DRAFT REPORT
July 31, 2012

Prepared for:
Resolution Copper Mining

RESULTS OF PHASE II HYDROGEOLOGIC INVESTIGATIONS IN SUPPORT OF TAILINGS PREFEASIBILITY STUDY

FAR WEST SITE

Prepared by:

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

www.elmontgomery.com 520-881-4912 1550 East Prince Road, Tucson AZ 85719

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MONTGOMERY
& ASSOCIATES

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1.0 EXECUTIVE SUMMARY

Phase II hydrogeologic investigations were conducted at the Far West Site to characterize principal hydrogeologic units and structural features, hydraulic properties of units in the unsaturated and saturated zones, and the occurrence, movement, and chemical quality of groundwater. Hydrogeologic investigations were conducted in conjunction with geotechnical investigations by Klohn Crippen Berger (KCB) in support of the Resolution Copper Mining LLC (RCM) tailings prefeasibility assessment for the Far West Site.

Hydrogeologic investigations included drilling, logging, construction, and testing of 5 groundwater monitor wells and 14 vadose zone piezometers; drilling of 2 geotechnical borings; and infiltration testing at 26 trenches/test pits. In addition, gravity data obtained during Phase I investigations at the Far West Site were remodeled by Hydrogeophysics Inc. using data obtained during Phase II investigations to refine estimates of depth to Precambrian bedrock.

GROUNDWATER MONITOR WELLS

1. Five groundwater monitor wells were drilled and installed to characterize geologic units in the unsaturated and saturated zones, conduct pumping tests, and obtain groundwater level and groundwater quality data. Borehole geophysical logging was conducted at each well following drilling and prior to well construction to provide additional information regarding subsurface geology. The monitor wells were drilled using rotary methods (wells FW3-R, FW4-R, FW7-R, and FW15-R) and the sonic method (well FW9-S), and were constructed to depths ranging from 113.5 to 344.4 meters below land surface (bls).

2. For well FW9-S (drilled using sonic method), standard penetration tests were conducted during drilling, and samples were obtained for laboratory analysis of moisture content, particle-size distribution, and a range of geotechnical parameters.

3. A constant-rate pumping test was conducted at each monitor well to estimate aquifer transmissivity and hydraulic conductivity. Near the end of each test, groundwater samples were collected for laboratory chemical analyses for common and trace inorganic constituents.

4. The monitor wells were equipped with integrated pressure transducer / datalogger equipment for continuous monitoring of groundwater levels.

VADOSE ZONE PIEZOMETERS AND GEOTECHNICAL BORINGS

5. Six dual-completion vadose zone piezometers and two single-completion piezometers were drilled and installed using the sonic drilling method to characterize geologic units in the unsaturated (vadose) zone, conduct standard penetration tests, obtain samples for laboratory analyses, and conduct injection tests for estimating hydraulic conductivity. The vadose zone piezometers were were constructed with 2-inch diameter blank and slotted schedule 80 PVC to depths ranging from 10.7 to 40.5 meters bls.

6. Samples from the sonic boreholes were obtained for laboratory analysis of moisture content, particle-size distribution, and a range of geotechnical parameters. Geotechnical data and samples were provided to KCB for processing and reporting.

7. A total of 14 injection tests were conducted to estimate saturated hydraulic conductivity of geologic units in the unsaturated zone.

8. Two geotechnical borings (FW7-S and FW12-S) were also drilled using the sonic method to characterize geologic units in the unsaturated zone, conduct standard penetration tests, and obtain samples for laboratory analysis. Geotechnical data and samples were provided to KCB for processing and reporting.

SURFACE INFILTRATION TESTING

9. Thirty-six trenches were excavated to characterize lithology and stratigraphy of the near-surface soils. Geotechnical data were collected by KCB during trenching operations.

10. Infiltration tests were conducted by Montgomery & Associates (M&A) in 26 of the trenches using the double-ring infiltrometer (and adapted single-ring infiltrometer) method or constant-head permeameter method. A total of 49 infiltration tests were conducted using the double-ring or single-ring infiltration method, and 5 infiltration tests were conducted using the constant-head permeameter method.

HYDROGEOLOGIC CHARACTERIZATION

11. Results of Phase II hydrogeologic investigations indicate the occurrence of four principal hydrogeologic units:

    - Quaternary alluvium (Qal) consists of alluvial and colluvial deposits of sand, gravel, silt and clay with localized variably-cemented zones (caliche). The Qal is present at all sites of investigation and ranges in thickness from 3.0 meters at FW5-S to 24.4 meters at FW15-R; average thickness is about 10 meters. The Qal is unsaturated at the Far West Site.

    - Quaternary and Tertiary basin-fill deposits (QTg) consist generally of weakly to well lithified deposits of gravel, sand, silt and clay. The contact between Qal and QTg was identified based on increased degree of cementation of QTg compared to Qal. The QTg is present at all monitor well and vadose zone piezometer locations, and where fully penetrated, ranges in thickness from 4.5 meters at FW5-S to 145.2 meters at FW15-R. At all locations except for FW9-S, the QTg is unsaturated. At FW9-S, the QTg is more than 173 meters thick (not fully penetrated) and is saturated below approximately 150 meters bls.

    - Tertiary Volcanic and Sedimentary Units include younger volcanic rocks (Tvy), older sedimentary units (Tso), and the Apache Leap Tuff (Tal).
        - The Tvy at Far West Site includes tilted basaltic lava flow units and a tuffaceous volcanic unit. The Tvy crops out in several locations at the Far West Site, and was encountered in the subsurface at FW3-R, FW7-R, and FW15-R. The Tvy at FW3-R is 30.2 meters thick; at FW3-R the Tvy is in fault contact with the underlying Tso. At wells FW7-R and FW15-R, the Tvy was only partially penetrated; thicknesses penetrated are 83 meters at FW7-R and 109 meters at FW15-R.
        - The older sedimentary units (Tso) were encountered at FW3-R and include tuffaceous sandstone, sandy mudstone, and silty sandstone units. The Tso is moderately to well lithified in comparison to the Qal and QTg.

  - The Tal was encountered at FW3-R and FW4-R. At FW4-R, an 18.8 meter thick interval of Tal was encountered between the QTg and bedrock. At FW3-R, a thicker sequence of the Tal was encountered below the Tso units. At FW3-R, the Tal is more than 94 meters thick and includes White Unit (Talw) and Gray Unit (Talg). The Tal crops out on Dromedary Peak, north of Far West Site.

- Precambrian Bedrock at the Far West Site includes older Precambrian granite (pCg), diabase (pCdiab), and Pinal Schist (pCpi). These units are exposed in the eastern part of the site. The pCg was encountered at FW4-R at a depth of 52.3 meters bls. The pCpi was encountered only at piezometers FW5-S and at FW10-S in the east part of the Far West Site.

12. Results of Phase I and Phase II modeling of gravity data indicate that top of Precambrian bedrock slopes from east to west, with a relatively steep gravity gradient in the central part of the site. The steep gradient is interpreted to indicate the occurrence of a fault, downthrown to the west, extending roughly south through the center of the Far West Site. This fault is believed to be the extension of the Elephant Butte Fault which is exposed north of the site and underlies basin-fill alluvium at the site. Due to incorporation of data on the Tertiary volcanic and sedimentary units in the Phase II gravity modeling, depth to Precambrian bedrock in the west part of the site is inferred be in the magnitude of 1,000 meters bls, approximately four times deeper than indicated by Phase I modeling.

13. Hydraulic conductivity of principal hydrogeologic units at the Far West Site was determined by conduct of 5 pumping tests, 14 vadose zone injection tests, and 56 near-surface infiltration tests. Hydraulic conductivity determined from these tests ranges widely, from 2.8×10^{-7} to 2.9×10^{-2} centimeters per second (cm/sec).

    - Quaternary Alluvium: Hydraulic conductivities for various types of Quaternary alluvium were estimated based on results of ring infiltrometer tests; saturated hydraulic conductivities were determined to be similar to corrected (vertical) infiltration rates. Corrected infiltration rates are summarized as follows:

SOIL PROFILE TYPE	NUMBER OF TESTS*	INFILTRATION TEST RESULTS** (meters per day)			
		LOW	HIGH	MEAN	MEDIAN
Unconsolidated Poorly-Sorted Sediments	28	0.04	5.5	1.01	0.67
Variably Cemented Caliche	15	0.10	0.97	0.40	0.33
Active Channel Deposits	2	3.3	23.2	13.4	---

* Number of tests used in the evaluation of results
** Results are for corrected (vertical) infiltration rates
--- = not applicable

- Quaternary and Tertiary Basin-Fill Deposits: Results from vadose zone injection tests conducted in Quaternary and Tertiary basin-fill deposits indicate that hydraulic conductivity ranges from 2.8 x 10^{-7} to 2.9 x 10^{-2} cm/sec; arithmetic mean is 3.5 x 10^{-3} and geometric mean is 3.4 x 10^{-4} cm/sec. Results of the pumping test conducted at well FW9-S, completed in moderately to well lithified basin-fill deposits, indicates hydraulic conductivity of 4 x 10^{-6} cm/sec. Geometric mean for all tests conducted in the basin-fill deposits is 2.5 x 10^{-4} cm/sec.

- Tertiary Volcanic and Sedimentary Units: Results from pumping tests conducted in the three monitor wells completed in Tertiary volcanic and sedimentary units (FW3-R, FW7-R, and FW15-R) indicate hydraulic conductivity ranging from 1 x 10^{-6} to 7 x 10^{-4} cm/sec. Arithmetic mean hydraulic conductivity is 2 x 10^{-4} cm/sec; geometric mean is 1 x 10^{-5} cm/sec.

- Precambrian Bedrock: Results from the injection test at piezometer FW5-S, completed in Pinal Schist, indicates hydraulic conductivity of 3.5 x 10^{-6} cm/sec. Results from the pumping test at well FW4-R, completed in Precambrian granodiorite, indicate hydraulic conductivity of 3 x 10^{-6} cm/sec. These results reflect the occurrence of secondary permeability due to fracturing and/or weathering of the rocks in the relatively shallow zones tested. Degree of fracturing and weathering, and therefore hydraulic conductivity, would be expected to be smaller at larger depths in the Precambrian bedrock.

14. A representative hydraulic conductivity was assigned to each principal soil profile type or hydrogeologic unit for the purpose of assessing effective large-scale hydraulic conductivity. Representative hydraulic conductivities for principal soil profile types and hydrogeologic units generally decrease with depth, and are summarized as follows:

SOIL PROFILE TYPE OR HYDROGEOLOGIC UNIT	REPRESENTATIVE HYDRAULIC CONDUCTIVITY (cm/sec)	NUMBER OF TESTS
Active Quaternary Alluvium	$1.6 \text{ X } 10^{-2}$	2
Younger Quaternary Alluvium (unconsolidated Sediments)	7.8×10^{-4}	28
Older Quaternary Alluvium (unconsolidated sediments underlain by variably-cemented caliche)	4.9×10^{-4}	15
Quaternary and Tertiary Basin-Fill Deposits	2.5×10^{-4}	14
Tertiary Volcanic and Sedimentary Units	1×10^{-5}	3
Precambrian Bedrock	3×10^{-6}	2

15. A total of 88 bulk samples of core from the sonic boreholes were analyzed for moisture content. Measured moisture content for ranged from 0.3 to 8.9 percent by weight; average moisture content for all samples was 2.5 percent. Based on an average bulk density of 2.2 grams per cubic centimeter (g/cc) for alluvial sediments that was assumed by HGI for gravity modeling, the average gravimetric moisture content of 2.5 percent would correspond to an average volumetric moisture content of 5.5 percent. Based on a representative particle density of 2.65 g/cc (silica-based minerals), estimated average porosity for the basin-fill deposits would be about 17 percent. The degree of saturation of the vadose zone sediments (ratio of volumetric moisture content to total porosity) would be about 0.32; this small degree of saturation indicates that the vadose zone has substantial available storage (retention) capacity for infiltrating water.

16. Groundwater level measurements obtained in May 2012 indicate that depth to groundwater level ranges from 41.90 meters bls at FW4-R to 187.47 meters bls at FW15-R. Groundwater level elevation ranged from about 598 meters above mean sea level (amsl) in the east part of the Far West Site at FW4-R to about 415 meters amsl at FW7-R in the west part of the site. General direction of groundwater movement is to the southwest. Hydraulic gradient ranges from about 80 meters per kilometer (m/km) in the central part of the site to about 30 m/km in the southwest part

of the site, which is much larger than in the regional basin-fill aquifer west of the site, where gradients are in the magnitude of 10 m/km or less.

17. Results of laboratory chemical analyses of groundwater samples obtained from monitor wells indicate that groundwater is of generally good quality with no exceedances of applicable primary maximum contaminant levels established by U.S. Environmental Protection Agency. Concentration of total dissolved solids ranges from 260 milligrams per liter (mg/L) at well FW9-S to 370 mg/L at well FW4-R. The dominant cation is sodium, except at well FW4-R where sodium and calcium are equally dominant, and the dominant anion is bicarbonate.

CONSIDERATIONS FOR TAILINGS PREFEASIBILITY ASSESSMENT

18. Key hydrogeologic considerations for assessing technical feasibility and potential design options for a tailings facility at the Far West Site are hydraulic conductivity and thickness of the vadose zone, chemical quality of groundwater, and hydraulic conductivity of the saturated zone.

    - Hydraulic conductivity of the vadose zone is small, which would limit rates of migration of any tailings water that enters the vadose zone.

    - The vadose zone is relatively thick due to large depth to groundwater level, particularly in the west part of the site. When combined with small moisture content, the vadose zone has substantial capacity to store water and potentially prevent small amounts of tailings water from reaching the saturated zone. As the volume of tailings water released to the vadose zone increases, the potential for tailings water to reach the saturated zone would also increase. For very large or sustained releases, tailings water would eventually reach the saturated zone.

    - The massive quantity of carbonate accumulation (cementation) in the vadose zone provides high acid neutralization capacity and would also reduce the mobility of dissolved metals.

    - Chemical quality of groundwater is good, with relatively low concentration of total dissolved solids. If tailings water reached the saturated zone, concentration of total dissolved solids in groundwater would increase.

    - Hydraulic conductivity of the saturated zone is very small, which would result in very small rates of migration of any groundwater affected by tailings water.

- Variably-saturated flow modeling would be required to simulate migration of tailings water through the vadose zone for specific tailings facility design options. For modeling scenarios in which tailings water would reach the saturated zone, particle path modeling would be required to assess rates and extent of migration of impacted groundwater in the regional aquifer. Solute transport modeling would be required to assess changes in chemical quality of groundwater beneath and down hydraulic gradient from the tailings facility.

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2.0 INTRODUCTION

In accordance with arrangements with Mr. Sergio Gonzalez, Resolution Copper Mining, LLC (RCM), Montgomery & Associates (M&A) has conducted Phase II hydrogeologic investigations of the Far West Site, in support of the RCM Tailings Prefeasibility Study. The purpose of Phase II hydrogeologic investigations is to characterize principal hydrogeologic units and structural features, occurrence and movement of groundwater, chemical quality of groundwater, and hydraulic properties of near-surface soils, the vadose zone, and the principal aquifer. If the Far West Site is pursued as a tailings storage site, results of Phase II investigations will also provide data needed to support an application to Arizona Department of Environmental Quality (ADEQ) for an Aquifer Protection Permit. The Phase II hydrogeologic investigations were conducted in conjunction with Klohn Crippen Berger (KCB) geotechnical investigations.

The Far West Site encompasses an area of 31 square kilometers (12 square miles) east-southeast of Florence Junction, along the east margin of the East Salt River Valley Sub-Basin, shown on **Figure 1**. The site includes sections 23, 24, 25, 26, 35, and 36 of T.2 S., R.10 E., and sections 19, 20, 29, 30, 31, and 32 of T.2 S., R.11 E., in Pinal County, Arizona.

The entire Far West Site, except for section 20, is controlled by the Arizona State Land Department.

Previous investigations include a preliminary regional hydrogeologic assessment for the vicinity of the Far West Site, and a Phase I hydrogeologic assessment of the site. The preliminary hydrogeologic assessment was conducted by M&A in April and May 2010, and involved compiling, reviewing, and summarizing readily-available hydrogeologic data, and assessing hydrogeologic conditions and water uses for a study area of approximately 470 square kilometers in the vicinity of the Far West Site. The Phase I hydrogeologic assessment was conducted by M&A in 2011, and included a site reconnaissance, gravity survey, and preparation of plans for Phase II investigations. Results of the preliminary and Phase I hydrogeologic assessments were reported in Technical Memoranda from M&A to Sergio Gonzalez of RCM (M&A, 2010 and 2011).

This report summarizes methods and results of Far West Phase II hydrogeologic investigations conducted during the period February through June 2012. The Phase II program included hydrogeologic and geotechnical investigations at 26 sites and solely test pits for geotechnical investigations at the remaining 10 sites. Hydrogeologic investigations included infiltration testing at 26 trenches/test pits to characterize the shallow subsurface; drilling, construction, and testing of five groundwater monitor wells and 14 vadose zone piezometers, and drilling of two geotechnical borings. Locations for monitor wells, vadose zone piezometers, geotechnical borings, and test pits are shown on **Figure 1**. **Table 1** summarizes the installation(s) at each site. Results of geotechnical investigations are given in a separate report by KCB.

TABLE 1. SUMMARY OF SITES AND INSTALLATIONS				
SITE	**MONITOR WELLS**	**VADOSE ZONE PIEZOMETERS**	**GEOTECHNICAL BORINGS**	**TEST PITS**
1				TP1
2		FW2-S		TP2
3	FW3-R	FW3-S		TP3
4	FW4-R	FW4-S		TP4
5		FW5-S		TP5
7[a]	FW7-R		FW7-S	TP7
8		FW8-S		TP8
9	FW9-S			TP9
10		FW10-S		TP10
11				TP11
12			FW12-S	TP12
13		FW13-S		TP13
14		FW14-S		TP14
15	FW15-R			TP15
16				TP16[b]
17				TP17[b]
18				TP18[b]
19				TP19
20				TP20
21				TP21
22				TP22
23				TP23
24				TP24
25				TP25[b]
26				TP26[b]
27				TP27
28				TP28
29				TP29[b]
30				TP30
31				TP31[b]
32				TP32
33				TP33
34				TP34[b]
35				TP35[b]
36				TP36
37				TP37[b]

[a] Site 6 was removed from the testing program

[b] Infiltration testing was not conducted at Sites 16, 17, 18, 25, 26, 29, 31, 34, 35, or 37

3.0 REGIONAL HYDROGEOLOGIC FRAMEWORK

The regional hydrogeologic framework for the Far West Site was documented during preliminary and Phase I hydrogeologic assessments for the Far West site based on review of publicly available reports, Arizona Department of Water Resources' well records databases, and a site reconnaissance (M&A, 2010 and 2011). Information obtained during Phase II field investigations is consistent with the regional hydrogeologic framework as described previously. The general hydrogeologic framework for the Far West Site is summarized below; detailed hydrogeologic characterization based on Phase II investigations is given in **Section 5.0**.

The Far West Site is underlain by the following hydrogeologic units:

- Quaternary alluvium consisting of alluvial and colluvial deposits of sand, gravel, silt and clay with localized variably-cemented zones

- Quaternary and Tertiary basin-fill alluvium consisting of alluvial fan and terrace deposits, with varying degrees of induration and cementation, increasing in thickness from east to west

- Older pre-basin sedimentary and extrusive volcanic rocks of relatively low permeability, except where fractured, which underlie basin-fill deposits

- Bedrock complex consisting of poorly permeable crystalline igneous and metamorphic rocks, which is exposed in the eastern part of the site and underlies younger units in the remainder of the site

The oldest alluvial deposits exposed at the Far West Site are located in the north central, eastern, and southern portions of the site. The alluvium becomes younger to the west and north. The oldest alluvial deposits mapped by Arizona Geological Survey (AZGS) is the Pliocene or late Miocene conglomerate (Tcy) (Spencer and others, 1998). The equivalent unit mapped by Huckleberry (1993) is the middle Tertiary basin deposits (Tsm) (**Figure 1**). The Tcy is poorly sorted with a sand, silt, and clay matrix. Clasts in the Tcy at the Far West Site consist of pebble, cobble, and boulder-sized fragments of locally derived Precambrian schist, diabase, amphibolites, and granodiorite. The Tcy is more resistant to weathering than the younger alluvium and tends to form steeply incised uplands.

Several Quaternary alluvial units were mapped by Spencer and others (1998) and Huckleberry (1993). Three stages of alluvial fan and terrace deposits mapped by Spencer and others (1998) are dated early (Qo), middle (Qm), and late (Ql) Pleistocene (**Figure 1**). The Qo is topographically higher and more heavily dissected than the Qm and Ql. The equivalent units mapped by Huckleberry (1993) include old alluvium (Oa) and two stages of middle alluvium (Ma1 and Ma2). These units are less resistant to erosion than the Tcy.

The active channel deposits (Qyc) present in the drainages which dissect the fan and terrace deposits on the site are late Pleistocene to Holocene age (**Figure 1**). The equivalent units mapped by Huckleberry (1993) include two stages of young alluvium (Ya1 and Ya2). The Qyc consists chiefly of unconsolidated sand, and is moderately to well sorted and very permeable. The Qyc thickens toward the western part of the site.

A Tertiary basalt unit (Tvy) crops out in the northwest and south central part of the Far West Site. The basalt is a strongly jointed flow unit. In the south-central part of the site, the unit strikes N20W, and dips 22°NE. This bedding attitude is consistent with strikes and dips of basalts located north of the Far West Site (Ferguson and Skotnicki, 1995; Spencer and others, 1998).

Dromedary Peak, located north of the site boundary, is an outcrop of Tertiary Apache Leap Tuff (Tal) or equivalent (Ferguson and Skotnicki, 1995; Spencer and others, 1998). Where the Tvy and Tal are exposed north of the site, the Tvy overlies the Tal.

Based on the hydroGEOPHYSICS, Inc. (HGI) gravity survey conducted during Phase I investigations, a north-northeast trending normal fault (down-dropped to the west) was inferred to occur west of Dromedary Peak and cross the center of the Far West Site (M&A, 2011, Appendix A, Figures 3 and 4). The fault was inferred to be an extension of the Elephant Butte Fault mapped north of the site by Ferguson and Skotnicki (1995).

Prior to Phase II investigations, the only reliable groundwater level data for the Far West site was a measurement obtained in an inactive stock well in October 2010; depth to water level was 74.2 meters below land surface (bls). Groundwater was inferred to be moving generally west or west-southwest based on regional information.

4.0 PHASE II FIELD INVESTIGATIONS

4.1 DRILLING AND CONSTRUCTION OF WELLS, PIEZOMETERS, AND GEOTECHNICAL BORINGS

For Phase II field investigations, five groundwater monitor wells, eight vadose zone piezometers or piezometer nests, and two geotechnical borings were completed. Locations are shown on **Figure 1**. Construction details for wells, piezometers, and geotechnical borings are summarized in **Table 2**. Rotary drilling methods were used to drill monitor wells FW3-R, FW4-R, FW7-R, and FW15-R, and the sonic drilling method was used to drill monitor well FW9-S. The sonic drilling method was used to drill the vadose zone piezometers and geotechnical borings. Schematic diagrams of construction for monitor wells, vadose zone piezometers, and geotechnical borings are given in **Appendix A**.

4.1.1 Rotary Drilling

Groundwater monitor wells FW3-R, FW4-R, FW7-R, and FW15-R were drilled and constructed by Layne Christensen Company of Chandler, Arizona during the period February 21 through April 19, 2012 using a top-head drive rotary drill rig. Monitor well locations are shown on **Figure 1**. Borehole depths and diameters are summarized in **Table 2**.

With the exception of wells FW3-R and FW15-R, air and water were the only fluids used during drilling operations. At well FW3-R, it was necessary to use drilling fluid additives (bentonite-based drilling mud) to stabilize the borehole for geophysical logging, and at FW15-R, it was necessary to use drilling fluid additives to maintain borehole stability during drilling. The boreholes were drilled in one pass except for FW15-R which was drilled in two passes (drilling of smaller diameter pilot hole followed by reaming to final diameter). Well FW15-R was designed as a groundwater production well; however, due to very small permeability of the volcanic rocks that comprise the aquifer at that location, productivity of the well is poor, and the well is used only as a monitor well.

Drill cuttings samples were collected at 10-foot intervals and placed in labeled bags. Lithologic descriptions for each sample were prepared by M&A personnel. Splits of each sample were placed in plastic chip trays and were provided to RCM. Detailed lithologic descriptions and graphic logs for the monitor wells are provided in **Appendix B-1**.

Geophysical logging was conducted when the boreholes reached total depth; logging services were provided by Southwest Exploration Services (SWE), LLC of Chandler, Arizona. The suite of geophysical logs obtained included: caliper, temperature, fluid resistivity, natural gamma ray, 16-inch and 64-inch normal resistivity, spontaneous potential, single point resistance, and sonic. An optical borehole imaging (OBI) log was obtained in the vadose zone at FW7-R only. **Table 3** shows logs obtained and depth intervals for each type of log. SWE submitted field logs in digital and hard copy format to RCM staff. Final logs were submitted electronically. Summary geophysical logs for FW3-R, FW4-R, FW7-R, and FW15-R are provided on **Figures A-1 through A-4**.

TABLE 3. SUMMARY OF BOREHOLE GEOPHYSICAL LOGS OBTAINED AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

GEOPHYSICAL LOG	FW3-R DEPTH INTERVAL (meters bls)[a]	FW4-R DEPTH INTERVAL (meters bls)	FW7-R DEPTH INTERVAL (meters bls)	FW9-S DEPTH INTERVAL (meters bls)	FW15-R DEPTH INTERVAL (meters bls)
Total Drilled Depth	344.4	113.5	216.4	182.1	278.9
Caliper	0 – 342	0 – 113	0 – 214	140 – 182	0 – 277
Temperature	3 – 343	3 – 113	0 – 214	150 – 183	3 – 278
Fluid resistivity	3 – 343	85 – 113	182 – 214	---	3 – 278
Natural gamma ray	0 – 341	0 – 112	0 – 213	137 – 180	0 – 276
16 and 64-inch normal resistivity	15 – 344	81 – 113	185 – 216	158 – 182	15 – 272
Single point resistance	15 – 344	81 – 113	185 – 216	158 – 182	11 – 272
Spontaneous potential	15 – 344	81 – 113	185 – 215	158 – 182	10 – 271
Sonic	0 – 343	82 – 113	183 – 215	150 – 181	2 – 278
OBI	---	---	8 – 181	---	---

[a] bls = below land surface
--- = not obtained

Geologic contacts were picked based on analysis of drill cuttings samples, geophysical logs, and information obtained during drilling. Depth intervals for geologic units encountered during drilling are summarized in **Table 4**. Detailed lithologic descriptions based on drill cuttings samples are provided in **Appendix B-1**. Geophysical logs were used to confirm the depth intervals given in **Table 4** and are shown on **Figures A-1 through A-5**.

TABLE 4. SUMMARY OF GEOLOGIC UNITS DRILLED AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R					
GEOLOGIC FORMATION	DEPTH INTERVAL (meters bls)[a]				
	FW3-R	FW4-R	FW7-R	FW9-S	FW15-R
Quaternary Alluvium (Qal)	0 – 7.9	0 – 7.6	0 – 12.2	0 – 8.8	0 – 24.4
Tertiary and Quaternary Basin-Fill Deposits (QTg)	7.9 – 133.0	7.6 – 33.5	12.2 – 133.0	8.8 – 182.1	24.4 – 169.6
Tertiary Younger Volcanics (Tvy) – Basalt	133.0 – 163.2	N/A	133.0 – 167.5 168.4 – 216.4	N/A	169.6 – 278.9
Tuffaceous Sandstone Fault Gouge	163.2 – 173.7	N/A	167.5 – 168.4	N/A	N/A
Tertiary Older Sediments (Tso)	173.7 – 249.9	N/A	N/A	N/A	N/A
Apache Leap Tuff – White Unit (Talw)	249.9 – 271.3	33.5 – 52.3	N/A	N/A	N/A
Apache Leap Tuff – Gray Unit (Talg)	271.3 – 344.4	N/A	N/A	N/A	N/A
Precambrian Granodiorite (pCg)	N/A	52.3 – 113.5	N/A	N/A	N/A

[a] bls = below land surface
N/A = not applicable

Well construction began with installation of 12-3/4-inch diameter blank steel surface casing at FW3-R, FW4-R, and FW7-R, and 16-inch diameter blank steel surface casing at FW15-R. The production intervals of the wells were constructed using threaded and coupled blank and perforated steel casing. Wells FW3-R, FW4-R, and FW7-R were constructed using 4-1/2-inch diameter casing, and well FW15-R was constructed using 8-5/8-inch diameter casing. Perforations are 1/8-inch wide by 3-inch long machine-cut slots, two slots per round, four rounds per foot, staggered (8 slots per foot). A bullnose end cap was welded to the bottom joint of casing. Well construction details are summarized in **Table 2**. **Figures A-1 through A-4** are schematic diagrams of construction for the wells. Other data summarized on the schematic diagrams include: hydrogeologic units, borehole geophysical logs, and groundwater level.

Surface completions consist of an extension of the steel surface casing to approximately 1 meter above land surface. The casing extension was cemented in place and secured with a locking cap. Horizontal and vertical well coordinates for the top of surface casing and top of the well caps were surveyed by Civiltec Engineering, Inc. (Civiltec) of Phoenix, Arizona, on June 15, 2012. Horizontal coordinates and computed land surface elevations are provided in **Table 2**. Dedicated Level TROLL integrated pressure transducer datalogger units were installed in each monitor well by M&A personnel on July 12, 2012 to monitor water level.

4.1.2 Sonic Drilling

Monitor well FW9-S, vadose zone piezometers FW2-S, FW3-S, FW4-S, FW5-S, FW8-S, FW10-S, FW13-S, and FW14-S, and geotechnical boreholes FW7-S and FW12-S were drilled and constructed by Boart Longyear Drilling Services of Glendale, Arizona during the period March 6 through May 5, 2012 using a sonic core drill rig. Locations are shown on **Figure 1**. Borehole depths and diameters are summarized in **Table 2**.

During sonic drilling, geotechnical testing was conducted and included standard penetration testing (SPT), split-spoon sampling (California Split Spoon [CSS]), and bulk soil sampling. SPT and CSS testing included measuring standard penetration blow counts at 5-foot intervals from 5 to 60 feet bls, at 10-foot intervals from 65 to 135 feet bls, and at 20-foot intervals below a depth of 135 feet. At each test depth, blow counts were measured for 6 consecutive 3-inch (0.08 m) intervals. If blow counts reached 50 before reaching 3 inches of penetration, this was considered "refusal", and penetration testing at that depth was discontinued. Refusal was encountered at most of the test depths due to high density and/or degree of cementation of the sediments. In addition, due to frequent refusal, and coarse-grained texture of the sediments, very few samples could be retrieved using the CSS sampler. Sample collection protocols and analysis schedule was directed by KCB with input from M&A. Soil physical properties were analyzed by ATL, Inc. of Phoenix, Arizona. Bulk samples were analyzed for moisture content (every 5 feet), for particle size distribution (every 25 feet), and for other properties to be used by KCB for geotechnical analyses and reported separately in a KCB geotechnical report. Results of laboratory analyses for moisture content are summarized in **Section 5.5** of the present report.

Sonic cores were obtained at approximate 2.5-foot intervals and contained in plastic sleeves. Core samples were photographed immediately following retrieval from the borehole; photographs of sonic cores are provided in **Appendix C**. Samples were obtained from the plastic sleeves for laboratory analyses for moisture content and particle size distribution, and lithologic descriptions were prepared. Detailed lithologic descriptions, graphic logs, results of SPT/CSS testing, and sample depths for the sonic boreholes are provided in **Appendix B-2** (log for FW9-S is included with the monitor wells in **Appendix B-1**).

When the borehole for FW9-S reached total depth, borehole geophysical logging was conducted by SWE. **Table 3** (**Section 4.1.1**) shows logs obtained and depth intervals for each type of log.

Geologic contacts were picked based on analysis of core samples and information obtained during drilling. Detailed lithologic descriptions are provided in **Appendix B-2**. A summary of geologic contacts for sonic boreholes is given in **Tables 5 and 6**.

TABLE 5. SUMMARY OF GEOLOGIC UNITS DRILLED AT VADOSE ZONE PIEZOMETERS FW2-S, FW3-S, FW4-S, FW5-S, FW8-S, FW10-S, FW13-S, AND FW14-S								
GEOLOGIC FORMATION	**DEPTH INTERVAL (meters bls)[a]**							
	FW2-S	**FW3-S**	**FW4-S**	**FW5-S**	**FW8-S**	**FW10-S**	**FW13-S**	**FW14-S**
Quaternary Alluvium (Qal)	0 – 4.6	0 – 9.1	0 – 7.8	0 – 3.0	0 – 12.7	0 – 10.7	0 – 16.0	0 – 7.3
Tertiary and Quaternary Basin-Fill Deposits (QTg)	4.6 – 41.4	9.1 – 41.6	7.8 – 19.8	3.0 – 7.5	12.7 – 41.1	10.7 – 23.5	16.0 – 41.1	7.3 – 41.1
Precambrian – Pinal Schist (pCpi)	N/A	N/A	N/A	7.5 – 10.7	N/A	23.5 – 29.0	N/A	N/A

[a] bls = below land surface
N/A = not applicable

TABLE 6. SUMMARY OF GEOLOGIC UNITS DRILLED AT GEOTECHNICAL BORINGS FW7-S AND FW12-S		
GEOLOGIC FORMATION	**DEPTH INTERVAL (meters bls)[a]**	
	FW7-S	**FW12-S**
Quaternary Alluvium (Qal)	0 – 12.2	0 – 7.9
Tertiary and Quaternary Basin-Fill Deposits (QTg)	12.2 – 19.8	7.9 – 19.8

[a] bls = below land surface

Construction at FW9-S began with installation of 12-inch diameter blank steel surface casing in the upper 6.1 meters (20 feet) of the borehole. The production interval of the well was constructed using 4-1/2-inch diameter threaded and coupled blank and perforated steel casing. Perforations are 1/8-inch wide by 3-inch long machine-cut slots, two slots per round, four rounds per foot, staggered (8 slots per foot). A bullnose end cap was welded to the bottom joint of casing. Well construction details are summarized in **Table 2**. **Figure A-5** is a schematic diagram of construction for well FW9-S. Other data summarized on the schematic diagram include: hydrogeologic units, borehole geophysical logs, and groundwater level.

Construction of a monitor well was originally planned for FW14-S and 12-3/4-inch blank steel surface casing was installed and cemented in place in the upper 6.1 meters (20 feet) of the borehole. Slow drilling progress due to hard formation made it necessary to terminate the borehole before reaching groundwater, and a vadose zone piezometer was completed instead.

In lieu of installing surface casing in the remaining vadose zone piezometers, the uppermost 6.1 meters (20 feet) of annular space was filled with neat cement to provide a legal surface seal. The vadose zone piezometers were constructed using 2-inch diameter blank steel casing to a depth of at least 20 feet, and blank and slotted Schedule 80 PVC casing below the steel casing. Piezometers were constructed with two casing strings in each borehole, except for piezometers FW4-S and FW5-S which were constructed with a single casing string. Construction details are summarized in **Table 2**. **Figures A-6 through A-13** show schematic diagrams of construction for the vadose zone piezometers and hydrogeologic units encountered.

Surface completions consist of an extension of the steel surface casing at monitor well FW9-S and vadose zone piezometer FW14-S to approximately 1 meter above land surface. Surface completions at the remaining vadose zone piezometers consist of 2-inch diameter blank steel casing that extends approximately 1 meter above land surface. In all installations, the casing is cemented in place and secured with a locking cap. Horizontal and vertical well coordinates for the top of surface casing and top of the well caps were surveyed by Civiltec, on June 15, 2012. Horizontal coordinates and computed land surface elevations are provided in **Table 2**. A dedicated Level TROLL pressure transducer datalogger was installed at well FW9-S by M&A personnel on July 12, 2012 to monitor water level.

Piezometers were not constructed in geotechnical boreholes FW7-S or FW12-S. Borehole depths and diameters are summarized in **Table 2**. Following geotechnical testing and sample collection, boreholes for FW7-S and FW12-S were abandoned by backfilling with drill cuttings, and installing neat cement in the upper 6.1 meters (20 feet) of the borehole. **Figures A-14 and A-15** show borehole details and hydrogeologic units encountered.

4.2 HYDROLOGIC TESTING OF MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

Short-term pumping tests were conducted during the period May 23 through June 6, 2012. The tests were conducted to provide aquifer parameters and groundwater quality data for the site. Operational parameters for pumped wells are summarized in **Table 7**.

TABLE 7. SUMMARY OF OPERATIONAL PARAMETERS FOR CONSTANT-RATE PUMPING TESTS AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

PUMPED WELL IDENTIFIER	DATE / TIME PUMPING STARTED	DURATION OF PUMPING PERIOD (hours)	AVERAGE PUMPING RATE (L/s)[a]	PRE-PUMPING WATER LEVEL (meters bls)[b]	MAXIMUM WATER LEVEL DRAWDOWN (meters)
FW3-R	31-May-2012 09:00	12	0.03	162.8	10.0
FW4-R	24-May-2012 16:30	24	0.03	42.0	10.3
FW7-R	30-May-2012 08:35	12	0.20	182.3	0.8
FW9-S	23-May-2012 19:00	18	0.03	150.9	15.0
FW15-R	5-June-2012 08:30	15	0.08	188.7	30.7

[a] L/s = liters per second
[b] bls = below land surface

Well locations are shown on **Figure 1**. Schematic diagrams of well construction for the pumped wells are shown on **Figures A-1 through A-5.** No observation wells were monitored during testing.

4.2.1 Pumping Equipment

Temporary submersible electric pumping equipment used for testing is summarized in **Table 8**.

TABLE 8. SUMMARY OF PUMPING EQUIPMENT USED FOR CONSTANT-RATE TESTING AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

PUMPED WELL IDENTIFIER	GRUNDFOS PUMP MODEL NUMBER	DEPTH TO INTAKE (meters btoc)[a]	Pump Motor
FW3-R	5SQ15-450	212	1.5 HP 240 volt single phase
FW4-R	5SQ07-270	97	3/4 HP 240 volt single phase
FW7-R	5SQ15-450	212	1.5 HP 240 volt single phase
FW9-S	5SQ15-450	180	1.5 HP 240 volt single phase
FW15-R	5S15-31	231	1.5 HP 460 volt three phase

[a] btoc = below top of casing

All pumps were installed on 1-inch galvanized steel column pipe. A 1-1/4-inch PVC sounder access tube was strapped to the column pipe using plastic “zip” ties. The sounder access tube was capped on the bottom and factory slotted in the lowermost 3 meters.

4.2.2 Discharge Assembly and Flow Measurement

The discharge assembly included a pressure gage at the wellhead, straight pipe sections upstream and downstream from the flowmeters, an inverted U-tube to assure full pipe flow, a gate valve, and a hose bib for obtaining water samples. Paddle-wheel inline flowmeters with totalizing and instantaneous digital readouts were used to measure discharge for all tests. The flowmeters were manufactured by Great Plains Industries, Wichita, Kansas. For all wells except FW7-R, the flowmeter was a model A109GMA025NA1 1-inch diameter meter, with a 0 to 3 gallon per minute (gpm) range. For well FW7-R, the flowmeter was a model G2S05N096MA 3/4-inch diameter meter, with a 1 to 10 gpm range. For all wells, discharge was also measured manually using a calibrated bucket and stopwatch.

Small diameter flowmeters are very sensitive to debris in the discharge stream at low pumping rates, and flowmeter operation for most of the tests was intermittent, especially during early portions of pumping tests. For the pumping test at FW15-R, flowmeter operation was continuous during testing. When the flowmeters were operational, the instantaneous meter readings showed good agreement with manual measurements. For the purpose of test analysis, discharge measurements using the manual method were used exclusively because these data were consistent throughout testing.

