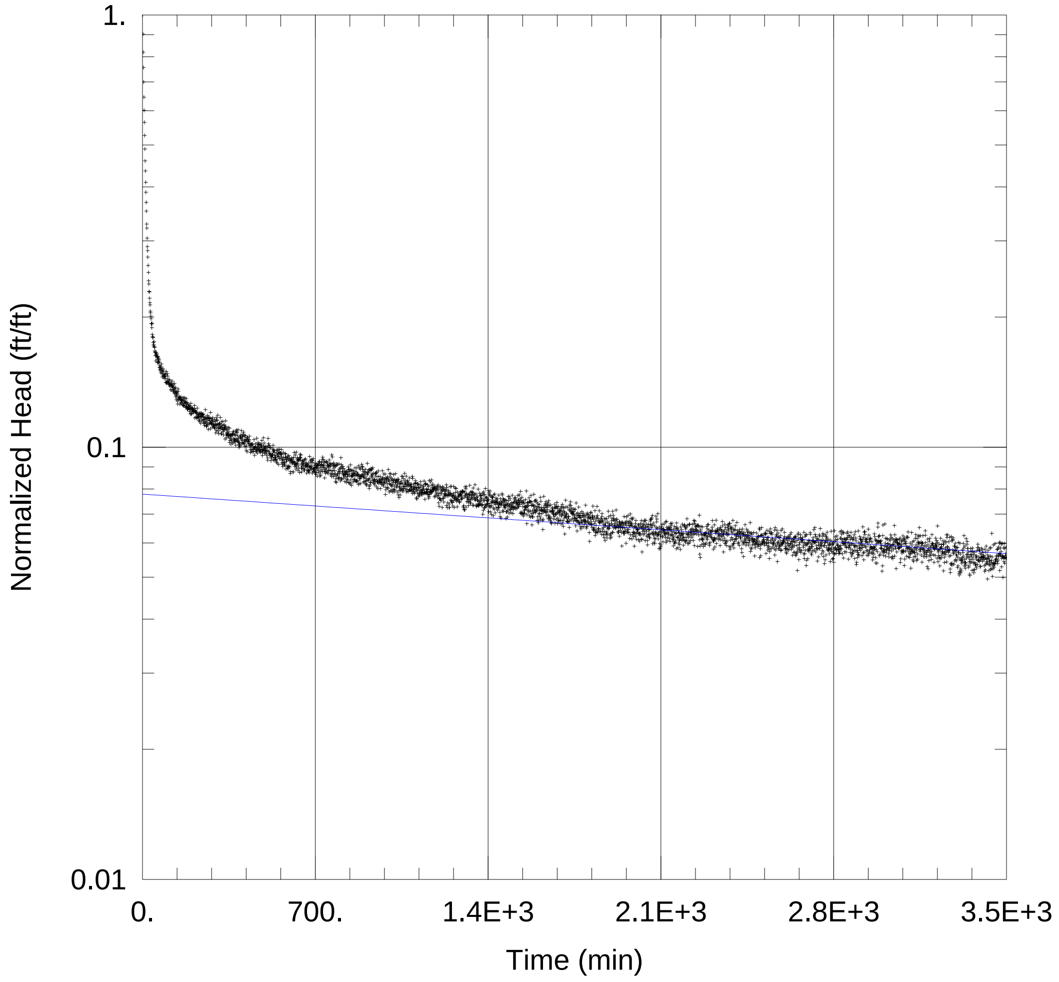


FIGURE 30. DS17-16 (DS-E) SLUG A + B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DS17-16
Test Date: 5/03/2017

AQUIFER DATA

Saturated Thickness: 77. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DS17-16)

Initial Displacement: 2.02 ft
Total Well Penetration Depth: 104.2 ft
Casing Radius: 0.1667 ft
Static Water Column Height: 104.2 ft
Screen Length: 73. ft
Well Radius: 0.4375 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0001043 ft/day
y0 = 0.1573 ft

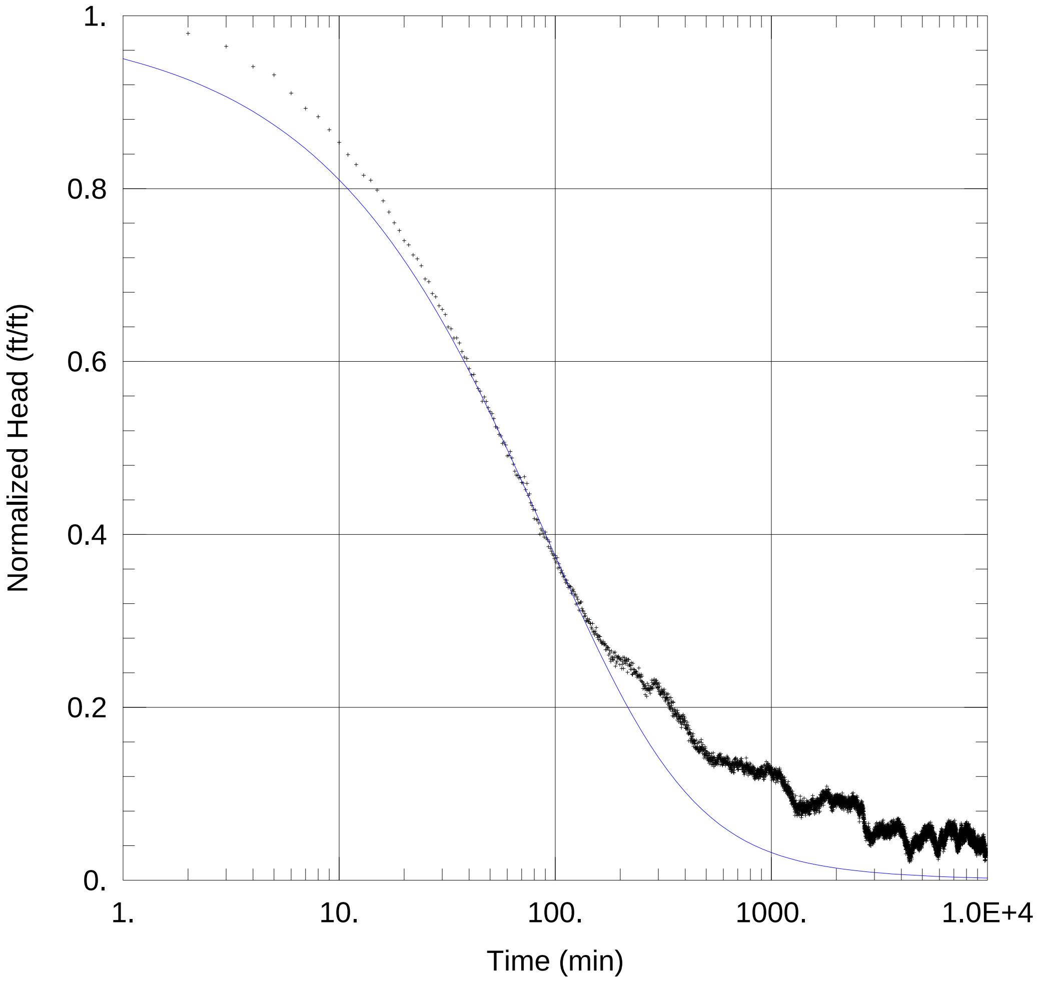


FIGURE 31. DH16-22 (GT-40) SLUG 2B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH16-22
Test Date: 4/28/2017

AQUIFER DATA

Saturated Thickness: 188.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH16-22)

Initial Displacement: 1.37 ft
Total Well Penetration Depth: 193.9 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 188.1 ft
Screen Length: 106.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1115 ft^2/day
S = 0.01

MONTGOMERY
& ASSOCIATES

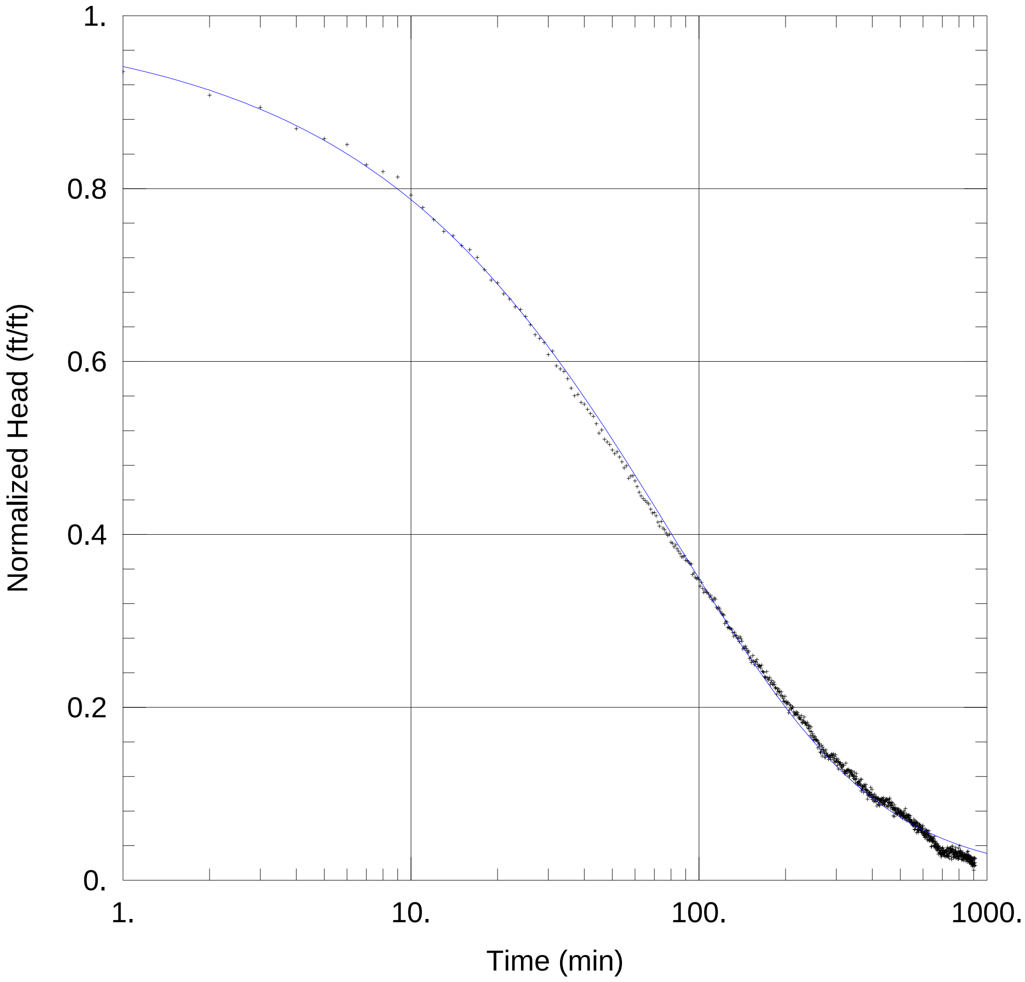


FIGURE 32. DH16-22 (GT-40) SLUG 2B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH16-22
Test Date: 05/05/2017