4.2.3 Discharge of Pumped Water

Pumped water was discharged to a 300 gallon stock tank. Turbid or muddy water was pumped from the stock tank to a 9,000 gallon Baker tank at each site, using an electric sump pump. At wells FW3-R and FW15-R, all pumped water was contained in the Baker tank. For all other tests, after pumped water cleared it was discharged to land surface, in accordance with an Arizona Pollutant Discharge Elimination System (AZPDES) General Permit for De Minimus Discharges to Waters of the U.S. Approximate total volume pumped from each well, including development pumping, is summarized in **Table 9**.

TABLE 9. SUMMARY OF DISCHARGE VOLUMES DURING TESTING AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

PUMPED WELL IDENTIFIER	TOTAL VOLUME PUMPED (LITERS)	TOTAL VOLUME PUMPED (GALLONS)
FW3-R	3,800	1,000
FW4-R	2,700	700
FW7-R	10,500	2,800
FW9-S	2,000	500
FW15-R	6,900	1,800

4.2.4 Analytical Methods

Semi-log drawdown and recovery graphs for pumped wells and pumping rate graphs are shown on **Figures 2 through 6**. Transmissivity estimates were prepared using the computer-based analytical aquifer test software AQTESOLV® for Windows, version 4.50.004 (Glenn M. Duffield, HydroSOLVE, Inc., 2008). Estimates were prepared using the Cooper-Jacob semi-log drawdown method (Cooper and Jacob, 1946), the Papadopulos-Cooper log-log drawdown and recovery method (Papadopulos and Cooper, 1967) and the Theis recovery method (Theis, 1935). AQTESOLV® plots are provided in **Appendix D**.

The Cooper-Jacob and Papadopulos-Cooper plots include a plot of the drawdown (s) and the logarithmic derivative of drawdown ($\delta s/\delta \log t$) as a function of time elapsed since the beginning of the test (t) on semi-log and log-log scales. The Papadopulos-Cooper analytical solution includes wellbore storage. The Cooper-Jacob and Theis analytical solutions are line-source solutions (no wellbore storage).

Because aquifer transmissivity at the Far West Site is low, water level response to pumping is strongly influenced by wellbore storage. The duration of wellbore storage effects depends on the ratio:

$$r_c^2/T,$$

where r_c is the casing or borehole radius in meters, and T is the transmissivity in meters squared per day (m^2/d) (Papadopulos and Cooper, 1967). Wellbore storage prolongs the pumping time required to estimate aquifer transmissivity. The estimated time required to establish radial flow conditions with minimal wellbore storage effects is approximately $t \geq 25r_c^2/T$ (Spane, 1993). Wellbore storage is indicated by a unit slope during early time on log-log plots of drawdown versus time (HydroSOLVE, 2008; Renard and others, 2008).

Estimated transmissivity using the various analytical methods, together with approximate effective borehole radius and computed values of $25r_c^2/T$ is summarized in **Table 10**.

TABLE 10. SUMMARY OF COMPUTED TRANSMISSIVITIES FROM CONSTANT-RATE PUMPING TESTS IN MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

PUMPED WELL	COOPER-JACOB (1946) SEMI-LOG DRAWDOWN METHOD (m^2/d)[a]	PAPADOPULOS-COOPER (1967) LOG-LOG DRAWDOWN AND RECOVERY METHOD (m^2/d)	THEIS (1935) SEMI-LOG RECOVERY METHOD (m^2/d)	APPROXIMATE EFFECTIVE BOREHOLE RADIUS (meters)	$25r_c^2/T$ (days)	PUMPING PERIOD DURATION (days)
FW3-R	**0.23**	0.06	0.04	0.05	0.27 days for T = 0.23	0.5
FW4-R	0.06	**0.10**	0.05	0.125	3.9 days for T = 0.10	1.0
FW7-R	**21**	36	27	0.05	0.0030 days for T = 21	0.5
FW9-S	0.10	**0.10**	0.04	0.076	1.4 days for T = 0.10	0.75
FW15-R	0.03	**0.04**	0.02	0.102	8.7 days for T = 0.03	0.625

[a] m^2/d = meters squared per day, **Bold** values judged most appropriate.

For gravel-packed wells, the effective borehole radius is assumed to be the casing radius. For wells without gravel pack, the effective borehole radius is assumed to be the drilled borehole radius.

4.2.5 Discussion and Summary of Results

For wells FW3-R and FW7-R, the wellbore storage effects are small and the Cooper-Jacob solution is judged to be appropriate. For wells FW4-R, FW9-S, and FW15-R, transmissivity is demonstrated to be low but is less well quantified, and the Papadopulos-

Cooper analytical method, which includes wellbore storage, is judged to be more appropriate. However, for the short pumping periods analyzed, the Papadopulos-Cooper method is relatively insensitive to changes in transmissivity, and solutions are non-unique.

All analytical methods used assume that groundwater occurs under confined conditions, the aquifer is homogeneous and isotropic, and flow to the well during pumping occurs in a radial flow pattern. Due to the heterogeneous aquifer conditions, and the large amount of drawdown observed during testing, conditions for pumping tests at the Far West Site deviated substantially from these simplifying assumptions.

Results of testing are summarized in **Table 11**. Hydraulic conductivity was computed by dividing estimated transmissivity by saturated screen length, using water levels measured at start of tests.

TABLE 11. SUMMARY OF RESULTS FOR CONSTANT-RATE PUMPING TESTS CONDUCTED IN MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R					
WELL IDENTIFIER	**FW3-R**	**FW4-R**	**FW7-R**	**FW9-S**	**FW15-R**
Description of Hydrologic Testing Zone (meters bls)[a]:	**Cased well** Saturated perforated interval 164.1 to 209.2; 254.3 to 331.7 (perf. interval fully saturated)	**Cased well** Saturated perforated interval 74.2 to 113.5 (perf. interval fully saturated)	**Cased well** Saturated perforated interval 182.3 to 215.1 (perf. interval partially saturated)	**Cased well** Saturated perforated interval 150.9 to 182.1 (perf. interval partially saturated)	**Cased well** Saturated perforated interval 188.7 to 234.3 (perf. interval partially saturated)
Geologic Units in Testing Zone	Fault gouge, Tertiary sandstone, basalt, mudstone, and Apache Leap Tuff	Precambrian granodiorite	Tertiary basalt	Tertiary alluvium	Tertiary basalt
Test Duration (hours):	12	24	12	18	15
Pre-pumping Depth to Water (meters bls):	162.7 31-May-2012	41.9 24-May-2012	182.3 30-May-2012	150.9 23-May-2012	188.7 5-June-2012
Average Discharge Rate (L/s)[b]:	0.03	0.03	0.20	0.03	0.08
Maximum Drawdown (meters):	10.0	10.3	0.8	15.0	30.7
Estimated Transmissivity (m^2/d)[c]:	0.23	0.10	21	0.10	0.04
Saturated Thickness (meters):	122.5	39.3	33.0	31.2	45.6
Estimated Average Hydraulic Conductivity (cm/s)[d]:	2×10^{-6}	3×10^{-6}	7×10^{-4}	4×10^{-6}	1×10^{-6}

[a] bls = below land surface
[b] L/s = liter per second
[c] m^2/d = meters squared per day
[d] cm/s = centimeters per second

4.3 GROUNDWATER SAMPLING

Groundwater samples were collected near the end of each pumping test. Samples were analyzed for common and trace constituents by TestAmerica Laboratories, Inc. of Phoenix, Arizona. Routine field parameters including temperature, pH, and specific conductance were measured and recorded during testing using a Myron-L parameter meter that was calibrated prior to each test. Sample identifiers, sampling date, and routine field parameters are summarized in **Table 12**. Results of laboratory chemical analyses for common and trace constituents are summarized in **Tables 13 and 14**.

TABLE 12. WATER SAMPLES COLLECTED DURING TESTING AT MONITOR WELLS FW3-R, FW4-R, FW7-R, FW9-S, AND FW15-R

SAMPLE DESCRIPTION	SAMPLE IDENTIFIER	DATE	TIME	FIELD PARAMETERS		
				TEMP (°C)[a]	pH (s.u.)[b]	SPECIFIC CONDUCTANCE (µS/cm)[c]
FW3-R	6062	31-May-2012	20:35	28.5	8.31	489.3
FW4-R	6003	25-May-2012	15:30	29.3	7.24	621.1
FW7-R	6005	30-May-2012	20:00	31.7	7.71	486.7
FW9-S	6002	24-May-2012	12:30	31.7	7.71	415.2
FW15-R	6006	5-June-2012	22:15	30.6	7.84	459.4
FW15-R (duplicate)	6007	5-June-2012	22:15	30.6	7.84	459.4

[a] Temp °C = temperature in degrees Celsius
[b] s.u. = standard units
[c] µS/cm = microSiemens per centimeter at 25 °C

During testing, discharge rates for all of the monitor wells were very small (0.03 to 0.20 liters per second). Due to the small discharge rates, total volume pumped (**Table 9**) was three borehole volumes or more only at FW7-R and FW9-S. Results of laboratory analyses of groundwater samples are discussed in **Section 5.7**.

4.4 VADOSE ZONE INJECTION TESTING

A total of 14 injection tests were conducted in the vadose zone piezometers at the Far West Site during the period from May 7 through May 14, 2012. The tests were conducted to provide estimates of saturated hydraulic conductivity (Ksat) of selected intervals in the "unsaturated" (vadose) zone. Injection tests were conducted in all eight vadose zone piezometers constructed at the site (**Figure 1**). Six of the piezometers are dual-completion piezometers with separate "shallow" and "deep" casing installations (both completions were tested); a bentonite seal in the borehole separates the perforated intervals of the two completions. Piezometers FW4-S and FW5-S were constructed with a single (shallow) casing installation. Lengths of the perforated intervals are 1.5, 3.0, and 6.1 meters for the various piezometer completions. The tested piezometer completions are listed in **Table 15**, including the perforated intervals, sediment types tested, and injection test results. Vadose zone piezometer drilling and construction details are described in **Section 4.1.2**. Construction details are summarized in **Table 2**. **Figures A-6 through A-13** are schematic diagrams of construction for the vadose zone piezometers tested and show geologic units encountered in the boreholes. A summary of geologic contacts for the piezometer boreholes is given in **Table 5**; detailed lithologic descriptions are provided in **Appendix B-2**.

Injection "pre-tests" were conducted in most of the piezometers on April 13, 2012. These pre-tests were conducted by manually adding water to each piezometer completion (via buckets) and measuring the rate of water level decline. The results were not analyzed for Ksat per se, but were conducted to simply provide a rough estimate of the relative permeability and the potential water supply needed to conduct the full-scale injection tests.

4.4.1 Injection Test Methods

Injection tests at the Far West Site were conducted using "constant-head" and "falling-head" methods depending on the anticipated Ksat of the test interval. Constant-head tests are typically preferred because the test interval is exposed to a constant water pressure and instead of a continually declining pressure. Although the Ksat value determined from an injection test should not be a function of the imposed head (for a homogeneous isotropic medium), in practice, larger imposed heads typically result in larger Ksat values because there is a larger gradient for horizontal flow, which is promoted by heterogeneities. For sediment intervals that have a very small Ksat, a larger imposed head is often needed, and maintaining a constant head (water level) in the piezometer can be difficult. Therefore, for such test intervals, the falling-head method is advantageous, if not necessary. The 14 injection tests conducted at the Far West Site included 10 constant-head tests and four falling-head tests (**Table 15**).

4.4.1.1: CONSTANT-HEAD TESTS: For the constant-head tests, water level (head) was maintained at a fixed height in the piezometer by controlling the delivery rate of water into the piezometer, which is equivalent to injecting water into the piezometer at a rate equal to the rate of water flowing out into the formation through the borehole. The “outflow rate” into the formation is a function of the Ksat of the porous media, dimensions of the screened portion of the borehole, the magnitude of head imposed in the piezometer, and the degree of saturation and wetted volume of the porous media. For typical injection tests, the outflow (injection) rate is largest during the early stage of an injection test when capillary forces contribute significantly to the infiltration of water and both vertical and horizontal flow are occurring as the flow field is being established. Injection rates typically decrease as the test proceeds due to the decreasing contribution of capillary forces (porous medium becomes more saturated) and flow within the saturated “bulb” becomes more established or controlled by vertical flow (lateral expansion of the wetted flow field diminishes).

For the Far West constant-head injection tests, a constant head was maintained by adjusting (reducing) the injection rate throughout the test. The injection tests were conducted until injection rates became relatively steady at the established head; test durations ranged from 2.3 to 6.5 hours. For these tests, the imposed head was targeted for the top of the perforated interval if possible (but not above the top of the perforated interval). For some tests, the rate of injection required to achieve a head corresponding to the top of the perforated interval was greater than the maximum pumping rate of the pumps used to deliver water to the piezometers. Conduct of the test with a constant-head below the top of the perforated interval is no less valid; however, the test zone simply does not include the entire perforated interval (the actual test interval extends from the water level in the piezometer to a substantial depth below the bottom of the piezometer as water moves downward).

4.4.1.2: FALLING-HEAD TESTS: As described previously, falling-head injection tests were conducted in piezometers/test zones where the Ksat was anticipated to be very small (based on the pre-tests and evaluation of lithologic conditions in the perforated interval). The falling-head tests were conducted by adding water to a piezometer to a level approaching land surface and measuring the water level decline; several falling-head cycles were repeated for each test. Total test durations ranged from 5 to 53 hours due to conduct of a varying number of falling-head cycles at the four tested piezometer completions, some of which were monitored overnight.

4.4.1.3: INJECTION TEST SETUP: The primary components of the injection test setup are the water delivery system to the piezometer and the instruments for monitoring water level in the piezometer. The constant-head tests required a substantial water supply, which was provided in one or two 9,000-gallon tanks at the piezometer locations. Submersible pumps were used to pump water from the tanks via standard garden hoses through an injection manifold at the piezometer wellhead and down into the piezometer completions. Two manifolds were assembled for the tests using steel pipe; a 1-inch diameter manifold was used for tests requiring larger injection rates, and a ½-inch diameter manifold was used for tests with small injection rates. Each manifold included a pressure gauge, gate valve, flowmeter, straight pipe sections upstream and downstream from the flowmeter, and an inverted U-tube to ensure full pipe flow through the flowmeter. The flowmeters consisted of 1-inch and ½-inch paddle-wheel inline meters with totalizing and instantaneous digital readouts; the appropriately-sized manifold and flowmeter was used for each test to accurately measure injection rates. The flowmeter for the 1-inch manifold was manufactured by Blancett Flowmeters, of Racine, Wisconsin, (Model 013009303) with a calibrated range of 5 to 50 gpm. The flowmeter for the ½-inch manifold was manufactured by Great Plains Industries, of Wichita, Kansas, (Model G2S05N09GMA) with a calibrated range of 1 to 10 gpm.

Several submersible pump sizes were used for pumping water into the piezometers for the constant-head tests; the appropriate pump was used for the injection rate needed. For many tests, two submersible pumps and associated hoses were connected to the manifold to achieve a larger injection rate. For most tests, a sufficiently large injection rate could be produced to achieve a water level (head) that was in the upper part of the perforated interval. However, for one injection test (in piezometer FW13-S Deep), the formation permeability was very large and the achievable head was only 1.4 meters (compared to a perforated interval length of 6.1 meters).

For the falling-head tests, a very small water supply was needed, water only had to be added to initiate each falling-head cycle, and the “injection rate” was essentially the rate of water level decline during the cycle (no flowmeter). Therefore, the delivery rate of water added to each piezometer completion was not relevant and was not measured.

For both the constant-head and falling-head tests, water level (head) in the piezometers was monitored using Level TROLL™ pressure transducers (with integrated datalogger), manufactured by In-Situ Inc., of Ft. Collins, Colorado, which were set at the bottom of the piezometer casings.

4.4.2 Analytical Methods

The constant-head injection tests were analyzed to determine Ksat values for the tested intervals using three analytical solutions for flow from a constant-head borehole permeameter in the vadose zone: Glover (Glover, 1953), Nasberg-Terletskata (Nasberg, 1951; Terletskata, 1954), and Zanger (Zanger, 1953). All three solutions compute Ksat based on the final ("steady") injection rate, the constant head (length of wetted borehole) established for the test, and the borehole radius. The Glover and Nasberg-Terletskata solutions are relevant when the height of the water column in the borehole is equal to the length of borehole in hydraulic contact with the formation; i.e., the constant-head (water level) is within the perforated interval. The Zanger solution is also relevant when the height of the water column in the borehole is greater than the length of borehole in hydraulic contact with the formation (when the water level is above the top of the perforated interval). The three analytical solutions are all commonly used and potentially valid for computing Ksat and all assume homogeneous conditions of the sediment intervals tested, but are based on slightly different theoretical derivations (assumptions for integrating head and outflow across the wetted borehole length).

Results for all three analytical solutions are given in **Table 15** for each test and provide a representative range of Ksat values for the sediment intervals tested. None of these constant-head solutions account for the effects of capillary flow (unsaturated flow at the edges of the primary saturated flow field), which, as described previously, diminish in importance as the test proceeds and the saturated flow field becomes larger and deeper. Disregarding capillary flow theoretically results in somewhat larger computed Ksat's because all the injected water is assumed to move within the saturated flow field. For most injection tests at the Far West Site, (especially for test intervals consisting of relatively coarse-grained sediments), the effect or "error" of disregarding capillary flow on computed Ksat values is small, and likely much less significant that errors inherent with the overall assumption of homogenous conditions in the tested sediment intervals. Nevertheless, it is relevant to note that the computed Ksat values may be slightly larger than the actual vertical Ksat values of the tested intervals.

Analysis of falling-head injection tests is typically based on a different analytical solution than the constant-head tests due to the decreasing head during the test. However, for the four falling-head tests conducted at the Far West Site, the test data were analyzed as “quasi-constant-head” tests using the Zanger solution. Although the tests were initiated with a very large head (initial water level close to land surface), to provide “more comparable” computed Ksat values to the constant-head tests (where a relatively small head was maintained within the perforated interval), only the “lowest-head” portions of the falling-head cycles were used to evaluate Ksat (when the head/water levels were closest to the top of the perforated interval). This analysis used the computed water volume flowing into the formation during a relatively small decline in head (water level) and the “constant-head” value associated with this inflow volume was computed as the average head during the associated water decline. This approach was used because, as described in **Section 4.4.1**, larger imposed heads typically result in larger Ksat values due to promoting horizontal flow (due to stratified sediments in the formation and larger hydraulic gradients.

An extensive analysis was conducted to compute Ksat for every discrete head drop during each falling-head cycle for each falling-head test. The computed Ksat values were confirmed to be highest for head drop intervals at the beginning of each falling-head cycle (very large heads) and lowest for head drop intervals at or near the end of each falling-head cycle (much smaller heads). Therefore, by analyzing and using only the lowest-head portions of the falling-head cycles and computing Ksat values based on a quasi-constant-head solution, the reported Ksat values more accurately represent vertical Ksat and are comparable to the constant-head test results.

4.4.3 Injection Test Results

Results of the 14 constant-head and falling-head injection tests conducted in the vadose zone piezometers at the Far West Site are summarized in **Table 15**. For the constant-head tests, computed Ksat values are given for the Glover, Nasberg-Terletskata, and Zanger analytical solutions. For the falling-head tests (quasi-constant-head tests), the Ksat values given in **Table 15** were computed using the Zanger solution. **Table 15** also lists the perforated intervals for the piezometers (essentially the test intervals), sediment types tested, test durations, constant-head values established for the constant-head tests, and head values for the falling-head tests at which the "quasi-constant-head" determination of Ksat was computed.

It is important to note that the computed Ksat values are considered to be representative of chiefly vertical flow (vertical Ksat), but they may be more accurately described as a "composite" value of Ksat in all directions. The difference between horizontal and vertical Ksat (anisotropy), and the effect or "contribution" of horizontal Ksat to the measured Ksat is not known (horizontal Ksat is typically larger than vertical Ksat by an order of magnitude or more for stratified sediments). However, it is assumed to be relatively small due to the consideration that as the test proceeds and the formation sediments become saturated to larger depths, the flow field becomes established and vertical flow is (theoretically) predominant. Therefore, the reported Ksat values **(Table 15)** will be used to represent vertical Ksat with the qualifier that they might be conservatively large estimates of vertical Ksat.

Results of the 14 injection tests, including relevant considerations for the tests and comparisons of the computed Ksat values to the lithology of the tested sediment intervals, are summarized in the following paragraphs.

1. The total range of Ksat values determined from all 14 injection tests, including the 10 constant-head tests and four falling-head tests is very large, from 2.8 x 10^{-7} to 2.9 x 10^{-2} centimeters per second (cm/s).

2. Overall, the Ksat values determined by the constant-head and falling-head injection tests correlate reasonably well with the lithologic conditions of the vadose zone intervals tested. Intervals with larger silt (or clay) content of the sediment matrix (non-gravel fraction) or with greater lithification generally had smaller measured Ksat values. The measured Ksat values for most tests also agree with ranges of Ksat values provided in available publications/studies for generally similar sediment lithologies (Freeze and Cherry, 1979). The relationships of measured Ksat values to the sediment lithologies tested are described in more detail below.

3. The three solutions used to determine Ksat for constant-head tests showed some variation in the computed Ksat values. The Nasberg-Terletskata solution consistently yielded the highest values of Ksat, while the Zanger solution consistently yielded the lowest values of Ksat. The range of Ksat values determined by the three solutions was consistently within a factor of 1.5 (comparing highest to lowest computed Ksat value for each test). For ease of discussion, Ksat values referenced herein are based on the Nasberg-Terletskata solution, which provided the highest values of the three analytical methods.

   - The highest Ksat value of 2.94 x 10^{-2} cm/s determined from the constant-head tests (and falling-head tests) was for piezometer completion FW-13S Deep. This test result is much higher than the Ksat values determined from the other nine constant-head injection tests. The lithology of the test interval (perforated interval) consisted chiefly of moderately lithified sand with some silt and gravel. The outflow rate was very large and a head (water level height) of only 1.4 meters in the perforated interval could be achieved and maintained. The Ksat value determined for this test interval (the top of which is only 1.4 meters above the bottom of the piezometer borehole) is higher than the Ksat values determined at other piezometer test intervals with similar lithology, but is within the estimated range of Ksat values for silty sand (Freeze and Cherry, 1979).

   - The lowest Ksat value of 4.0 x 10^{-4} cm/s determined from the constant-head tests was for piezometer completion FW10-S Deep. The lithology in the screened interval consisted of well lithified, silty and gravelly sand. However, the screened interval (bottom of the borehole) is directly underlain by Pinal schist (bedrock). Based on results of the injection test conducted at piezometer FW-5 (in Pinal Schist, as described further below) Ksat of the schist is likely to be very low. Therefore, the Ksat value determined for the test interval in FW10-S Deep is unrepresentatively small for the test interval lithology and may chiefly be a function of horizontal flow above the schist contact.

- Ksat values determined from the eight remaining constant-head tests ranged from 5.5×10^{-4} to 5.7×10^{-3} cm/s. Although the sediment lithologies of the test intervals in all these piezometers were not the same, most can be generally described as "silt and sand" (with variable gravel content), typically weakly to moderately lithified (carbonate cemented). These sediment lithologies, and therefore the range of Ksat values determined from these eight tests, are likely to represent the predominant vadose zone sediment types in the basin-fill alluvium at the Far West Site.

4. The four falling-head tests were intentionally conducted in the piezometers/intervals that had small permeability (based on evaluation of the sonic drill core and results of the injection pre-tests); the magnitude of computed Ksat values for these tests is very small as expected, ranging from 2.8×10^{-7} to 3.5×10^{-5} cm/s.

    - The lowest Ksat value of 2.8×10^{-7} cm/s was determined for piezometer FW-4S (a single shallow completion). The sediment test interval (perforated interval) consisted of silty clay with high plasticity. This high-clay content sediment lithology was not encountered during drilling of any of the other piezometer boreholes. The very low Ksat is clearly due to the sediment texture; the sediments were only weakly carbonate-cemented. The estimated Ksat is within the expected range of Ksat values for a silty and/or clayey soil. For this test, Ksat was computed for an average head of 12.8 meters, which was essentially the lowest water level for the falling-head cycles. It is likely that the measured Ksat would be lower for a smaller head (closer to the top of the perforated interval).

    - The second lowest Ksat value of 7.1×10^{-7} cm/s was determined for piezometer completion FW2-S Deep. The lithology of the test interval (perforated interval) consisted chiefly of well lithified fine sand with some silt; this uniformly textured and cemented interval was essentially a conglomerate or sandstone. Despite the "sand" texture, the lithification of this formation appeared to result in very low Ksat. The magnitude of the measured Ksat is within the estimated Ksat range for sandstone. As for the injection test at piezometer FW4-S (previous bullet), Ksat was computed for an average head of 15.5 meters, which was essentially the lowest water level for the falling-head cycles. It is likely that the measured Ksat would be lower for a smaller head (closer to the top of the perforated interval).

    - Piezometer FW5-S was completed (perforated) entirely within Pinal schist (approximately 1.5 m below the alluvium/schist contact). The measured Ksat is 3.5×10^{-6} cm/s, which although low, is higher than might be expected for competent schist bedrock. This suggests that the upper part of the schist formation is weathered or fractured.

- The highest Ksat value determined from the falling-head tests was 3.53 x10^{-5} cm/s, which was measured for piezometer completion FW14-S Deep. The lithology of the test interval (perforated interval) consists chiefly of moderately lithified sand, with some gravel, and minor silt. The measured Ksat value appears somewhat lower than might be expected for this sediment lithology, which suggests that the sediments underlying the bottom of the perforated interval (borehole) might be finer-grained or more cemented.

4.5 NEAR-SURFACE INFILTRATION TESTING

The purpose of the infiltration testing program was to characterize and quantify infiltration properties of representative sediment strata in the near-surface zone across the Far West Site. Infiltration tests were targeted for only the upper 1.5 meters of the near-surface zone due to safe work practices in excavated test pits. When combined with results of the exploration trenching, results of infiltration testing provide a basis for estimating infiltration capacity and hydraulic conductivity of the near-surface sediments.

4.5.1 Infiltration Test Methods

During the period March 28 through May 4, 2012, a total of 56 infiltration tests were conducted in 26 test pits distributed across the Far West Site; locations for the test pits are shown on **Figure 1**. Generally two tests were conducted in each test pit, although additional tests were conducted in four of the test pits, and only one test was conducted in three of the test pits. The tests were conducted at depths ranging from land surface to 1.65 meters; the test pits were excavated by Copper Resource Contracting, Inc. (CRC), Superior, Arizona, using an Extenda-hoe (backhoe). The infiltration testing was conducted in combination with KCB's trenching investigation for geotechnical characterization. At each targeted infiltration test site, a test pit was first excavated to a depth of approximately 1.5 meters, and, following inspection of the exposed sediments, an M&A field geologist determined approximate depths for two infiltration tests. Although the pre-determined depths were approximately 0.6 and 1.5 meters, test depths had to be more selectively chosen based on lithologic conditions encountered in each test pit and the goal of testing representative sediment layers, as explained further below. CRC excavated benches at the selected test depths, and also benched the entire test pit to ensure safe working conditions in the pits. The infiltration tests were then set up by the M&A geologist and conducted with assistance by a KCB field geologist on the benches or pit bottom. After completion of the tests, a trench was excavated inside the pit to a total depth of about 3.7 meters for additional geotechnical sampling and characterization by the KCB geologist.

4.5.1.1 RING INFILTROMETER: A total of 49 infiltration tests were conducted using the double-ring infiltrometer method (and adapted single-ring method) in accordance with American Society for Testing and Materials (ASTM) methods D 3385-94 and D 5126-90. The double-ring infiltrometer consists of two concentric cylinders or "rings": an inner ring with a diameter of 1.0 foot (0.30 meters) and an outer ring with a diameter of 2.0 feet (0.61 meters); the height of both rings is about 0.3 meters. In the simplest terms, the infiltration tests were conducted by driving the rings (concentrically) approximately 0.09 to 0.12 meters into the test surface, adding water inside the rings, and recording the volume of water infiltrating into the sediments through the cross-sectional area of the inner ring, and through the cross-sectional area of the annulus between the inner and outer rings, in a given period of time. Float valves installed inside the rings regulated the flow of water to the rings from calibrated reservoirs to maintain a constant water level ("head") of 0.15 meters. Water used for the infiltration tests was obtained from a storage tank in the Far West laydown yard; the source of this water was an irrigation canal of the Florence Irrigation District, located several kilometers from the site. The water was generally clear and free of substantial suspended sediment; measured water quality parameters were: pH of 8.5 and specific conductance of 1,100 microSiemens per centimeter at 19.3 degrees Celsius. The infiltration tests were conducted for a sufficient time period to achieve relatively stable rates of infiltration; typical duration of the tests ranged from about 2 to 3 hours, although a stable rate was achieved more quickly for some tests. The infiltration test result for each test was essentially equal to the relatively stable rate achieved by the end of the test period. For some tests, measured rates were "somewhat sporadic" after 2 or 3 hours of operation and the test result was determined by averaging the incremental rates measured during the final 0.5 to 1 hour of the test. It is important to note that the test result is "infiltration rate at a head of 0.15 meters", which is similar to but not equivalent to saturated hydraulic conductivity (as described in **Section 4.5.3.3**).

Due to the very gravelly/cobbly and/or "cemented" condition of the sediments encountered in many of the test pits, one or both rings could not be successfully driven into the test surface without substantially disturbing the sediments, either by dislodging cobbles or by fracturing the cemented layers (in both cases, this disruption would lead to "gaps" and excessive leakage of water around the outer ring). At many of the test depths, several attempts had to be made to drive the rings and/or only one ring could be driven (use of only one ring for the tests is a valid method, and arguably is no less effective than using the double-ring setup). Several tests were conducted using a single-ring "falling-head" method, which consisted of adding water inside the ring to a height (head) of 0.15 meters and measuring water level decline inside the ring (as opposed to maintaining a constant head). These tests were conducted in two types of sediment lithology: (1) moderately to well lithified carbonate-cemented "caliche" (this method is further described in **Section 4.5.2**); and (2) coarse-grained sediments of very high permeability (water level decline was too rapid for maintaining a constant water level).

Some of the ring-infiltrometer tests required plugging/filling of small gaps created by soil disturbance with hydrated bentonite after the test started and leakage became apparent. Despite the notable challenges of driving the rings, two valid tests were ultimately completed in most test pits. **Table 16** provides a summary of the infiltration tests, including depths at each test pit, lithology of the primary (targeted) test interval and of deeper underlying sediment layers that may have affected the measured infiltration rates, and relevant notes about the test conditions and test validity.

Following completion of the ring-infiltrometer tests, composite soil samples were obtained from the wetted volume of the test interval inside and underlying the rings to a depth of approximately 0.3 meters. The sediment lithology was evaluated and described, which is summarized for each test in **Table 16**, including particle size distribution, cohesiveness (plasticity), and relative degree of lithification (cementation). In addition, a trench was excavated through the middle of the test (infiltration ring) area to evaluate lithologic conditions underlying the test surface to a depth of 0.6 to 0.9 meters (also summarized in **Table 16**) and to evaluate and document the wetting pattern laterally from and below the test surface. The observed wetting pattern was used to evaluate the extent of lateral and/or capillary flow, which is important in "correcting" the measured infiltration rates to a more representative "vertical" infiltration rate; this process is described further in **Section 4.5.3**. Photographs of the ring-infiltrometer setup are provided in **Appendix E**.

4.5.1.2 CONSTANT-HEAD PERMEAMETER: Another method, the "constant-head permeameter" (Dane and Topp, 2002) was also utilized early in the testing program in five test pits **(Table 16)**. The constant-head permeameter consists of a 0.25-foot diameter reservoir tube (about 1.2 meters in length) that is sealed at the top and perforated/screened at the bottom, and has an inner small-diameter tube that extends through the upper seal to the atmosphere. The location of the bottom of this inner tube can be adjusted to establish the magnitude of applied pressure or "head" (this is an air-entry bubbler that operates in accordance with the "Mariotte bottle principle"). The water-filled permeameter is inserted into a hand-excavated/augered hole of 0.33-foot diameter; for the Far West tests, the hole was approximately 0.3 meters in depth and a constant head of 0.253 meters was used. As water infiltrates through the borehole wall, a saturated bulb or wetting pattern forms around the shallow borehole and a relatively steady in-flow rate into the borehole is reached in a short time period (typically about 10 minutes); the test measurements consist of volume of water infiltrated per unit time. Photographs of the constant-head permeameter setup are provided in **Appendix E**.

The mathematical solution for the constant-head permeameter test is based on empirical input parameters regarding the geometry of the wetted bulb and the effects of capillarity (during unsaturated flow), which are specific to soil type; the empirical factors are available from published studies. The computed test result is saturated hydraulic conductivity (Ksat) as opposed to "infiltration rate at a head of 0.15 meters" for the double-ring infiltrometer. Although the computed Ksat is regarded to be chiefly a function of vertical flow, it is more accurately a composite Ksat of 3-dimensional flow (horizontal and vertical). Due to the uncertain wetting pattern and use of empirical factors in the analytical solution, the Ksat values determined from the constant-head permeameter tests are not "directly" comparable to the "infiltration rates" determined through the ring-infiltrometer tests, although the results of both tests have the same units (length per time). The different meanings of these two results, and the degree of comparability of the results is further addressed in **Section 4.5.3.3**. The primary advantages of the constant-head permeameter is the typically easier setup, small water supply needed (about 4 liters), and the short time-frame for the test (10 to 20 minutes); the double-ring infiltrometer tests require several hours for setup and conduct of the test and a minimum of about 75 liters of water. The primary disadvantages of the constant-head permeameter are the very small-scale of the test and potentially substantial effect of "non-representative" features, which for the Far West tests includes disturbance/fracturing of the cemented sediments during excavation of the shallow borehole.

4.5.2 Lithologic Considerations and Mapped Surficial Geology

As described previously, the M&A field geologist determined approximate depths for two infiltration tests at each test pit (within the upper 1.5 meters); this determination was based on lithologic conditions encountered in each test pit and the goal of measuring infiltration capacity of the most prevalent or representative sediment strata encountered in the pits. The lithologic profile of the majority of test pits, to a depth of 1.5 meters, can be differentiated into two "general" types, with one test pit (TP-36) consisting of a third type (photos of the three profile types are provided in **Appendix E)**.:

1. The entire profile consisted of unconsolidated/non-lithified, poorly sorted sediments (ranging from silty and/or clayey sand and gravel to gravelly sandy silt); although the

gravel content was variable (including very cobbly intervals), the sediment matrix was often relatively consistent within each trench. Some sediment intervals in a few of these pits were weakly to moderately "cemented" with a non-carbonate agent, likely siliceous; this cementation tended to weaken with wetting and was no longer apparent in the post-test characterization of the wetting pattern. Test pits of this general lithologic profile were located in the north half of the Far West Site (with the exception of TP-9), and most commonly within the mapped Quaternary surficial geologic unit (Spencer and others, 1998) of "moderately dissected alluvial fan and terrace deposits" (Late Pleistocene, Ql), although three of these test pits, TP-5, TP-9, and TP-30 were located within the mapped unit of "dissected alluvial fan and terrace deposits" (Middle Pleistocene, Qm). The test pits with this general lithologic profile, together with the mapped surficial geologic unit (Spencer and others, 1998; Huckleberry, 1993) are given in **Table 17**.

TABLE 17. SUMMARY OF TEST PITS WITH 1ST LITHOLOGIC PROFILE TYPE AND MAPPED SURFICIAL GEOLOGIC UNITS

	SURFICIAL GEOLOGIC UNIT	
TEST PIT	Spencer and Others (1998)	Huckleberry (1993)
TP-1	Ql	Ma2
TP-3	Ql	Ma2
TP-4	Ql/Qyc*	Ma2/Ya2
TP-5	Qm	Ma1/Oa
TP-9	Qm	Ma1
TP-14	Ql	Ma2
TP-24	Ql	Ma2
TP-27	Ql	Ma2
TP-30	Qm	Ma1

*TP-4 is located near "active alluvium" (drainage channel); sediments below 0.46 meters are channel deposits.

At essentially all the test pits with the general lithologic profile described above, test depths were not generally restricted, with the exception of very cobbly intervals that presented substantial challenges for driving the infiltration rings (or excavating a uniform borehole for the constant-head permeameter). At test pits of this general lithologic profile, infiltration tests were typically conducted at depths ranging from 0.3 to 1.2 meters.

2. The profile consisted of two or three layers, including a surface layer of essentially the same sediments described for the first profile type above, underlain by moderately to well cemented/lithified caliche (gravelly/cobbly), which was typically underlain by weakly lithified caliche. The surface layer most commonly ranged in thickness from

0.3 to 0.6 meters, although at some test pits this layer extended to 0.9 or 1.2 meters. The moderately to well lithified caliche was often variable in carbonate cementation over relatively small distances, but occasionally was consistently cemented across the pit width. Test pits of this general lithologic profile were located throughout the Far West Site, although more prevalent in the south half. These test pits were located most commonly within the mapped Qm surficial geologic unit (Spencer and others, 1998) and the mapped Tertiary unit of "conglomerate" (Pliocene or Late Miocene, Tcy), although three test pits, TP-12, TP-13, and TP-22, were located within the mapped Ql unit. One test pit, TP-10, was located in the mapped unit of "deeply dissected alluvial fan remnants" (Early Pleistocene, Qo). Another test pit, TP-11, appeared to be located in the mapped unit of "Pinal Schist" (Early Proterozoic, pCpi), but based on the alluvial sediments encountered, was actually in the Qo unit (TP-11 is very close to the Qo mapped unit). The test pits with this general lithologic profile, together with the mapped surficial geologic unit (Spencer and others, 1998; Huckleberry, 1993) are given in **Table 18**.

TABLE 18. SUMMARY OF TEST PITS WITH 2ND LITHOLOGIC PROFILE TYPE AND MAPPED SURFICIAL GEOLOGIC UNITS

TEST PIT	**SURFICIAL GEOLOGIC UNIT**	
	Spencer and others (1998)	Huckleberry (1993)
TP-2	Tcy	Tsm
TP-7	Qm	Ma1
TP-8	Qm	Ma1
TP-10	Qo	Ma1
TP-11	Qo*	Ma1
TP-12	Ql	Ma2
TP-13	Ql	Ma2
TP-15	Qm	Ma1
TP-19	Tcy	Oa
TP-20	Tcy	Oa
TP-21	Qm	Ma1
TP-22	Ql	Ma2
TP-23**	Ql	Ma2
TP-28	Qm	Ma1
TP-32	Qm	Ma1
TP-33	Qm	Ma1

*TP-11 is shown on **Figure 1** to be located within "Pinal Schist" (pCpi) but is clearly located with alluvium (Qo)

**TP-23 lithology could also be considered part of the first lithologic profile type described above (carbonate cementation was weak and occurred at a depth of 1.2 meters)

At these test pits, test depths were essentially dictated by the lithologic contacts and the ability to sufficiently drive in the infiltration rings. Tests conducted above the caliche contact were either conducted near land surface (upper 0.15 meters) so that the test results would represent the unconsolidated surface sediments (and not be significantly affected by the underlying caliche) or were conducted 0.30 meters or less above the caliche layer in an attempt to document the expected impedance of the caliche layer. The deeper test was most often conducted at a depth where lithologic conditions would allow driving of the infiltration rings (or excavating a uniform borehole for the constant-head permeameter), which was typically in weakly lithified (and not very cobbly) caliche. However, at several test pits (TP-19, TP-20, TP-28, TP-32, and TP-33), tests were conducted directly in a moderately to well lithified caliche layer. Four of these tests were conducted using a single ring "falling-head" method (general concept described in **Section 4.5.1.1**). The tests were set up without driving the ring into the test surface, but rather by "chipping" a shallow groove in the surface (matching the ring circumference), setting the ring into the groove, and applying a bentonite paste in the groove to seal the bottom of the ring in the test surface. Although this method was reasonably successful, some of the tests exhibited leakage or capillary wetting at the surface that required much attention during the tests and/or had to be accounted for in the data analysis. Overall, at test pits with caliche in the lithologic profile, infiltration tests were conducted at depths ranging from land surface to 1.52 meters.

3. The lithologic profile at test pit TP-36 was unique from the other test pits in that it consisted entirely of unconsolidated/loose gravel/cobbles with some sand. This test pit was located in an active drainage and the sediments encountered to a depth of 1.52 meters are channel deposits. This pit is located near the center of the Far West Site within the mapped surficial geologic unit of "active alluvium" (Holocene, Qyc). The subsurface lithologic profile at test pit TP-4 also includes gravelly/cobbly channel deposits below a depth of 0.46 meters; this pit is located within the mapped Ql unit but is very near a drainage and the associated mapped Qyc unit.

It is important to note that the general relationships or correlations noted above between the test pit lithologic profiles and the mapped surficial geologic units is based only on sediments encountered in the upper 1.5 meters, but the near-surface zone is expected to be the most relevant part of the lithologic profile for surface geologic mapping, and reasonably consistent correlation is therefore expected. Probably the primary reason that the relationships or correlations are not more ideal is the imperfect mapping of surficial geologic units (large scale mapping is approximate and cannot feasibly be conducted to accurately delineate the boundaries). In addition, some lithologic variability would be expected with each mapped unit even if the mapping was completely accurate.

4.5.3 Analysis and Correction of Infiltration Test Results

Analysis of the infiltration test results includes post-test documentation and evaluation of the sediments tested, the subsurface wetting pattern and effects of underlying sediments, and determination of a correction factor to provide results that reflect vertical flow. In addition, a general relationship is described for potential comparison/conversion of measured infiltration rates to Ksat values.

4.5.3.1 LITHOLOGIC EVALUATION: As described previously, following completion of the ring-infiltrometer tests, composite soil samples were obtained from the wetted volume of the test interval and the sediment lithology was evaluated and described **(Table 16)**, including particle size distribution, cohesiveness (plasticity), and relative degree of lithification (cementation). In addition, a trench was excavated through the middle of the test (infiltration ring) area to evaluate lithologic conditions underlying the test surface to a depth of 0.6 to 0.9 meters **(Table 16)** and to evaluate and document the wetting pattern laterally from and below the test surface. Although the composite samples obtained from the upper foot of the test interval for most tests were representative of the sediments believed to control infiltration rates, for some tests, deeper sediment strata likely affected/limited the infiltration rates; these test conditions are described further below and are noted in the comment section of **Table 16**.

4.5.3.2 WETTING PATTERN AND VERTICAL FLOW CORRECTION: Analysis of the subsurface wetting pattern is critical for evaluating the extent of lateral and/or capillary flow during the test, which was used to “correct” the measured infiltration rates to a more representative “vertical” infiltration rate. Although infiltration naturally occurs laterally as well as vertically, for purposes of applying small-scale infiltration test results to evaluation of large-scale infiltration, the vertical permeability or infiltration rate is the relevant parameter. Both the uncorrected and corrected infiltration test results are summarized in **Table 16**. The correction factor was based on the observed shape and width of the subsurface wetting pattern, and accounts for the actual or effective cross-sectional flow area or volume relative to the ring-infiltrometer cross-sectional area. The extent of lateral wetting varied greatly for the tests (and was often irregular), ranging from about 0.06 to 0.5 meters from the outer edge of the outer ring. Photographs of post-test subsurface wetting patterns for selected tests are provided in **Appendix E**. The correction factor was computed as the ratio of the wetted cylindrical area (or volume) directly below the ring-infiltrometer circumference and the effective cross-sectional area (or volume); this ratio was multiplied by the test result to compute the "corrected" rate reported in **Table 16**. The correction factors (ratios) ranged from 0.2 to 0.8 (two tests required no correction) and were most commonly about 0.4 to 0.6, which reduced the measured infiltration rates substantially in many cases. It is important to reiterate that measuring the extent of lateral wetting, especially for highly irregular wetting patterns, and correcting for it, is approximate but can have a relatively large effect on the corrected infiltration rate. However, using uncorrected rates to estimate large-scale infiltration capacity, such as for a tailing impoundment, would result in excessively large rates. In general, the correction applied to the measured infiltration rates is believed to result in representative values of vertical infiltration.

Some users of the double-ring method assume that this setup and procedure accounts for lateral or capillary wetting to some degree; water infiltrating through the annulus between the two rings theoretically alleviates lateral spreading of water away from the inner ring and promotes chiefly downward movement of water through and beneath the inner ring. If this was true, infiltration rates measured in the inner ring would be considered representative of chiefly vertical flow, and infiltration rates measured in the annulus would be larger than those measured in the inner ring. However, in practice, this theoretical assumption is often not valid, and it was apparent from evaluation of most tests at the Far West Site that infiltration rates measured for both the inner ring and annulus (outer ring) should be used in combination for determination of the “uncorrected” infiltration capacity and that an overall correction for lateral flow should be applied.

Another challenge in determining or interpreting the infiltration test results was due to subsurface flow patterns that were clearly affected by underlying sediment layers of differing lithology; this was often the case for tests conducted in unconsolidated surface sediments underlain by moderately to well lithified caliche (2nd profile type described above). For these cases, the test data were analyzed to determine if and when the incremental infiltration rates may have decreased due to the wetting front encountering the caliche layer. Although this process was somewhat subjective, the test data typically provided a relatively conclusive determination regarding the effect of the caliche layer and the representativeness of the test result for the primary (targeted) test interval. For some tests, the underlying caliche did appear to affect the infiltration rate and the test result is indicated to represent the combined effect of the two layers; this condition is noted in the comment section of **Table 16**. In these cases, the observed wetting pattern is a qualitative indication of the lower permeability of the caliche layer, but cannot be quantified.

4.5.3.3 RELATIONSHIP OF INFILTRATION RATES TO KSAT: Bouwer (1986) applied Darcy’s Law equation, based on the Green-Ampt “piston flow” theory for vertical infiltration (Green and Ampt, 1911) to express measured infiltration rate in terms of four parameters: (1) hydraulic conductivity “at the water content behind the wetting front” (Kwf), (2) applied head, (3) depth of the wetting front, and 4) “pressure head of water at the wetting front” (h_f), which is a function of the “water entry value” of the soil and therefore specific to soil type. Kwf is not equal to Ksat because the soil behind the wetting front is not saturated; however, the water content may be sufficiently close to saturation such that Kwf approaches Ksat (Bouwer suggests a possible general relationship that Kwf may be approximately equal to 0.5 x Ksat). Bouwer’s equation can be solved for Kwf as a function of the measured (vertical) infiltration rate.

It is important to note that the conversion from infiltration rate to Kwf is only valid if the wetting front occurs within the same sediments as the primary (targeted) test interval (sediments are essentially homogeneous) and the wetting pattern is not affected by an underlying layer of differing sediments (especially when it results in lateral flow). As described previously and noted in **Table 16**, most of the infiltration tests conducted at the Far West Site did not comply with these conditions; i.e. the wetting front for most of the tests encountered a differing sediment layer than the targeted test interval and exhibited notable lateral flow. In addition, the parameter "h_f" for the numerous tests (sediments) could not be feasibly determined. Therefore, a conversion from infiltration rate to Kwf was not conducted for the ring-infiltrometer test results. Nonetheless, an approximate relationship between infiltration rate and Kwf can be demonstrated based on assumptions for h_f, and use of the typical wetting depths for tests that were not substantially affected by a differing sediment layer underlying the targeted test sediments. The h_f value for the sediments tested may range from approximately -0.3 meters (a "tension" of 0.30 meters) to -0.9 meters, with a median of -0.6 meters. A typical wetting front depth for these tests was approximately 0.6 meters. Based on these assumed values, Kwf would be computed to be approximately 2.2 x infiltration rate, but since Kwf could be equal to approximately 0.5 x Ksat, the resulting estimated Ksat would be equal to 1.1 x infiltration rate. If other wetted depths and values for h_f are used, a more realistic range of relationships would include Ksat varying from approximately 0.5 to 1.3 x infiltration rate. It should be reiterated that this relationship is approximate and is based on several assumptions in addition to the requirement for essentially homogeneous conditions, which is rarely met. However, it does demonstrate that the measured vertical infiltration rates for the tested sediments may be related to the Ksat values by less than a factor of 2.

4.5.4 Summary of Infiltration Test Results

A total of 49 double-ring (and single-ring) infiltrometer tests and 6 constant-head permeameter tests were conducted at the Far West Site. Results of all the infiltration tests are summarized in **Table 16**, including depths at each test pit, lithology of the primary (targeted) test interval and of deeper underlying sediment layers that may have affected the measured infiltration rates, and relevant notes about the test conditions and test validity. It is important to reiterate that the infiltration tests targeted “sediment layers”, not entire “profiles” (which would require much larger-scale and longer-duration tests), although some tests were affected by layers other than those being targeted. Due to the small number of constant-head permeameter tests and the very small scale of these tests, results of the ring-infiltrometer results are the primary results considered in the present evaluation, although comparison of the constant-head permeameter results (hydraulic conductivities) and the relationship to infiltration rate is also provided.

4.5.4.1 RING-INFILTROMETER TESTS: Considering all 49 ring-infiltrometer tests, regardless of any special conditions, the measured (uncorrected) and corrected infiltration rates range from 0.04 to 23.2 meters per day (m/d); the same range applies to both the measured and corrected rates because the smallest and largest measured rates happened to not require correction (essentially no lateral flow). Excluding the tests for which no correction was applied (includes only 3 tests), the measured (uncorrected) infiltration rates range from 0.17 to 5.5 m/d and the corrected rates range from 0.100 to 5.5 m/d. The overall median infiltration rates were 0.91 m/d for the measured (uncorrected) infiltration rates and 0.49 m/d for the corrected rates. The corrected results are considered to be representative of vertical infiltration rates, which allows more accurate evaluation of large-scale infiltration capacity as would occur under a tailing impoundment. Although the correction factors ranged from about 0.2 (5-fold reduction) to 1 (no correction), the most typical correction factors ranged from about 0.4 to 0.6 (essentially a 2-fold reduction of measured rates). The corrected “vertical” infiltration rates were evaluated in relation to the general sediment types tested to provide a more useful means of applying the results to near-surface conditions at the Far West Site, as summarized in the following paragraphs (the uncorrected rates are not further considered in this evaluation).

As described in **Section 4.5.2**, three types of general lithologic profiles were encountered in the upper 1.5 meters of the test pits at the Far West Site:

1. The entire profile consisted of unconsolidated/non-lithified, poorly sorted sediments (ranging from silty and/or clayey sand and gravel to gravelly sandy silt), often with substantial content of cobbles. This profile type was most commonly encountered within the mapped surficial geologic unit Ql (Late Pleistocene alluvium) but includes some test pits within the mapped unit Qm (Middle Pleistocene alluvium).

2. The profile consisted of two or three layers, including a surface layer of essentially the same sediments described for the first profile type above, underlain by moderately to well cemented/lithified caliche (gravelly/cobbly), which typically became less cemented (weakly lithified) with depth. This profile type was most commonly encountered within the mapped surficial geologic unit Qm, but includes some test pits within the mapped units Ql, Qo (Early Pleistocene alluvium), and Tcy (Tertiary conglomerate).

3. The entire profile consisted of unconsolidated/loose gravel/cobbles with some sand, which are channel deposits within an active drainage. This profile type was encountered in only test pit, TP-36, within the mapped surficial geologic unit Qyc (Holocene alluvium). However, the subsurface lithologic profile at test pit TP-4 also included gravelly/cobbly channel deposits below a depth of 0.46 meters; this pit is located within the mapped Ql unit but is very near a drainage and the associated mapped Qyc unit.

The infiltration test results potentially could be grouped and summarized based on these three general profile types. However, because the infiltration tests targeted representative “sediment layers” rather than “profiles”, the more appropriate grouping of the results would be based on the general sediment types tested. The primary reason for this is that the 2nd profile type described above is very heterogeneous/layered (typically two tests were conducted in each pit in substantially different layers), and the infiltration test results could vary substantially within any given pit or profile. Therefore, comparison of test results for a given test pit or profile to other pits would be inconsistent and/or provide poorer relationships and correlations. Based on the approach of trying to evaluate and compare test results based on generally similar sediment types tested, the test results were grouped according to three lithologic types:

1. Unconsolidated poorly-sorted sediments
2. Variably cemented caliche
3. Channel deposits

The following sections describe these lithologic groupings and associated infiltration test conditions and results. **Table 19** provides a summary of the ring-infiltrometer test results based on the three general lithologic types.

TABLE 19. SUMMARY OF RING-INFILTROMETER TEST RESULTS

LITHOLOGIC GROUP	NUMBER OF TESTS*	INFILTRATION TEST RESULTS** (METERS PER DAY)			
		LOW	HIGH	MEAN	MEDIAN
Unconsolidated Poorly-Sorted Sediments	28	0.040	5.5	1.01	0.67
Variably Cemented Caliche	15	0.101	0.97	0.40	0.33
Active Channel Deposits	2	3.3	23.2	13.4	---

* Number of tests used in the evaluation of results
** Results are for corrected (vertical) infiltration rates
--- = not applicable

Unconsolidated Poorly Sorted Sediments: The general sediment type encountered in test pits of the 1st profile type described above is essentially the same as the surface layer encountered in test pits of the 2nd profile type. Therefore, infiltration tests conducted in the pits identified as the 1st profile type **(Table 17)**, which includes both the shallower and deeper test depths, together with tests conducted in the surface layer of pits identified as the 2nd profile type, have been grouped for evaluation of results. This grouping is referred to as "unconsolidated poorly sorted sediments". An important qualifier is that for tests conducted in the surface layer of pits of the 2nd profile type, if the test results were affected/controlled by the underlying caliche (based on post-test evaluation of the subsurface wetting pattern), the test was then grouped together with the "variably cemented caliche" tests.

The infiltration test results for the "unconsolidated poorly sorted sediments", which included 31 tests, are summarized below, including ranges, mean values, and median values. In general, the median value is considered more representative of the "average" vertical infiltration capacity of the tested sediments than the mean because the mean is more substantially affected by one or two "more extreme" results. The test conducted at TP-9 (0.15 meter depth) had very sporadic measurements that never stabilized and could not be analyzed; this test was not considered in the evaluation of results.

- Considering all 31 tests, infiltration rates ranged from 0.040 to 5.5 m/d, with a mean of 1.04 m/d and a median of 0.64 m/d.

- Three tests were determined to be unrepresentative for the unconsolidated poorly sorted sediments lithologic type, including:
  - TP-4 (0.46-meter depth), which was clearly in channel deposits
  - TP-9 (1.16-meter depth), which had anomalously small result of 0.061m/d for the type of sediments tested (weakly lithified clayey sandy gravel), which was likely due to smearing of the wet test surface during test setup (the test pit had been excavated in the same location as a previously positioned 9,000-gallon water tank, from which water spillage/leakage had pre-wetted the subsurface).
  - TP-32 (0.03-meter depth), which was not interpretable due to excessive lateral flow through a cobbly zone located about 0.15 meters beneath the test surface.

  Excluding the results for these three tests, infiltration rates for the remaining 28 tests still ranged from 0.040 to 5.5 m/d, but had a mean of 1.01 m/d and a median of 0.67 m/d.

- The largest infiltration rate of 5.5 m/d was for a test conducted at a depth of 0.30 meters at pit TP-19, which is actually located in the mapped Tcy surficial geologic unit (Tertiary conglomerate) **(Figure 1)**; however, the surface sediments consisted of non-lithified sandy gravel, which may be colluvial deposits.

- In general, the smaller infiltration test results (on the order of 0.3 m/d) were for sediments that had sufficient silt and clay in the matrix to provide moderate to high cohesiveness (plasticity), although some sediments tested had less plasticity with similar infiltration rates. For the smallest test result of 0.040 m/d, the surface sediments tested were very fine-grained (80 percent silt and clay content) with moderate to large plasticity; this very fine-grained sediment texture was not commonly encountered in the test pits at the Far West Site.

Variably Cemented Caliche: The general sediment type encountered below the surface unconsolidated sediments in test pits of the 2nd profile type (described above) consisted of variably lithified (carbonate cemented) caliche. Most typically, the caliche was moderately to well lithified at the top of this interval with decreasing cementation (weakly lithified) with depth, although in some test pits the caliche was only weakly lithified throughout the interval. Infiltration tests conducted at depths within the caliche interval in the pits identified as the 2nd profile type **(Table 18)**, which typically were the deeper of the two test depths, have been grouped for evaluation of results. This grouping is referred to as "variably cemented caliche". As described previously, this grouping includes tests conducted in the overlying unconsolidated surface sediments if the test results were affected/controlled by the underlying caliche; some of these tests were deliberately set up in this manner in an attempt to measure infiltration capacity of the underlying caliche (rings could be driven into the unconsolidated sediments but not into the caliche).

The infiltration test results for the "variably cemented caliche", which included 16 tests, are summarized below, including ranges, mean values, and median values. The test conducted at TP-10 (1.46-meter depth) had excessive leakage and very sporadic measurements and could not be analyzed; this test was not considered in the evaluation of results.

- Considering all 16 tests, infiltration rates ranged from 0.101 to 1.49 m/d, with a mean of 0.46 m/d and a median of 0.40 m/d.

- The test conducted at TP-12 (1.5-meter depth) was analyzed but determined to be unreliable due to leakage and sporadic readings. Excluding the result for this test, infiltration rates ranged from 0.101 to 0.97 m/d, with a mean of 0.40 m/d and median of 0.33 m/d.

- The high end of this range of infiltration rates (greater than about 0.61 m/d) were generally for tests conducted in weakly lithified caliche comprised of sand and gravel with relatively small silt content.

- The low end of this range of infiltration rates (on the order of 0.101 to 0.30 m/d) were generally for tests conducted in caliche that was moderately to well lithified and/or had substantial silt and clay content in the sediment matrix (moderate to high cohesiveness/plasticity).

  - As described in **Section 4.5.2**, several infiltration tests were conducted directly on a moderately to well lithified caliche surface (TP-19, TP-20, TP-28, TP-32, and TP-33), most of them through use of a single-ring falling-head method where the ring was installed in a shallow groove in the test surface and sealed with hydrated bentonite. The vertical infiltration rates for these tests ranged from 0.101 to 0.43 m/d with a mean of 0.207 m/d and a median of 0.152 m/d. These tests are considered representative of the commonly encountered caliche intervals with moderate to strong carbonate cementation.

  - Five tests conducted in the unconsolidated sediments overlying the caliche interval provided results that are believed to be essentially composite infiltration rates for both sediment intervals (water both entered and moved laterally above the caliche contact, although the extent of infiltration into the caliche was generally on the order of 0.1 foot); the vertical infiltration rates for these tests ranged from 0.56 to 1.6 ft/day with a mean and median of 1.1 ft/day.

- The intermediate infiltration test results (on the order of 0.3 to 0.6 m/d) were generally for tests conducted in moderately lithified caliche and/or weakly lithified caliche that had substantial silt content in the sediment matrix. Four of the five test results referred to in the previous paragraph ("composite" rates for unconsolidated sediments underlain by caliche) were also in the range of 0.3 to 0.6 m/d.

- It is important to note that the degree of "caliche development" (extent of carbonate cementation/lithification) varied substantially both vertically and, to a lesser extent, horizontally within a given test pit. Therefore, the infiltration capacity determined by the "caliche tests" at various depths in pits of the 2nd profile type also varied substantially. For this reason, it is difficult and/or can be misleading to represent the carbonate-cemented (caliche) intervals, and especially the entire near-surface "profile" with a given infiltration rate based on these small-scale tests. Based on the "caliche test" results, at locations where the caliche contact is strongly cemented and relatively continuous, the infiltration rate will be small. However, it is more likely that this contact will have variable cementation laterally, and that the overall infiltration capacity for a larger area would be better represented by a composite infiltration rate based on all test results for the caliche intervals.

Active Channel Deposits: The sediment type for the entire profile at test pit TP-36, located in an active drainage (Qyc), consisted of the coarsest sediments encountered in the test pits at the Far West Site (unconsolidated/loose gravel/cobbles with some sand). The single infiltration test conducted in this test pit was very rapid and had to be conducted using a single-ring falling-head method. Infiltration was entirely vertical, so the measured rate of 23.2 m/d is considered to be the representative vertical rate. In addition, the subsurface lithologic profile at test pit TP-4, located very near an active drainage, also included gravelly/cobbly channel deposits below a depth of 0.46 meters. A single-ring falling-head test was conducted at a depth of 0.46 meters; the vertical (corrected) infiltration rate was 3.3 m/d (some correction for lateral flow was required).

4.5.4.2 CONSTANT-HEAD PERMEAMETER TESTS: As described in **Section 4.5.1.2**, the constant-head permeameter was utilized early in the testing program in five test pits (TP-5, TP-7, TP-8, TP-15, and TP-21) **(Table 16)**; two tests were conducted in test pit TP-15. The primary purpose for conducting these tests was to determine if this test method would provide a viable alternative for infiltration testing in sediment intervals where the ring-infiltrometer might not be useable. During the field program, many more attempts were made to use the constant-head permeameter than shown on **Table 16**, but the shallow borehole could not be successfully excavated with a uniform 0.076-meter (0.25-foot) diameter due to the generally cobbly (or excessively cemented) conditions encountered in the test pits. In addition, the very small scale of these tests results in potentially less reliable results than the ring-infiltrometer method. Therefore, use of the constant-head permeameter was very limited, and more effort was directed toward finding ways to make the ring-infiltrometer more successful.

Computed Ksat values from the six constant-head permeameter tests ranged from 0.229 to 1.68 m/d **(Table 16)**. As described in **Section 4.5.3.3**, Ksat values determined from these tests do not have the same meaning as the infiltration rates determined from the ring-infiltrometer tests; Ksat is theoretically a hydraulic property of the sediments, whereas infiltration rate is a function of the sediments and the specific head applied. The permeameter tests were conducted with an applied head of 0.253 meters, but differing heads could be used and would theoretically result in the same (similar) Ksat value because the analytical solution accounts for the head value used. Infiltration rates determined from the ring-infiltrometer would be expected to increase with increasing head. Nonethelesss, because the ring-infiltrometer tests were conducted with an applied head of 0.15 meters (similar to the constant-head permeameter tests), the test results, after correcting to vertical flow, are expected to be reasonably comparable to results of the permeameter tests (assuming the same sediments were actually tested). Because the Ksat values also reflect horizontal flow to some (unknown) extent, the Ksat value determined for a given sediment interval might be expected to be somewhat larger than the vertical (corrected) infiltration rate measured for the same sediment interval (for an applied head of 0.15 meters). This discrepancy could be substantial if saturated lateral flow above an impeding layer occurred during a constant-head permeameter test (this would not be known or corrected for; the analytical solution is based on an assumed vertical flow field geometry and accounts for capillary flow but does not account for the occurrence of saturated lateral flow). For both tests, a relatively small head was applied to minimize the amount of lateral flow. Results of the constant-head permeameter tests are tabulated in **Table 20** together with results of ring-infiltrometer tests (for tests that were conducted in the same sediment interval):

TABLE 20. COMPARISON OF RING-INFILTROMETER AND CONSTANT-HEAD PERMEAMETER TEST RESULTS

TEST PIT	INFILTRATION TEST RESULT (meters per day)		
	DEPTH	KSAT (constant-head permeameter)	INFILTRATION RATE (ring infiltrometer)
TP-5	0.76	1.68	2.29
TP-7	1.65	1.28	0.97
TP-8	0.76	0.23	---*
TP-15	0.40	0.30	0.04
TP-15	1.04	0.29	0.22
TP-21	1.52	0.82	---*

*No corresponding ring-infiltrometer tests at TP-8 (0.76 meters) and TP-21 (1.52 meters)

The tabulated results indicate that the Ksat values (constant-head permeameter tests) compare reasonably well with the vertical infiltration rates (ring-infiltrometer tests) for the tests conducted at the same pits and depths. Although Ksat values and infiltration rates are measured differently and have different meanings, these direct comparisons of the constant-head permeameter and ring-infiltrometer results suggest that the corrected (vertical) infiltration rates can be used as a close approximation for Ksat values, and at a minimum, the measured infiltration rates and Ksat values are comparable within the estimated range of relative magnitude described in **Section 4.5.3.3** (factors ranging from 0.5 to 1.3). The larger relative difference for the test results at TP-15 (0.40-meter depth) is believed to be due to small-scale heterogeneities (resulting in some differences in lithology of the sediments tested using the two methods).

4.5.5 Conclusions and Applicability of Infiltration Test Results

The ring-infiltrometer test results have been grouped and presented based on the lithology of the sediment intervals tested, as delineated by three general lithologic types: Unconsolidated Poorly Sorted Sediments, Variably Cemented Caliche, and Active Channel Deposits. The results are summarized in **Table 19**. Evaluation of the ring-infiltrometer results, grouped based on sediment lithologic type, allows some meaningful comparisons with this otherwise diverse set of results, which are summarized as follows:

1. Although there is substantial variability of vertical infiltration rates within each lithologic type, the range of measured rates and the average (mean and median) rates for the “variably cemented caliche” lithology type are clearly smaller than for the “unconsolidated poorly-sorted sediments”.

2. The measured infiltration rates for “active channel deposits” are very large, which is expected for chiefly gravelly/cobbly sediments with little or no silt and clay. This sediment lithology (mapped as Qyc) comprises a very small portion of the Far West Site.

3. The range of measured infiltration rates for the “unconsolidated poorly-sorted sediments” is very large and is chiefly a function of the variability of sediment texture, especially the silt and clay content in the sediment matrix (regardless of

gravel content). These are the surficial sediments that cover the majority of the Far West Site, with thickness ranging from approximately 0.3 meters to more than 1.5 meters, except in areas where bedrock occurs essentially at land surface in the east part of the site (mapped as Precambrian geologic units).

4. In areas where the surface unconsolidated sediments contain a substantial amount of silt and clay (which cannot be ascertained from the mapped surficial geologic units), the infiltration capacity would be small (on the order of 0.15 m/d or less); several tests conducted in such sediments resulted in infiltration rates similar to (if not smaller than) the rates measured in the most cemented/lithified caliche.

5. Whereas the moderately to well lithified caliche generally had small measured infiltration rates (based chiefly on the tests set up to directly measure infiltration into this caliche surface), the vertical infiltration rates ranged from 0.101 to 0.43 m/d and were not as small as might be expected. For tests described previously that were conducted in the surface unconsolidated sediments a short distance above an underlying caliche contact, inspection of the post-test subsurface wetting pattern for these tests revealed lateral flow above the caliche contact with little penetration into the caliche. However, this observed condition does not necessarily indicate a "nearly impenetrable" caliche contact, because the infiltrating water could move laterally within the overlying and potentially higher permeability surface sediments. The smallest measured vertical infiltration rate for moderate to well lithified caliche was 0.101 m/d (TP-32, 0.70-meter depth); these cemented sediments also contained a significant silt and clay content in the sediment matrix (moderate to high cohesiveness/plasticity).

Although the infiltration tests targeted representative sediment layers rather than the three sediment "profile types" (initially described in **Section 4.5.2**), the infiltration test results can still be applied to these profile types, and in turn, to their correlation to the mapped surficial geologic units (Spencer and others, 1998; Huckleberry, 1993), but the applicability may be limited to the uppermost part of the near-surface profiles (to a depth of 1.5 meters). As a reminder, the 1st and 2nd profile types are defined by M&A based on lithologic conditions encountered in the test pits to the depth of 1.5 meters: the 1st profile type consists entirely of unconsolidated poorly sorted sediments; the 2nd profile type consists of unconsolidated sediments overlying variably-cemented caliche; and the 3rd profile type is the gravelly/cobbly channel deposits encountered in the active drainages. The following considerations for the profile types and associated mapped surficial geologic units are relevant in applying the infiltration test results:

1. Whereas some of the unconsolidated surface sediments have a substantial silt and clay content and associated small infiltration capacity, the variably cemented caliche intervals generally have a more consistently small infiltration capacity and would tend to be the more limiting or controlling layer for evaluating infiltration capacity across the Far West Site.

2. Based on M&A's test pit characterization, and KCB's trench characterization **(Appendix F)**, the "older alluvium" (mapped geologic units Qm, Qo, and Tcy, which typically correlate to the 2nd profile type) appears to have caliche intervals of generally stronger development and cementation at shallower depths than the "younger alluvium" (chiefly the mapped Ql units, which typically correlate to the 1st profile type). The youngest (Holocene) alluvium in the active drainage channels contains no cementation (and no significant silt and clay content), and clearly has very large infiltration capacity.

3. In general, based on the first point above, the 2nd profile type <u>to a depth of 1.5 meters</u> would likely have a smaller infiltration capacity than the 1st profile type, although there are areas of finer-grained surface sediments that would have small infiltration capacity. Therefore, the mapped surficial geologic units of "older alluvium" (Qm, Qo, and Tcy) would tend to have smaller overall infiltration capacity than the "younger alluvium" (Ql).

4. Based on the preceding points, a representative vertical infiltration rate for the upper 1.5 meters of areas that have the 1st profile type (chiefly the "younger alluvium") would be the median value determined from the 28 tests conducted in the unconsolidated poorly sorted sediments, or 0.67 m/d **(Table 19)**. Similarly, for areas that have the 2nd profile type (chiefly the "older alluvium"), infiltration rates would be limited by the subsurface caliche intervals, represented by the median value determined from the 15 tests conducted in the variably-cemented caliche, or 0.33 m/d **(Table 19)**. The overall representative average infiltration rate for the 2nd profile type would be a composite (harmonic mean) of the median values for the unconsolidated surface sediments and the variably-cemented caliche intervals, or 0.43 m/d. It is important to reiterate that these "representative infiltration rates" are large-scale averages and that infiltration rates for localized areas could vary substantially. As described in **Sections 4.5.3.3 and 4.5.4.2**, Ksat values may be very nearly equal to the corresponding vertical infiltration rates.

5. Based on the test pit profiles (to 1.5 meters) and KCB's lithologic characterization of the deeper trenches (to 3.7 meters) **(Appendix F)**, moderate to well lithified caliche intervals were also encountered in the near-surface zone at locations of test pits of the 1st profile type and/or within the mapped Ql units, at depths greater than 1.5 meters.

6. Overall, it is apparent that the caliche intervals are variably cemented and/or discontinuous on both small and large scales across the Far West Site, whether the caliche intervals occur within the upper 1.5 meters (test pits) or somewhat deeper in the near-surface zone (trenches). Even in areas where the caliche intervals are prevalent, it is likely that the degree of cementation and associated hydraulic properties are variable, such that the larger scale infiltration capacity would be a composite of the infiltration rates measured for the various caliche intervals.

7. Overall, the relationships/correlations between near-surface lithologic conditions encountered in the test pits and the mapped surficial geologic units may be reasonably reliable and useful for the purposes of estimating or projecting large-scale lithologic and hydraulic characteristics of the uppermost part of the near-surface profiles (to a depth of 1.5 meters) based on the mapped units. However, these relationships would not be expected to remain consistent with increasing depth, and estimation of these properties (especially hydraulic properties) based on correlation to mapped surficial geologic units is likely not very reliable beyond the shallow depths of the test pits. For example, a more permeable near surface profile, perhaps within a “young alluvium (Ql)” mapped unit, is likely underlain at a slightly larger depth by lower permeability layers of moderately to well-lithified caliche across much of the Far West Site.

5.0 HYDROGEOLOGIC CHARACTERIZATION OF FAR WEST SITE

Hydrogeologic conditions at the Far West Site were characterized based on subsurface investigations conducted at 36 locations at the Far West Site during the period February through June 2012. Investigations included drilling, construction, and testing of 5 groundwater monitor wells, 8 vadose zone piezometers, 2 geotechnical borings, and 36 test pits. At 26 of the 36 locations, subsurface investigations included both hydrogeologic investigations by M&A and geotechnical investigations by KCB; at the remaining 10 sites, only geotechnical investigations were conducted **(Table 1; Figure 1)**. Hydrogeologic features are shown on **Figure 7**. Hydrogeologic sections A-A' and B-B' are shown on **Figures 8 and 9**.

5.1 PRINCIPAL HYDROGEOLOGIC UNITS

Results of subsurface investigations indicate the occurrence of four principal hydrogeologic units at the Far West Site, summarized as follows:

- Quaternary alluvium (Qal) consists of alluvial and colluvial deposits of sand, gravel, silt and clay with localized variably-cemented zones (caliche). The Qal includes the Qyc, Qtc, Qs, Ql, Qm, and Qo mapped by Spencer and others (1998), and the Ya2, Ya1, Ma2, and Ma1 mapped by Huckleberry (1993) (**Figure 7**). The Qal is present at all sites of investigation and ranges in thickness from 3.0 meters at FW5-S to 24.4 meters at FW15-R; average thickness is about 10 meters. The Qal is unsaturated at the Far West Site.

- Quaternary and Tertiary basin-fill deposits (QTg) consist generally of weakly to well lithified deposits of gravel, sand, silt and clay. The contact between Qal and QTg was identified based on increased degree of cementation of QTg compared to Qal. The QTg includes the Tcy of Spencer and others (1998) and the Oa and Tsm of Huckleberry (1993) (**Figure 7**). The QTg is present at all locations, and where fully penetrated, ranges in thickness from 4.5 meters at FW5-S to 145.2 meters at FW15-R. At all locations except for FW9-S, the QTg is unsaturated. At FW9-S, the QTg is more than 173 meters thick (not fully penetrated) and is saturated below approximately 150 meters bls.

- Tertiary Volcanic and Sedimentary Units include younger volcanic rocks (Tvy), older sedimentary units (Tso), and the Apache Leap Tuff (Tal). The "younger" designation for the volcanic units indicates the relative age relationship with respect to the Tal.
    - The Tvy at Far West Site includes tilted basaltic lava flow units and a tuffaceous volcanic unit. The Tvy is equivalent to the Tb mapped by Spencer and others (1998) and the Tqb mapped by Ferguson and Skotnicki (1995). The Tvy crops out in several locations at the Far West Site, and was encountered in the subsurface at FW3-R, FW7-R, and FW15-R. The Tvy at FW3-R is 30.2 meters thick; at FW3-R the Tvy is in fault contact with the underlying Tso. At wells FW7-R and FW15-R, the Tvy was only partially penetrated; thicknesses penetrated are 83 meters at FW7-R, and 109 meters at FW15-R.
    - The older sedimentary units (Tso) were encountered at FW3-R and include tuffaceous sandstone, sandy mudstone, and silty sandstone units. The Tso is moderately to well lithified in comparison to the Qal and QTg. The Tso may be equivalent to the Unit of Queen Valley (Tq) mapped by Ferguson and Skotnicki (1995).
    - The Tal was encountered at FW3-R and FW4-R. At FW4-R, an 18.8-meter thick interval of Tal was encountered between the QTg and bedrock. At FW3-R, a thicker sequence of the Tal was encountered below the Tso units. At FW3-R, the Tal is more than 94 meters thick and included White Unit

(Talw) and Gray Unit (Talg). The Tal crops out on Dromedary Peak, north of Far West Site (**Figure 7**), and is equivalent to the Tcp mapped by Ferguson and Skotnicki (1995).

- Precambrian Bedrock at the Far West Site includes older Precambrian granite (pCg), diabase (pCdiab), and Pinal Schist (pCpi) (**Figure 7**). These units are exposed in the eastern part of the site. The pCg was encountered at FW4-R at a depth of 52.3 meters bls. The pCpi was encountered only at piezometers FW5-S and at FW10-S in the east part of the Far West Site, at depths of 7.5 and 23.5 meters bls, respectively.

Table 21 shows the correlation of geologic units and nomenclature used in previous reports for the region and the present report for the Far West Site.

TABLE 21. CORRELATION OF GEOLOGIC UNITS AND NOMENCLATURE FOR FAR WEST SITE AND VICINITY

Huckleberry (1993)	**Ferguson & Skotnicki (1995)**	**Spencer & others (1998)**		**This report (2012)**
Ya2 (<0.5 ka)[a]	Qa	Qyc	Qs, Qtc	Qal
Ya1 (<10 ka)				
Ma2 (10 – 100 ka)		Ql		
Ma1 (100 – 500 ka)		Qm		
Oa		Qo		
Tsm		Tcy		QTg
b	Tq	Tcu		Tso
	Tqb	Tb		Tvy
	Tcp	Tal		Tal
	Yd	Yd		pCdiab
	YXge	Xgd		pCg
	Xp	Xp		pCpi

[a] ka = thousands of years ago

5.2 DEPTH TO PRECAMBRIAN BEDROCK

Precambrian bedrock (granite [pCg], diabase [pCdiab], and Pinal Schist [pCpi]) is considered to act as barrier to groundwater movement and comprises the base of the regional aquifer system. Gravity data obtained during Phase I investigations were remodeled by HGI with incorporation of Phase II hydrogeologic data to refine estimates of depth to Precambrian bedrock. The principal hydrogeologic features that were incorporated into the gravity remodeling are:

- Cementation of basin-fill sediments (QTg), resulting in a slightly larger estimated average density of 2.20 grams per cubic centimeter (g/cc), compared to the previously assigned density of 2.00 g/cc;
- The substantial thickness of Tertiary volcanic and sedimentary units at the Far West Site; Tvy, Tso, and Tal units were represented explicitly in the gravity remodeling, using estimated average densities of 2.60 g/cc for Tvy and Tso, and 2.50 g/cc for Tal;
- Depths to Precambrian bedrock encountered at well FW4-R and at piezometers FW5-S and FW10-S.

A focused residual Bouger anomaly map and revised gravity profiles provided by HGI are given in **Appendix G**. Elevation contours for top of Precambrian bedrock are shown on **Figure 7**, and indicate that top of bedrock slopes from east to west, with a relatively steep gradient in the central part of the site, as indicated by the Phase I modeling as well as the Phase 2 modeling. However, due to the explicit representation of Tertiary volcanic and sedimentary units, the Phase 2 modeling suggests that depth to Precambrian bedrock in the west part of the site may be in the magnitude of 1,000 meters bls, approximately four times deeper than indicated by Phase I modeling.

5.3 STRUCTURAL FEATURES

The principal structural feature at the Far West Site is the Elephant Butte Fault. Mapping by Ferguson and Skotnicki (1995) north of the Far West Site shows a high-angle normal fault, downthrown to the west. The fault is mapped approximately 3 miles north of the site, and is inferred to occur beneath the Quaternary alluvial deposits immediately west of Dromedary Peak (Ferguson and Skotnicki, 1995). HGI infers a location for the fault based on gravity data obtained at the Far West Site (**Appendix G**).

Figure 7 shows the approximate location of the Elephant Butte Fault at the Far West Site. The fault trace is shown as a dotted line because the fault is buried beneath the alluvial cover. There is an apparent left lateral offset of the fault in the vicinity of well FW9-S.

5.4 HYDRAULIC CONDUCTIVITY FOR PRINCIPAL HYDROGEOLOGIC UNITS

Hydraulic conductivity of principal hydrogeologic units at the Far West Site was determined by conduct of 5 pumping tests, 14 vadose zone injection tests, and 56 near-surface infiltration tests, as described in **Sections 4.2, 4.4, and 4.5**. Hydraulic conductivity determined from these tests ranges widely, from 2.8 x 10^{-7} to 2.9 x 10^{-2} centimeters per second (cm/sec).

5.4.1 Quaternary Alluvium

Hydraulic conductivity for Quaternary alluvium was estimated based on results of ring infiltrometer tests and estimated direct correlation with Ksat values. Detailed descriptions of test methods and results are given in **Section 4.5**. The ring-infiltrometer test results have been grouped and presented based on the lithology of the sediment intervals tested, as delineated by three general lithologic types and summarized previously in **Table 19**, reproduced below:

TABLE 19. SUMMARY OF RING-INFILTROMETER TEST RESULTS

LITHOLOGIC GROUP	NUMBER OF TESTS*	INFILTRATION TEST RESULTS** (meters per day)			
		LOW	HIGH	MEAN	MEDIAN
Unconsolidated Poorly-Sorted Sediments	28	0.04	5.5	1.01	0.67
Variably Cemented Caliche	15	0.10	0.97	0.40	0.33
Active Channel Deposits	2	3.3	23.2	13.4	---

* Number of tests used in the evaluation of results
** Results are for corrected (vertical) infiltration rates
--- = not applicable

Although the infiltration tests targeted specific layers of the general lithologic types described above, three sediment “profile types” were encountered in the test pits to a depth of 1.5 meters (initially described in **Section 4.5.2**): the 1st profile type consists entirely of unconsolidated poorly sorted sediments; the 2nd profile type consists of unconsolidated sediments overlying variably-cemented caliche; and the 3rd profile type is the gravelly/cobbly channel deposits encountered in the active drainages.