AQUIFER DATA

Saturated Thickness: 188.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH16-22)

Initial Displacement: 1.47 ft
Total Well Penetration Depth: 194.1 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 188.2 ft
Screen Length: 106.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1108 ft^2/day
S = 0.01521

MONTGOMERY & ASSOCIATES

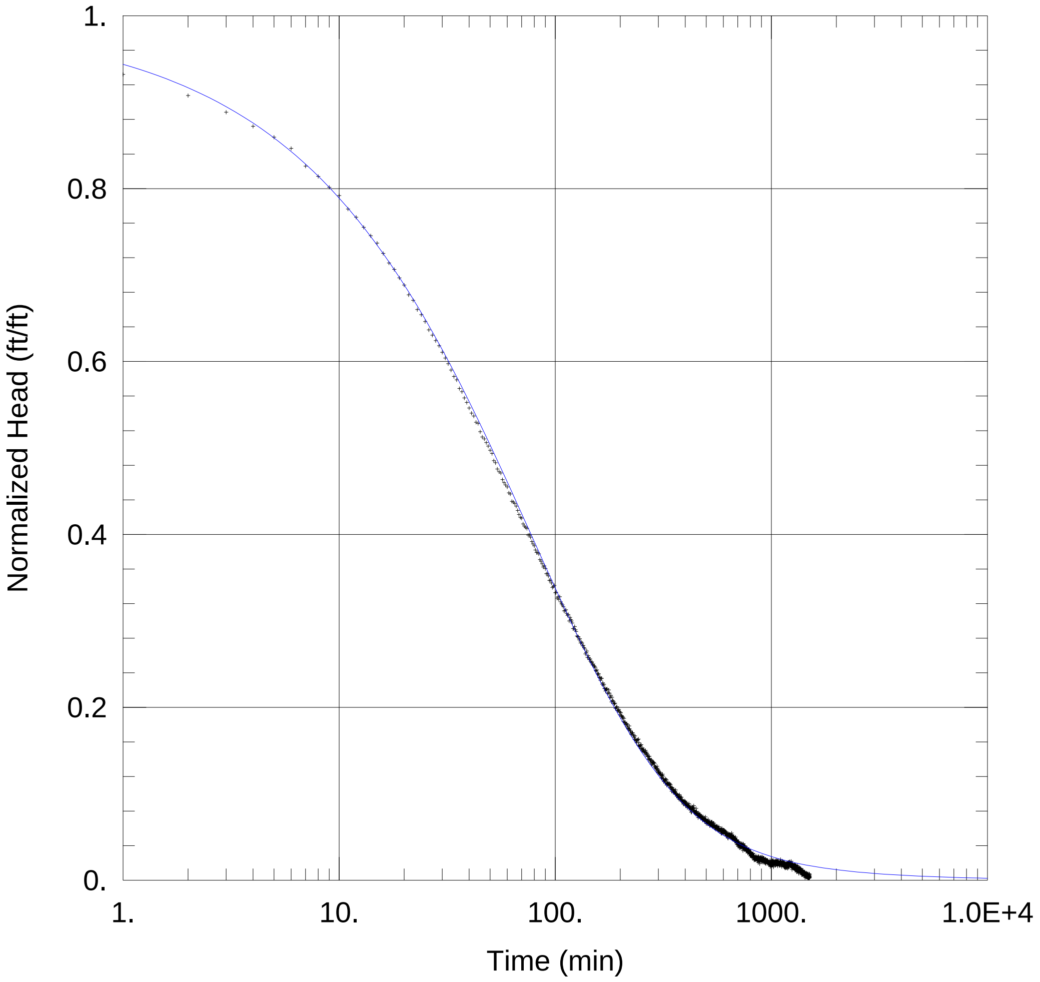


FIGURE 33. DH16-22 (GT-40) SLUG 4B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH16-22
Test Date: 05/12/2017

AQUIFER DATA

Saturated Thickness: 188.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH16-22)

Initial Displacement: 2.9 ft
Total Well Penetration Depth: 194. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 188.1 ft
Screen Length: 106.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1254 ft^2/day
S = 0.01149

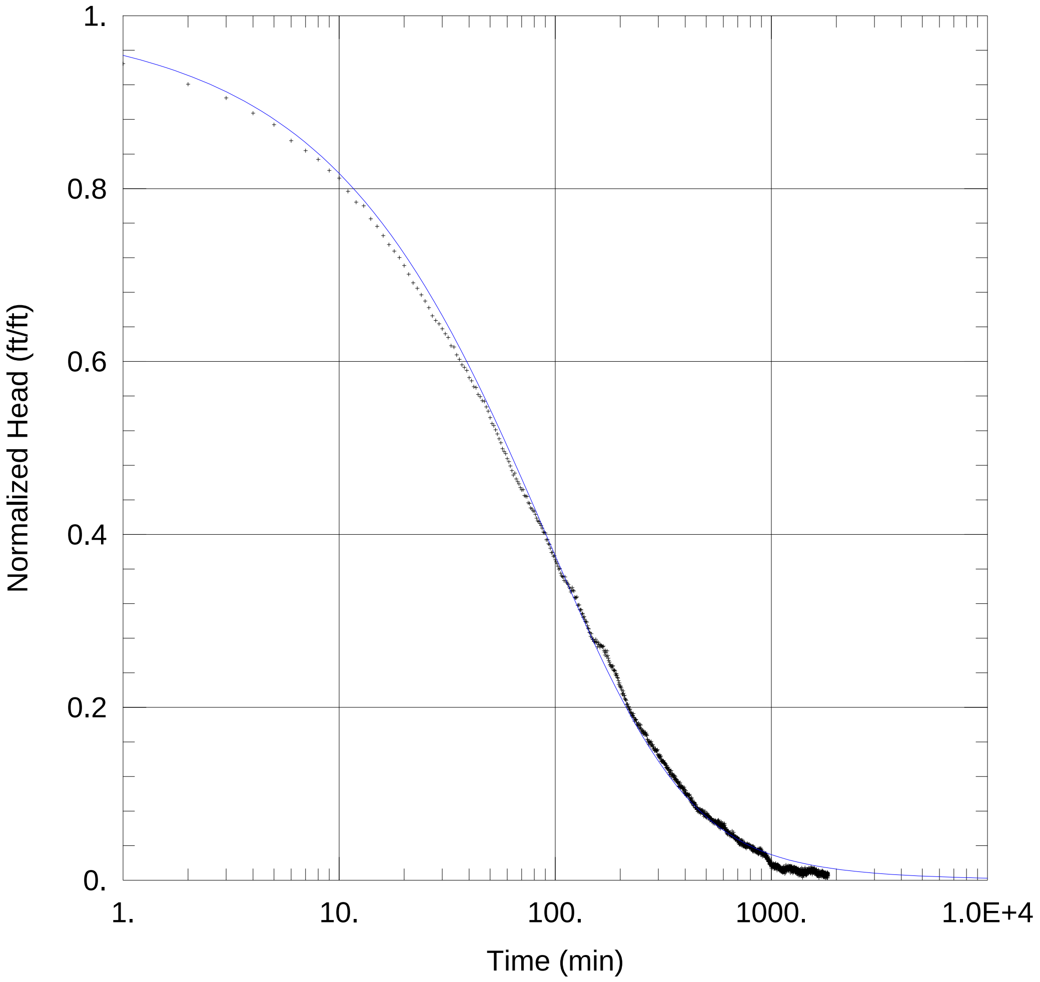


FIGURE 34. DH16-22 (GT-40) SLUG 4B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH16-22
Test Date: 05/17/2017

AQUIFER DATA

Saturated Thickness: 188. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH16-22)

Initial Displacement: 2.9 ft
Total Well Penetration Depth: 193.9 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 188. ft
Screen Length: 106.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1209 ft^2/day
S = 0.00722

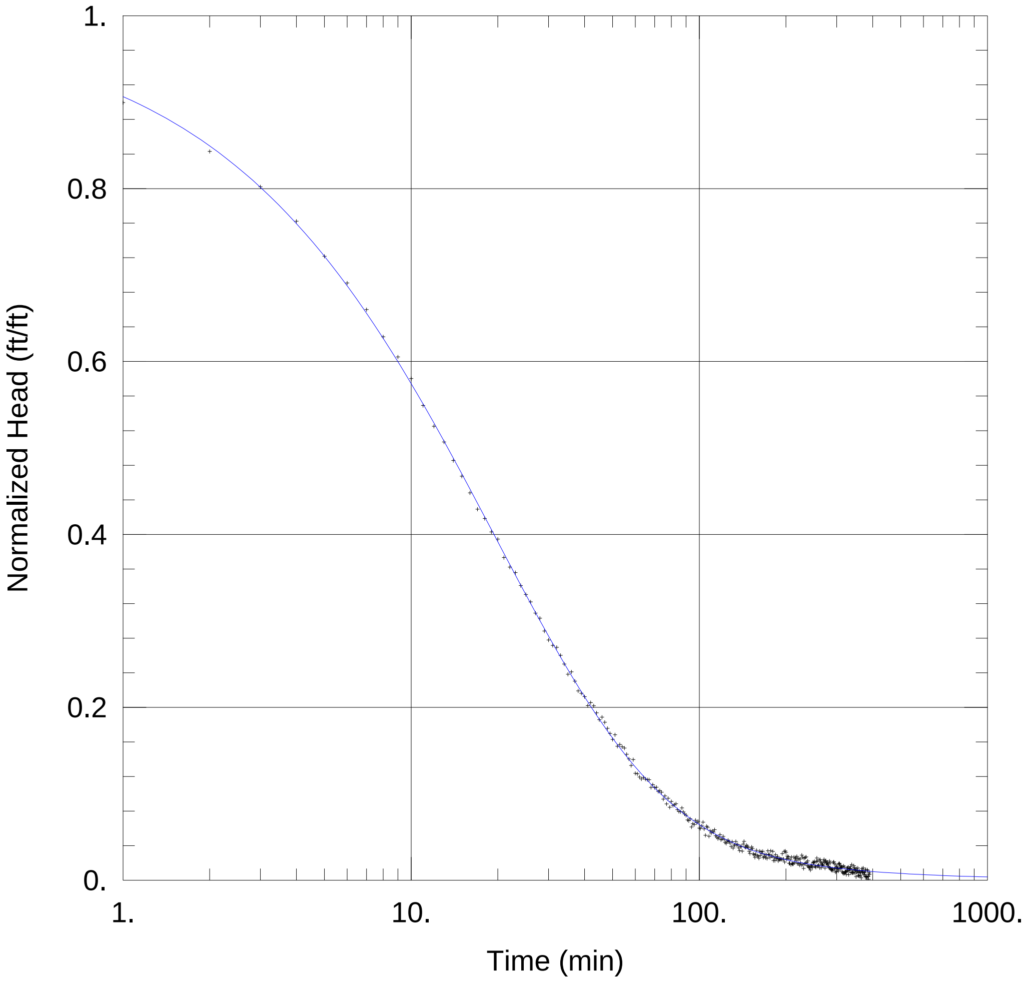


FIGURE 35. DH17-24 (GT-40-2) SLUG 4A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-24
Test Date: 4/28/2017

AQUIFER DATA

Saturated Thickness: 43.12 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-24)

Initial Displacement: 2.4 ft
Total Well Penetration Depth: 43.12 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 43.12 ft
Screen Length: 41.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.7739 ft^2/day
S = 0.001669

MONTGOMERY & ASSOCIATES

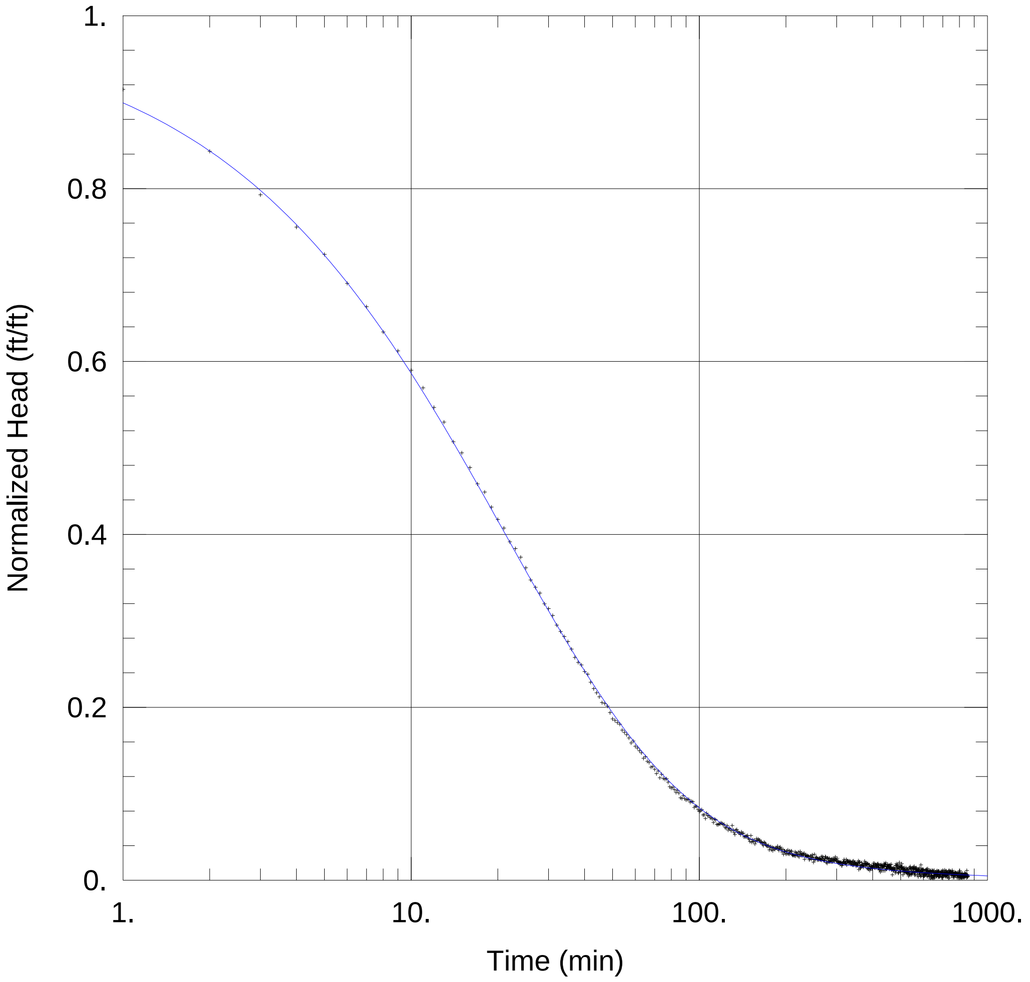


FIGURE 36. DH17-24 (GT-40-2) SLUG 4A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-24
Test Date: 05/02/2017

AQUIFER DATA

Saturated Thickness: 43.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-24)

Initial Displacement: 2.48 ft
Total Well Penetration Depth: 43.1 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 43.1 ft
Screen Length: 41.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.5779 ft^2/day
S = 0.00447

MONTGOMERY
& ASSOCIATES

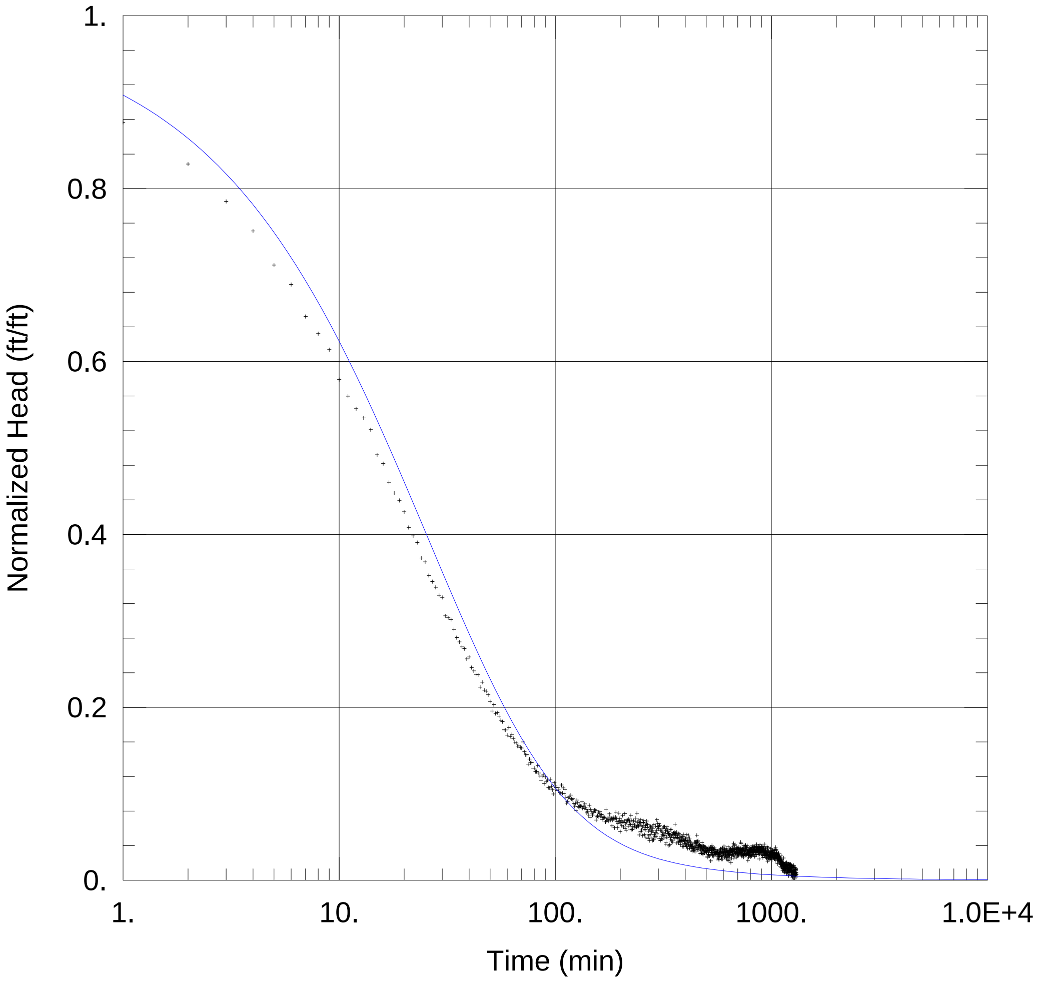


FIGURE 37. DH17-24 (GT-40-2) SLUG 2A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-24
Test Date: 05/05/2017

AQUIFER DATA

Saturated Thickness: 43.12 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-24)

Initial Displacement: 1.32 ft
Total Well Penetration Depth: 43.12 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 43.12 ft
Screen Length: 41.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.4721 ft^2/day
S = 0.005