Representative vertical infiltration rate for the upper 1.5 meters of areas that have the 1st profile type (chiefly the “younger alluvium”) would be the median value determined from the 28 tests conducted in the unconsolidated poorly sorted sediments, or 0.67 m/d **(Table 19)**. For areas that have the 2nd profile type (chiefly the “older alluvium”), the representative infiltration rate would be limited by the subsurface caliche intervals, represented by the median value determined from the 15 tests conducted in the variably-cemented caliche, or 0.33 m/d **(Table 19)**. The overall representative average infiltration rate for the 2nd profile type at the Far West Site would be a composite (harmonic mean) of the median values for the unconsolidated surface sediments and the variably-cemented caliche intervals, or 0.41 m/d. Representative vertical infiltration rate for areas that have the 3rd profile type (active channel deposits) would be the mean value determined from the two tests conducted in these sediments, or 13.4 m/d

(Table 19). It is important to reiterate that these "representative infiltration rates" are large-scale averages and that infiltration rates for localized areas could vary substantially.

Although Ksat values and infiltration rates are measured differently and have different meanings, the corrected (vertical) infiltration rates can be used as a close approximation to Ksat values. This is based on the theoretical relationship between vertical infiltration rates and Ksat values described in **Section 4.5.3.3**, and on the generally good agreement between ring-infiltrometer test results (vertical infiltration rates) and constant-head permeameter test results (Ksat values) (presented in **Section 4.5.4.2 and Table 20)**. At a minimum, the measured infiltration rates and Ksat values are comparable within the estimated range of relative magnitude described in **Section 4.5.3.3** (factors ranging from 0.5 to 1.3).

Based on median corrected (vertical) infiltration rates and estimated direct correlation to Ksat values, representative Ksat for the near-surface Quaternary alluvium is estimated to be 0.67 m/d (7.8 x 10^{-4} cm/sec) for the unconsolidated poorly sorted sediments, 0.33 m/d (3.8 x 10^{-4} cm/sec) for the variably-cemented caliche, and 13.4 m/d (1.6 x 10^{-2} cm/sec) for the active channel deposits. Estimated Ksat for the 1st profile type (chiefly the "younger alluvium") would be the same as for the unconsolidated poorly sorted sediments, or 0.67 m/d (7.8 x 10^{-4} cm/sec). Estimated Ksat for the 2nd profile type (chiefly the "older alluvium"), would be a composite (harmonic mean) of the median values for the unconsolidated poorly sorted surface sediments and the underlying variably-cemented caliche intervals, or 0.41 m/d (4.8 x 10^{-4} cm/sec). Finally, estimated Ksat for the 3rd profile type (active channel deposits) would be 13.4 m/d (1.6 x 10^{-2} cm/sec).

5.4.2 Quaternary and Tertiary Basin-Fill Deposits

With the exception of piezometer FW5-S, which was completed in Pinal Schist, all remaining piezometers were completed in the basin-fill deposits. Results from vadose zone injection tests conducted in these deposits indicate that hydraulic conductivity ranges from 2.8×10^{-7} to 2.9×10^{-2} cm/sec; arithmetic mean is 3.5×10^{-3} and geometric mean is 3.4×10^{-4} cm/sec. Results of the pumping test conducted at well FW9-S, completed in moderately to well lithified basin-fill deposits, indicates hydraulic conductivity of 4×10^{-6} cm/sec. Geometric mean for all tests conducted in the basin-fill deposits is 2.5×10^{-4} cm/sec.

5.4.3 Tertiary Volcanic and Sedimentary Units

Results from pumping tests conducted in the three monitor wells completed in Tertiary volcanic and sedimentary units (FW3-R, FW7-R, and FW15-R) indicate hydraulic conductivity ranging from 1×10^{-6} to 7×10^{-4} cm/sec. Arithmetic mean hydraulic conductivity is 2×10^{-4} cm/sec; geometric mean is 1×10^{-5} cm/sec.

5.4.4 Precambrian Bedrock

Results from the injection test at piezometer FW5-S, completed in Pinal Schist, indicates hydraulic conductivity of 3.5×10^{-6} cm/sec. Results from the pumping test at well FW4-R, completed in Precambrian granodiorite, indicate hydraulic conductivity of 3×10^{-6} cm/sec. Hydraulic conductivity of unfractured and unweathered igneous and metamorphic rocks would be much smaller than 10^{-6} cm/sec, and is normally considered to be zero for practical purposes. Results of tests at the Far West Site indicate the occurrence of secondary permeability due to fracturing and/or weathering of the rocks in the relatively shallow zones tested. Degree of fracturing and weathering, and therefore hydraulic conductivity, would be expected to decrease at larger depths below the top of these units.

5.4.5 Summary of Representative Hydraulic Conductivities

Hydraulic conductivity (under saturated conditions, Ksat) of each principal hydrogeologic unit ranges substantially due to the heterogeneous nature of each unit. Except for the Quaternary alluvium and Precambrian bedrock, a representative hydraulic conductivity for each unit was determined based on geometric mean of hydraulic conductivities determined for that unit. For the Quaternary alluvium, the median vertical infiltration rate from the near-surface infiltration tests was determined, and hydraulic conductivity was assumed to be equivalent to infiltration rate (as explained in **Section 4.5.4.2**). Results of infiltration tests, injection tests, and pumping tests indicate that hydraulic conductivity ranges widely, from 2.8 x 10^{-7} to 2.9 x 10^{-2} cm/sec, and hydraulic conductivity generally decreases with depth. Representative hydraulic conductivities for principal hydrogeologic units are summarized in **Table 22.**

TABLE 22. SUMMARY OF REPRESENTATIVE HYDRAULIC CONDUCTIVITIES FOR LITHOLOGIC PROFILE TYPES AND PRINCIPAL HYDROGEOLOGIC UNITS

SOIL PROFILE TYPE OR HYDROGEOLOGIC UNIT	REPRESENTATIVE HYDRAULIC CONDUCTIVITY (cm/sec)	NUMBER OF TESTS
Active Quaternary Alluvium	1.6 X 10^{-2} (arithmetic mean)	2
Younger Quaternary Alluvium (unconsolidated sediments)	7.8 x 10^{-4} (median)	28
Older Quaternary Alluvium (unconsolidated sediments underlain by variably-cemented caliche)	4.8 x 10^{-4} (harmonic mean of medians for two soil types)	15
Quaternary and Tertiary Basin-Fill Deposits	2.5 x 10^{-4} (geometric mean)	14
Tertiary Volcanic and Sedimentary Units	1 x 10^{-5} (geometric mean)	3
Precambrian Bedrock	3 x 10^{-6} (arithmetic mean)	2

5.5 MOISTURE CONTENT FOR UNSATURATED ZONE

A total of 88 bulk samples of core from the sonic boreholes were analyzed for moisture content. With the exception of well FW9-S, all sonic boreholes were drilled to depths of 40 meters or less; therefore, most of the moisture data are for the upper 40 meters of the vadose zone. At well FW9-S, samples were obtained to a depth of 178 meters. Results of analyses for moisture content are provided in **Appendix F.**

Results indicate that moisture content ranges from 0.3 to 8.9 percent by weight; average moisture content for all samples was 2.5 percent. Moisture content was larger than 5 percent for only eight samples.

The measured moisture contents for the vadose zone sediments at the Far West Site are very small, compared to other alluvial basins in southern Arizona in which M&A has conducted investigations. Mass-based moisture content (MC_m) can be converted to volumetric moisture content (MC_v) based on the simple relationship: $MC_v = MC_m$ x bulk density (in grams per cubic centimeter [g/cc]). Bulk density measurements are not available for the vadose zone sediments at the site, but a representative value for consolidated variably-cemented gravelly sediments of 2.2 g/cc was assumed by HGI for gravity modeling. Based on this assumption, the average measured MC_m of 2.5 percent would be approximately equivalent to an average MC_v of 5.5 percent.

The volumetric moisture content can be directly compared to the sediment porosity to provide an estimate of the degree of saturation of the vadose zone sediments. Total porosity measurements are not available for the vadose zone sediments at the site, but a representative value can be estimated based on bulk density (BD) and particle density (PD): Total porosity (percent) = 1 – (BD/PD) x 100. A representative particle density for silica-based minerals is 2.65 g/cc. Therefore, the estimated total porosity for vadose zone alluvial sediments at the Far West Site would be approximately equal to 17 percent. The degree of saturation of the vadose zone sediments is the ratio of MC_v to total porosity, or 5.5 percent/17 percent = 0.32. This small degree of saturation indicates that the vadose zone has substantial available storage (retention) capacity for infiltrating water.

5.6 OCCURRENCE AND MOVEMENT OF GROUNDWATER

Groundwater level measurements obtained from the five monitor wells and the stock well on May 22, 2012, were used to assess occurrence of groundwater in relation to principal hydrogeologic units, and patterns of groundwater movement at the Far West Site. Inspection of hydrogeologic sections A-A’ and B-B’ (**Figures 8 and 9**) indicate that in the west part of the site, on the downthrown side of the Elephant Butte Fault, groundwater level occurs near the contact between the basin-fill alluvial deposits and the underlying Tertiary volcanic and sedimentary units. The volcanic and sedimentary units are fully or nearly fully saturated. In some areas, the overlying the basin-fill deposits are partly saturated; maximum saturated thickness may be on the order of 50 meters. In the east part of the site, on the upthrown side of the Elephant Butte Fault, the basin-fill deposits are believed to be unsaturated. However, during periods immediately following a storm runoff event, the basin-fill sediments may become temporarily saturated in some areas due to development of localized perched groundwater bodies at the top of the Precambrian bedrock.

Inspection of groundwater level elevation contours on **Figure 7** indicates that direction of groundwater movement is to the southwest. Hydraulic gradient ranges from about 80 meters per kilometer (m/km) in the central part of the site to about 30 m/km in the southwest part of the site. The smaller hydraulic gradient in the southwest part of the site is believed to reflect larger transmissivity of the aquifer due to larger saturated thickness of Tertiary volcanic and sedimentary units and overlying basin-fill sediments. However, hydraulic gradients at the Far West Site are substantially larger than in the regional basin-fill aquifer west of the site. In the vicinity of the Desert wellfield 5 to 8 km west of the site, gradients are in the magnitude of 10 m/km or less (M&A, 2010).

5.7 CHEMICAL QUALITY OF GROUNDWATER

Groundwater samples were obtained near the end of the pumping tests at the five monitor wells installed at the Far West Site and were analyzed for common and trace inorganic constituents. Results of groundwater sampling at the monitor wells indicate that groundwater is of generally good quality with no exceedances of applicable primary maximum contaminant levels established by U.S. Environmental Protection Agency (U.S. EPA). The dominant cation in groundwater is sodium, except at well FW4-R, where the sodium and calcium concentrations are approximately equal. The dominant anion is bicarbonate at all monitor wells (**Table 13**).

Total dissolved solids concentrations in groundwater samples ranges from 260 milligrams per liter (mg/L) at FW9-S to 370 mg/L at FW4-R. Laboratory pH ranges from 7.72 at FW4-R to 8.43 at FW3-R (**Table 13**).

Three trace metals were detected at concentrations exceeding secondary maximum contaminant levels (SMCLs) recommended by U.S. EPA. At well FW15-R, the concentration of total aluminum exceeds the SMCL of 0.2 mg/L while the concentration of dissolved aluminum does not exceed this standard (**Table 14**). At all wells except for FW7-R, the concentration of total iron exceeds the SMCL of 0.3 mg/L; at FW4-R, the concentration of dissolved iron also exceeds this standard. At all wells except for FW3-R, the concentration of total and dissolved manganese exceeds the SMCL of 0.50 mg/L.

5.8 CONSIDERATIONS FOR TAILINGS PREFEASIBILITY ASSESSMENT

1. Key hydrogeologic considerations for assessing technical feasibility and potential design options for a tailings facility at the Far West Site are hydraulic conductivity and thickness of the vadose zone, chemical quality of groundwater, and hydraulic conductivity of the saturated zone.

- Hydraulic conductivity of the vadose zone is small, which would limit rates of migration of any tailings water that enters the vadose zone.

- The vadose zone is relatively thick due to large depth to groundwater level, particularly in the west part of the site. When combined with small moisture content, the vadose zone has substantial capacity to store water and potentially prevent small amounts of tailings water from reaching the saturated zone. As the volume of tailings water released to the vadose zone increases, the potential for tailings water to reach the saturated zone would also increase. For very large or sustained releases, tailings water would eventually reach the saturated zone.

- The massive quantity of carbonate accumulation (cementation) in the vadose zone provides high acid neutralization capacity and would also reduce the mobility of dissolved metals.

- Chemical quality of groundwater is good, with relatively low concentration of total dissolved solids. If tailings water reached the saturated zone, concentration of total dissolved solids in groundwater would increase.

- Hydraulic conductivity of the saturated zone is very small, which would result in very small rates of migration of any groundwater affected by tailings water.

- Variably-saturated flow modeling would be required to simulate migration of tailings water through the vadose zone for specific tailings facility design options. For modeling scenarios in which tailings water would reach the saturated zone, particle path modeling would be required to assess rates and extent of migration of impacted groundwater in the regional aquifer. Solute transport modeling would be required to assess changes in chemical quality of groundwater beneath and down hydraulic gradient from the tailings facility.

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TABLE 2. SUMMARY OF CONSTRUCTION DETAILS FOR MONITOR WELLS, VADOSE ZONE PIEZOMETERS, AND GEOTECHNICAL BORINGS
FAR WEST SITE, PINAL COUNTY, ARIZONA

				………..BOREHOLE………..		………..……………………..CASING……………………………..				………...SURVEY COORDINATES[c]………..			…..NON-PUMPING WATER LEVEL…..		
WELL IDENTIFIER	CADASTRAL LOCATION	WELL REGISTRATION NUMBER	DATE COMPLETED	BOREHOLE DIAMETER (inches)	BOREHOLE DEPTH (meters bls)[a]	DIAMETER (inches)	DEPTH (meters bls)	PERFORATED INTERVAL (meters bls)	GRAVEL OR SAND PACK INTERVAL[b] (meters bls)	NORTHING (meters)	EASTING (meters)	LAND SURFACE ELEVATION (meters amsl)[d]	DATE	DEPTH (meters bls)	WATER LEVEL ELEVATION (meters amsl)
MONITOR WELLS															
FW3-R	(D-2-10)26baa1	55-914079	6-Apr-12	18 9-7/8	0 - 7.6 7.6 - 344.4	12-3/4 4-1/2	0 - 7.6 0 - 338.3	--- 164.2 - 209.2 254.3 - 331.7	--- 157.6 - 213.4 217.0 - 344.1	3677124.660	472533.737	606.63	22-May-12	161.36	445.26
FW4-R	(D-2-10)25aab1	55-914258	23-Apr-12	18 9-7/8	0 - 7.6 7.6 - 113.5	12-3/4 4-1/2	0 - 7.6 0 - 113.5	--- 74.7 - 113.5	--- ---	3677204.340	474817.724	640.27	22-May-12	41.90	598.37
FW7-R	(D-2-10)35bbb	55-914080	12-Apr-12	18 9-7/8	0 - 7.6 7.6 - 216.4	12-3/4 4-1/2	0 - 7.6 0 - 215.1	--- 176.2 - 215.1	--- 169.8 - 216.4	3675560.172	471880.642	596.96	22-May-12	182.06	414.90
FW15-R	(D-2-10)35bdb	55-914044	16-Mar-12	24 14-3/4 9-7/8	0 - 14.3 14.3 - 246.9 246.9 - 278.9	16 8-5/8	0 - 14.3 0 - 240.8	--- 105.9 - 189.4 195.9 - 234.3	--- 96.0 - 189.6 195.1 - 244.8	3675115.946	472469.545	604.77	22-May-12	187.47	417.30
FW9-S	(D-2-10)36aaa	55-914088	28-Mar-12	16 9 8 7 6	0 - 6.1 6.1 - 45.7 45.7 - 150.0 150.0 - 158.5 158.5 - 182.1	12 4-1/2	0 - 6.1 0 - 182.1	--- 143.7 - 182.1	--- ---	3675504.620	475028.649	646.93	22-May-12	149.84	497.09
VADOSE ZONE PIEZOMETERS															
FW2-S	(D-2-10)24aab	55-914091	25-Apr-12	9 8 7	0 - 6.1 6.1 - 23.5 23.5 - 41.4	--- 2 2	--- 0 - 22.9 0 - 38.1	--- 19.8 - 22.9[f] 32.0 - 38.1[f]	--- 19.2 - 23.5 30.8 - 38.7	3678765.313	474664.865	641.61	---	---	---
FW3-S	(D-2-10)26baa2	55-914092	1-May-12	9 8 7	0 - 6.1 6.1 - 35.7 35.7 - 41.6	--- 2 2	--- 0 - 15.2 0 - 39.6	--- 9.1 - 15.2[f] 33.5 - 39.6[f]	--- 8.5 - 15.8 32.9 - 40.2	3677139.944	472535.910	606.92[g]	---	---	---
FW4-S	(D-2-10)25aab2	55-914093	5-May-12	8 6	0 - 9.1 9.1 - 19.8	--- 2	--- 0 - 19.5	--- 18.0 - 19.5[f]	--- 17.7 - 19.7	3677217.842	474820.242	640.11[g]	---	---	---
FW5-S	(D-2-11)30aaa	55-914087	20-Apr-12	8 6	0 - 6.1 6.1 - 10.7	--- 2	--- 0 - 10.7	--- 9.1 - 10.7[f]	--- 8.7 - 10.7	3677122.925	476685.549	690.29	---	---	---
FW7-S[e]	(D-2-10)35bbb	55-914094	4-May-12	9 8	0 - 6.1 6.1 - 19.8	---	---	---	---	3675560	471885	597	---	---	---
FW8-S	(D-2-10)26bcb	55-914095	10-Apr-12	9 8 7	0 - 6.1 6.1 - 32.9 32.9 - 41.1	--- 2 2	--- 0 - 17.7 0 - 40.5	--- 11.6 - 17.7[f] 34.4 - 40.5[f]	--- 10.1 - 18.3 32.9 - 41.1	3675118.161	473460.249	618.39	---	---	---
FW10-S	(D-2-11)32cbc	55-914089	12-Apr-12	9 8 7	0 - 6.1 6.1 - 24.1 24.1 - 29.0	--- 2 2	--- 0 - 10.7 0 - 21.9	--- 7.6 - 10.7[f] 15.8 - 21.9[f]	--- 6.7 - 11.3 14.9 - 22.6	3674535.939	476886.919	694.84	---	---	---
FW12-S[e]	(D-2-10)35ccc	not registered	3-May-12	9 8	0 - 6.1 6.1 - 19.8	---	---	---	---	3673989	471851	591	---	---	---
FW13-S	(D-2-10)36dda	55-914096	20-Apr-12	9 8 7	0 - 6.1 6.1 - 35.7 35.7 - 41.1	--- 2 2	--- 0 - 16.8 0 - 40.5	--- 10.7 - 16.8[f] 34.4 - 41.0[f]	--- 9.4 - 17.4 33.2 - 41.1	3674201.751	475018.924	648.07	---	---	---
FW14-S	(D-2-10)24cbc	55-914090	7-Apr-12	16 9 7	0 - 6.1 6.1 - 32.6 32.6 - 41.1	12-3/4 2 2	0 - 6.1 0 - 15.1 0 - 40.4	--- 8.9 - 15.0 37.3 - 40.3	--- 7.9 - 15.8 36.0 - 41.1	3677653.982	473471.087	619.46	---	---	---

[a] bls = below land surface

[b] The specified intervals are the gravel pack interval (Tacna No. 9 gravel) for the monitor wells and the sand pack interval (No. 8-12 silica sand) for the piezometer nests.

[c] Universal Transverse Mercator Zone 12 North, North American Datum 1927

[d] amsl = above mean sea level

[e] Geotechnical boreholes were backfilled with drill cuttings following drilling and sampling

[f] Includes 3/4-inch PVC end cap

[g] Estimated surface elevations

--- = not applicable

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TABLE 13. COMMON CONSTITUENTS AND ROUTINE PARAMETERS FOR GROUNDWATER SAMPLES OBTAINED FROM MONITOR WELLS AT FAR WEST SITE

SAMPLE LOCATION	SAMPLE IDENTIFIER/ DESCRIPTION	SAMPLE DATE	COMMON CONSTITUENTS[a] (mg/L)[b]													ROUTINE PARAMETERS					ANALYTICAL LABORATORY
																FIELD			LABORATORY		
			Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	SiO_2	Br	F	$NO_3 + NO_2$ (as N)	TDS	TEMP (°C)[c]	pH	SC (µS/cm)[d]	pH	SC (µS/cm)	
Unknown Aquifer																					
FW15-R	6006	05-Jun-12	---	---	---	---	---	---	---	---	---	---	---	---	---	30.6	7.84	459.4	---	---	
FW15-R	6006	05-Jun-12	21	9.8	64	3.1	---	---	---	---	42	---	---	---	---	---	---	---	---	---	TestAmerica
FW15-R	6006	05-Jun-12	24	11	62	3.3	20	--	219.6	23	46	<0.50	0.71	2.6	330	---	---	---	7.90	430	TestAmerica
FW15-R DUP	6007	05-Jun-12	---	---	---	---	---	---	---	---	---	---	---	---	---	30.6	7.84	459.4	---	---	
FW15-R DUP	6007	05-Jun-12	21	9.8	64	3.1	---	---	---	---	42	---	---	---	---	---	---	---	---	---	TestAmerica
FW15-R DUP	6007	05-Jun-12	24	12	62	3.4	20	--	219.6	23	48	<0.50	0.72	2.6	320	---	---	---	7.94	430	TestAmerica
FW3-R	6062	31-May-12	---	---	---	---	---	---	---	---	---	---	---	---	---	28.5	8.31	489.3	---	---	
FW3-R	6062	31-May-12	7.4	<2.0	100	2.0	---	---	---	---	21	---	---	---	---	---	---	---	---	---	TestAmerica
FW3-R	6062	31-May-12	7.4	<2.0	97	<2.0	18	--	207.4	41	22	<0.50	0.62	2.4	310	---	---	---	8.43	470	TestAmerica
FW4-R	6003	25-May-12	---	---	---	---	---	---	---	---	---	---	---	---	---	29.3	7.24	621.1	---	---	
FW4-R	6003	25-May-12	48	18	49	4.0	---	---	---	---	37	---	---	---	---	---	---	---	---	---	TestAmerica
FW4-R	6003	25-May-12	48	17	48	3.7	58	--	256.2	17	35	<0.50	0.44	3.1	370	---	---	---	7.72	590	TestAmerica
FW7-R	6005	30-May-12	---	---	---	---	---	---	---	---	---	---	---	---	---	31.7	7.71	486.7	---	---	
FW7-R	6005	30-May-12	23	17	54	2.9	---	---	---	---	35	---	---	---	---	---	---	---	---	---	TestAmerica
FW7-R	6005	30-May-12	23	17	53	2.8	23	--	207.4	45	37	<0.50	0.60	2.7	310	---	---	---	8.16	450	TestAmerica
FW9-S	6002	24-May-12	---	---	---	---	---	---	---	---	---	---	---	---	---	31.7	7.71	415.2	---	---	
FW9-S	6002	24-May-12	14	4.1	70	2.9	---	---	---	---	31	---	---	---	---	---	---	---	---	---	TestAmerica
FW9-S	6002	24-May-12	14	4.2	74	3.0	34	--	183	11	32	<0.50	1.1	0.93	260	---	---	---	8.07	390	TestAmerica

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TABLE 13. COMMON CONSTITUENTS AND ROUTINE PARAMETERS
FOR GROUNDWATER SAMPLES OBTAINED FROM MONITOR WELLS AT FAR WEST SITE

SAMPLE LOCATION	SAMPLE IDENTIFIER/ DESCRIPTION	SAMPLE DATE	COMMON CONSTITUENTS[a] (mg/L)[b]													ROUTINE PARAMETERS					ANALYTICAL LABORATORY
																FIELD			LABORATORY		
			Ca	Mg	Na	K	Cl	CO_3	HCO_3	SO_4	SiO_2	Br	F	$NO_3 + NO_2$ (as N)	TDS	TEMP (°C)[c]	pH	SC (µS/cm)[d]	pH	SC (µS/cm)	
U.S EPA National Primary Drinking Water Regulations			---	---	---	---	---	---	---	---	---	---	4.0	10	---	---	---	---	---	---	
U.S EPA National Secondary Drinking Water Regulations			---	---	---	---	250	---	---	250	---	---	2.0	---	500	---	6.5 to 8.5	---	6.5 to 8.5	---	
Arizona Numeric Aquifer Water Quality Standards			---	---	---	---	---	---	---	---	---	---	---	10	---	---	---	---	---	---	

Values in bold red are out of compliance with EPA primary water quality standards

Values in red italics are out of compliance with EPA secondary water quality standards

Values in red underline are out of compliance with Arizona numeric water quality standards

Values in blue indicate that detection limit exceeds standard

--- = Not available, not applicable
-- = Not calculated due to non-detect
* = Value reported as Na+K

🟦 Shading indicates dissolved results
⬜ Shading indicates total results
🟥 Shading indicates total recoverable results
⬜ Shading indicates unknown filtration or no filtration method provided for analyses

[a] Ca = Calcium
Mg = Magnesium
Na = Sodium
K = Potassium
Cl = Chloride
CO_3 = Carbonate
HCO_3 = Bicarbonate
SO_4 = Sulfate
SiO_2 = Silica
Br = Bromide
F = Fluoride
NO_3+NO_2 (as N) = Nitrate plus Nitrite, in equivalent milligrams of nitrogen per liter
TDS = Total dissolved solids

[b] mg/L = milligrams per liter

[c] TEMP (°C) = Temperature, in degrees Celsius

[d] SC (µS/cm) = Specific Conductance in microsiemens per centimeter

Explanation of Codes

Absent = Analyte not present
ge = Greater than or equal to reported value
i = Insufficient sample
j = Estimated value
j+ = Estimated value, high bias
j- = Estimated value, low bias
Lost = Sample lost in processing
n = Not measured
na = Not available
ND = Not Detected
np = Analyte not applicable
Present = Analyte was detected
q = Uncertain value
r = Unusable data
< = Less than reported detection limit
> = Greater than reported value
d = Diluted. Diluted samples are indicated only when value is estimated.
DUP = Field Duplicate
LD = Laboratory duplicate
SP = Split sample
SPD = Split-Duplicate

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TABLE 14. TRACE CONSTITUENTS
FOR GROUNDWATER SAMPLES OBTAINED FROM MONITOR WELLS AT FAR WEST SITE

SAMPLE LOCATION	SAMPLE IDENTIFIER/ DESCRIPTION	SAMPLE DATE	TRACE CONSTITUENTS[a] (mg/L)[b]																						ANALYTICAL LABORATORY
			Al	Sb	As	Ba	Be	B	Cd	Cr	Co	Cu	CN	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	S	Tl	Zn	
Unknown Aquifer																									
FW15-R	6006	05-Jun-12	<0.20	<0.0030	0.0062	0.019	<0.0010	<0.20	<0.0010	0.0052	<0.0010	<0.0010	---	0.052	<0.0010	*0.17*	<0.00020	0.0076	0.0040	<0.0020	<0.0010	---	<0.0010	0.46	TestAmerica
FW15-R	6006	05-Jun-12	*3.6*	<0.0030	0.0083	0.029	<0.0010	<0.20	<0.0010	0.014	0.0036	0.0099	<0.050	*4.5*	0.0027	*0.23*	<0.00020	0.0064	0.011	0.0025	<0.0010	<0.050	<0.0010	0.74	TestAmerica
FW15-R DUP	6007	05-Jun-12	<0.20	<0.0030	0.0062	0.019	<0.0010	<0.20	<0.0010	0.0043	<0.0010	<0.0010	---	<0.050	<0.0010	*0.17*	<0.00020	0.0075	0.0040	<0.0020	<0.0010	---	<0.0010	0.45	TestAmerica
FW15-R DUP	6007	05-Jun-12	*3.6*	<0.0030	0.0077	0.031	<0.0010	<0.20	<0.0010	0.015	0.0031	0.0096	<0.050	*4.5*	0.0021	*0.24*	<0.00020	0.0055	0.011	<0.0020	<0.0010	<0.050	<0.0010	0.77	TestAmerica
FW3-R	6062	31-May-12	<0.20	<0.0030	0.0071	0.012	<0.0010	<0.20	<0.0010	0.0023	<0.0010	0.0016	---	<0.050	<0.0010	0.016	<0.00020	0.0058	<0.0010	<0.0020	<0.0010	---	<0.0010	0.17	TestAmerica
FW3-R	6062	31-May-12	<0.20	<0.0030	0.0074	0.013	<0.0010	0.20	<0.0010	0.0061	<0.0010	0.0044	<0.050	*0.37*	<0.0010	0.017	<0.00020	0.0055	0.0016	<0.0020	<0.0010	<0.050	<0.0010	0.15	TestAmerica
FW4-R	6003	25-May-12	<0.20	<0.0030	0.0019	0.047	<0.0010	<0.20	<0.0010	<0.0010	<0.0010	0.0014	---	*2.1*	<0.0010	*0.084*	<0.00020	0.0022	<0.0010	<0.0020	<0.0010	---	<0.0010	1.0	TestAmerica
FW4-R	6003	25-May-12	<0.20	<0.0030	0.0062	0.050	<0.0010	<0.20	<0.0010	<0.0010	<0.0010	<0.0010	<0.050	*2.1*	0.0018	*0.086*	<0.00020	0.0021	<0.0010	<0.0020	<0.0010	<0.050	<0.0010	1.0	TestAmerica
FW7-R	6005	30-May-12	<0.20	<0.0030	0.0026	0.015	<0.0010	<0.20	<0.0010	0.017	<0.0010	<0.0010	---	<0.050	<0.0010	*0.055*	<0.00020	0.0062	<0.0010	<0.0020	<0.0010	---	<0.0010	0.68	TestAmerica
FW7-R	6005	30-May-12	<0.20	<0.0030	0.0028	0.017	<0.0010	0.34	<0.0010	0.019	<0.0010	0.0010	<0.050	0.17	0.0011	*0.054*	<0.00020	0.0066	<0.0010	<0.0020	<0.0010	<0.050	<0.0010	0.67	TestAmerica
FW9-S	6002	24-May-12	<0.20	<0.0030	0.0031	0.011	<0.0010	<0.20	<0.0010	0.0029	<0.0010	0.0010	---	<0.050	<0.0010	*0.098*	<0.00020	0.0062	<0.0010	<0.0020	<0.0010	---	<0.0010	0.43	TestAmerica
FW9-S	6002	24-May-12	<0.20	<0.0030	0.0033	0.012	<0.0010	<0.20	<0.0010	0.0094	<0.0010	0.0027	<0.050	*0.73*	0.0026	*0.11*	<0.00020	0.0060	<0.0010	<0.0020	<0.0010	<0.050	<0.0010	0.53	TestAmerica
U.S EPA National Primary Drinking Water Regulations			---	0.006	0.010	2	0.004	---	0.005	0.1	---	1.3	0.20	---	0.015	---	0.002	---	---	0.05	---	---	0.002	---	
U.S EPA National Secondary Drinking Water Regulations			0.05 to 0.2	---	---	---	---	---	---	---	---	1.0	---	0.3	---	0.050	---	---	---	---	0.1	---	---	5	
Arizona Numeric Aquifer Water Quality Standards			---	0.006	0.05	2.0	0.004	---	0.005	0.1	---	---	0.20	---	0.05	---	0.002	---	0.1	0.05	---	---	0.002	---	

Values in bold red are out of compliance with EPA primary water quality standards

Values in red italics are out of compliance with EPA secondary water quality standards

Values in red underline are out of compliance with Arizona numeric water quality standards

Values in blue indicate that detection limit exceeds standard

--- = Not available, not applicable

-- = Not calculated due to non-detect

🟦 Shading indicates dissolved results
▨ Shading indicates total results
🟥 Shading indicates total recoverable results
☐ Shading indicates unknown filtration or no filtration method provided for analyses

[a] Al = Aluminum
Sb = Antimony
As = Arsenic
Ba = Barium
Be = Beryllium
B = Boron
Cd = Cadmium
Cr = Chromium (total)
Co = Cobalt
Cu = Copper
CN = Cyanide (amenable)
Fe = Iron
Pb = Lead
Mn = Manganese
Hg = Mercury
Mo = Molybdenum
Ni = Nickel
Se = Selenium
Ag = Silver
S = Sulfide
Tl = Thallium
Zn = Zinc

[b] mg/L = milligrams per liter

Explanation of Codes

Absent = Analyte not present
ge = Greater than or equal to reported value
i = Insufficient sample
j = Estimated value
j+ = Estimated value, high bias
j- = Estimated value, low bias
Lost = Sample lost in processing
n = Not measured
na = Not available
ND = Not Detected
np = Analyte not applicable
Present = Analyte was detected
q = Uncertain value
r = Unusable data
< = Less than reported detection limit
> = Greater than reported value
d = Diluted. Diluted samples are indicated only when value is estimated.
DUP = Field Duplicate
LD = Laboratory duplicate
SP = Split sample
SPD = Split-Duplicate

TABLE 15. SUMMARY OF RESULTS OF INJECTION TESTS CONDUCTED IN VADOSE ZONE PIEZOMETERS AT FAR WEST SITE

					CONSTANT-HEAD TESTS					
					HYDRAULIC CONDUCTIVITY (cm/s)[c]			FALLING-HEAD TESTS		
PIEZOMETER IDENTIFIER	Perforated Interval (meters bls)[a]	HEAD (Height of Water in the Borehole)[b] (meters)	LITHOLOGY OF TEST INTERVAL	Test Duration (hours)	ZANGER[d]	NASBERG-TERLETSKATA[e]	GLOVER[f]	Number of Falling Head Cycles	Total Head[g] (meters)	Hydraulic Conductivity (cm/s)
FW-2S Shallow	19.8-22.9	3.66	Sand and gravel, some silt, well lithified	4.5	7.04E-04	1.05E-03	9.10E-04	---	---	---
FW-3S Shallow	9.1-15.2	6.71	Sand and silt, trace gravel, non-lithified to moderately lithified	6.0	4.63E-04	6.67E-04	5.78E-04	---	---	---
FW-3S Deep	33.5-40.2	4.88	Sand, silt, and gravel; interbedded, non-lithified to well lithified	6.0	2.15E-03	3.15E-03	2.73E-03	---	---	---
FWS-8S Shallow	11.6-17.7	6.95	Sand and silt, trace gravel; moderately lithified	2.3	3.79E-04	5.45E-04	4.73E-04	---	---	---
FW-8S Deep	34.4-40.5	3.54	Sand, gravel, silt: interbedded, weakly to moderately lithified, very slightly cohesive	6.5	3.80E-03	5.68E-03	4.92E-03	---	---	---
FW-10S Shallow	7.6-10.7	3.66	Gravel and sand, some silt; weakly lithified	4.7	7.32E-04	1.09E-03	9.46E-04	---	---	---
FW-10S Deep	15.8-21.9	6.71	Silty and gravelly sand; well lithified	4.0	2.78E-04	4.01E-04	3.47E-04	---	---	---
FW-13S Shallow	10.7-16.8	3.90	Sand, some silt and gravel; moderately to well lithified	6.5	1.55E-03	2.30E-03	1.99E-03	---	---	---
FW-13S Deep	34.4-40.5	1.40	Sand, some silt and gravel; moderately to well lithified	5.5	1.81E-02	2.94E-02	2.55E-02	---	---	---
FW-14S Shallow	8.8-14.9	7.01	Sand and silt, some gravel; weakly to moderately lithified; slightly to non-cohesive	6.3	3.82E-04	5.49E-04	4.75E-04	---	---	---
FW-2S Deep	32-38.1	7.92	Sandstone; well lithified	5.0	---	---	---	4	15.50	7.06E-07
FW-4S	18-19.7	1.98	Silty clay; weakly lithified; very cohesive	53.0	---	---	---	3	12.80	2.82E-07
FW-5S	9.1-10.7	1.98	Schist; well lithified	48.0	---	---	---	3	2.60	3.53E-06
FW-14S Deep	37.2-40.2	5.18	Gravelly sand, some silt; moderately lithified	5.5	---	---	---	7	5.79	3.53E-05

[a] bls = below land surface

[b] For constant head tests, the established water level (head) was within the perforated interval; note that the magnitude of head is equal to the height of water in the borehole; the bottom of the borehole is typically 0.5 meters below the bottom of the perforated interva

[c] cm/s = centimeters per second

[d] Zangar (1953)

[e] Nasberg (1951); Terletskata (1954)

[f] Glover (1953)

[g] Head value (height of water in the borehole) at which hydraulic conductivity was calculated