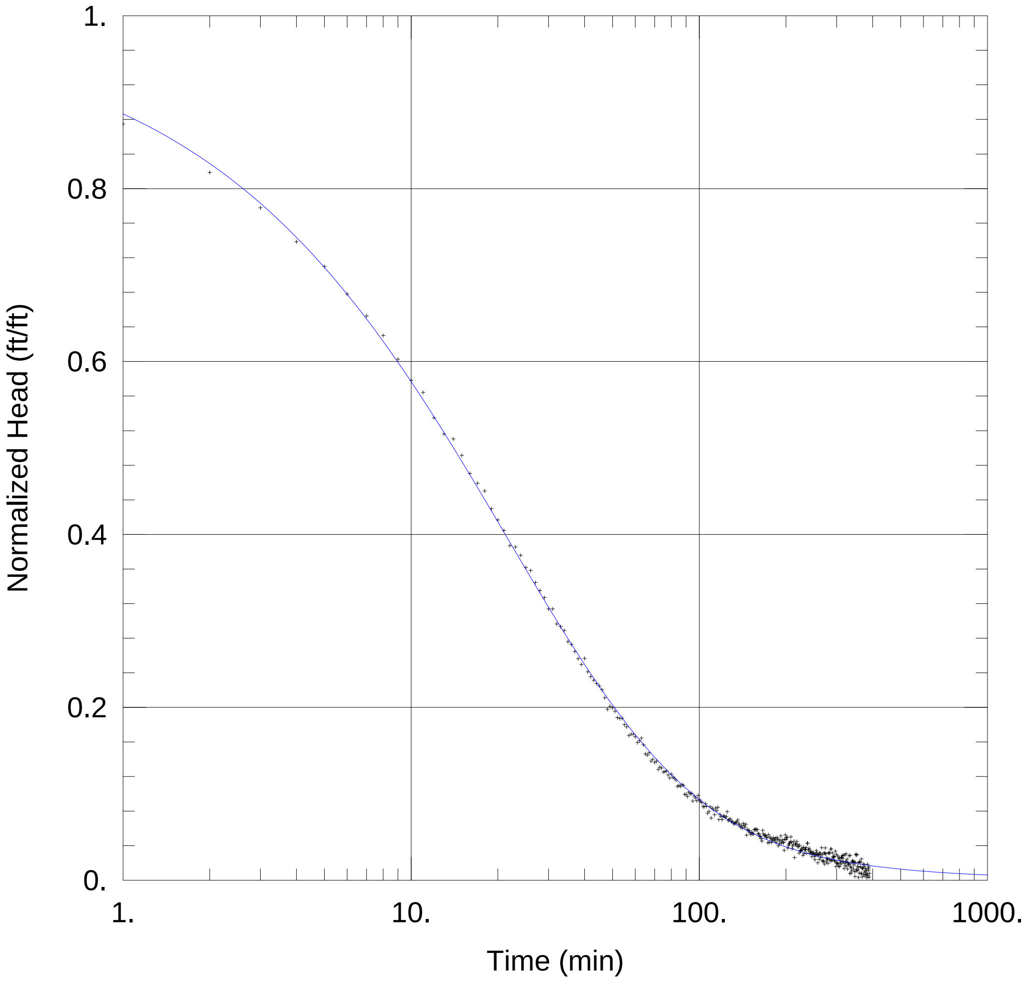


FIGURE 38. DH17-24 (GT-40-2) SLUG 2A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-24
Test Date: 05/11/2017

AQUIFER DATA

Saturated Thickness: 43.15 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-24)

Initial Displacement: 1.29 ft
Total Well Penetration Depth: 43.15 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 43.15 ft
Screen Length: 41.8 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.4841 ft^2/day
S = 0.009277

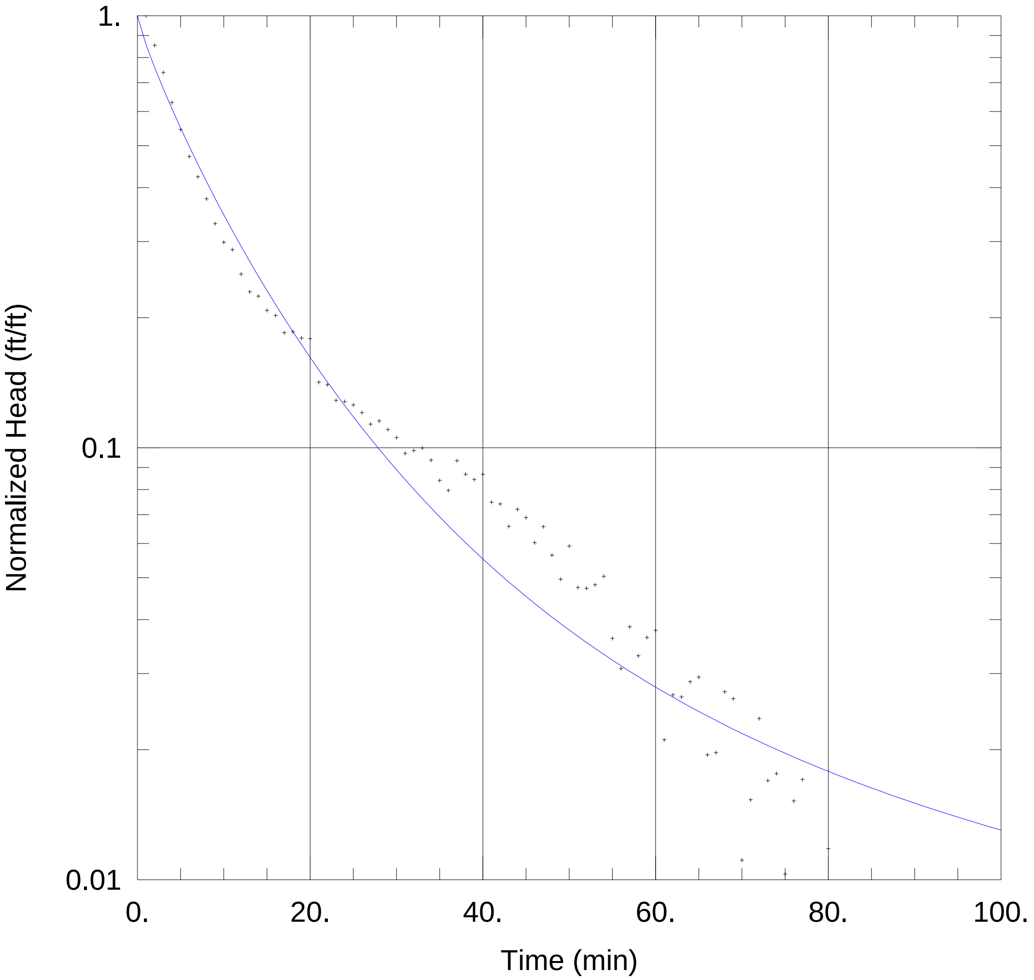


FIGURE 39. DH17-27 (GT-12) SLUG 2A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 4/26/2017

AQUIFER DATA

Saturated Thickness: 87.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 1.05 ft
Total Well Penetration Depth: 87.9 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 87.9 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 2.62 ft^2/day
S = 0.0001321

MONTGOMERY
& ASSOCIATES

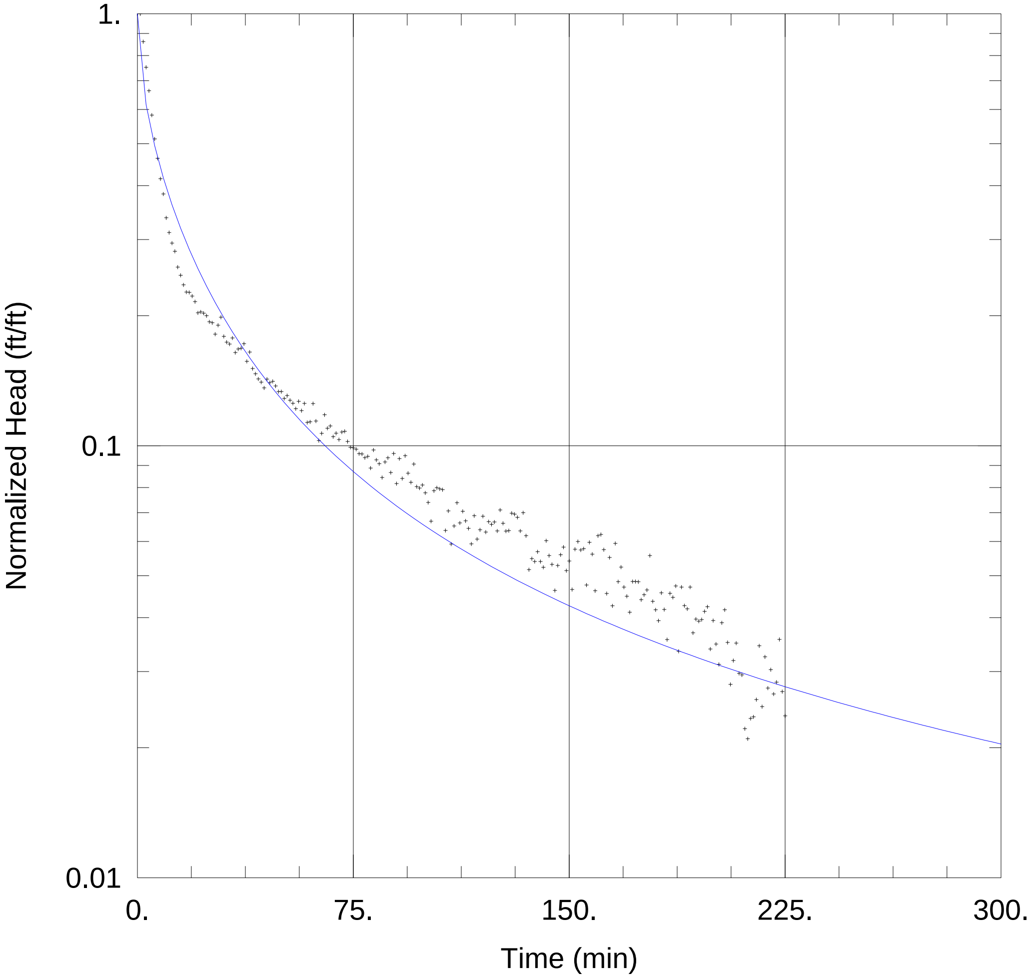


FIGURE 40. DH17-27 (GT-12) SLUG 2A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 4/26/2017

AQUIFER DATA

Saturated Thickness: 87.89 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 1.081 ft
Total Well Penetration Depth: 87.89 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 87.89 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.4768 ft^2/day
S = 0.08