--- = not applicable

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

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TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-1	Ql	11-Apr-12	**0.09**	Double-ring Infiltrometer	Light brown, non-lithified gravelly silty sand	none	20	65/35	0.37 m bts: same matrix as primary sediments but more gravelly	none	**1.52**	**1.01**		No post-test subsurface wetting pattern obtained; corrected IR is an estimate
	Ql		**0.85**	Double-ring Infiltrometer	Light brown, non-lithified silty sandy gravel/cobbles	none	60 to 80	60/40	Same as primary to >0.67 m bts	none	**0.73**	**0.55**		No post-test subsurface wetting pattern obtained; corrected IR is an estimate
TP-2	Tcy	17-Apr-12	**0.03**	Double-ring Infiltrometer	Brown, non-lithified gravelly silt and sand (slightly cohesive)	generally none	40	50/50	0.30 m bts: moderately lithified sandy gravel/cobbles, some silt (caliche)	moderate, carbonate	**0.55**	**0.34**		Test result reflects combined effect of finer-grained surface sediments and underlying caliche (0.30 m bts); some lateral flow above caliche but also notable infiltration into it.
	Tcy		**1.65**	Single-ring (0.61-m) Infiltrometer	Grayish tan, moderately lithified sandy gravel/cobbles, some silt (caliche)	moderate to weak, carbonate	70	80/20	Same as primary to >1.22 m bts	moderate to weak, carbonate	**1.40**	**0.46**		This is a direct test of mod. to weakly lithified caliche. There was notable leakage around the ring (disturbance from ring being driven into cobbly caliche) during the entire test, but was corrected for; test result appears valid.
TP-3	Ql	13-Apr-12	**0.46**	Double-ring Infiltrometer	Light brown, non-lithified silty fine sand (slightly cohesive), trace gravel	none	10	60/40	Same as primary to 0.76 m bts	weak, non-carbonate (siliceous)	**2.23**	**1.04**		Test result represents primary sediment interval.
	Ql		**1.22**	Double-ring Infiltrometer	SAA but with slightly larger gravel content	carbonate rinds on small clasts	25	65/35	Same as primary to >0.61 m bts	carbonate rinds on small clasts	**1.43**	**1.16**		Test result represents primary sediment interval.
TP-4	Ql/Qyc	10-Apr-12	**0.06**	Double-ring Infiltrometer	Light brown, non-lithified silty fine sand (slightly cohesive), some gravel	none	20	70/30	Same as primary to 0.85 m bts	none	**0.37**	**0.21**		Test result is smaller than expected for the sediment lithology.
	Ql/Qyc		**0.46**	Single-ring (0.30-m) Infiltrometer - Falling Head	Light brown, non-lithified sandy gravel/cobbles, some silt	none	75	80/20	Same as primary to >1.07 m bts; includes layer of chiefly cobbles	none	**7.32**	**3.35**		Only 2 falling head cycles run and IR was very high; test values are approximate but are generally representative of sediments tested.
TP-5	Qm/Tcy	9-Apr-12	**0.46**	Single-ring (0.30-m) Infiltrometer	Reddish brown, non-lithified sandy gravel/cobbles, some silt (slightly cohesive matrix)	none	60	70/30	Same as primary to 0.61 m bts	none	**5.18**	**2.29**		Measured IR is very large; corrected IR is approximate because subsurface wetting pattern was very wide due to previous attempt at double-ring test.
	Qm/Tcy		**0.76**	Constant-head permeameter	SAA	none	ND	ND	Same as primary to 0.30 m below test hole	none			**1.68**	Test result represents primary sediment interval.
	Qm/Tcy		**1.31**	Single-ring (0.61-m) Infiltrometer	Light reddish brown, non-lithified silty and sandy gravel/cobbles (slightly to moderate cohesive matrix)	very weak, carbonate	80	50/50	Same as primary to >0.61 m bts	weak, carbonate	**1.71**	**0.73**		Measured IR is approximate due to significant leakage around outside of ring and uncertain correction factor.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-7	Qm	########	**0.37**	Double-ring Infiltrometer	Brown, non-lithified sandy clayey gravel/cobbles (very cohesive matrix)	none	55	20/80	0.40 m bts: well-lithified caliche with substantial gravel/cobbles	strong, carbonate	**0.24**	**0.17**		Test result is believed to be representative of the combined effects of the primary (surface) sediments and underlying caliche; some lateral flow occurred above the caliche.
	Qm		**1.65**	Double-ring Infiltrometer	Grayish tan, weakly lithified silty sandy gravel (caliche)	weak, carbonate	70	70/30	0.76 m bts: same as primary, but moderately lithified	moderate, carbonate	**2.93**	**0.98**		Substantial lateral flow occurred above underlying caliche, but the corrected IR represents primary sediment interval.
	Qm		**1.65**	Constant-head permeameter	SAA	weak, carbonate	60	60/40	0.46 m below test hole: same as primary, but moderately lithified	moderate, carbonate			**1.28**	Test result represents primary sediment interval.
TP-8	Qm	2-Apr-12	**0.37**	Double-ring Infiltrometer	Reddish brown, non-lithified silty and clayey sand (moderately cohesvie), some gravel	none	20	55/45	0.58 m bts: well lithified silty sand with gravel/cobbles (caliche)	strong, carbonate	**0.91**	**0.64**		Only slight lateral flow occurred above underlying caliche; corrected IR represents primary sediment interval.
	Qm		**0.58**	Double-ring Infiltrometer	SAA	none	20	50/50	0.40 m bts: well lithified silty sand with gravel/cobbles (caliche)	strong, carbonate	**0.70**	**0.49**		Substantial lateral flow occurred above underlying caliche (little infiltration into caliche), but the corrected IR represents the primary sediment interval.
	Qm		**0.76**	Constant-head permeameter	Light tan, well-lithified silty sand with gravel/cobbles (caliche)	strong, carbonate	ND	ND	0.46 m below test hole: same as primary but less lithified	moderate to weak, carbonate			**0.23**	Test result represents moderately to well lithified caliche.
TP-9	Qm	3-Apr-12	**0.15**	Double-ring Infiltrometer	Reddish brown, non-lithified clayey sandy gravel/cobbles (moderately cohesive matrix)	none	65	70/30	Same as primary to 0.91 m bts	none	**N/A**	**N/A**		Test measurements were very sporadic and never stablized; a reliable determination of infiltration rate was not possible (note that Baker tanks were previously located at this test pit site).
	Qm		**1.16**	Double-ring Infiltrometer	Reddish brown, weakly lithified clayey sandy gravel/cobbles (moderate to very cohesive matrix)	moderate to weak, non-carbonate (siliceous)	70	60/40	0.30 m bts: same as primary but stronger siliceous cementation	moderate, non-carbonate (siliceous)	**0.06**	**0.06**		Test result is smaller than expected for the sediment lithology, which might be due to smearing of previously wetted soil.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-10	Qo	5-Apr-12	**0.21**	Double-ring Infiltrometer	Reddish brown, non-lithified, silty and clayey, sandy gravel/cobbles (moderate to very cohesive matrix)	none	50	50/50	0.43 m bts: well lithified caliche with substantial gravel/cobbles	very strong, carbonate	**0.46**	**0.30**		Substantial lateral flow occurred above the underlying caliche; however, corrected test result is believed to chiefly represent the primary sediment interval.
	Qo		**1.46**	SIngle-ring (0.61-m) Infiltrometer	Light tan, weakly lithified silty, clayey gravel with sand (moderate to very cohesive matrix) (caliche)	moderate to weak, carbonate	70	35/65	Same as primary to 0.61 m bts	moderate to weak, carbonate	**N/A**	**N/A**		Excessive leakage occurred around ring; test measurements were very sporadic and never stablized; a reliable determination of infiltration rate was not possible.
TP-11	Qo	6-Apr-12	**0.18**	Double-ring Infiltrometer	Light brown, non-lithified sandy gravel/cobbles	none	45	75/25	0.46 m bts: moderately to weakly lithified sandy gravel (caliche)	moderate to weak, carbonate	**3.66**	**1.71**		Substantial lateral flow occurred above the underlying caliche but water also infiltrated into the (weakly lithified) caliche; test result is believed to chiefly represent the primary sediment interval.
	Qo		**1.16**	SIngle-ring (0.61-m) Infiltrometer	Light tan, weakly to mod. lithified sandy gravel/cobbles (caliche)	moderate to weak, carbonate	60	75/25	Same as primary to >0.61 m bts	moderate to weak, carbonate	**1.28**	**0.85**		Corrected IR is approximate due to substantial lateral flow and previously wetted subsurface (from pre-soaking).
TP-12	Ql	20-Apr-12	**0.40**	Double-ring Infiltrometer	Light reddish brown, non-lithified clayey silty sand (slightly to moderately cohesive), trace gravel	none	10	55/45	0.30 m bts: same as primary but includes patches of variable cementation; 0.79 m bts: well lithified sandy gravel (caliche)	moderate to strong, carbonate	**2.20**	**0.98**		Test result is larger than expected for the sediment lithology. Water infiltrated readily into underlying variably lithified caliche (0.30 m bts) but did not infiltrate into well lithified caliche (0.79 m bts).
	Ql		**1.52**	Single-ring (0.61-m) Infiltrometer	Grayish tan, weakly lithified silty sandy gravel/cobbles (caliche)	weak, carbonate	65	65/35	Same as primary to >0.61 m bts	weak, carbonate	**4.57**	**1.49**		This is a direct test of weakly lithified caliche; test result is larger than expected for the sediment lithology (water infiltrated readily into the weakly lithified caliche).
TP-13	Ql	4-Apr-12	**0.06**	Double-ring Infiltrometer	Dark reddish brown, non-lithified sandy silt and clay (very cohesive), with gravel/cobbles	none	30	35/65	0.37 m bts: moderately to well lithified caliche with substantial gravel/cobbles	moderate to strong, carbonate	**0.85**	**0.43**		Test result is believed to be representative of the combined effects of primary (surface) sediments and underlying caliche; substantial lateral flow occurred above caliche and corrected IR is approximate.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT^a	TEST DATE	TEST DEPTH (m bls)^b	INFILTRATION TEST METHOD^c	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation^d	Gravel %	Matrix % Sand/Fines	Description^e	Cementation	Uncorrected^f m/d^g	Corrected^f m/d	m/d	
TP-14	Ql	16-Apr-12	**0.40**	Double-ring Infiltrometer	Reddish brown, non-lithified silty sandy gravel (slightly cohesive matrix)	none	55	65/35	0.21 m bts: weakly lithified silty sand and gravel (caliche)	weak, carbonate	**5.18**	**2.32**		Test result is representative of primary sediment interval, with minor lateral flow above the underlying weakly lithified caliche.
	Ql		**1.16**	Double-ring Infiltrometer	Brown, non-lithified sandy gravel	very weak, carbonate	60	85/15	Same as primary to >1.37 m bts	weak to very weak, carbonate	**6.40**	**2.71**		Substantial vertical and lateral flow occurred during the test; corrected IR is approximate.
TP-15	Qm	########	**0.40**	Double-ring Infiltrometer	Reddish brown, non-lithified sandy silt and clay (moderate to very cohesive), trace gravel	None	10	20/80	0.34 m bts: mod. lithified caliche with substantial gravel/cobbles	moderate to weak, carbonate	**0.04**	**0.04**		Test result is representative of primary sediment interval, with minor lateral flow above the underlying caliche and some infiltration into the caliche.
	Qm		**0.40**	Constant-head permeameter	SAA	None			0.09 m below test hole: mod. lithified caliche with substantial gravel/cobbles				**0.30**	Test result is likely representative of the combined effects of primary (surface) sediments and underlying caliche, and may be affected by lateral flow.
	Qm		**1.04**	Single-ring (0.61-m) Infiltrometer	Light tan, weakly lithified sandy silt and gravel/cobbles (caliche)	weak, carbonate	40	45/55	Same as primary to >0.46 m bts	weak, carbonate	**0.40**	**0.22**		This is a direct test of weakly lithified (finer-grained) caliche.
	Qm		**1.04**	Constant-head permeameter	Light tan, weakly lithified silty sand, some gravel/cobbles (caliche)	weak, carbonate	25	65/35	Same as primary to >0.21 m below test hole	weak, carbonate			**0.29**	This is a direct test of weakly lithified (finer-grained) caliche.
TP-19	Tcy	2-May-12	**0.30**	Single-ring (0.61-m) Infiltrometer Falling-Head	Reddish brown, non-lithified sandy gravel, some silt	none	60	80/20	0.61 m bts: knob of moderately to weakly lithified caliche	moderate to weak, carbonate	**8.84**	**5.49**		Substantial lateral flow occurred above the underlying caliche; test result chiefly represents the primary sediment interval, but may be affected by root channels.
	Tcy		**0.91**	Single-ring (0.30-m) Infiltrometer Falling-Head	Grayish tan, well lithified sandy gravel/cobbles, trace silt (caliche)	strong to moderate, carbonate	80	80/20	Same as primary to >0.61 m bts	strong to moderate, carbonate	**1.55**	**0.43**		This test was conducted directly on mod. to well lithified caliche surface; the ring was sealed on test surface with bentonite. Due to substantial lateral/capillary flow on test surface, a large correction was necessary.
TP-20	Tcy	3-May-12	**0.30**	Double-ring Infiltrometer	Reddish brown, weakly lithified clayey sandy gravel (moderate to very cohesive matrix)	weak, non-carbonate (siliceous)	50	50/50	0.30 m bts: well lithified caliche	strong, carbonate	**0.46**	**0.27**		Some lateral flow occurred above the underlying caliche; test result chiefly represents the primary sediment interval.
	Tcy		**0.76**	Single-ring (0.30-m) Infiltrometer Falling-Head	Grayish tan, well lithified sandy gravel/cobbles (caliche)	strong, carbonate	50	80/20	Same as primary to >0.61 m bts	strong, carbonate	**0.70**	**0.15**		This test was conducted directly on well lithified caliche surface; the ring was sealed on test surface with bentonite. Due to substantial lateral/capillary flow on test surface, a large correction was necessary.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-21	Qm	########	**0.40**	Double-ring Infiltrometer	Brown, non-lithified silty clayey sand with gravel/cobbles (moderate to very cohesive)	none	>25	50/50	0.34 m bts: well lithified caliche with substantial gravel/cobbles	strong, carbonate	**0.55**	**0.34**		Some lateral flow occurred above the underlying caliche; test result chiefly represents the primary sediment interval.
	Qm		**1.52**	Constant-head permeameter	Light tan, weakly lithified sandy gravel/cobbles, some silt (caliche)	weak, carbonate	>30	80/20	Same as primary to >0.37 m ft below test hole	weak, carbonate			**0.82**	This is a direct test of weakly lithified caliche.
TP-22	Ql	18-Apr-12	**0.46**	Double-ring Infiltrometer	Light brown, non-lithified silty gravelly sand (slightly cohesive)	none	30	65/35	0.30 m bts: same matrix as primary but very cobbly; 0.46 m bts: mod. to well lithified sandy gravel (caliche)	moderate to strong, carbonate	**2.90**	**1.28**		Some lateral flow occurred above the underlying caliche (with only slight infiltration into it); test result chiefly represents the primary sediment interval.
	Ql		**1.37**	Double-ring Infiltrometer	Light grayish brown, moderately lithified sandy gravel, some silt (slightly cohesive matrix) (caliche)	moderate, carbonate	45	75/25	Same as primary to >0.61 m bts	moderate, carbonate	**0.64**	**0.49**		This is a direct test of moderately lithified caliche (with rings driven into surface); only minor lateral flow occurred.
TP-23	Ql	19-Apr-12	**0.55**	Double-ring Infiltrometer	Brown, non-lithified clayey silty sand (moderately cohesive), trace gravel	none	10	55/45	0.70 m bts: thin moderately lithified caliche lens	moderate to strong, carbonate	**1.28**	**0.70**		Test result is representative of primary sediment interval; minor lateral flow occurred above underlying caliche lens but there was notable infiltration into it.
	Ql		**1.22**	Double-ring Infiltrometer	Light brown, weakly lithified sandy silty gravel (slightly to mod. cohesive matrix); includes layer of sandy gravel (caliche)	weak, carbonate	40	50/50	0.46 m bts: thin lens of moderately to well lithified caliche	moderate to strong, carbonate	**1.04**	**0.64**		Test result is representative of primary sediment interval; minor lateral flow occurred above underlying caliche lens but there was notable infiltration into it.
TP-24	Ql	1-May-12	**0.46**	Double-ring Infiltrometer	Light brown, non-lithified sandy gravel, some silt (slightly cohesive matrix)	none	50	80/20	0.61 m bts: similar to primary, but slightly larger silt content	none	**3.02**	**1.71**		Test result is representative of primary sediment interval.
	Ql		**1.07**	Double-ring Infiltrometer	Light brown, non-lithified silty sandy gravel (slightly to mod. cohesive matrix)	none	40	65/35	Same as primary to >0.61 m bts	none	**0.88**	**0.67**		Test result is representative of primary sediment interval.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-27	Ql	23-Apr-12	**0.03**	Double-ring Infiltrometer	Reddish brown, weakly lithified silty sand and gravel/cobbles (slightly cohesive matrix)	weak, non-carbonate (siliceous)	40	60/40	0.30 m bts: similar matrix as primary but more cobbly	weak, non-carbonate (siliceous); some carbonate patches	**0.40**	**0.30**		Test result is smaller than expected for the sediment lithology; siliceous cementation may be responsible for the small IR.
	Ql		**0.85**	Double-ring Infiltrometer	Reddish brown, moderately lithified sandy gravel/cobbles, some silt (slightly cohesive matrix)	moderate, non-carbonate (siliceous); some carbonate patches	60	80/20	Same as primary to >0.61 m bts	moderate, non-carbonate (siliceous); some carbonate patches	**0.30**	**0.21**		Test result is much smaller than expected for the sediment lithology; siliceous cementation may be responsible for the small IR.
TP-28	Qm	24-Apr-12	**0.15**	Single-ring (0.61-m) Infiltrometer	Reddish brown, non-lithified clayey sandy silt, some gravel (moderately cohesive)	none	25	45/55	0.18 m bts: well lithified sandy gravel (caliche)	strong, carbonate	**0.30**	**0.25**		Test result is representative of primary sediment interval; minor lateral flow occurred above underlying caliche and there was only slight infiltration into it.
	Qm		**0.61**	Single-ring (0.30-m) Infiltrometer Falling-Head	Grayish tan, well lithified sandy gravel/cobbles (caliche)	strong, carbonate	65	85/15	0.30 m bts: moderately lithified caliche	strong, carbonate	**0.34**	**0.23**		This test was conducted directly on well lithified caliche surface; the ring was sealed on test surface with bentonite. Only minor lateral/capillary flow occurred with resulting small correction.
TP-30	Qm	25-Apr-12	**0.37**	Double-ring Infiltrometer	Reddish brown, non-lithified clayey sandy gravel/cobbles (moderate to very cohesive matrix)	none	50	60/40	0.24 m bts: similar matrix as primary but more gravelly	weak, non-carbonate (siliceous)	**0.30**	**0.25**		Test result is representative of primary sediment interval.
TP-32	Qm	30-Apr-12	**0.03**	Double-ring Infiltrometer	Reddish brown, non-lithified clayey sandy gravel (moderate to very cohesive matrix)	none	40	50/50	0.15 m bts: cobbly layer with less fines in matrix	none	**1.83**	**0.30**		Excessive lateral flow occurred within cobbly zone directly underlying thin layer of primary sediments; a large correction was applied but the test result is unreliable.
	Qm		**0.70**	Double-ring Infiltrometer	Reddish brown, weakly to moderate lithified clayey sandy gravel (moderate to very cohesive matrix)	weak to moderate, siliceous; some carbonate patches	60	65/35	0.37 m bts: moderate to well lithified caliche	strong to moderate, carbonate	**0.17**	**0.10**		Test result may be representative of the combined effects of primary sediments and underlying caliche, but is likely controlled by the caliche; substantial lateral flow occurred above the caliche with only slight infiltration into it.

TABLE 16. SUMMARY OF RESULTS OF INFILTRATION TESTS CONDUCTED IN TEST PITS AT FAR WEST SITE

DRAFT

TEST PIT IDENTIFIER	SURFICIAL GEOLOGIC UNIT[a]	TEST DATE	TEST DEPTH (m bls)[b]	INFILTRATION TEST METHOD[c]	LITHOLOGY OF PRIMARY SEDIMENT TEST INTERVAL		PARTICLE SIZE		LITHOLOGY OF UNDERLYING SEDIMENTS		INFILTRATION RATE		HYDRAULIC CONDUCTIVITY	COMMENTS
					Description	Cementation[d]	Gravel %	Matrix % Sand/Fines	Description[e]	Cementation	Uncorrected[f] m/d[g]	Corrected[f] m/d	m/d	
TP-33	Qm	27-Apr-12	**0.15**	Double-ring Infiltrometer	Reddish brown, weakly lithified clayey sandy gravel/cobbles (mod. cohesive matrix)	Weak to moderate, non-carbonate (siliceous)	70	65/35	0.46 m bts: well lithified caliche	strong, carbonate	**0.34**	**0.23**		Test result is representative of primary sediment interval; wetting front barely reached the underlying caliche.
	Qm		**0.79**	Single-ring (0.30-m) Infiltrometer Falling-Head	Grayish tan, well lithified clayey and silty sandy gravel (moderately cohesive matrix) (caliche)	strong, carbonate	40	50/50	0.43 m bts: moderately lithified caliche	moderate, carbonate	**0.29**	**0.13**		This test was conducted directly on well lithified caliche surface; the ring was sealed on test surface with bentonite. Some lateral flow occurred with resulting moderate correction.
TP-36	Qyc	4-May-12	**0.09**	Single-ring (0.30-m) Infiltrometer Falling-Head	Dark grayish brown, non-lithified sandy gravel/cobbles	none	80	90/10	Same as primary to >1.22 m bts	none	**23.2**	**23.2**		Post-test wetting pattern was not documented but a correction factor is likely irrelevant for these very coarse-grained sediments (channel deposits).

[a] Mapped surficial geologic units, per Spencer and others (1998), for the test pit locations

[b] m, bls = meters below land surface

[c] Infiltration test methods used for the tests consisted of: (1) double-ring infiltrometer; (2) single-ring infiltrometer, using either the 0.30-meter diameter ring or the 0.61-meter diameter ring; (3) single-ring infiltrometer with "falling-head" measurements; or (4) constant-head permeameter. Refer to **Section 4.5.1** for description of methods.

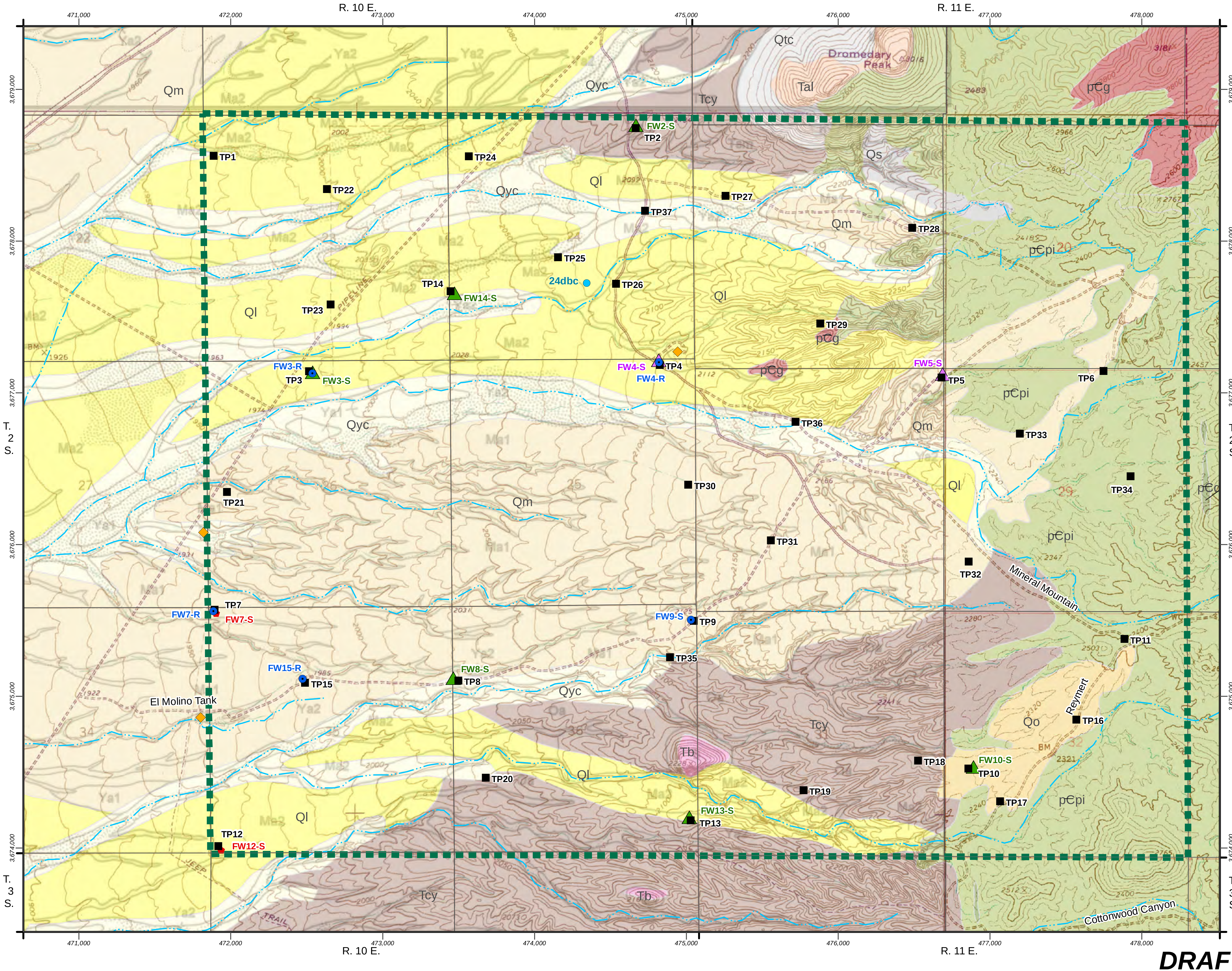
[d] Degree and type of sediment cementation

[e] Brief description of sediments underlying the "primary" test sediment interval (i.e. the first sediment layer of differing lithology below the targeted test interval); the description includes the depth of this layer below the test surface; "bts" = below test surface. "Primary" refers to the sediment type of the primary (targeted) test interval. If the description states "same as primary to X m bts" without an indication of a differing underlying sediment type, it means that a layer of differing lithology exists at a depth of "X" meters below the test surface but the wetting front did not extend to this layer. If the description states "same as primary to > X m bts" without an indication of a differing underlying sediment type, it means that the post-test excavation extended to a depth of "X" meters below the test surface without encountering a different sediment layer.

[f] Uncorrected infiltration rate is the raw test result; Corrected infiltration rate is the raw test result corrected for lateral flow that occurred during the test based on post-test evaluation of the subsurface wetting pattern. Correcting the raw test result for lateral flow results in a more representative vertical infiltration rate.

[g] m/d = meters per day

<u>Other abbreviations used in the table:</u>
IR = Infiltration rate
bts = below test surface
SAA = same as above; refers to the sediment lithologic description provided in the preceeding row (i.e. the sediments tested in the "deeper" infiltration test are the same as tested in the "shallower" test).
ND = not determined or documented
N/A = not available; refers to infiltration test results that could not be quantified and used, due chiefly to excessive lateral flow and/or excessive leakage from the ring-infiltrometer.



EXPLANATION

●	Monitor Well
●	Stock Well
▲	Dual-Completion Vadose Zone Piezometer
▲	Single-Completion Vadose Zone Piezometer
⬟	Geotechnical Borehole
■	Test Pit
◆	Stock Tank
▬ ▬ ▬	Site Boundary
—	Road

Geologic Units

Geology from Spencer and others (1998)

Quaternary

Qyc	Active alluvium (Holocene)
Qtc	Talus and colluvium (Holocene and Late Pleistocene)
Ql	Moderately dissected alluvial fan and terrace deposits (Late Pleistocene)
Qm	Dissected alluvial-fan and terrace deposits (Middle Pleistocene)
Qo	Deeply dissected alluvial-fan remnants (Early Pleistocene)
Qs	Surficial deposits, undifferentiated

Tertiary

Tcy	Conglomerate (Pliocene or Late Miocene)
Tvy	Basaltic rocks (Miocene)
Tal	Apache Leap Tuff (Early Miocene)

Precambrian

pCdiab	Diabase (Middle Proterozoic)
pCg	Granodiorite to granite (Early Proterozoic)
pCpi	Pinal Schist (Early Proterozoic)

Surficial Geologic Units (background)

From surficial geologic maps by Huckleberry (1993).

Quaternary

Ya2	Young alluvium (< 0.5 ka) [Qyc Active alluvium (Holocene)]
Ya1	Young alluvium (< 10 ka) [Qy Low terrace and alluvial fan deposits (Holocene)]
Ma2	Middle alluvium (10-100 ka) [Ql Moderately dissected alluvial fan and terrace deposits (Late Pleistocene)]
Ma1	Middle alluvium (100-500 ka) [Qm Dissected alluvial-fan and terrace deposits (Middle Pleistocene)]

Tertiary

Oa	Old alluvium [Tcy Conglomerate (Pliocene or Late Miocene)]
Tsm	Middle Tertiary basin deposits with steeply dipping beds [Tcy Conglomerate (Pliocene or Late Miocene)]
b	Steeply sloping bedrock surfaces [Tvy Basaltic Rocks (Miocene)]

0 2,000
Feet

0 200 400 600 800
Meters

N

Resolution Copper Company

Far West Tailings
Pre-Feasibility Study

SITE MAP

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2012

FIGURE 1

DRAFT

GIS-TUC\605.7157\site_map2\20July2012 UTM-NAD27

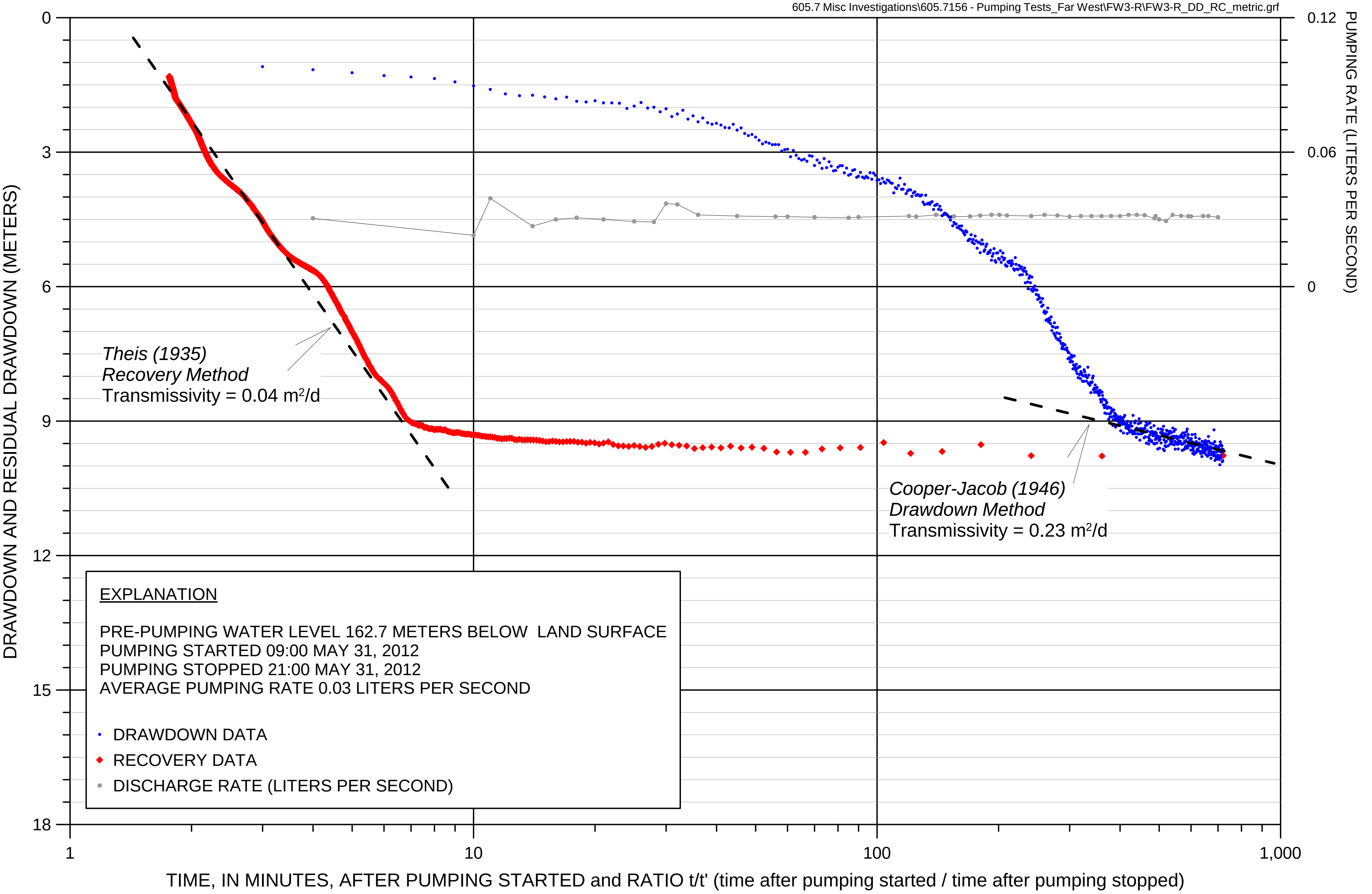


FIGURE 2. DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL FW3-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

DRAFT

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& ASSOCIATES

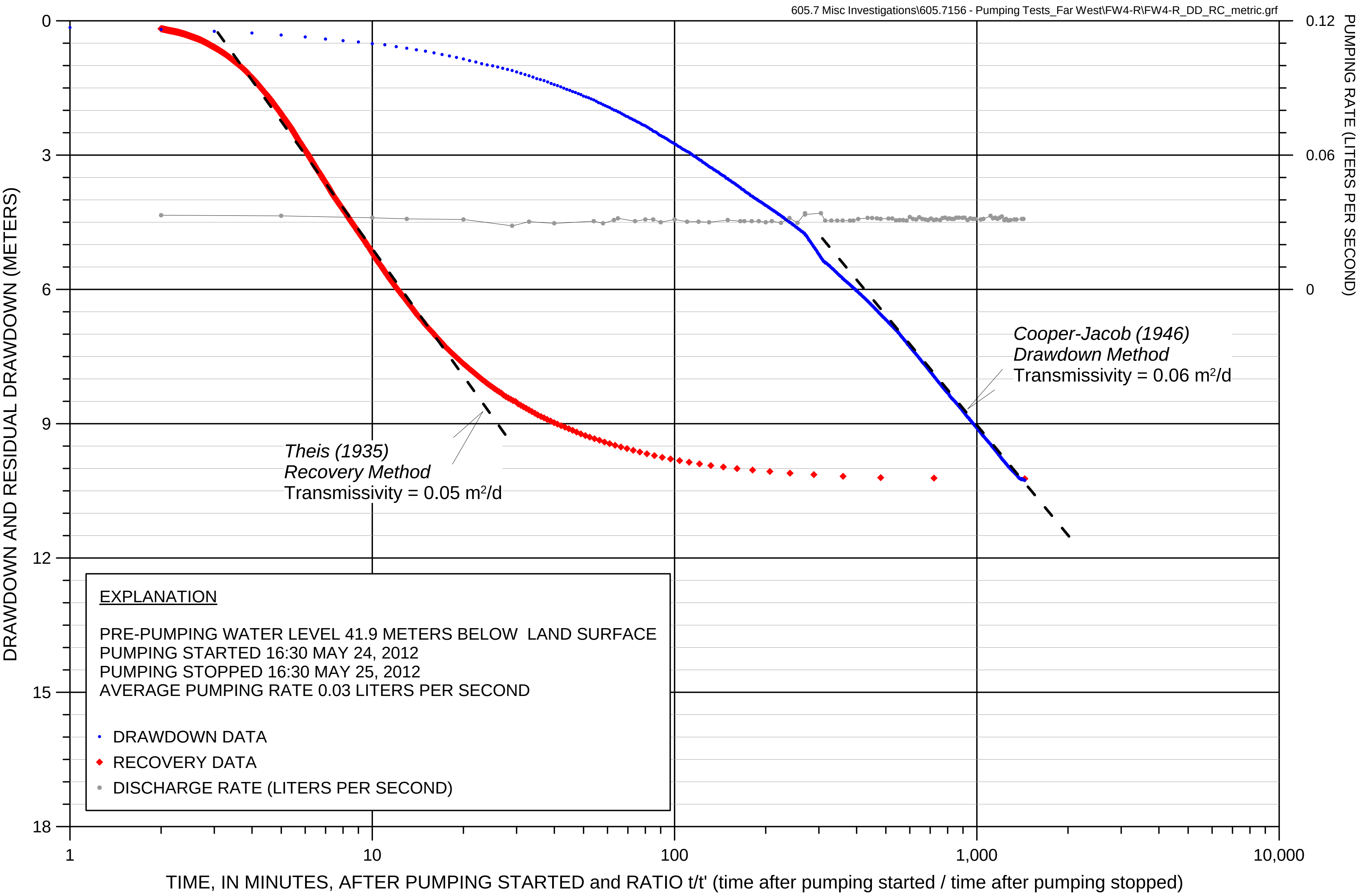
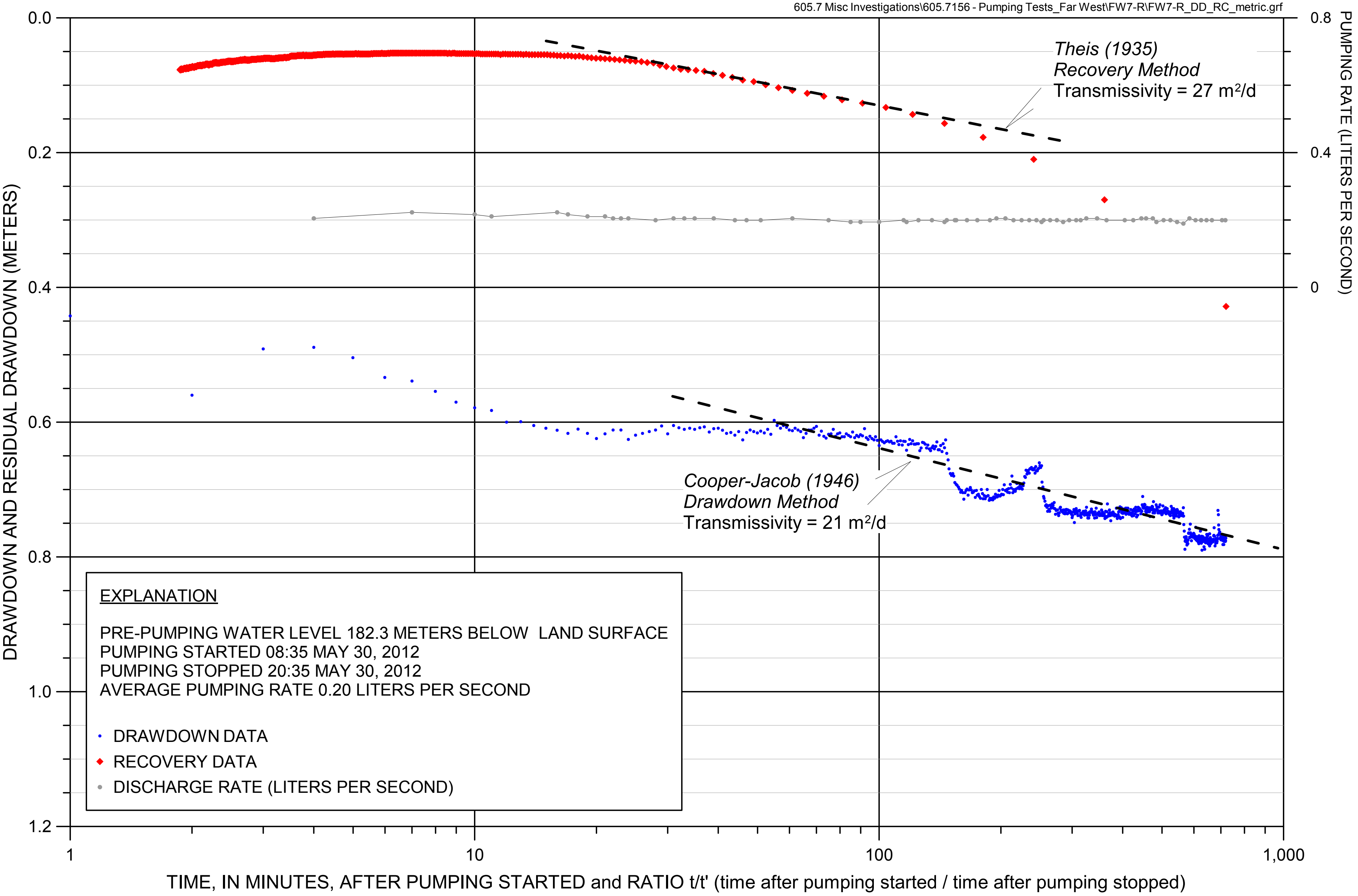


FIGURE 3. DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL FW4-R DURING 24-HOUR CONSTANT-RATE PUMPING TEST

DRAFT

MONTGOMERY
& ASSOCIATES

605.7 Misc Investigations\605.7156 - Pumping Tests_Far West\FW7-R\FW7-R_DD_RC_metric.grf



DRAFT

FIGURE 4. DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL FW7-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