MONTGOMERY
& ASSOCIATES

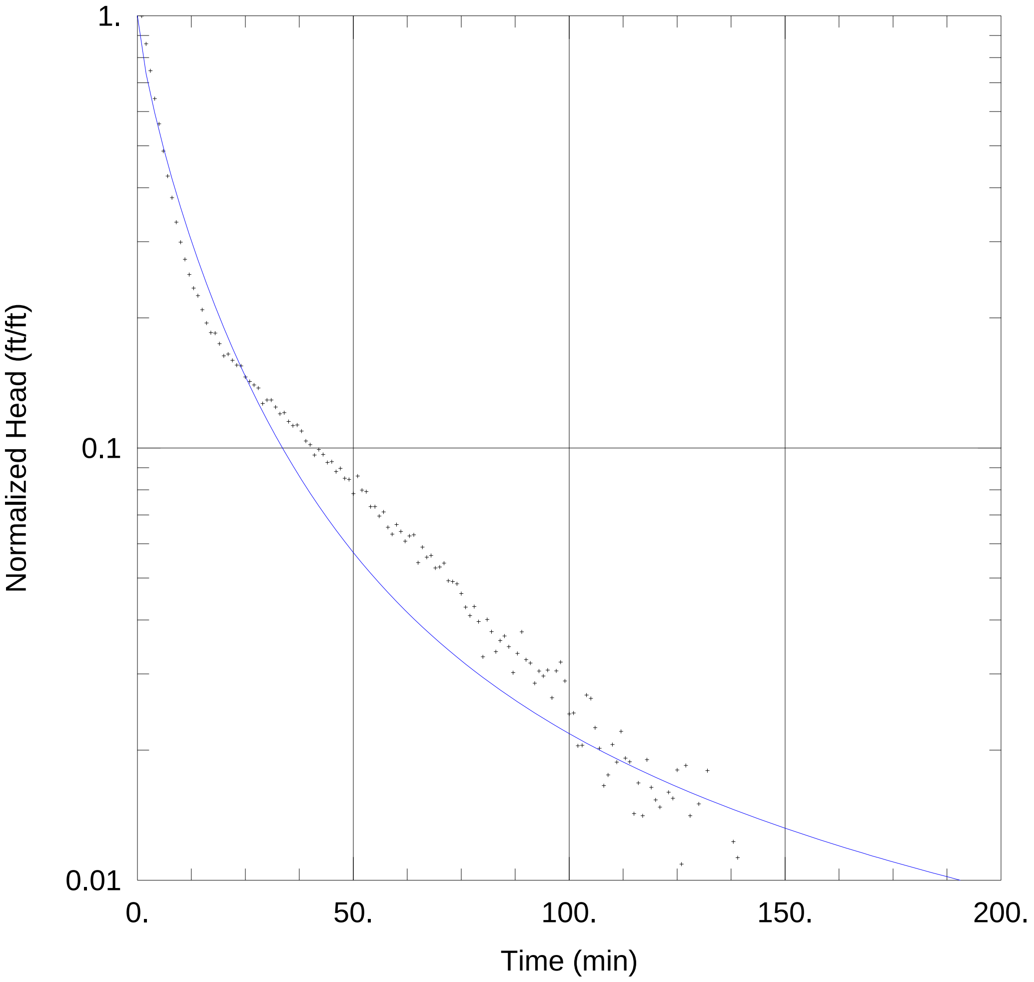


FIGURE 41. DH17-27 (GT-12) SLUG 4B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 4/27/2017

AQUIFER DATA

Saturated Thickness: 87.85 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 2.07 ft
Total Well Penetration Depth: 87.85 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 87.85 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 1.616 ft^2/day
S = 0.002455

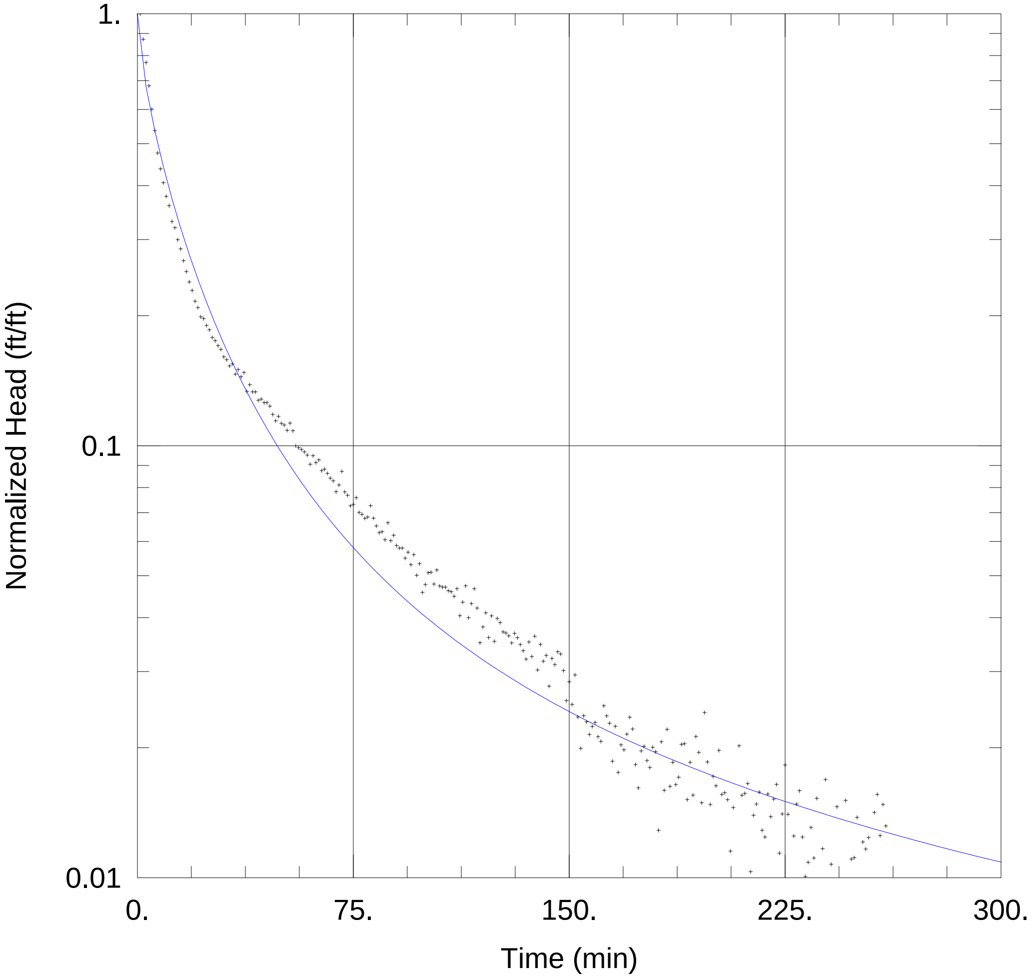


FIGURE 42. DH17-27 (GT-12) SLUG 4B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 4/28/2017

AQUIFER DATA

Saturated Thickness: 87.84 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 2.122 ft
Total Well Penetration Depth: 87.84 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 87.84 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.9259 ft^2/day
S = 0.01041

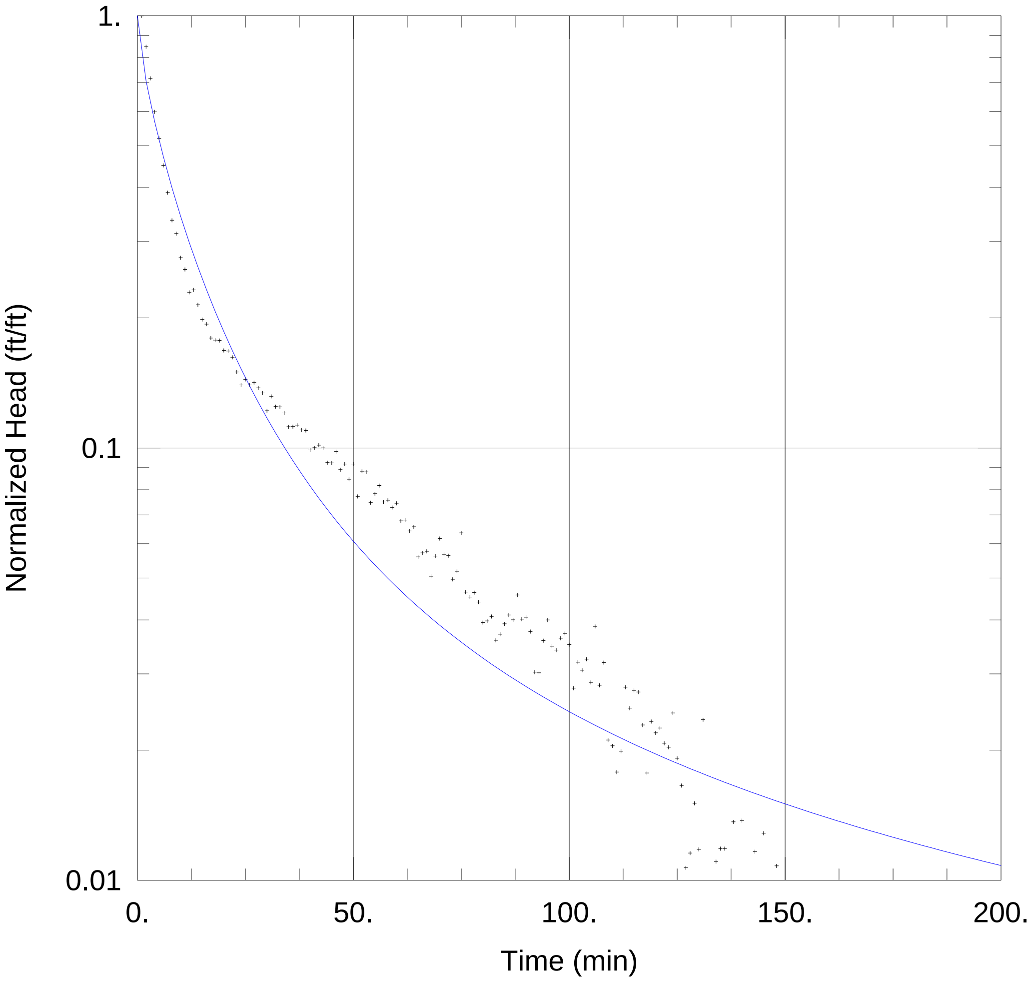


FIGURE 43. DH17-27 (GT-12) SLUG 2A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 4/30/2017

AQUIFER DATA

Saturated Thickness: 87.89 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 1.06 ft
Total Well Penetration Depth: 87.89 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 87.89 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft
Gravel Pack Porosity: 0.28

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 1.411 ft^2/day
S = 0.006398

MONTGOMERY & ASSOCIATES

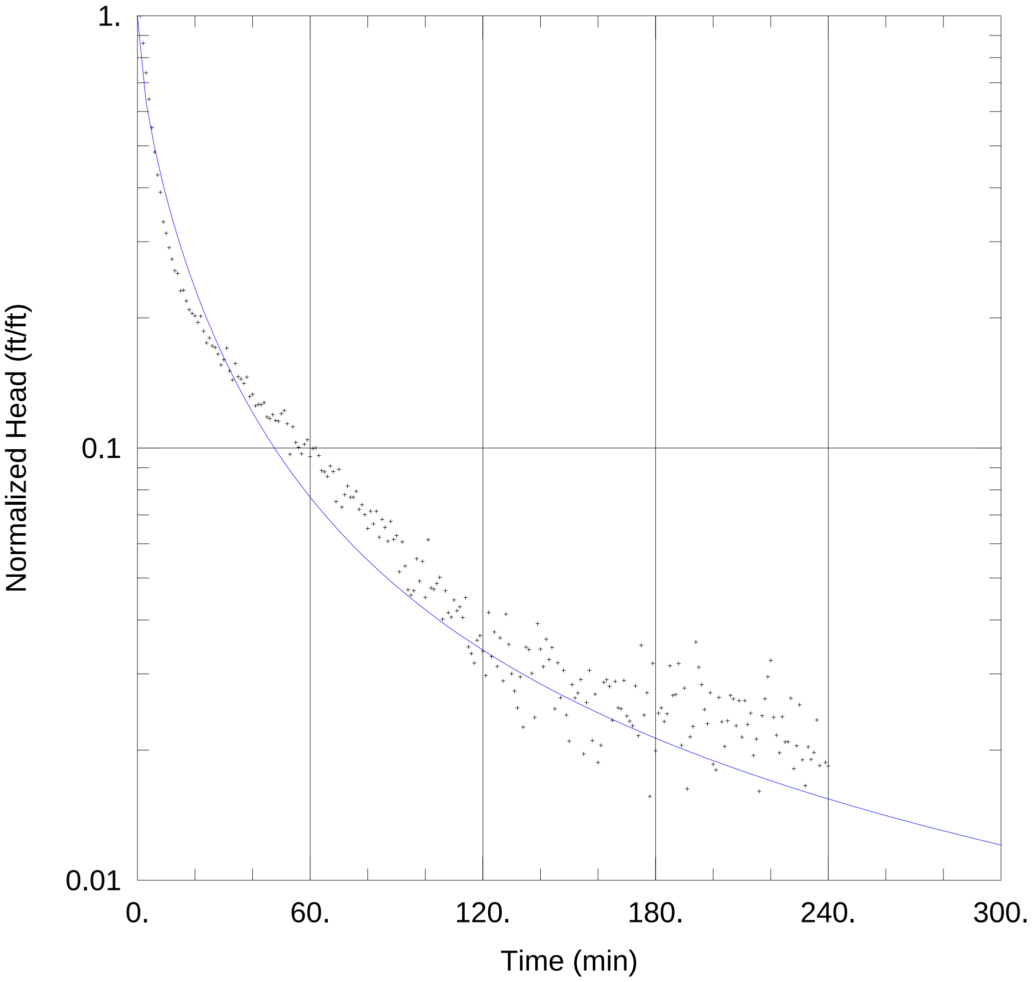


FIGURE 44. DH17-27 (GT-12) SLUG 2A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-27
Test Date: 5/2/2017

AQUIFER DATA

Saturated Thickness: 87.88 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DH17-27)

Initial Displacement: 1.05 ft
Total Well Penetration Depth: 87.88 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 87.88 ft
Screen Length: 87. ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Bredehoeft-Papadopulos

T = 0.8215 ft^2/day

S = 0.02532

MONTGOMERY
& ASSOCIATES

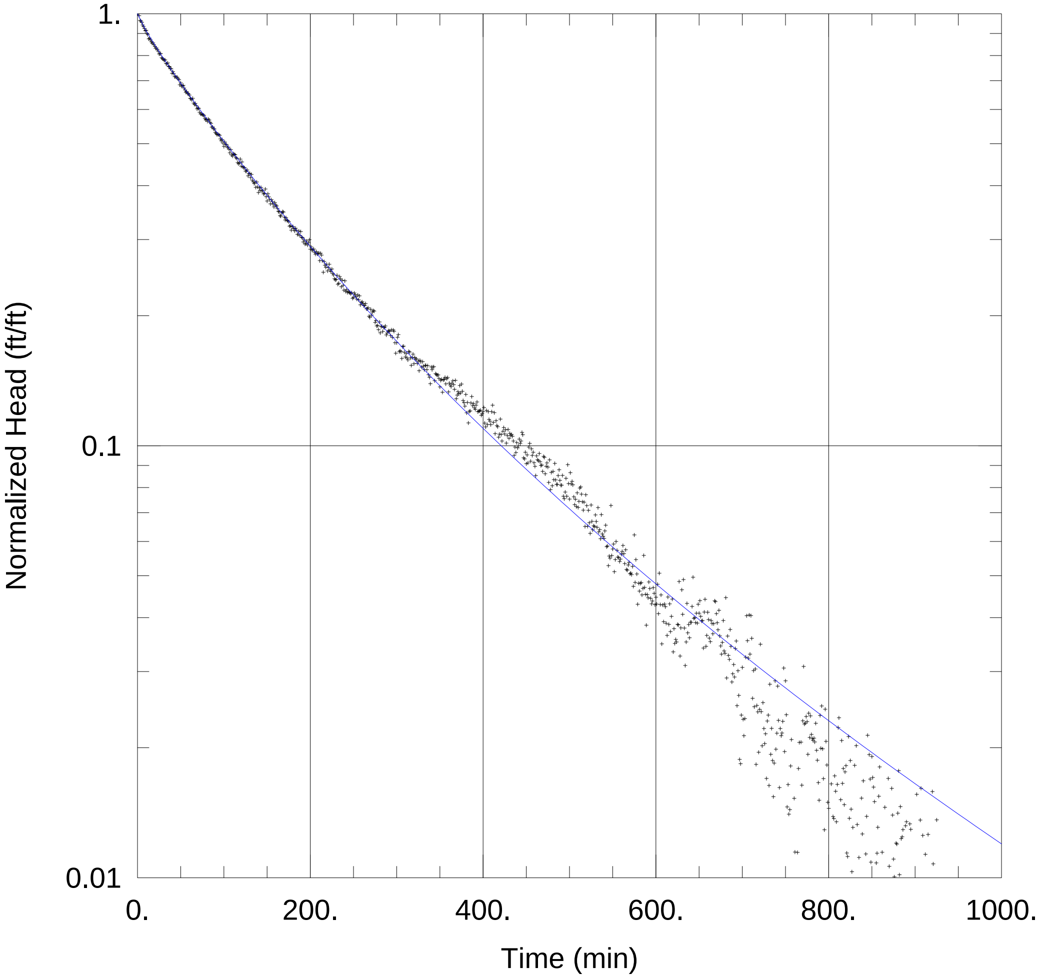


FIGURE 45. DH17-36 (GT-14-3) SLUG 4A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 4/26/2017

AQUIFER DATA

Saturated Thickness: 62.35 ft

WELL DATA (DH17-36)

Initial Displacement: 1.47 ft
Total Well Penetration Depth: 62.35 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 62.35 ft
Screen Length: 62.35 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.00259 ft/day
Kz/Kr = 1.

Ss = 8.795E-7 ft^{-1}

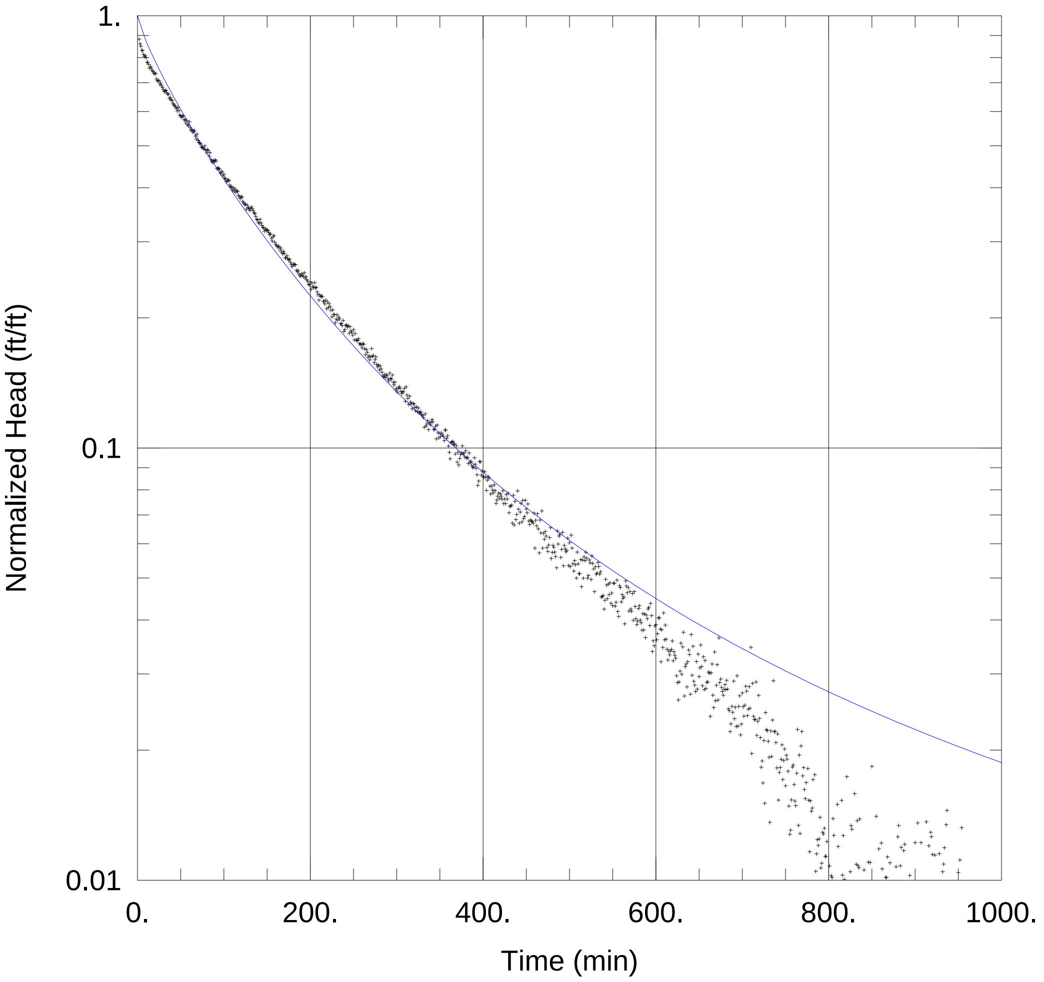


FIGURE 46. DH17-36 (GT-14-3) SLUG 4A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 4/27/2017

AQUIFER DATA

Saturated Thickness: 62.34 ft

WELL DATA (DH17-36)

Initial Displacement: 1.92 ft
Total Well Penetration Depth: 62.34 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 62.34 ft
Screen Length: 62.34 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.002612 ft/day
Kz/Kr = 1.