MONTGOMERY
& ASSOCIATES

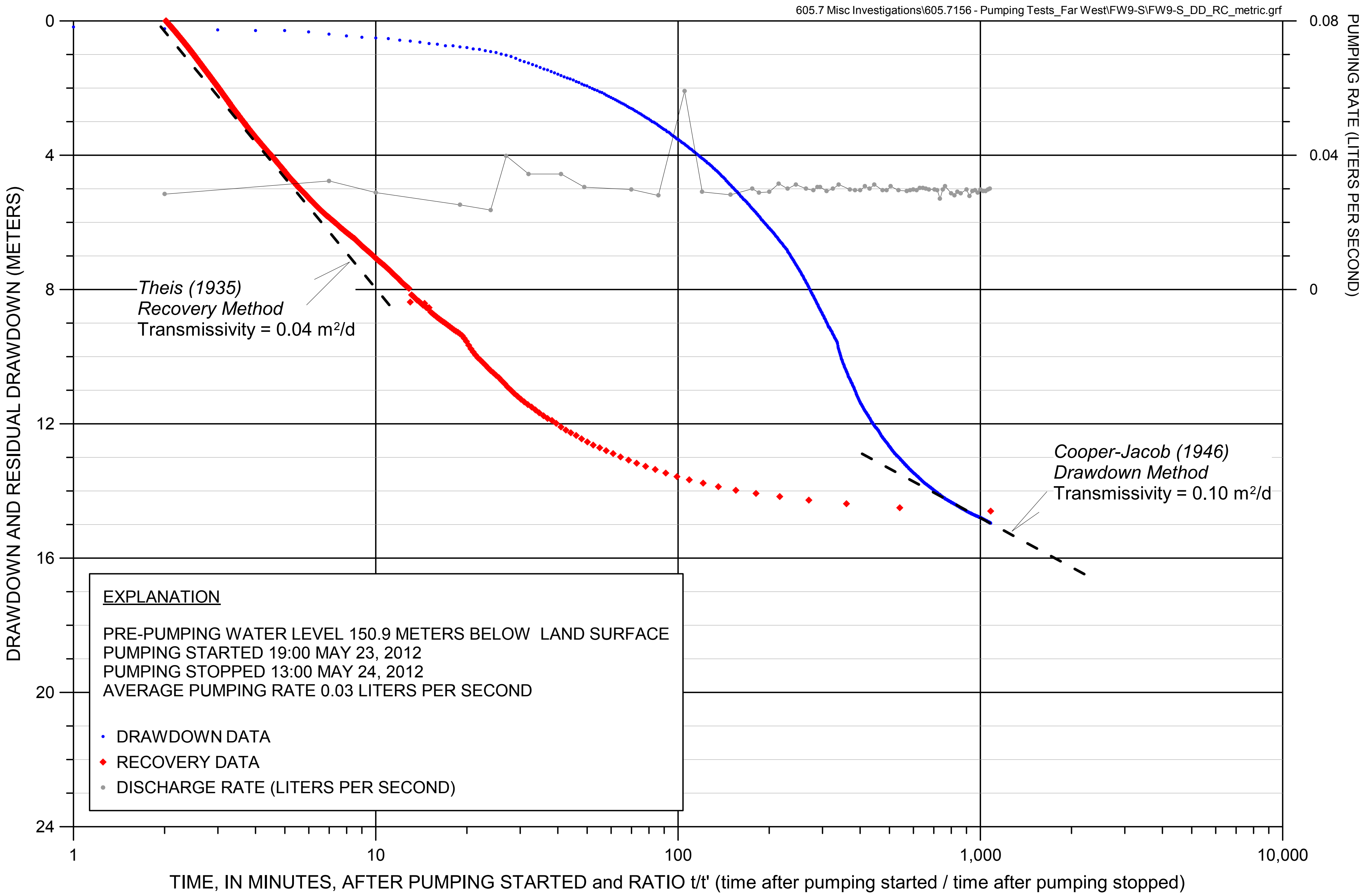


FIGURE 5. DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL FW9-S DURING 18-HOUR CONSTANT-RATE PUMPING TEST

DRAFT

MONTGOMERY & ASSOCIATES

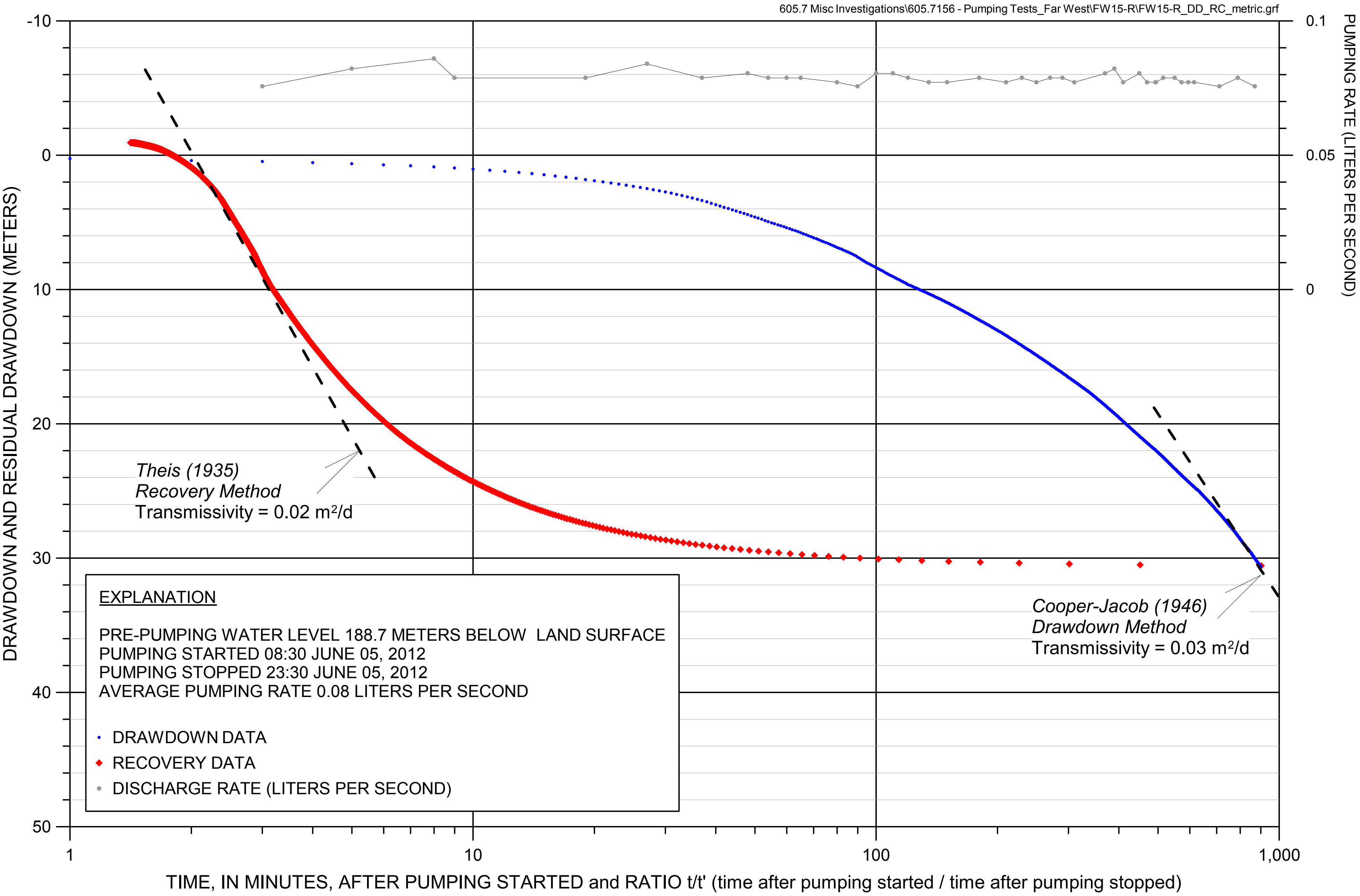
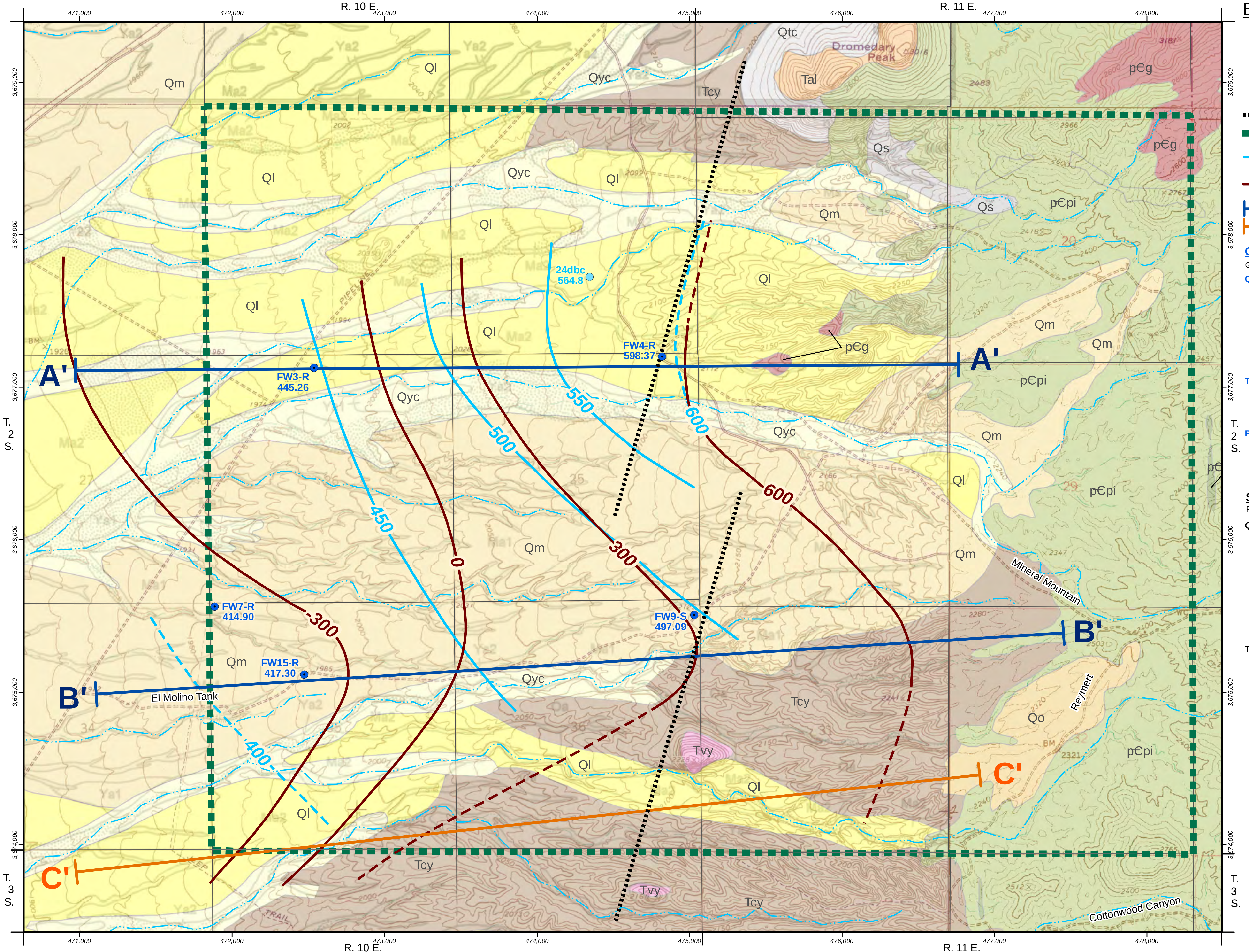


FIGURE 6. DRAWDOWN AND RECOVERY GRAPH FOR PUMPED WELL FW15-R DURING 15-HOUR CONSTANT-RATE PUMPING TEST

DRAFT

MONTGOMERY
& ASSOCIATES



EXPLANATION

FW4-R 598.37 — Monitor Well and Identifier; Groundwater Level Elevation, 22May2012 (meters, msl)

24dbc 564.8 — Stock Well and Identifier; Groundwater Level Elevation, 22May2012 (meters, msl)

Inferred Fault (Elephant Butte Fault)

Site Boundary

400 — Groundwater Level Elevation Contour (meters, msl), dashed where uncertain

300 — Top of Precambrian Bedrock Elevation Contour (meters, msl)

Hydrogeologic Section and Gravity Profile

Gravity Profile

Geologic Units

Geology from Spencer and others (1998)

Quaternary

Qyc	Active alluvium (Holocene)
Qtc	Talus and colluvium (Holocene and Late Pleistocene)
Ql	Moderately dissected alluvial fan and terrace deposits (Late Pleistocene)
Qm	Dissected alluvial-fan and terrace deposits (Middle Pleistocene)
Qo	Deeply dissected alluvial-fan remnants (Early Pleistocene)
Qs	Surficial deposits, undifferentiated

Tertiary

Tcy	Conglomerate (Pliocene or Late Miocene)
Tvy	Basaltic rocks (Miocene)
Tal	Apache Leap Tuff (Early Miocene)

Precambrian

pЄdiab	Diabase (Middle Proterozoic)
pЄg	Granodiorite to granite (Early Proterozoic)
pЄpi	Pinal Schist (Early Proterozoic)

Surficial Geologic Units (background)

From surficial geologic maps by Huckleberry (1993).

Quaternary

Ya2	Young alluvium (< 0.5 ka) [Qyc Active alluvium (Holocene)]
Ya1	Young alluvium (< 10 ka) [Qy Low terrace and alluvial fan deposits (Holocene)]
Ma2	Middle alluvium (10-100 ka) [Ql Moderately dissected alluvial fan and terrace deposits (Late Pleistocene)]
Ma1	Middle alluvium (100-500 ka) [Qm Dissected alluvial-fan and terrace deposits (Middle Pleistocene)]

Tertiary

Oa	Old alluvium [Tcy Conglomerate (Pliocene or Late Miocene)]
Tsm	Middle Tertiary basin deposits with steeply dipping beds [Tcy Conglomerate (Pliocene or Late Miocene)]
b	Steeply sloping bedrock surfaces [Tvy Basaltic Rocks (Miocene)]

0 2,000
Feet
0 200 400 600 800
Meters

Resolution Copper Company

Far West Tailings
Pre-Feasibility Study

HYDROGEOLOGIC FEATURES

MONTGOMERY & ASSOCIATES
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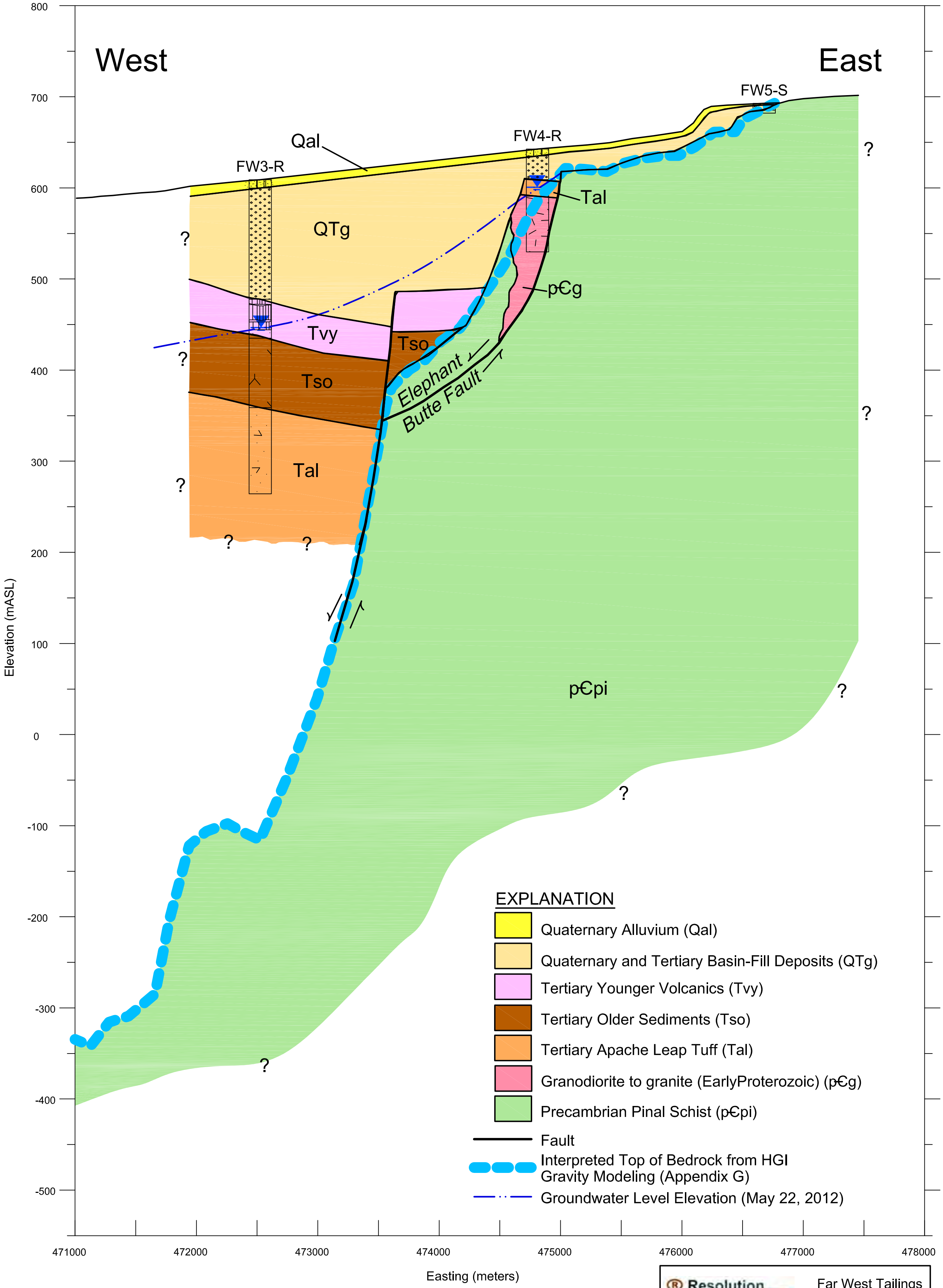
2012

FIGURE 7

DRAFT

GIS-TUC\605.7157\HydroFeatures\25July2012 UTM-NAD27



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Far West Tailings
Pre-Feasibility Study

HYDROGEOLOGIC
SECTION A-A'

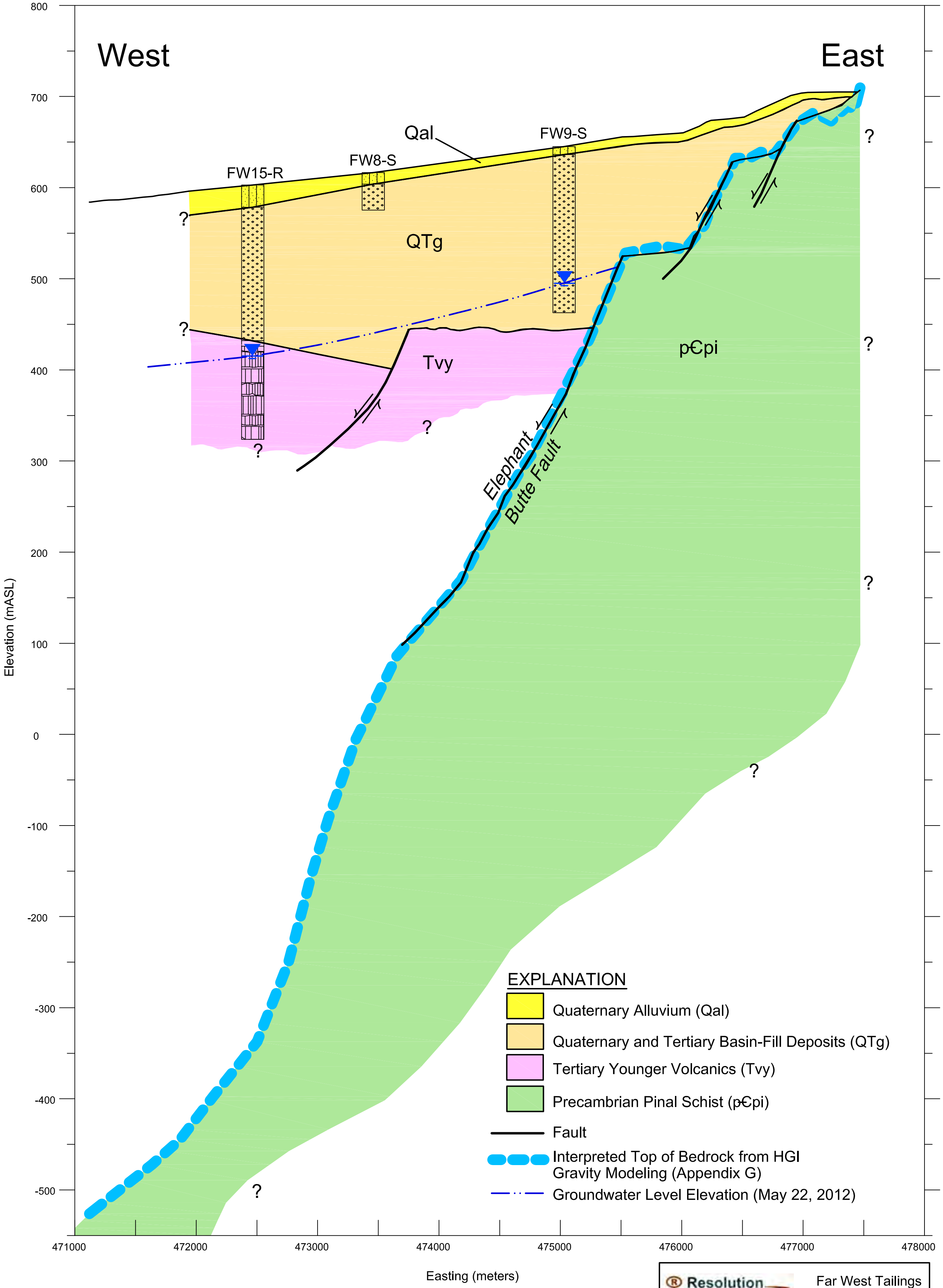
MONTGOMERY & ASSOCIATES
Water Resource Consultants

2012

FIGURE 8

DRAFT

Drafting\605.7157\xsectionA_LandSurface_Bedrock\30July2012



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Far West Tailings
Pre-Feasibility Study

HYDROGEOLOGIC SECTION B-B'

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2012

FIGURE 9

DRAFT

Drafting\605.7157\xsectionB_LandSurface_Bedrock\30July2012

APPENDIX A

AS-BUILT SCHEMATIC DIAGRAMS OF CONSTRUCTION FOR WELLS, VADOSE ZONE PIEZOMETERS, AND GEOTECHNICAL BORINGS

APPENDIX A

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Figure

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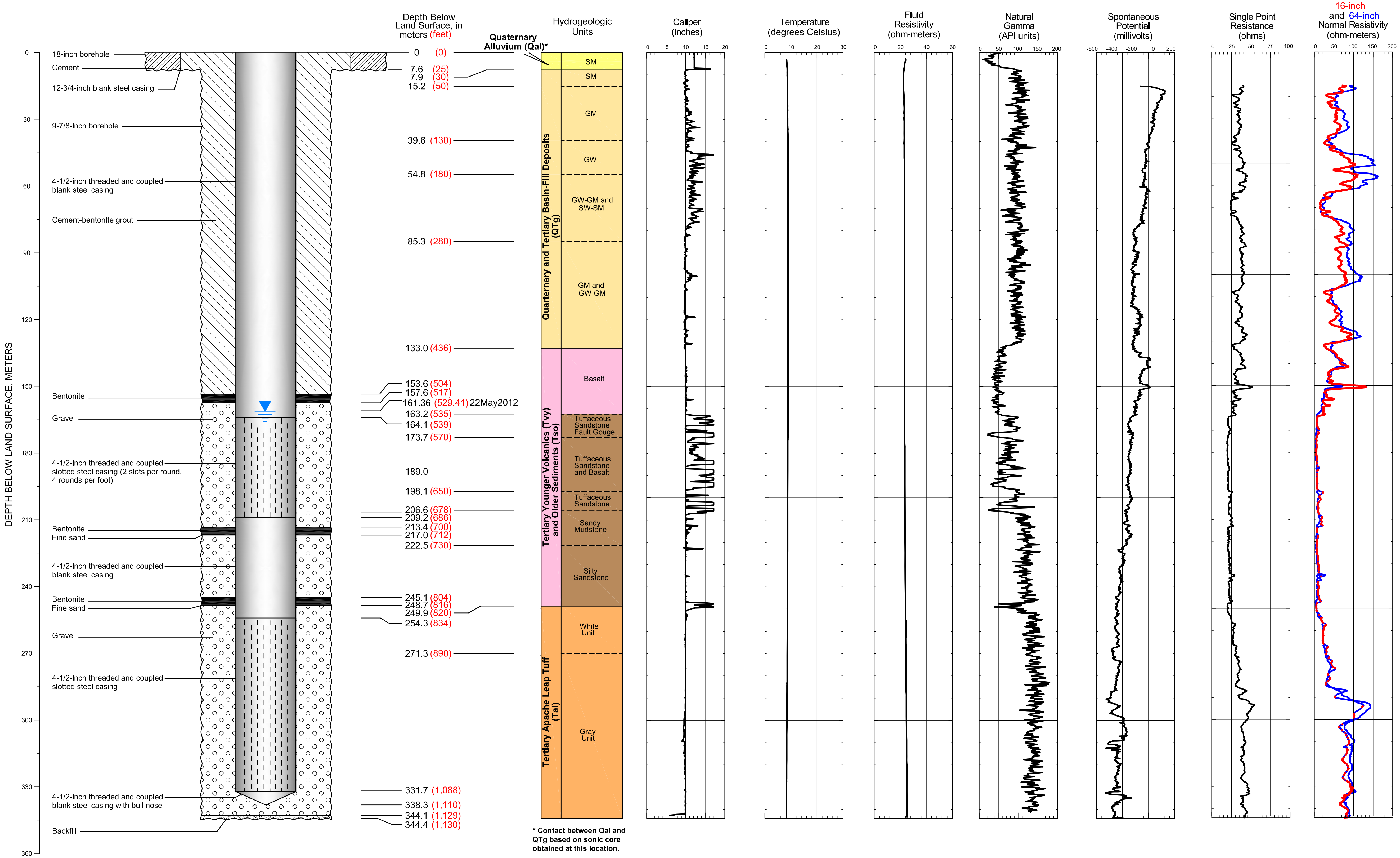
Figure



* Contact between Qal and QTg based on sonic core obtained at this location.

DRAFT

CADASTRAL: (D-2-10)26baa
ADWR NO: 55-914079
NORTHING: 3677124.660
EASTING: 472533.737
LAND SURFACE ELEVATION: 606.63

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

▼ Non-pumping Water Level

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Water Resource Consultants

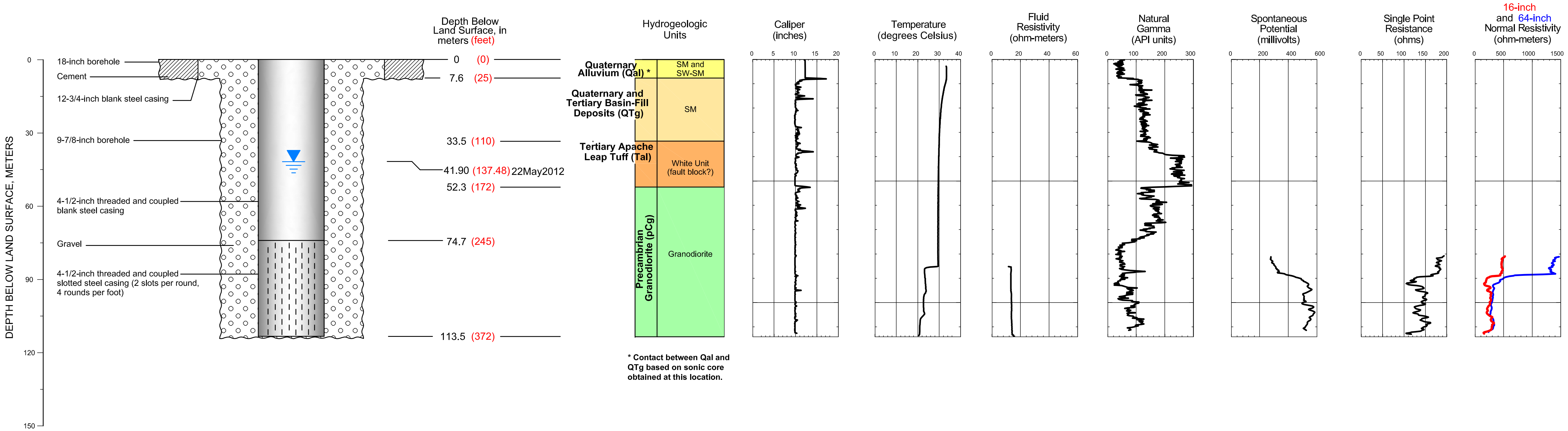
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR WELL FW3-R

Version: July 26, 2012

FIGURE A-1

605\wellschematics2012\FW3-R_ws\26July2012



* Contact between Qal and QTg based on sonic core obtained at this location.

DRAFT

CADASTRAL: (D-2-10)25aab	ADWR NO: 55-914258
NORTHING: 3677204.340	EASTING: 474817.724
LAND SURFACE ELEVATION: 640.27	
DATUM: UTM12N, NAD 27, meters VERTICAL: NGVD 29 METERS	

▽ Non-pumping Water Level

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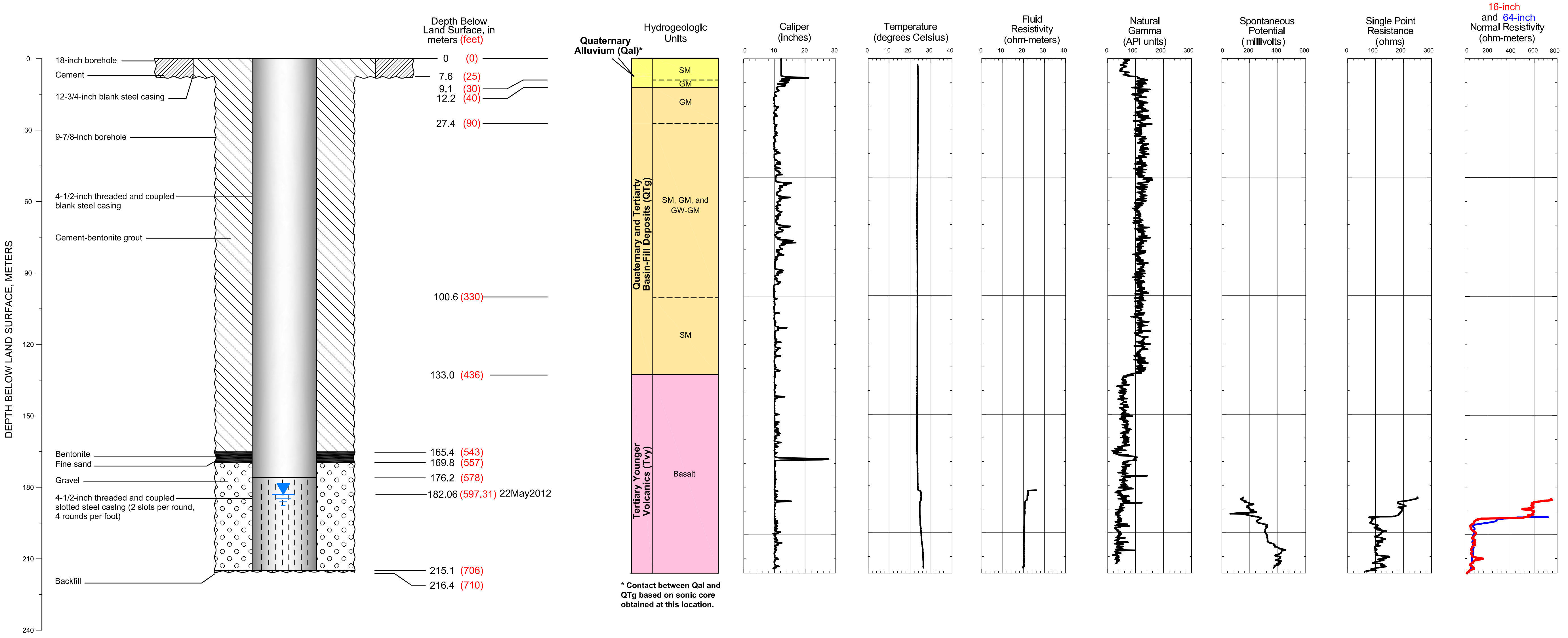
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM
OF CONSTRUCTION FOR
WELL FW4-R

Version: July 26, 2012

FIGURE A-2

605\wellschematics2012\FW4-R_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)35bbb1	ADWR NO: 55-914080
NORTHING: 3675560*	EASTING: 471885*

LAND SURFACE ELEVATION: 597.4*

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

▼ Non-pumping Water Level
(feet below measuring point)

* Hand-held GPS

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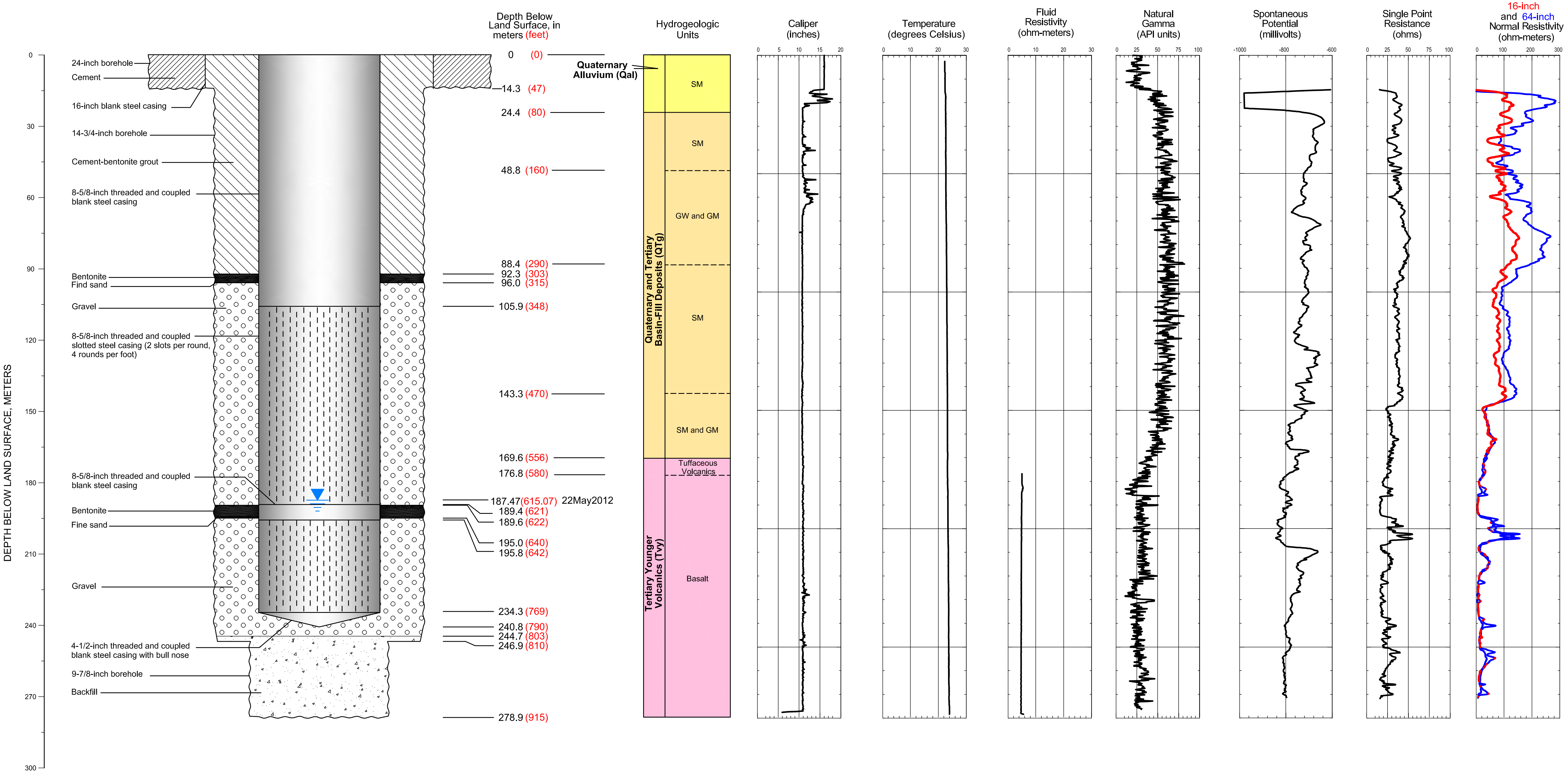
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM
OF CONSTRUCTION FOR
WELL FW7-R

Version: July 26, 2012

FIGURE A-3

605\wellschematics2012\FW7-R_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)35bdb | ADWR NO: 55-914044

NORTHING: 3675115.946 | EASTING: 472469.545

LAND SURFACE ELEVATION: 604.77

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

▼ Non-pumping Water Level

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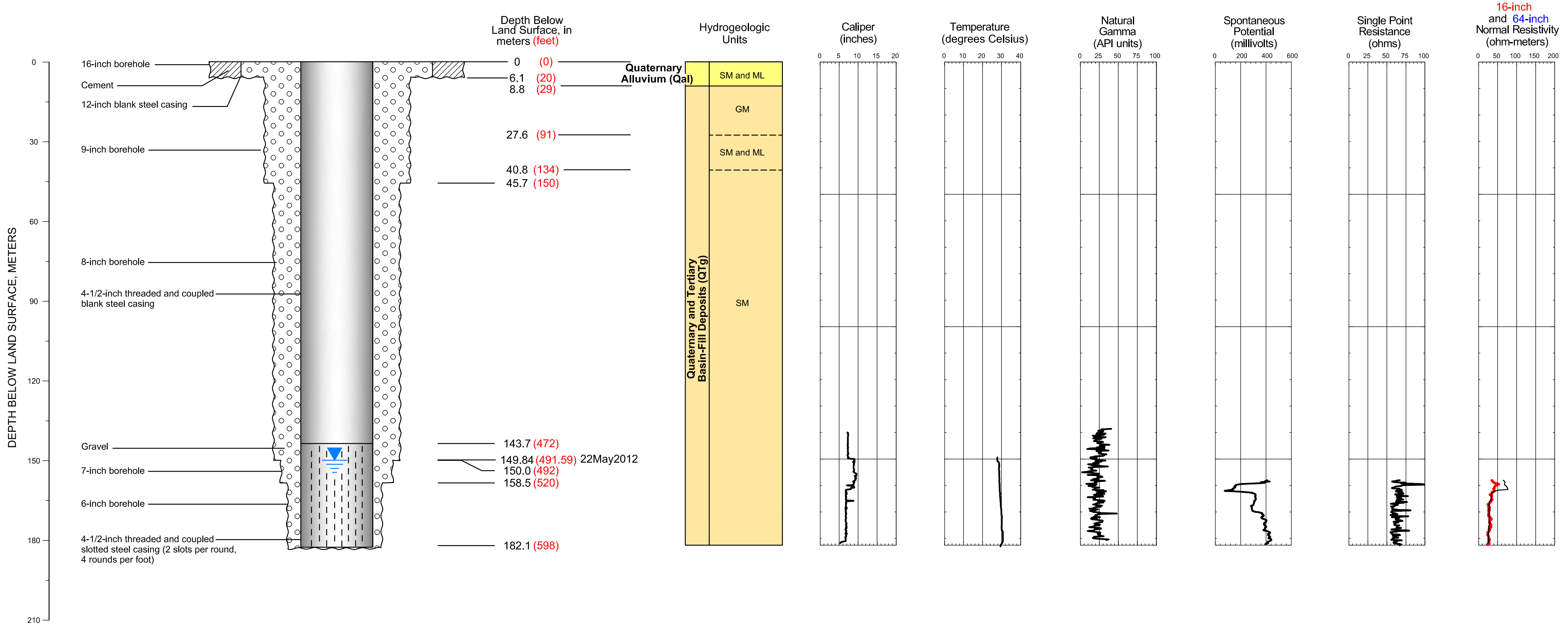
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM
OF CONSTRUCTION FOR
WELL FW15-R

Version: July 26, 2012

FIGURE A-4

605\wellschematics2012\FW15-R_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)36aaa
ADWR NO: 55-914088
NORTHING: 3675504.620
EASTING: 475028.649
LAND SURFACE ELEVATION: 646.93