Ss = 9.7E-6 ft^{-1}

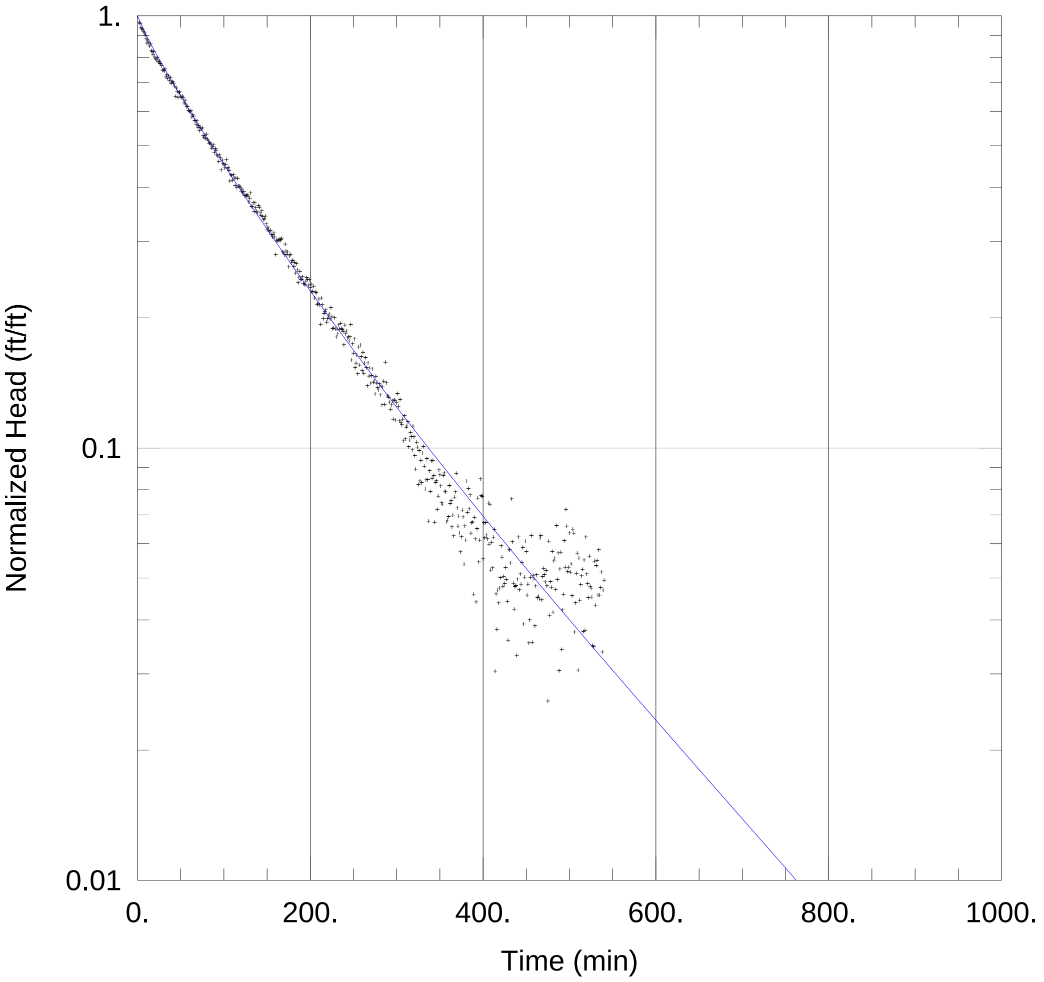


FIGURE 47. DH17-36 (GT-14-3) SLUG 2A FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 4/28/2017

AQUIFER DATA

Saturated Thickness: 62.33 ft

WELL DATA (DH17-36)

Initial Displacement: 0.79 ft
Total Well Penetration Depth: 62.33 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 62.33 ft
Screen Length: 62.33 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.00326 ft/day
Kz/Kr = 1.

Ss = 4.544E-7 ft^{-1}

MONTGOMERY
& ASSOCIATES

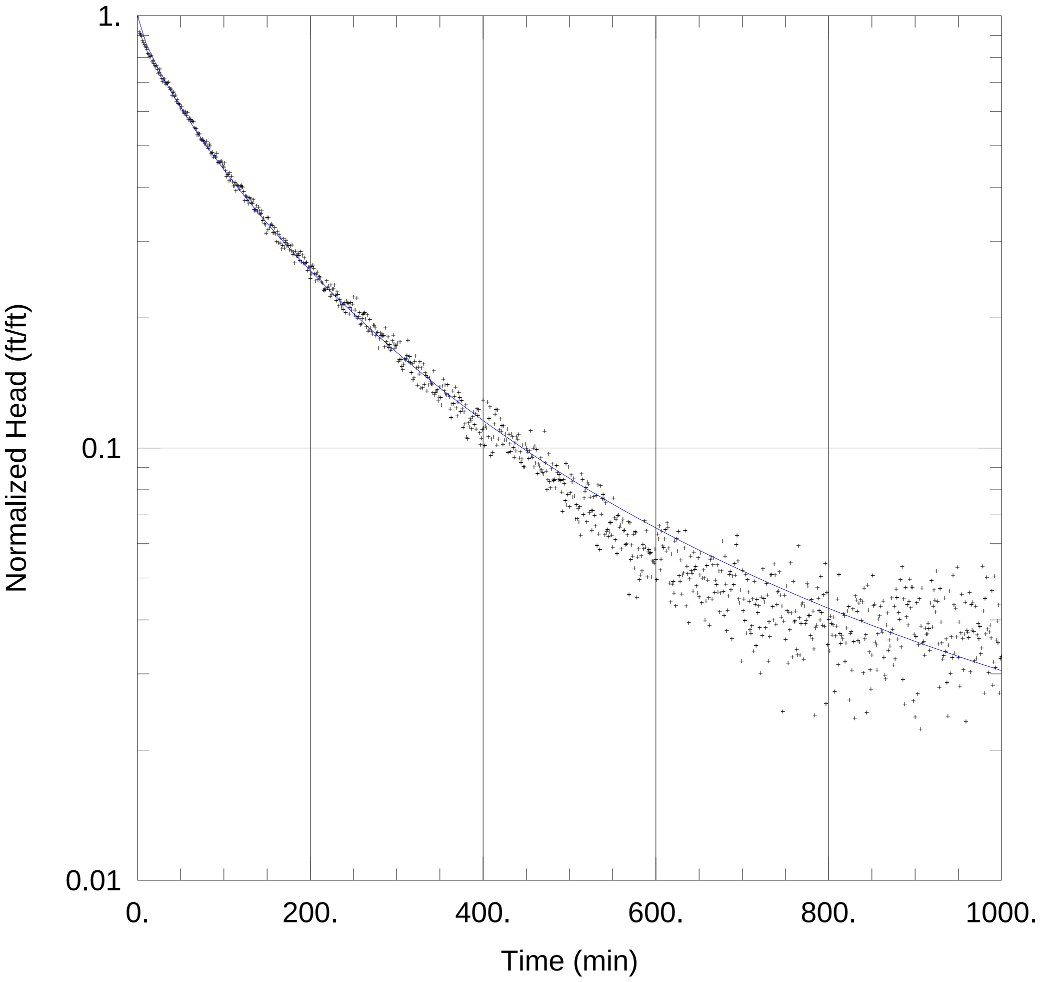


FIGURE 48. DH17-36 (GT-14-3) SLUG 2A RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 4/30/2017

AQUIFER DATA

Saturated Thickness: 62.44 ft

WELL DATA (DH17-36)

Initial Displacement: 0.895 ft
Total Well Penetration Depth: 62.44 ft
Casing Radius: 0.0861 ft
Static Water Column Height: 62.44 ft
Screen Length: 62.44 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 0.001893 ft/day
Kz/Kr = 1.
Ss = 3.926E-5 ft^{-1}

MONTGOMERY
& ASSOCIATES

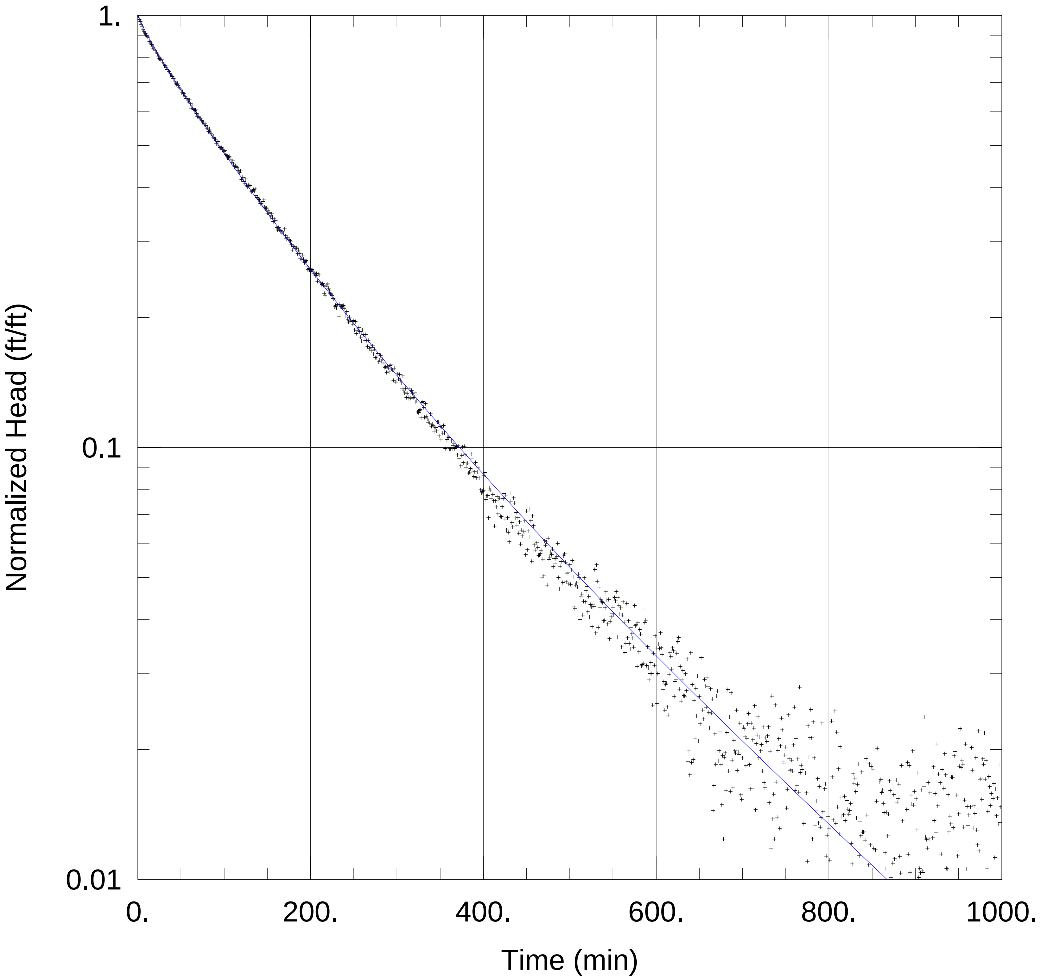


FIGURE 49. DH17-36 (GT-14-3) SLUG 4B FALLING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 05/02/2017

AQUIFER DATA

Saturated Thickness: 62.39 ft

WELL DATA (DH17-36)

Initial Displacement: 1.53 ft
Total Well Penetration Depth: 62.39 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 62.39 ft
Screen Length: 62.39 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.002945 ft/day
Kz/Kr = 1.

Ss = 5.553E-7 ft^{-1}

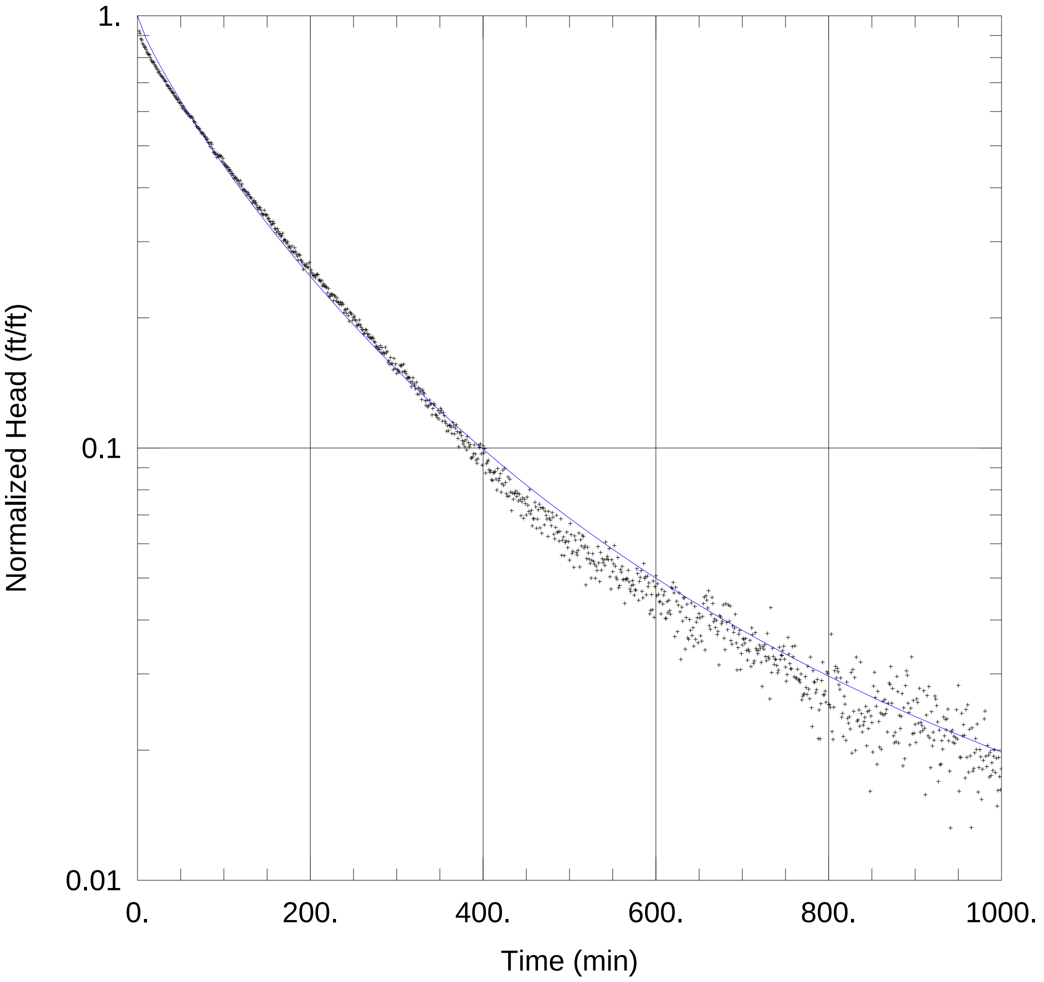


FIGURE 50. DH17-36 (GT-14-3) SLUG 4B RISING HEAD

PROJECT INFORMATION

Company: Montgomery & Associates
Client: Resolution
Project: 605.7807
Location: Superior, AZ
Test Well: DH17-36
Test Date: 05/05/2017

AQUIFER DATA

Saturated Thickness: 62.39 ft

WELL DATA (DH17-36)

Initial Displacement: 1.815 ft
Total Well Penetration Depth: 62.39 ft
Casing Radius: 0.0861 ft

Static Water Column Height: 62.39 ft
Screen Length: 62.39 ft
Well Radius: 0.1571 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: KGS Model

Kr = 0.002491 ft/day
Kz/Kr = 1.

Ss = 6.339E-6 ft^{-1}

MONTGOMERY
& ASSOCIATES

RESOLUTION
COPPER

402 W. Main Street
Superior, Arizona
+1 (520) 689 9374

October 20, 2017

US Forest Service
Supervisor's Office
2324 East McDowell Road
Phoenix, AZ 85006-2496

Subject: Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – Baseline Hydrologic Information

Dear Ms. Rasmussen,

Enclosed for your review and consideration, please find copies of the following baseline hydrology report titled "*Construction, Development, and Testing of Hydrologic Test Wells at the Near West Tailings Site*" and associated appendices.

Should you have any questions or require further information please do not hesitate to contact me.

Sincerely,

Vicky Peacey

Vicky Peacey,
Senior Manager, Permitting and Approvals; Resolution Copper Company, as Manager of Resolution Copper Mining, LLC

Cc: Ms. Mary Morissette; Senior Environmental Specialist; Resolution Copper Company

Enclosure(s): Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – Baseline Hydrologic Information

RESOLUTION
COPPER

402 W. Main Street
Superior, Arizona
+1 (520) 689 9374

December 5, 2017

US Forest Service
Supervisor's Office
2324 East McDowell Road
Phoenix, AZ 85006-2496

Subject: Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – Baseline Hydrological Information

Dear Ms. Rasmussen,

On October 20, 2017, Resolution Copper submitted a report for your review and consideration titled "*Construction, Development, and Testing of Hydrologic Test Wells at the Near West Tailings Site*" and associated appendices. After submittal, it was noticed that there was an error in Table 2 of the main document. Enclosed with this letter is an updated report with corrections to Table 2. No changes were made to the appendices so they have not been included.

Should you have any questions or require further information please do not hesitate to contact me.

Sincerely,

Vicky Peacey

Vicky Peacey,
Senior Manager, Permitting and Approvals; Resolution Copper Company, as Manager of Resolution Copper Mining, LLC

Cc: Ms. Mary Morissette; Senior Environmental Specialist; Resolution Copper Company

Enclosure(s): Resolution Copper Mining, LLC – Mine Plan of Operations and Land Exchange – Conceptual Hydrogeologic Model for Proposed Near West Tailings Storage Facility

Victoria Boyne

From:	ResolutionProjectRecord
Subject:	FW: Resolution Copper - Baseline Hydrological Submittal Correction
Attachments:	01_NearWestReport_Final.pdf; Letter to USFS - SWCA Baseline Hydrological Information 12-5-2017.pdf

From: Morissette, Mary (RC) [mailto:Mary.Morissette@riotinto.com]
Sent: Tuesday, December 5, 2017 1:21 PM
To: Mary Rasmussen (mcrasmussen@fs.fed.us) <mcrasmussen@fs.fed.us>; Chris Garrett <cgarrett@swca.com>
Cc: Peacey, Victoria (RC) <Victoria.Peacey@riotinto.com>; Flood, Cameo <Cameo.Flood@tetratech.com>; Donna Morey <dmorey@swca.com>; Gluski, Heather (RC) <Heather.Gluski@riotinto.com>
Subject: Resolution Copper - Baseline Hydrological Submittal Correction

Hello Mary,

Attached please find a cover letter and submittal regarding corrections to hydrological information that was originally submitted on October 20, 2017. Should you have any questions or require additional information please do not hesitate to ask.

Regards,

Mary Morissette

Mary Morissette
Senior Environmental Specialist
Permitting & Approvals

RESOLUTION
COPPER
102 Magma Heights
Superior, AZ 85173, United States
T: +1 520.689.3238
mary.morissette@riotinto.com www.resolutioncopper.com