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

▼ Non-pumping Water Level

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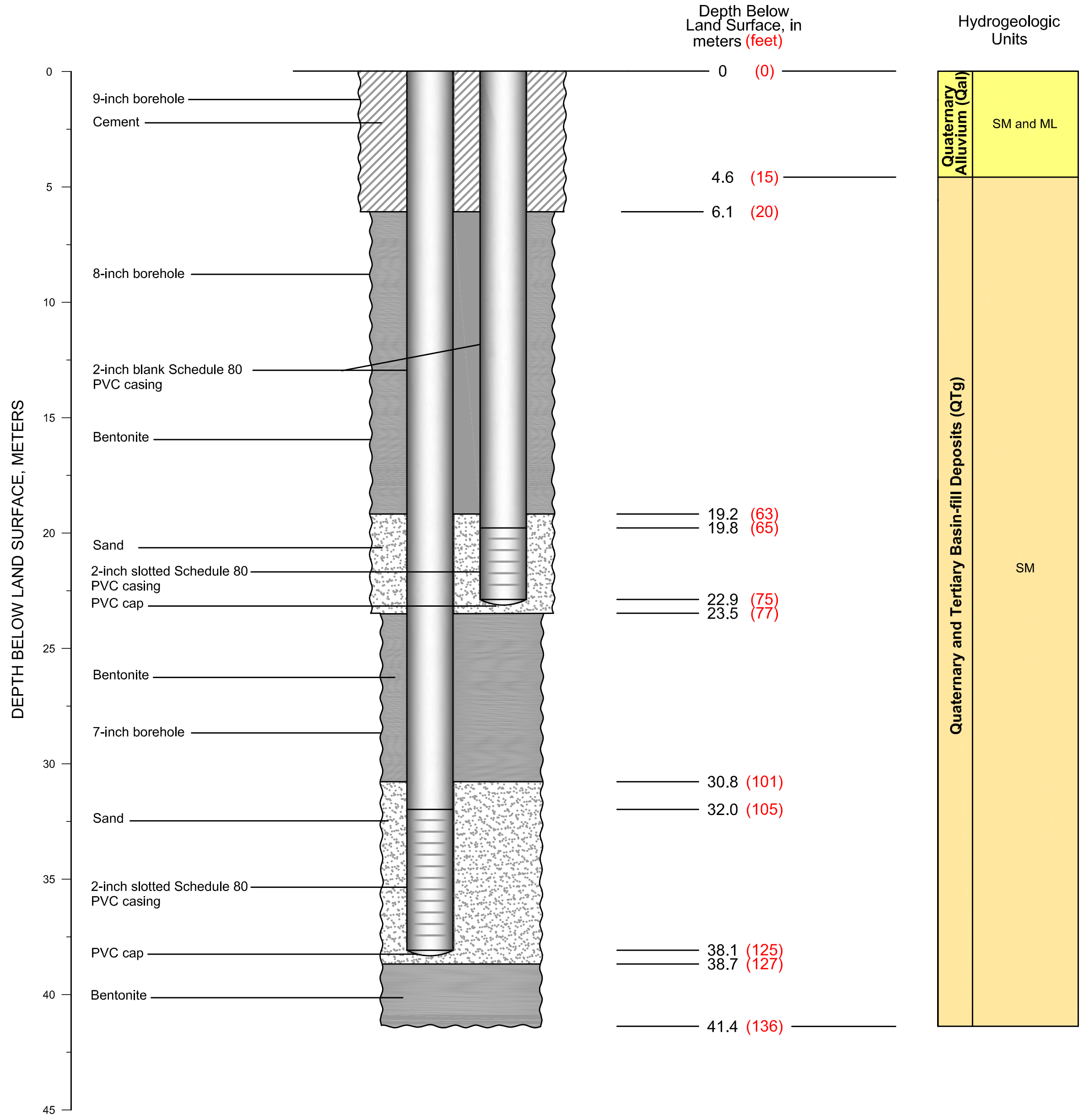
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM
OF CONSTRUCTION FOR
WELL FW9-S

Version: July 26, 2012

FIGURE A-5

605\wellschematics2012\FW9-S_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)24aab
ADWR NO: 55-914091
NORTHING: 3678765.313
EASTING: 474664.865
LAND SURFACE ELEVATION: 641.61
DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

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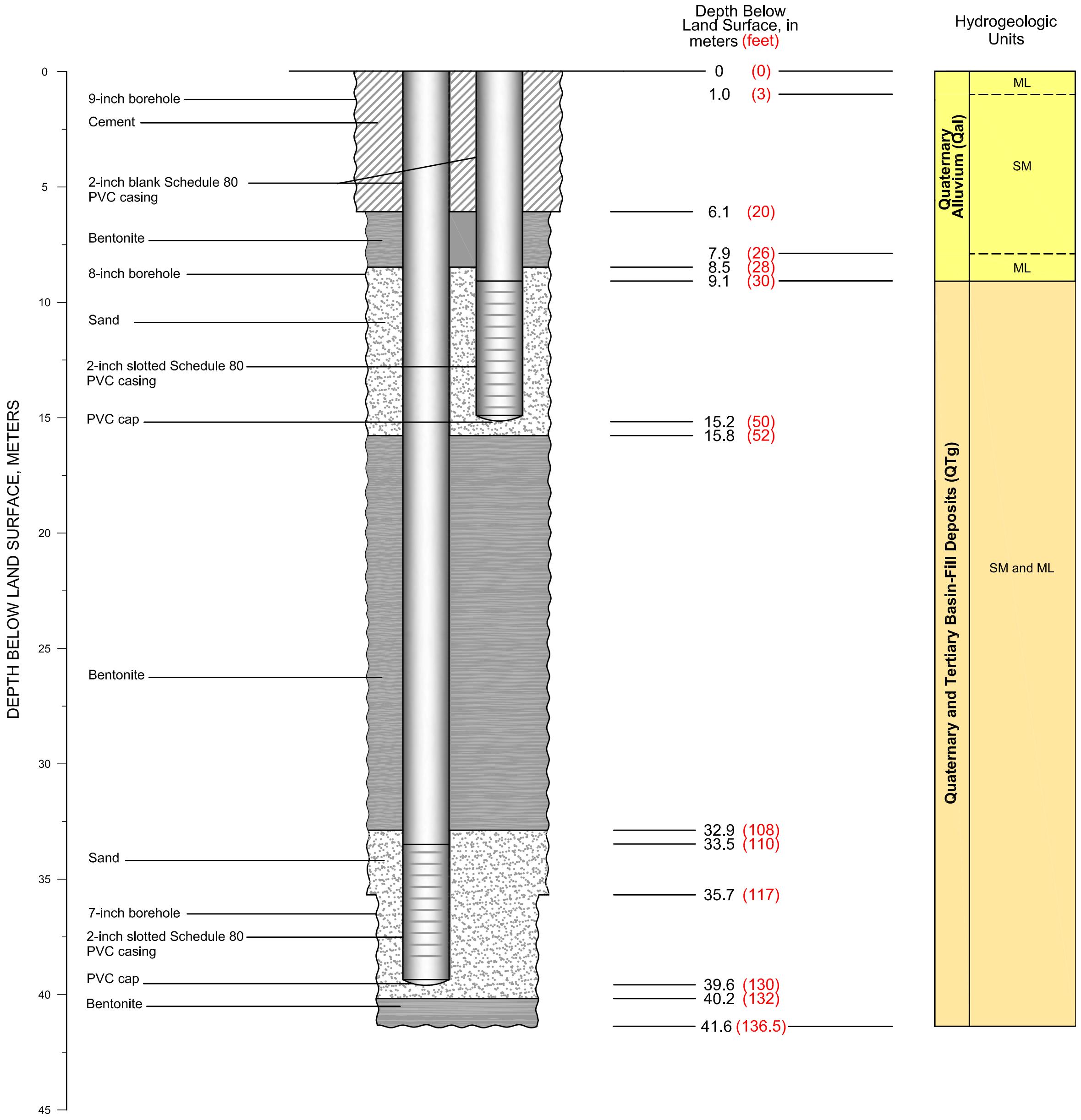
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW2-S

Version: July 26, 2012

FIGURE A-6



DRAFT

CADASTRAL: (D-2-10)26baa2	ADWR NO: 55-914092
NORTHING: 3677139.944	EASTING: 472535.910

TOP OF WELL VAULT ELEVATION: 607.77

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

▽ Non-pumping Water Level
(feet below measuring point)

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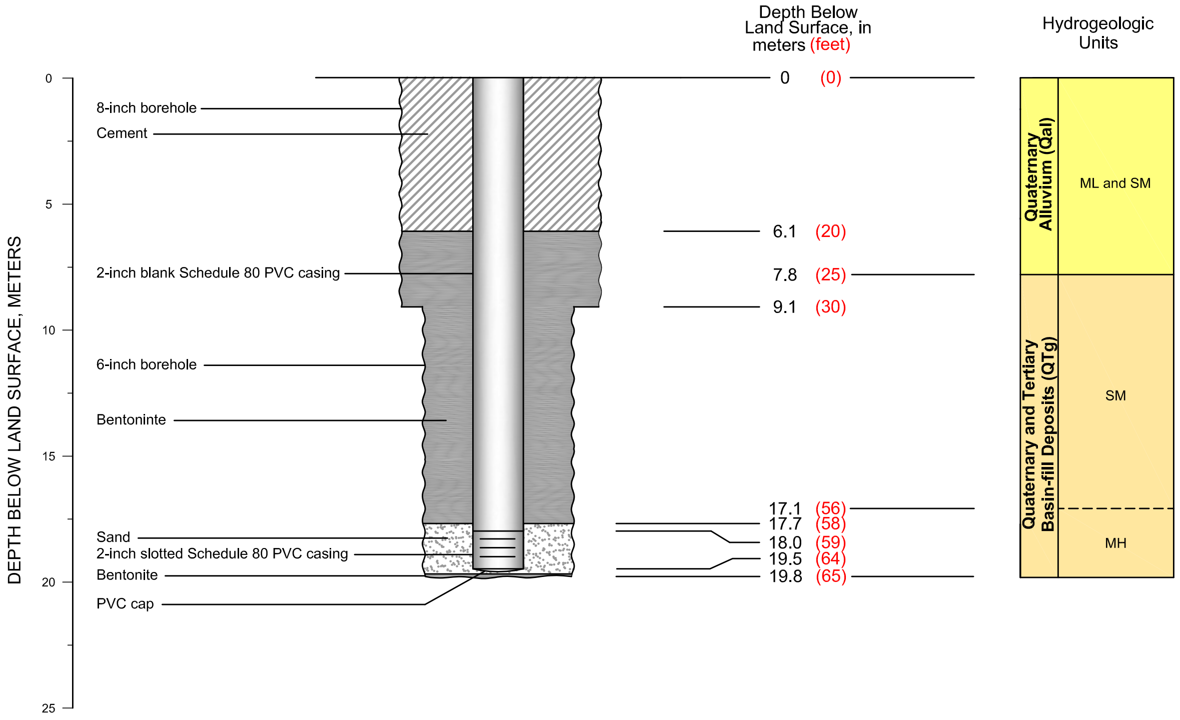
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW3-S

Version: July 26, 2012

FIGURE A-7

605\wellschematics2012\FW3-S_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)24aab2
ADWR NO: 55-914093
NORTHING: 3677217.842
EASTING: 474820.242
TOP OF WELL VAULT ELEVATION: 640.96
DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

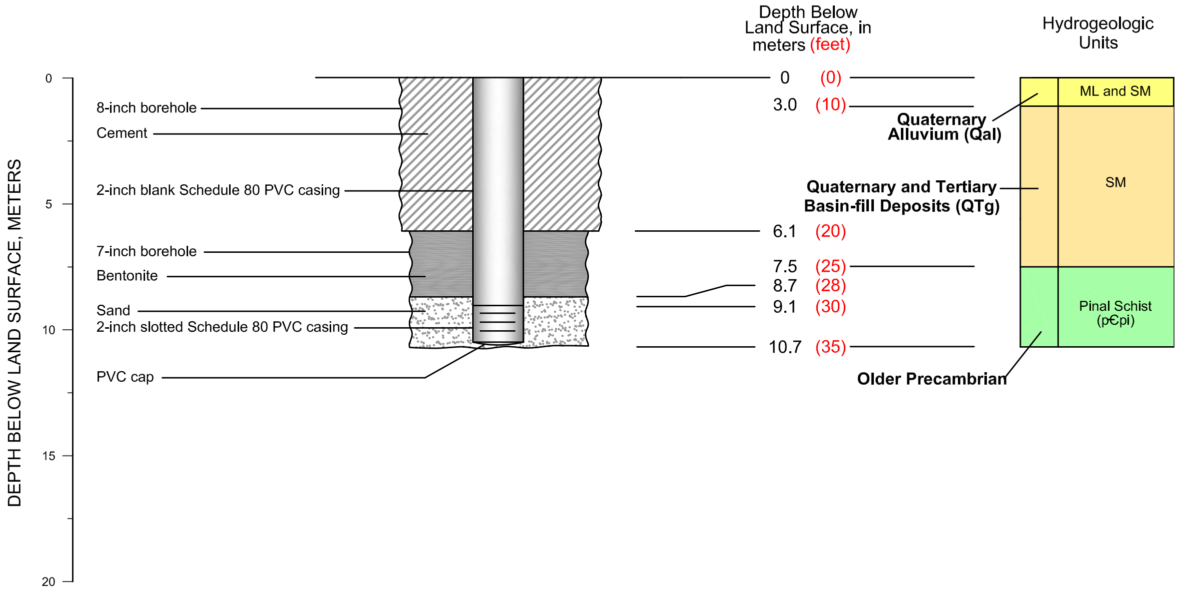
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW4-S

Version: July 26, 2012

FIGURE A-8

605\wellschematics2012\FW4-S_ws\26July2012



DRAFT

CADASTRAL: (D-2-11)30aaa	ADWR NO: 55-914087
NORTHING: 3677122.925	EASTING: 476685.549

LAND SURFACE ELEVATION: 690.29

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

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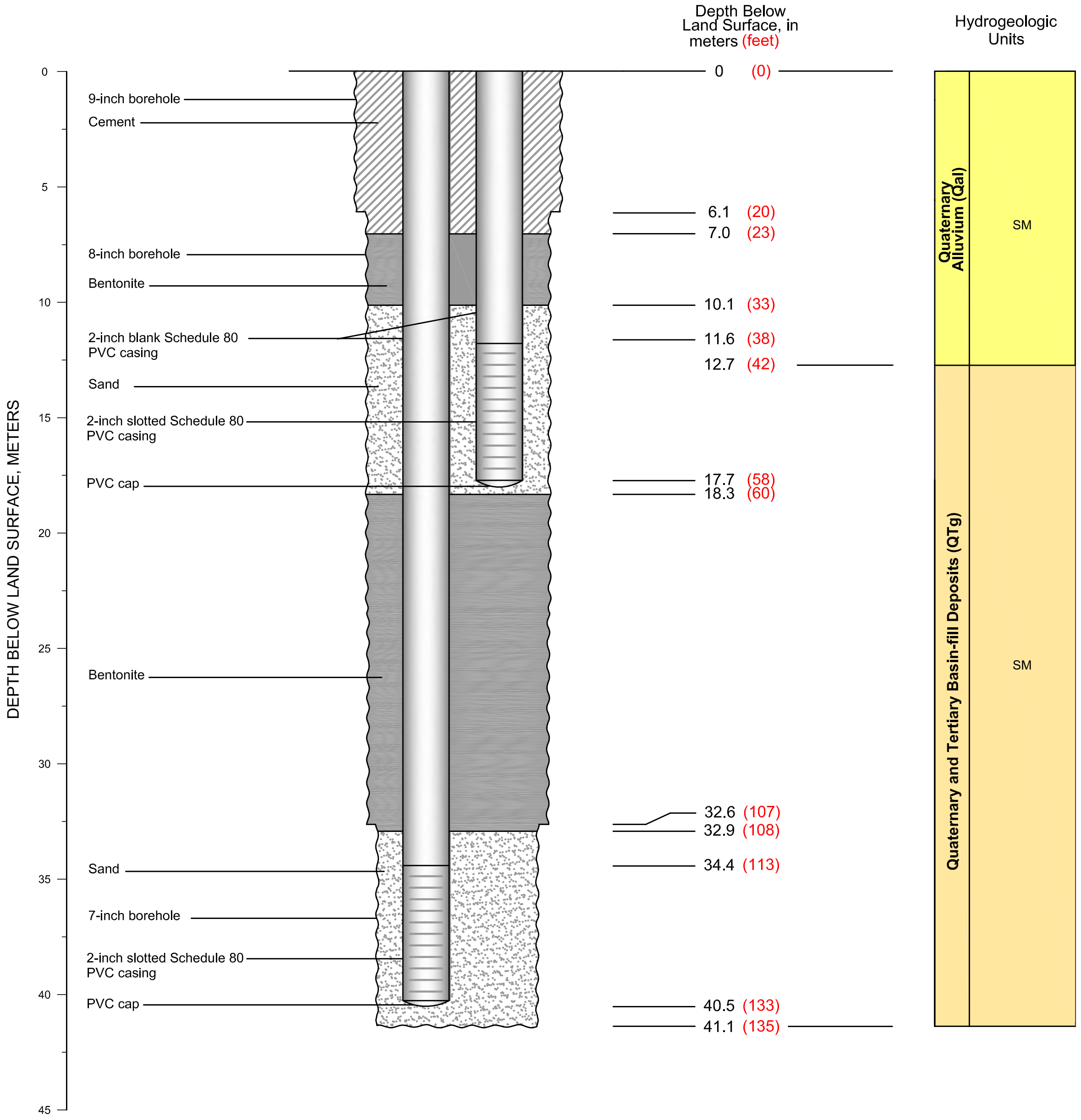
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW5-S

Version: July 26, 2012

FIGURE A-9



DRAFT

CADASTRAL: (D-2-10)26bcb	ADWR NO: 55-914095
NORTHING: 3675118.161	EASTING: 473460.249
LAND SURFACE ELEVATION: 614.39	

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

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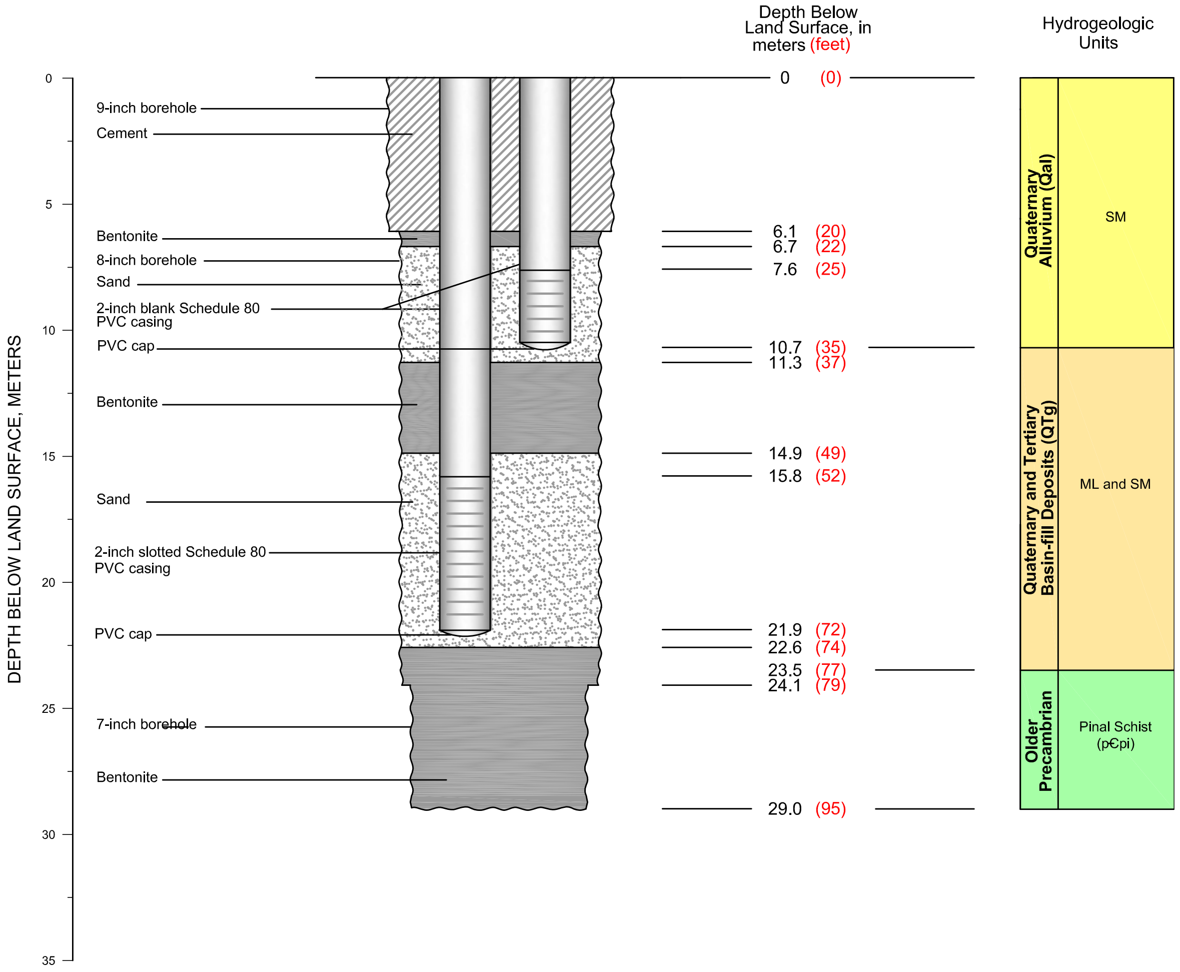
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW8-S

Version: July 26, 2012

FIGURE A-10



DRAFT

CADASTRAL: (D-2-11)32cbc
ADWR NO: 55-914089
NORTHING: 3674535.939
EASTING: 476886.919
LAND SURFACE ELEVATION: 694.84
DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

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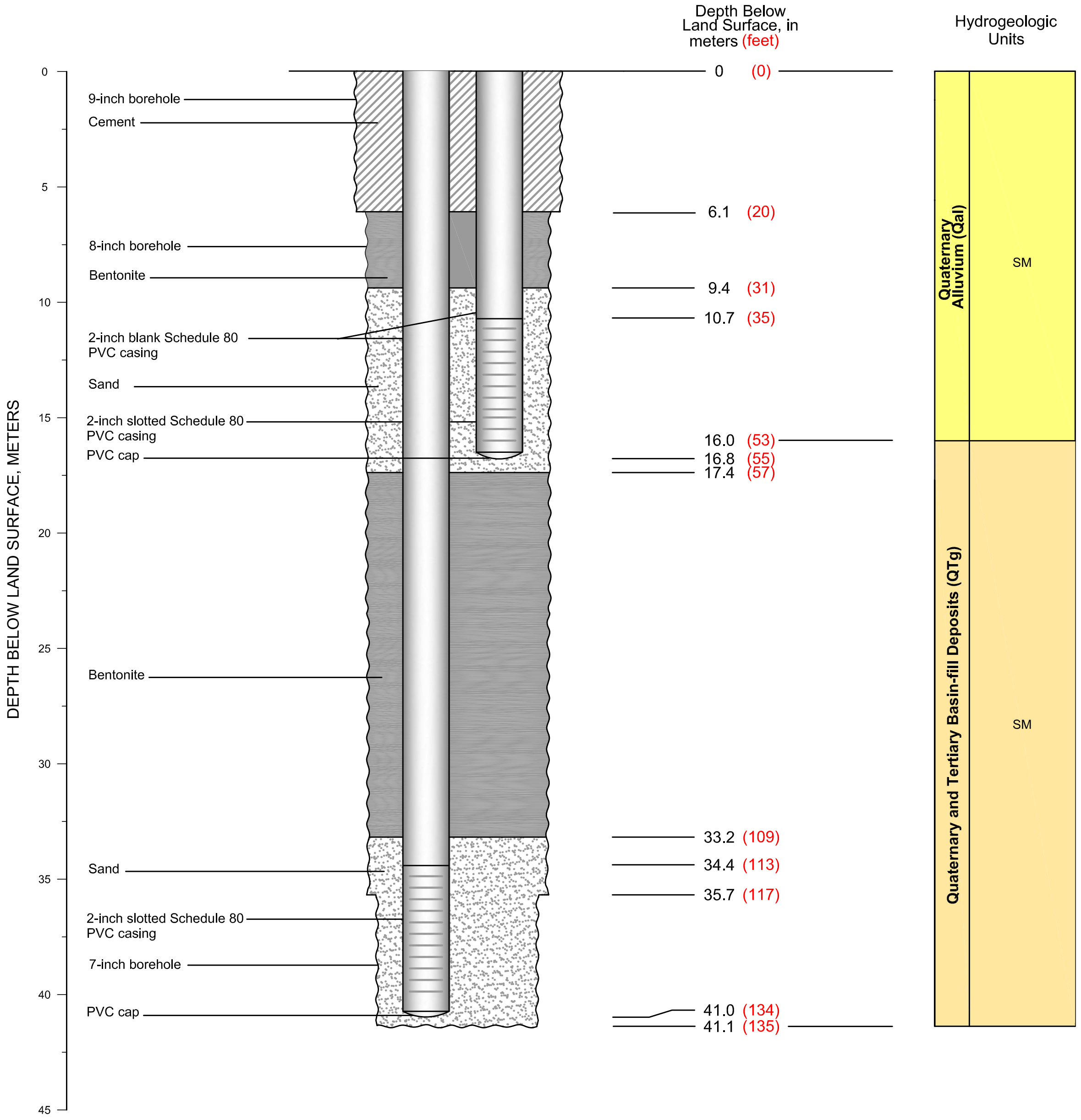
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW10-S

Version: July 26, 2012

FIGURE A-11



CADASTRAL: (D-2-10)36dda	ADWR NO: 55-914096
NORTHING: 3674201.751	EASTING: 475018.924
LAND SURFACE ELEVATION: 646.09	
DATUM: UTM12N, NAD 27, meters VERTICAL: NGVD 29 METERS	

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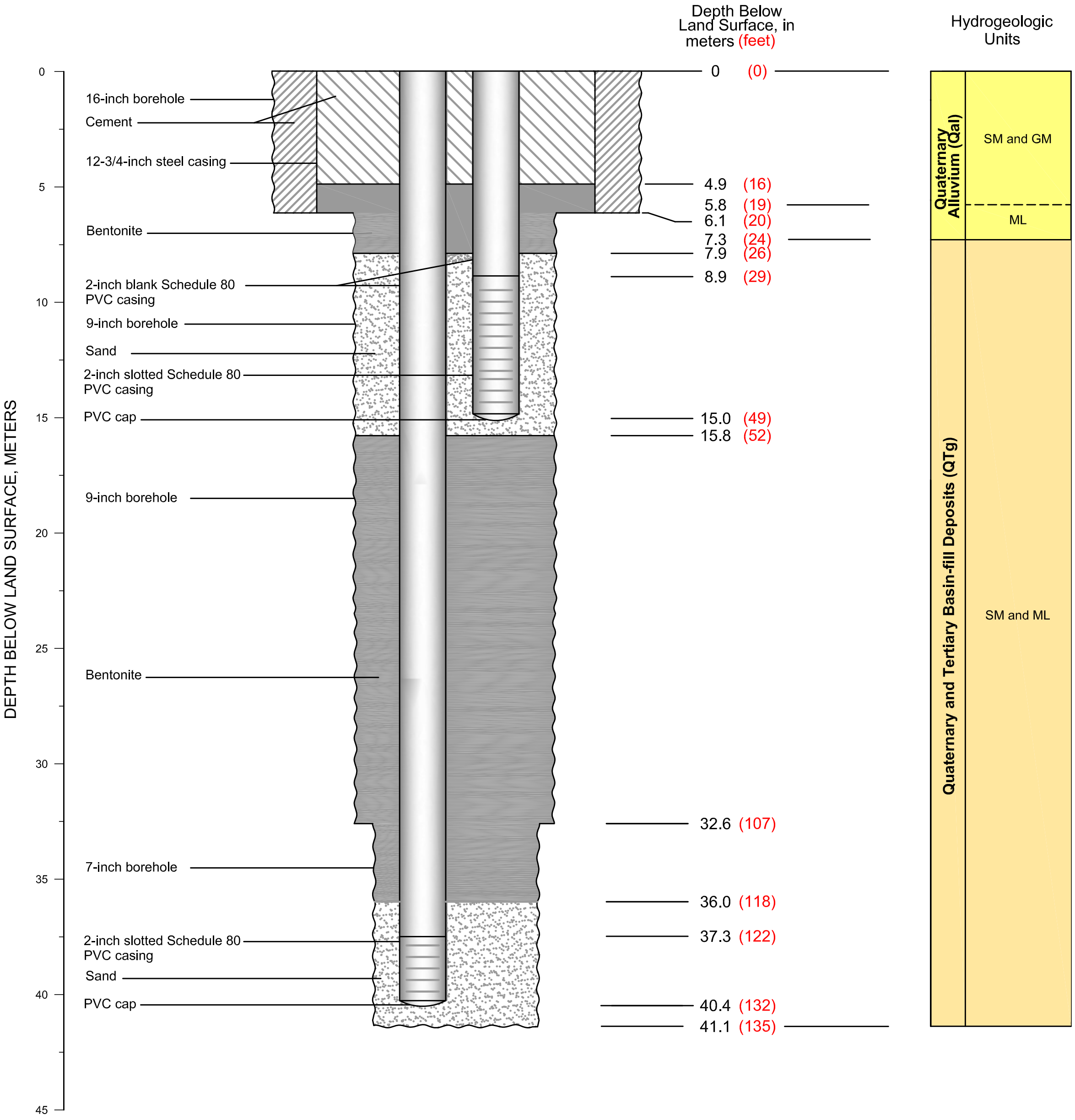
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR VADOSE ZONE PIEZOMETER FW13-S

Version: July 26, 2012

FIGURE A-12

605\wellschematics2012\FW13-S_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)24cbc	ADWR NO: 55-914090
NORTHING: 3677653.982	EASTING: 473471.087
LAND SURFACE ELEVATION: 646.09	

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

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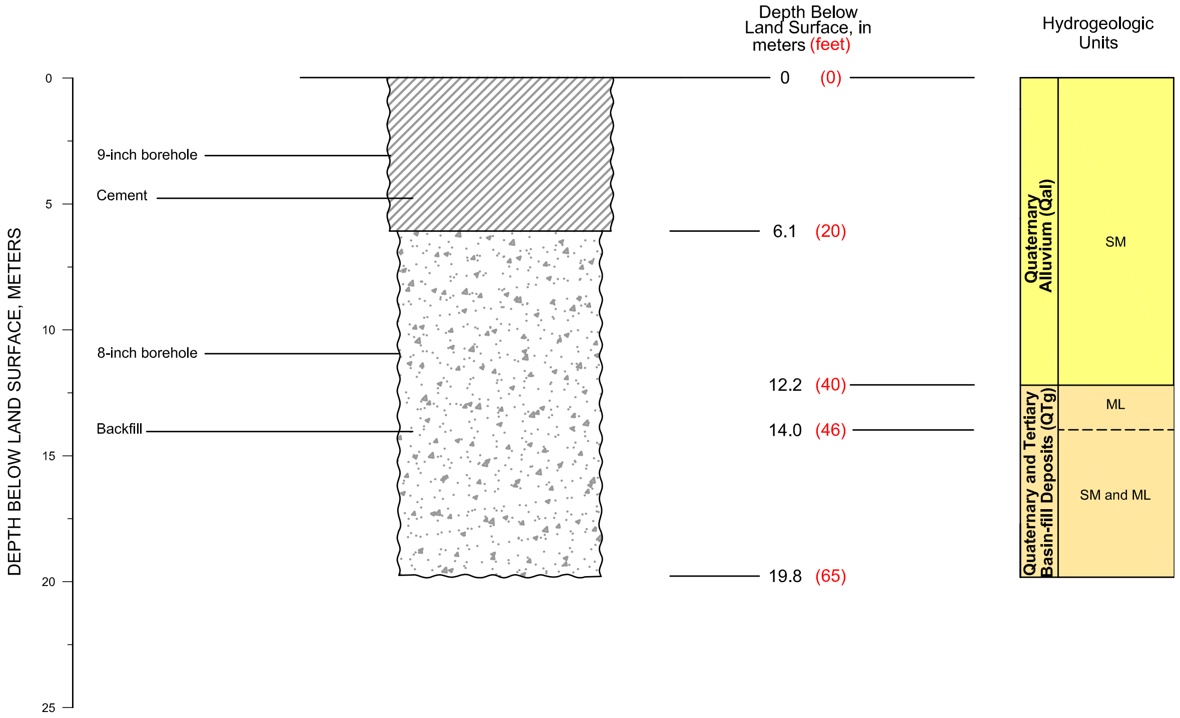
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM
OF CONSTRUCTION FOR
VADOSE ZONE PIEZOMETER FW14-S

Version: July 26, 2012

FIGURE A-13



DRAFT

CADASTRAL: (D-2-10)25aab2	Not Registered
NORTHING: 3675560*	EASTING: 471885*
LAND SURFACE ELEVATION: 597.41*	

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

* Hand-held GPS

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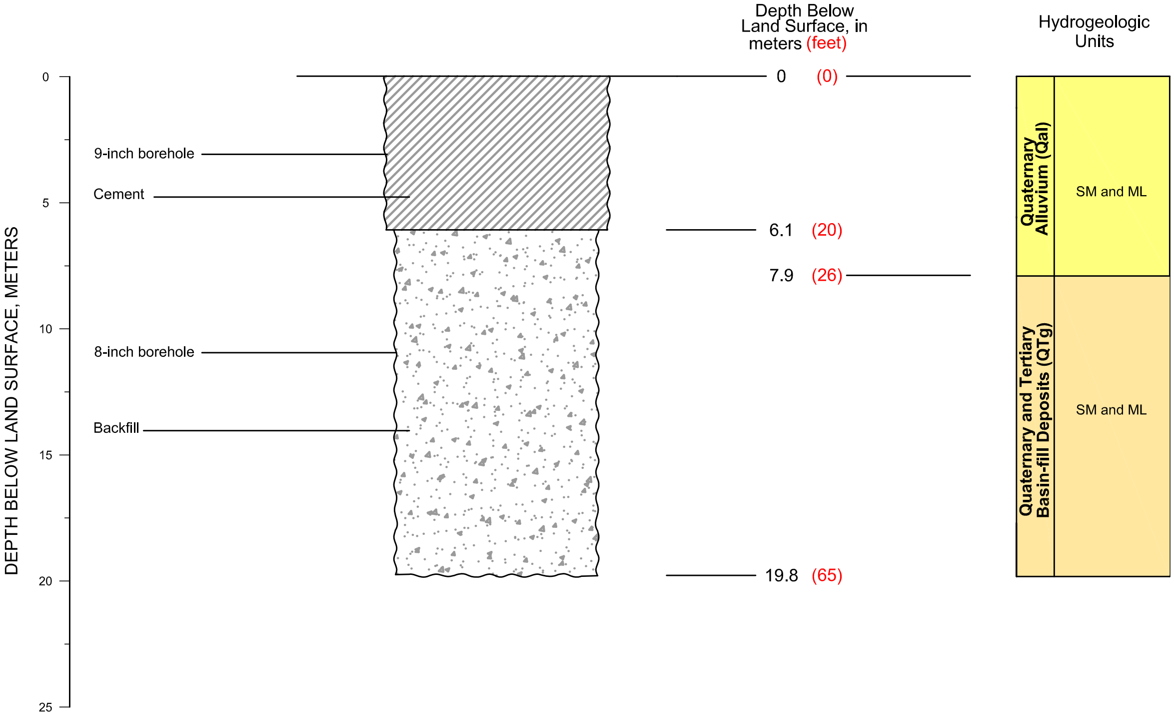
FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR GEOTECHNICAL BORING FW7-S

Version: July 26, 2012

FIGURE A-14

605\wellschematics2012\FW7-S_ws\26July2012



DRAFT

CADASTRAL: (D-2-10)35ccc	Not registered
NORTHING: 3673989*	EASTING: 471851*
LAND SURFACE ELEVATION: 590.70*	

DATUM: UTM12N, NAD 27, meters
VERTICAL: NGVD 29 METERS

* Hand-held GPS

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FAR WEST SITE

AS-BUILT SCHEMATIC DIAGRAM OF CONSTRUCTION FOR GEOTECHNICAL BORING FW12-S

Version: July 26, 2012

FIGURE A-15

605\wellschematics2012\FW12-S_ws\26July2012

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APPENDIX B

LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FOR MONITOR WELLS, VADOSE ZONE PIEZOMETERS, AND GEOTECHNICAL BORINGS

APPENDIX B-1

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Figure

APPENDIX B-2

CONTENTS

Figure

CONTENTS – continued

Figure

DRAFT

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 10.0	0.0 - 3.0	**SAND, SOME SILT, TRACE GRAVEL (SM)**: Strong brown [7.5YR5/6]; subangular to rounded, fine to medium sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 8.5 cm. Non-lithified. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Trace hematite; sand fraction is mostly quartz.
10.0 - 20.0	3.0 - 6.1	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Strong brown [7.5YR5/6], brown [7.5yr4/4]; subangular to rounded, fine to medium sand 65%, gravel 20%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 3.1 cm. Non-lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Very trace tan well lithified matrix chips. Trace magnetite, trace hematite; sand fraction is mostly quartz.
20.0 - 25.0	6.1 - 7.6	**SAND, SILTY, GRAVELLY (SM)**: Strong brown [7.5YR5/6]; subangular to subrounded, fine to coarse sand 45%, silt 30%, gravel 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 6.2 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Trace tan matrix chips. Trace hematite.
25.0 - 30.0	7.6 - 9.1	**SILT, SANDY, GRAVELLY (SM)**: Brown [7.5YR5/4]; silt 40%, subangular to subrounded, fine to medium sand 35%, gravel 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 7.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% white to tan calcareous matrix chips. Trace hematite, very trace limonite, minor magnetite; sand is mostly quartz.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
30.0 - 40.0	9.1 - 12.2	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Strong brown [7.5YR5/6], brown [7.5yr5/4]; gravel 60%, subangular to rounded, fine to medium sand 25%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace hematite, very trace limonite, trace magnetite, very trace brown silt balls; sand fraction contains quartz and schist.
40.0 - 50.0	12.2 - 15.2	**SAND, GRAVELLY, SOME SILT (SM)**: Yellowish brown [10YR5/4]; subangular to rounded, fine to medium sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular, fine to coarse gravel up to 5.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% whitish-tan matrix chips. Trace hematite, trace magnetite; sand fraction is mostly quartz.
50.0 - 60.0	15.2 - 18.3	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 60%, subangular to subrounded, fine to medium sand 30%, silt 10%. Gravel fraction: subangular fine gravel up to 1.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips. Trace hematite, trace magnetite; sand fraction is mostly quartz and mica in sand fraction.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

DRAFT

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
60.0 - 70.0	18.3 - 21.3	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 55%, subangular to subrounded, fine to medium sand 35%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 2.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% tan well lithified matrix chips. Trace hematite, minor magnetite; sand fraction is mostly quartz and mica in sand fraction fraction.
70.0 - 80.0	21.3 - 24.4	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to subrounded, fine to medium sand 35%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 2.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 3% tan well lithified matrix chips. Trace hematite, trace magnetite.
80.0 - 90.0	24.4 - 27.4	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to subrounded, fine to medium sand 35%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 2.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 5% tan well lithified matrix chips. Trace hematite, trace magnetite.
90.0 - 100.0	27.4 - 30.5	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 60%, subangular to subrounded, fine to medium sand 25%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% tan well lithified matrix chips. Trace hematite, trace magnetite; sand fraction same composition as gravel.
100.0 - 110.0	30.5 - 33.5	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 60%, subangular to subrounded, fine to medium sand 25%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 7% tan well lithified matrix chips. Trace magnetite.
110.0 - 120.0	33.5 - 36.6	**GRAVEL, SILTY, SOME SAND (GM)**: Brown [10YR5/3]; gravel 55%, silt 25%, subangular to rounded, fine to medium sand 20%. Gravel fraction: subangular, fine to coarse gravel up to 3.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 4% tan well lithified matrix chips. Trace weathering (iron oxide), trace magnetite.
120.0 - 130.0	36.6 - 39.6	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 55%, subangular to subrounded, fine to medium sand 30%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 2.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 10% tan well lithified matrix chips. Very trace magnetite.
130.0 - 140.0	39.6 - 42.7	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Light yellowish brown [10YR6/4]; gravel 55%, subangular to rounded, fine to coarse sand 30%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 2.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 6% tan well lithified matrix chips. Trace hematite, very trace magnetite; sand fraction composition is same as gravel composition.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
140.0 - 150.0	42.7 - 45.7	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Light yellowish brown [10YR6/4]; gravel 55%, subangular to rounded, fine to coarse sand 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% tan well lithified matrix chips. Very trace magnetite; very trace carbonate rinds.
150.0 - 160.0	45.7 - 48.8	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Yellowish brown [10YR5/4]; subangular to rounded, fine to coarse sand 45%, gravel 40%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips. Trace magnetite; sand fraction composition is same as gravel composition.
160.0 - 170.0	48.8 - 51.8	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 60%, subangular to rounded, fine to coarse sand 30%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips.
170.0 - 180.0	51.8 - 54.9	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 60%, subangular to rounded, fine to coarse sand 30%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 2.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. Trace hematite, trace magnetite, common white hematite and limonite.
180.0 - 190.0	54.9 - 57.9	**GRAVEL, TRACE SILT (GP)**: Light yellowish brown [10YR6/4]; gravel 95%, silt 5%, sand 0%. Gravel fraction: subangular, fine to coarse gravel up to 5.5 cm. Non-lithified. Non-cohesive. Uniformly graded. Reaction to acid: strong. Trace weathering (limonite), common weathering (hematite).
190.0 - 200.0	57.9 - 61.0	**SAND, GRAVELLY, TRACE SILT (SW-SM)**: Brown [10YR5/3]; subangular to rounded, fine to medium sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan matrix chips. Trace weathering (hematite).
200.0 - 210.0	61.0 - 64.0	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 65%, subangular to rounded, fine to medium sand 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Minor weathering (hematite), very trace magnetite; sand fraction has same composition as gravel, more quartz.
210.0 - 220.0	64.0 - 67.1	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Yellowish brown [10YR5/4]; subangular to rounded, fine to coarse sand 45%, gravel 40%, silt 15%. Gravel fraction: subangular to subrounded fine gravel up to 1.6 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace magnetite, trace weathering (hematite); sand fraction has same composition as gravel.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
220.0 - 230.0	67.1 - 70.1	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 60%, subangular to rounded, fine to coarse sand 30%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% tan calcareous well lithified matrix chips. Very trace magnetite; trace weathering.
230.0 - 240.0	70.1 - 73.2	**GRAVEL AND SAND, TRACE SILT (SW-SM)**: Yellowish brown [10YR5/4]; gravel 45%, subangular to rounded, fine to coarse sand 45%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan matrix chips chips; very trace matrix coatings. Trace hematite, trace magnetite.
240.0 - 250.0	73.2 - 76.2	**NO SAMPLE**.
250.0 - 260.0	76.2 - 79.2	**GRAVEL, TRACE SILT, TRACE SAND (GP)**: Yellowish brown [10YR5/4]; gravel 90%, subangular to rounded, fine to coarse sand 5%, silt 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non to weakly lithified. Non-cohesive. Uniformly graded. Reaction to acid: strong.
260.0 - 270.0	79.2 - 82.3	**GRAVEL, TRACE SILT, TRACE SAND (GP)**: Yellowish brown [10YR5/4]; gravel 90%, subangular to rounded, fine to coarse sand 5%, silt 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 6.3 cm. Non to weakly lithified. Non-cohesive. Uniformly graded. Reaction to acid: strong. Trace weathering (hematite), very trace magnetite.
270.0 - 280.0	82.3 - 85.3	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to rounded, fine to medium sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular, fine to coarse gravel up to 2.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 10% tan well lithified matrix chips. Very trace weathering (hematite); sand fraction has the same composition as gravel with more quartz.
280.0 - 290.0	85.3 - 88.4	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to rounded, fine to medium sand 35%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 2.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 7% tan well lithified matrix chips. Trace magnetite; sand fraction has the same composition as the gravel.
290.0 - 300.0	88.4 - 91.4	**GRAVEL, SANDY, SOME SILT (GM)**: Yellowish brown [10YR5/4]; gravel 55%, subangular to rounded, fine to medium sand 25%, silt 20%. Gravel fraction: subangular, fine to coarse gravel up to 4.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips. Very trace weathering (hematite), trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
300.0 - 310.0	91.4 - 94.5	**GRAVEL, SANDY, SILTY (GM)**: Yellowish brown [10YR5/4]; gravel 40%, subangular to rounded, fine to medium sand 35%, silt 25%. Gravel fraction: subangular, fine to coarse gravel up to 3.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips. Very trace magnetite.
310.0 - 320.0	94.5 - 97.5	**GRAVEL, SANDY, SOME SILT (GM)**: Brown [10YR5/3]; gravel 55%, subangular to subrounded, fine to medium sand 25%, silt 20%. Gravel fraction: subangular, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips. Very trace weathering (hematite), trace magnetite.
320.0 - 330.0	97.5 - 100.6	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular, fine to coarse gravel up to 3.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan well lithified matrix chips. Trace weathering (hematite and limonite), trace magnetite.
330.0 - 340.0	100.6 - 103.6	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 55%, subangular to subrounded, fine to medium sand 35%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 3.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan well lithified matrix chips. Very trace weathering (hematite), trace magnetite, very trace calcite on fractures.
340.0 - 350.0	103.6 - 106.7	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 65%, subangular to subrounded, fine to medium sand 25%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Very trace tan well lithified matrix chips. Trace magnetite.
350.0 - 360.0	106.7 - 109.7	**GRAVEL AND SAND, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to medium sand 40%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 3% tan well lithified matrix chips. Very trace magnetite.
360.0 - 370.0	109.7 - 112.8	**GRAVEL AND SAND, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to medium sand 40%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 2.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 3% tan well lithified matrix chips. Very trace magnetite.
370.0 - 380.0	112.8 - 115.8	**GRAVEL AND SAND, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to medium sand 40%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 4.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan well lithified matrix chips. Very trace magnetite.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
380.0 - 390.0	115.8 - 118.9	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to medium sand 50%, gravel 35%, silt 15%. Gravel fraction: subangular, fine to coarse gravel up to 3.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan well lithified matrix chips. Very trace weathering (hematite and limonite).
390.0 - 400.0	118.9 - 121.9	**GRAVEL, SANDY, SOME SILT (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to medium sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong.
400.0 - 410.0	121.9 - 125.0	**SAND AND GRAVEL, TRACE SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 2.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong.
410.0 - 420.0	125.0 - 128.0	**SAND AND GRAVEL, TRACE SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular, fine to coarse gravel up to 4.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Trace tan well lithified matrix chips. Trace magnetite, very trace calcite on fractures; sand fraction mostly quartz.
420.0 - 430.0	128.0 - 131.1	**GRAVEL, SANDY, TRACE SILT (GW-GM)**: Brown [10YR5/3]; gravel 60%, subangular to subrounded, fine to coarse sand 30%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Very trace cement matrix chips. Very trace hematite and limonite, very trace magnetite.
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
430.0 - 440.0	131.1 - 134.1	**BASALT**: Brown [10YR5/3]. Well lithified. Reaction to acid: very strong. Grayish-brown to grayish black basalt, 15% tan tuffaceous sandstone and calcareous cement, 1% gray basalt with disseminated hematite, trace schist; trace hematite, trace magnetite, very trace quartz vein, trace tan cement on fractures, trace tan cement coatings.
440.0 - 450.0	134.1 - 137.2	**BASALT**: Brown [10YR5/3]. Well lithified. Reaction to acid: strong. Grayish-brown to grayish black basalt, 15% tan tuffaceous sandstone and calcareous cement, very trace schist; very trace disseminated hematite, very trace quartz vein, very trace tan cement coatings.
450.0 - 460.0	137.2 - 140.2	**BASALT**: Brown [10YR5/3]. Well lithified. Reaction to acid: strong. Grayish-brown basalt, 5% tan tuffaceous calcareous sandstone, 2% grayish black basalt, and very trace tuff; very trace disseminated hematite, trace magnetite.
460.0 - 470.0	140.2 - 143.3	**BASALT**: Brown [7.5YR5/4]. Well lithified. Reaction to acid: strong. Grayish-brown to grayish black basalt, 2% tan tuffaceous calcareous sandstone; 4% white gypsum, 1% white calcite vein, trace hematite, minor magnetite.

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
470.0 - 480.0	143.3 - 146.3	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 2% white gypsum, 2% white calcite, trace disseminated hematite, trace magnetite.
480.0 - 490.0	146.3 - 149.4	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 3% white gypsum, 3% white calcite, trace disseminated hematite, trace magnetite.
490.0 - 500.0	149.4 - 152.4	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 1% white calcite, trace white gypsum, trace disseminated hematite, trace hematite, minor magnetite.
500.0 - 510.0	152.4 - 155.4	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 1% white gypsum, 1% white calcite, minor disseminated hematite, minor magnetite.
510.0 - 520.0	155.4 - 158.5	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: strong. Grayish-black basalt; trace white gypsum, trace white calcite, minor disseminated hematite, trace magnetite.
520.0 - 530.0	158.5 - 161.5	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 1% white calcite, 1% white quartz, trace white gypsum, minor disseminated hematite, trace magnetite.
530.0 - 540.0	161.5 - 164.6	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: moderate. Grayish-black basalt; 1% white calcite, trace white quartz, trace white gypsum, minor disseminated hematite, trace magnetite.
TUFFACEOUS SANDSTONE FAULT GOUGE		
540.0 - 550.0	164.6 - 167.6	**TUFFACEOUS SANDSTONE (FAULT GOUGE)**: Light reddish brown [2.5YR6/4]. Weakly lithified. Reaction to acid: moderate. Fine-grained tuffaceous sandstone with trace gravel, 5% grayish black basalt with disseminated hematite; minor disseminated hematite, very trace magnetite.
550.0 - 560.0	167.6 - 170.7	**TUFFACEOUS SANDSTONE (FAULT GOUGE)**: Reddish yellow [5YR6/6]. Weakly to well lithified. Reaction to acid: strong. Well lithified orangish brown fine-grained tuffaceous sandstone, 15% grayish black basalt with disseminated hematite, and 10% weakly lithified fine-grained tuffaceous sandstone.
560.0 - 570.0	170.7 - 173.7	**TUFFACEOUS SANDSTONE (FAULT GOUGE)**: Light brown [7.5YR6/4]. Well lithified. Reaction to acid: moderate. Well lithified orangish brown fine-grained tuffaceous sandstone, 50% dark gray to black basalt with minor disseminated hematite, 1% weakly lithified tuffaceous sandstone, trace orangish brown tuff.
TERTIARY OLDER SEDIMENTS (Tso) - TUFFACEOUS SANDSTONE AND BASALT		
570.0 - 580.0	173.7 - 176.8	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt, 5% weakly to moderately lithified fine-grained tan to orangish brown sandstone; very trace white calcite on fractures, very trace white calcite veins, minor disseminated hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY OLDER SEDIMENTS (Tso) - TUFFACEOUS SANDSTONE AND BASALT		
580.0 - 590.0	176.8 - 179.8	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/4]. Well lithified. Reaction to acid: moderate. Dark gray to black basalt, trace moderately lithified fine-grained tan tuffaceous sandstone, and very trace moderately lithified fine-grained orangish brown tuffaceous sandstone; very trace magnetite, trace disseminated hematite.
590.0 - 600.0	179.8 - 182.9	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: moderate. Dark gray to black basalt, 1% weakly-lithified fine-grained tan tuffaceous sandstone, very trace well-lithified orangish brown tuffaceous sandstone; trace disseminated hematite, very trace quartz, very trace white calcite on fractures.
600.0 - 610.0	182.9 - 185.9	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: weak. Dark gray to black basalt, 40% well lithified fine-grained tan tuffaceous sandstone; trace disseminated hematite.
610.0 - 620.0	185.9 - 189.0	**BASALT AND TUFFACEOUS SANDSTONE**: Light reddish brown [5YR6/4]. Well lithified. Reaction to acid: weak. Reddish-brown tuffaceous sandstone, trace dark gray to black basalt, trace well lithified fine-grained tan tuffaceous sandstone; very trace magnetite.
620.0 - 630.0	189.0 - 192.0	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: moderate. Fine-grained tan tuffaceous sandstone, 3% dark gray to black basalt, trace reddish brown tuff; trace disseminated hematite.
630.0 - 640.0	192.0 - 195.1	**BASALT AND TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: moderate to strong. Dark gray to black basalt, 40% well lithified fine-grained tan tuffaceous sandstone, trace weakly lithified fine-grained reddish brown tuffaceous sandstone; trace disseminated hematite, very trace magnetite.
640.0 - 650.0	195.1 - 198.1	**BASALT AND TUFFACEOUS SANDSTONE**: Pink [7.5YR7/3]. Well lithified. Reaction to acid: moderate. 50% dark gray to black basalt, 50% well lithified fine-grained tan tuffaceous sandstone, trace well lithified fine-grained reddish brown tuffaceous sandstone; trace disseminated hematite, very trace magnetite.
TERTIARY OLDER SEDIMENTS (Tso) - TUFFACEOUS SANDSTONE		
650.0 - 660.0	198.1 - 201.2	**TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: moderate. Fine-grained tan tuffaceous sandstone with calcareous cement, 7% dark gray to black basalt; very trace disseminated hematite, very trace magnetite.
660.0 - 670.0	201.2 - 204.2	**TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/4]. Well lithified. Reaction to acid: moderate. Fine-grained tan tuffaceous sandstone with carbonate cement, very trace dark gray to black basalt; very trace magnetite.
670.0 - 680.0	204.2 - 207.3	**TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/4]. Well lithified. Reaction to acid: moderate to strong. Fine-grained tan tuffaceous sandstone with carbonate cement, 10% dark gray to black basalt; trace disseminated hematite, very trace hematite, very trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY OLDER SEDIMENTS (Tso) - TUFFACEOUS SANDSTONE		
680.0 - 690.0	207.3 - 210.3	**TUFFACEOUS SANDSTONE**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: strong. Fine-grained tan tuffaceous sandstone with carbonate cement, trace basalt, trace fine-grained reddish brown tuffaceous sandstone.
TERTIARY OLDER SEDIMENTS (Tso) - SANDY MUDSTONE		
690.0 - 700.0	210.3 - 213.4	**SANDY MUDSTONE**: Yellowish red [5YR5/6]. Moderately lithified. Reaction to acid: moderate. 4% basalt, tuffaceous sandstone, and tuff contamination; very trace magnetite.
700.0 - 710.0	213.4 - 216.4	**SANDY MUDSTONE**: Yellowish red [5YR5/6]. Moderately lithified. Reaction to acid: moderate. Some matrix chips. Trace basalt and tuff contamination; very trace calcite vein, very trace magnetite.
710.0 - 720.0	216.4 - 219.5	**SANDY MUDSTONE**: Reddish yellow [7.5YR6/6]. Moderately lithified. Reaction to acid: moderate. Some matrix chips. Very trace basalt and tuff contamination; very trace magnetite, very trace clear calcite vein.
720.0 - 730.0	219.5 - 222.5	**SANDY MUDSTONE**: Yellowish red [5YR5/6]. Moderately lithified. Reaction to acid: moderate. Common matrix chips. Very trace basalt and tuff contamination; very trace magnetite, very trace clear calcite vein.
TERTIARY OLDER SEDIMENTS (Tso) - SILTY SANDSTONE		
730.0 - 740.0	222.5 - 225.6	**SILTY SANDSTONE**: Yellowish red [5YR5/6]; silt 60%, sand 40%, trace gravel. gravel. Moderately lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 60% silt, 40% subangular to subrounded, fine to medium sand, trace gravel; reddish brown weathered porphyritic tuff with aphanitic groundmass and phenocrysts of biotite, feldspar, and quartz, 10% reddish brown siltstone, 1% black basalt, trace well lithified tan tuff; very trace magnetite.
740.0 - 750.0	225.6 - 228.6	**SILTY SANDSTONE**: Yellowish red [5YR5/6]; sand 70%, silt 30%, trace gravel. gravel. Moderately to well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 70% subangular to subrounded, fine to coarse sand, 30% silt, trace gravel; 1% clear quartz, trace white talc, trace white calcite, trace magnetite, trace paleosol.
750.0 - 760.0	228.6 - 231.6	**SILTY SANDSTONE**: Yellowish red [5YR5/6]; sand 85%, silt 10%, gravel 5%. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 85% subangular to subrounded, fine to coarse sand, 10% silt, 5% gravel; 1% clear to white quartz, trace white talc, very trace hematite and limonite.
760.0 - 770.0	231.6 - 234.7	**SILTY SANDSTONE**: Reddish brown [5YR5/4]; sand 90%, gravel 5%, silt 5%. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate to strong. Silty sandstone consisting of 90% subangular to subrounded, fine to coarse sand, 5% silt, 5% gravel; 5% white to clear calcite, trace hematite, trace paleosol.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY OLDER SEDIMENTS (Tso) - SILTY SANDSTONE		
770.0 - 780.0	234.7 - 237.7	**SILTY SANDSTONE**: Brown [7.5YR5/4]; sand 85%, silt 10%, gravel 5%. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 85% subangular to subrounded, fine to coarse sand, 10% silt, 5% gravel; 5% clear to white quartz, trace white calcite, trace hematite, very trace paleosol.
780.0 - 790.0	237.7 - 240.8	**SILTY SANDSTONE**: Brown [7.5YR5/4]; sand 75%, silt 25%, trace gravel. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 75% subangular to subrounded, fine to coarse sand, 25% silt, trace gravel; 2% white to clear quartz, trace white calcite, trace hematite, very trace limonite.
790.0 - 800.0	240.8 - 243.8	**SILTY SANDSTONE**: Brown [7.5YR5/4]; sand 80%, silt 20%, trace gravel. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 80% subangular to subrounded, fine to coarse sand, 20% silt, trace gravel; 5% clear to white quartz, trace white calcite, very trace white to pink gypsum.
800.0 - 810.0	243.8 - 246.9	**SILTY SANDSTONE**: Brown [7.5YR5/4]; sand 85%, silt 10%, gravel 5%. gravel. Well lithified. Non-cohesive. Reaction to acid: moderate. Silty sandstone consisting of 85% subangular to subrounded, fine to coarse sand, 10% silt, 5% garvel; trace white calcite, trace hematite, trace limonite, trace magnetite.
810.0 - 820.0	246.9 - 249.9	**SILTY SANDSTONE**: Brown [7.5YR5/3]; sand 65%, silt 35%, trace gravel. gravel. Well lithified. Non-cohesive. Reaction to acid: weak. Silty sandstone consisting of 65% subangular to subrounded, fine to coarse sand, 35% silt, trace gravel; trace white quartz, very trace white calcite, very trace magnetite.
APACHE LEAP TUFF - White Unit (Talw)		
820.0 - 830.0	249.9 - 253.0	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: weak. Pinkish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of milky feldspar, quartz, and black biotite, trace magnetite, trace pumice, and trace quartzite lithics; 1% clear quartz, trace hematite.
830.0 - 840.0	253.0 - 256.0	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: weak. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, and trace lithics; trace white talc, trace clear quartz, trace clear to white calcite.
840.0 - 850.0	256.0 - 259.1	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: weak. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, and trace lithics; trace clear quartz, trace clear calcite, very trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
APACHE LEAP TUFF - White Unit (Talw)		
850.0 - 860.0	259.1 - 262.1	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: weak. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, trace tan pumice, and trace lithics; trace clear calcite, trace red siltstone (contamination?).
860.0 - 870.0	262.1 - 265.2	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: weak. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace lithics; very trace clear quartz, very trace clear calcite.
870.0 - 880.0	265.2 - 268.2	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: moderate. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics; trace clear calcite, very trace hematite.
880.0 - 890.0	268.2 - 271.3	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: moderate. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, visible magnetite; very trace red siltstone; trace clear quartz.
APACHE LEAP TUFF - Gray Unit (Talg)		
890.0 - 900.0	271.3 - 274.3	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: moderate. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace pumice; trace clear calcite, trace white quartz.
900.0 - 910.0	274.3 - 277.4	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/3]. Well lithified. Reaction to acid: moderate. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz.
910.0 - 920.0	277.4 - 280.4	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: moderate. Grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz.
920.0 - 930.0	280.4 - 283.5	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: strong. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, trace lithics; minor white calcite, very trace clear quartz.
930.0 - 940.0	283.5 - 286.5	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: strong. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace clear calcite, trace clear quartz.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
APACHE LEAP TUFF - Gray Unit (Talg)		
940.0 - 950.0	286.5 - 289.6	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite.
950.0 - 960.0	289.6 - 292.6	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: moderate. Brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz.
960.0 - 970.0	292.6 - 295.7	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: moderate. Brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice, trace lithics; very trace clear quartz; very trace hematite.
970.0 - 980.0	295.7 - 298.7	**APACHE LEAP TUFF (WHITE UNIT)**: Brown [7.5YR5/4]. Well lithified. Reaction to acid: moderate. Brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; very trace reddish brown siltstone; very trace hematite.
980.0 - 990.0	298.7 - 301.8	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice; very trace clear quartz.
990.0 - 1,000.0	301.8 - 304.8	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; very trace clear quartz.
1,000.0 - 1,010.0	304.8 - 307.8	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, trace hematite.
1,010.0 - 1,020.0	307.8 - 310.9	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, very trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
APACHE LEAP TUFF - Gray Unit (Talg)		
1,020.0 - 1,030.0	310.9 - 313.9	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, very trace hematite.
1,030.0 - 1,040.0	313.9 - 317.0	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice; very trace hematite.
1,040.0 - 1,050.0	317.0 - 320.0	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, very trace lithics; trace white calcite, very trace hematite.
1,050.0 - 1,060.0	320.0 - 323.1	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak to moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; trace clear quartz.
1,060.0 - 1,070.0	323.1 - 326.1	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; trace white to clear calcite, very trace clear to white quartz.
1,070.0 - 1,080.0	326.1 - 329.2	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; 5% tan weathered tuff; 2% reddish brown siltstone; very trace gypsum.
1,080.0 - 1,090.0	329.2 - 332.2	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak to moderate. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; very trace clear calcite, very trace hematite.
1,090.0 - 1,100.0	332.2 - 335.3	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; very trace hematite.
1,100.0 - 1,110.0	335.3 - 338.3	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, 1% lithics, trace pumice; very trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
APACHE LEAP TUFF - Gray Unit (Talg)		
1,110.0 - 1,120.0	338.3 - 341.4	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/4]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace lithics, trace pumice; very trace gypsum, very trace calcite.
1,120.0 - 1,130.0	341.4 - 344.4	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [5YR5/3]. Well lithified. Reaction to acid: weak. Grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, 1% lithics, trace pumice; trace clear calcite, trace clear quartz.

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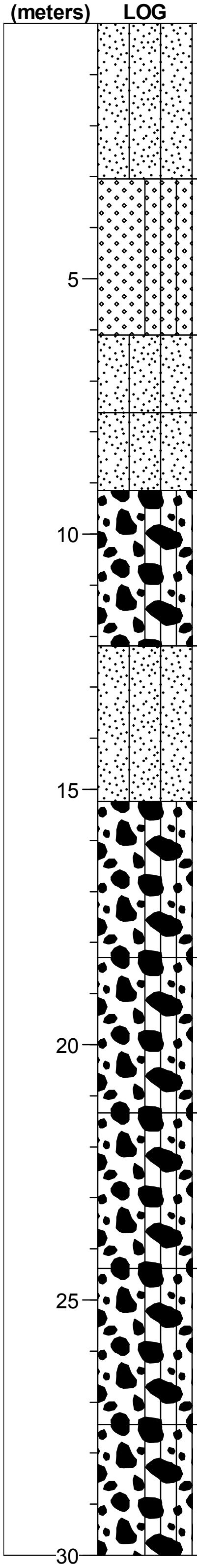
B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SAND, SOME SILT, TRACE GRAVEL (SM)	10 / 70 / 20	Non-lithified; non-cohesive; dry; uniformly graded; trace hematite; sand fraction is mostly quartz
SAND, SOME GRAVEL, SOME SILT (SW-SM)	20 / 65 / 15	Non-lithified; non-cohesive; slightly moist; well graded; trace magnetite, trace hematite; sand fraction is mostly quartz
SAND, SILTY, GRAVELLY (SM)	25 / 45 / 30	Non to weakly lithified; non-cohesive; slightly moist; well graded; trace hematite
SILT, SANDY, GRAVELLY (SM)	25 / 35 / 40	Non to weakly lithified; non-cohesive; well graded; trace hematite, very trace limonite, minor magnetite; sand is mostly quartz
GRAVEL, SANDY, SOME SILT (GW-GM)	60 / 25 / 15	Non to weakly lithified; non-cohesive; well graded; trace hematite, very trace limonite, trace magnetite, very trace brown silt balls; sand fraction contains quartz and schist
SAND, GRAVELLY, SOME SILT (SM)	30 / 50 / 20	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite; sand fraction is mostly quartz
GRAVEL, SANDY, TRACE SILT (GW-GM)	60 / 30 / 10	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite; sand fraction is mostly quartz and mica in sand fraction
GRAVEL, SANDY, TRACE SILT (GW-GM)	55 / 35 / 10	Non to weakly lithified; non-cohesive; well graded; trace hematite, minor magnetite; sand fraction is mostly quartz and mica in sand fraction fraction
GRAVEL, SANDY, SOME SILT (GW-GM)	50 / 35 / 15	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite
GRAVEL, SANDY, SOME SILT (GW-GM)	50 / 35 / 15	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite
GRAVEL, SANDY, SOME SILT (GW-GM)	60 / 25 / 15	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite; sand fraction same composition as gravel

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		GRAVEL, SANDY, SOME SILT (GW-GM)	60 / 25 / 15	Non to weakly lithified; non-cohesive; well graded; trace magnetite
35		GRAVEL, SILTY, SOME SAND (GM)	55 / 20 / 25	Non to weakly lithified; non-cohesive; well graded; trace weathering (iron oxide), trace magnetite
		GRAVEL, SANDY, SOME SILT (GW-GM)	55 / 30 / 15	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
40		GRAVEL, SANDY, SOME SILT (GW-GM)	55 / 30 / 15	Non to weakly lithified; non-cohesive; well graded; trace hematite, very trace magnetite; sand fraction composition is same as gravel composition
45		GRAVEL, SANDY, TRACE SILT (GW-GM)	55 / 35 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite; very trace carbonate rinds
		SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 45 / 15	Non to weakly lithified; non-cohesive; well graded; trace magnetite; sand fraction composition is same as gravel composition
50		GRAVEL, SANDY, TRACE SILT (GW-GM)	60 / 30 / 10	Non to weakly lithified; non-cohesive; well graded
		GRAVEL, SANDY, TRACE SILT (GW-GM)	60 / 30 / 10	Non-lithified; non-cohesive; well graded; trace hematite, trace magnetite, common white hematite and limonite
55		GRAVEL, TRACE SILT (GP)	95 / 0 / 5	Non-lithified; non-cohesive; uniformly graded; trace weathering (limonite), common weathering (hematite)
60		SAND, GRAVELLY, TRACE	25 / 65 / 10	Non to weakly lithified; non-cohesive; well graded; trace weathering (hematite)

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* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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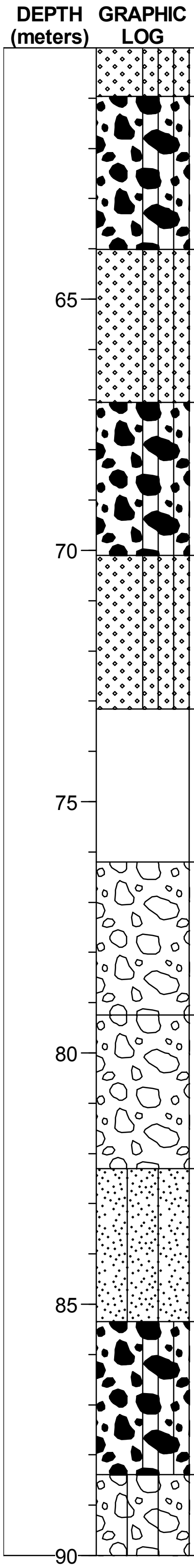
B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SILT (SW-SM)		
GRAVEL, SANDY, TRACE SILT (GW-GM)	65 / 25 / 10	Non-lithified; non-cohesive; well graded; minor weathering (hematite), very trace magnetite; sand fraction has same composition as gravel, more quartz
SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 45 / 15	Non-lithified; non-cohesive; well graded; trace magnetite, trace weathering (hematite); sand fraction has same composition as gravel
GRAVEL, SANDY, TRACE SILT (GW-GM)	60 / 30 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite; trace weathering
GRAVEL AND SAND, TRACE SILT (SW-SM)	45 / 45 / 10	Non to weakly lithified; non-cohesive; well graded; trace hematite, trace magnetite
NO SAMPLE		
GRAVEL, TRACE SILT, TRACE SAND (GP)	90 / 5 / 5	Non to weakly lithified; non-cohesive; uniformly graded
GRAVEL, TRACE SILT, TRACE SAND (GP)	90 / 5 / 5	Non to weakly lithified; non-cohesive; uniformly graded; trace weathering (hematite), very trace magnetite
SAND, GRAVELLY, SILTY (SM)	30 / 40 / 30	Non to weakly lithified; non-cohesive; well graded; very trace weathering (hematite); sand fraction has the same composition as gravel with more quartz
GRAVEL, SANDY, SOME SILT (GW-GM)	50 / 35 / 15	Non to weakly lithified; non-cohesive; well graded; trace magnetite; sand fraction has the same composition as the gravel

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		GRAVEL, SANDY, SOME SILT (GM)	55 / 25 / 20	Non to weakly lithified; non-cohesive; well graded; very trace weathering (hematite), trace magnetite
		GRAVEL, SANDY, SILTY (GM)	40 / 35 / 25	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
95		GRAVEL, SANDY, SOME SILT (GM)	55 / 25 / 20	Non to weakly lithified; non-cohesive; well graded; very trace weathering (hematite), trace magnetite
100		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Non to weakly lithified; non-cohesive; well graded; trace weathering (hematite and limonite), trace magnetite
		GRAVEL, SANDY, TRACE SILT (GW-GM)	55 / 35 / 10	Non to weakly lithified; non-cohesive; well graded; very trace weathering (hematite), trace magnetite, very trace calcite on fractures
105		GRAVEL, SANDY, TRACE SILT (GW-GM)	65 / 25 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite
		GRAVEL AND SAND, TRACE SILT (GW-GM)	50 / 40 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
110		GRAVEL AND SAND, TRACE SILT (GW-GM)	50 / 40 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
115		GRAVEL AND SAND, TRACE SILT (GW-GM)	50 / 40 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
		SAND, GRAVELLY, SOME SILT (SW-SM)	35 / 50 / 15	Non to weakly lithified; non-cohesive; well graded; very trace weathering (hematite and limonite)
120				

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
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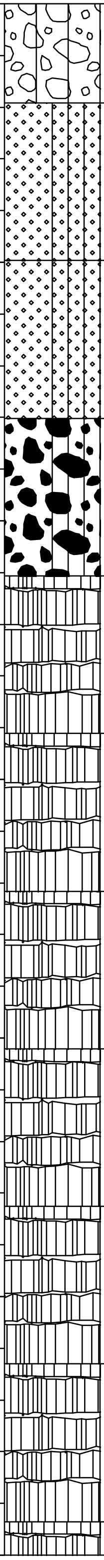
DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		**GRAVEL, SANDY, SOME SILT (GM)**	50 / 30 / 20	Non to weakly lithified; non-cohesive; well graded
		SAND AND GRAVEL, TRACE SILT (SW-SM)	40 / 50 / 10	Non to weakly lithified; non-cohesive; well graded
125		**SAND AND GRAVEL, TRACE SILT (SW-SM)**	40 / 50 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite, very trace calcite on fractures; sand fraction mostly quartz
130		**GRAVEL, SANDY, TRACE SILT (GW-GM)**	60 / 30 / 10	Non to weakly lithified; well graded; very trace hematite and limonite, very trace magnetite
		BASALT		Well lithified; grayish-brown to grayish black basalt, 15% tan tuffaceous sandstone and calcareous cement, 1% gray basalt with disseminated hematite, trace schist; trace hematite, trace magnetite, very trace quartz vein, trace tan cement on fractures, trace tan cement coatings
135		**BASALT**		Well lithified; grayish-brown to grayish black basalt, 15% tan tuffaceous sandstone and calcareous cement, very trace schist; very trace disseminated hematite, very trace quartz vein, very trace tan cement coatings
140		**BASALT**		Well lithified; grayish-brown basalt, 5% tan tuffaceous calcareous sandstone, 2% grayish black basalt, and very trace tuff; very trace disseminated hematite, trace magnetite
		BASALT		Well lithified; grayish-brown to grayish black basalt, 2% tan tuffaceous calcareous sandstone; 4% white gypsum, 1% white calcite vein, trace hematite, minor magnetite
145		**BASALT**		Well lithified; grayish-black basalt; 2% white gypsum, 2% white calcite, trace disseminated hematite, trace magnetite
		BASALT		Well lithified; grayish-black basalt; 3% white gypsum, 3% white calcite, trace disseminated hematite, trace magnetite
150				

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

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LOGGED BY: M. Rheaume
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DATE DRILLED: Mar. 28 - Apr. 2, 2012
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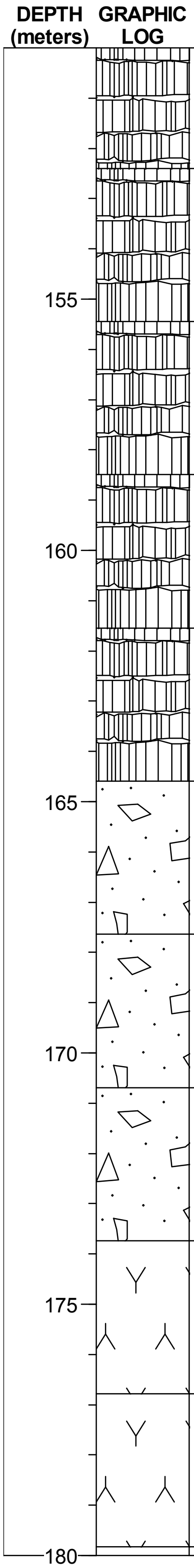
BOREHOLE DIAMETER: 9-7/8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
BASALT		Well lithified; grayish-black basalt; 1% white calcite, trace white gypsum, trace disseminated hematite, trace hematite, minor magnetite
BASALT		Well lithified; grayish-black basalt; 1% white gypsum, 1% white calcite, minor disseminated hematite, minor magnetite
BASALT		Well lithified; grayish-black basalt; trace white gypsum, trace white calcite, minor disseminated hematite, trace magnetite
BASALT		Well lithified; grayish-black basalt; 1% white calcite, 1% white quartz, trace white gypsum, minor disseminated hematite, trace magnetite
BASALT		Well lithified; grayish-black basalt; 1% white calcite, trace white quartz, trace white gypsum, minor disseminated hematite, trace magnetite
TUFFACEOUS SANDSTONE (FAULT GOUGE)		Weakly lithified; fine-grained tuffaceous sandstone with trace gravel, 5% grayish black basalt with disseminated hematite; minor disseminated hematite, very trace magnetite
TUFFACEOUS SANDSTONE (FAULT GOUGE)		Weakly to well lithified; well lithified orangish brown fine-grained tuffaceous sandstone, 15% grayish black basalt with disseminated hematite, and 10% weakly lithified fine-grained tuffaceous sandstone
TUFFACEOUS SANDSTONE (FAULT GOUGE)		Well lithified; well lithified orangish brown fine-grained tuffaceous sandstone, 50% dark gray to black basalt with minor disseminated hematite, 1% weakly lithified tuffaceous sandstone, trace orangish brown tuff
BASALT AND TUFFACEOUS SANDSTONE		Well lithified; dark gray to black basalt, 5% weakly to moderately lithified fine-grained tan to orangish brown sandstone; very trace white calcite on fractures, very trace white calcite veins, minor disseminated hematite
BASALT AND TUFFACEOUS SANDSTONE		Well lithified; dark gray to black basalt, trace moderately lithified fine-grained tan tuffaceous sandstone, and very trace moderately lithified fine-grained orangish brown tuffaceous sandstone; very trace magnetite, trace disseminated hematite

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level DATE DRILLED: Mar. 28 - Apr. 2, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; dark gray to black basalt, 1% weakly-lithified fine-grained tan tuffaceous sandstone, very trace well-lithified orangish brown tuffaceous sandstone; trace disseminated hematite, very trace quartz, very trace white calcite on fractures
185		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; dark gray to black basalt, 40% well lithified fine-grained tan tuffaceous sandstone; trace disseminated hematite
		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; reddish-brown tuffaceous sandstone, trace dark gray to black basalt, trace well lithified fine-grained tan tuffaceous sandstone; very trace magnetite
190		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; fine-grained tan tuffaceous sandstone, 3% dark gray to black basalt, trace reddish brown tuff; trace disseminated hematite
195		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; dark gray to black basalt, 40% well lithified fine-grained tan tuffaceous sandstone, trace weakly lithified fine-grained reddish brown tuffaceous sandstone; trace disseminated hematite, very trace magnetite
		BASALT AND TUFFACEOUS SANDSTONE		Well lithified; 50% dark gray to black basalt, 50% well lithified fine-grained tan tuffaceous sandstone, trace well lithified fine-grained reddish brown tuffaceous sandstone; trace disseminated hematite, very trace magnetite
200		TUFFACEOUS SANDSTONE		Well lithified; fine-grained tan tuffaceous sandstone with calcareous cement, 7% dark gray to black basalt; very trace disseminated hematite, very trace magnetite
		TUFFACEOUS SANDSTONE		Well lithified; fine-grained tan tuffaceous sandstone with carbonate cement, very trace dark gray to black basalt; very trace magnetite
205		TUFFACEOUS SANDSTONE		Well lithified; fine-grained tan tuffaceous sandstone with carbonate cement, 10% dark gray to black basalt; trace disseminated hematite, very trace hematite, very trace magnetite
210		TUFFACEOUS SANDSTONE		Well lithified; fine-grained tan tuffaceous sandstone with carbonate cement, trace basalt, trace fine-grained reddish brown tuffaceous sandstone

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
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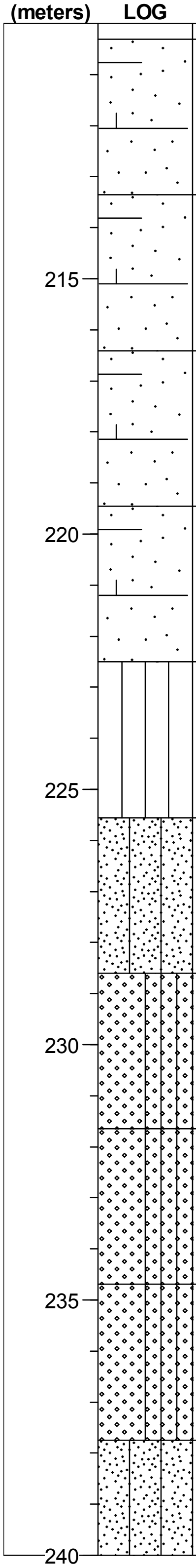
DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SANDY MUDSTONE		Moderately lithified; 4% basalt, tuffaceous sandstone, and tuff contamination; very trace magnetite
SANDY MUDSTONE		Moderately lithified; trace basalt and tuff contamination; very trace calcite vein, very trace magnetite
SANDY MUDSTONE		Moderately lithified; very trace basalt and tuff contamination; very trace magnetite, very trace clear calcite vein
SANDY MUDSTONE		Moderately lithified; very trace basalt and tuff contamination; very trace magnetite, very trace clear calcite vein
SILT AND SAND, TRACE GRAVEL (ML)	tr / 40 / 60	Moderately lithified; non-cohesive; reddish-brown weathered porphyritic tuff with aphanitic groundmass and phenocrysts of biotite, feldspar, and quartz, 10% reddish brown siltstone, 1% black basalt, trace well lithified tan tuff; very trace magnetite
SAND, SILTY, TRACE GRAVEL (SM)	tr / 70 / 30	Moderately to well lithified; non-cohesive; 1% clear quartz, trace white talc, trace white calcite, trace magnetite, trace paleosol
SAND, SOME SILT, TRACE GRAVEL (SW-SM)	5 / 85 / 10	Well lithified; non-cohesive; 1% clear to white quartz, trace white talc, very trace hematite and limonite
SAND, TRACE GRAVEL, TRACE SILT (SW-SM)	5 / 90 / 5	Well lithified; non-cohesive; 5% white to clear calcite, trace hematite, trace paleosol
SAND, SOME SILT, TRACE GRAVEL (SW-SM)	5 / 85 / 10	Well lithified; non-cohesive; 5% gravel; 5% clear to white quartz, trace white calcite, trace hematite, very trace paleosol
SAND, SILTY, TRACE GRAVEL (SM)	tr / 75 / 25	Well lithified; non-cohesive; 2% white to clear quartz, trace white calcite, trace hematite, very trace limonite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND, SILTY, TRACE GRAVEL (SM)	tr / 80 / 20	Well lithified; non-cohesive; 5% clear to white quartz, trace white calcite, very trace white to pink gypsum
245		SAND, SOME SILT, TRACE GRAVEL (SW-SM)	5 / 85 / 10	Well lithified; non-cohesive; trace white calcite, trace hematite, trace limonite, trace magnetite
		SAND AND SILT, TRACE GRAVEL (SM)	tr / 65 / 35	Well lithified; non-cohesive; trace white quartz, very trace white calcite, very trace magnetite
250		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; pinkish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of milky feldspar, quartz, and black biotite, trace magnetite, trace pumice, and trace quartzite lithics; 1% clear quartz, trace hematite
255		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, and trace lithics; trace white talc, trace clear quartz, trace clear to white calcite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, and trace lithics; trace clear quartz, trace clear calcite, very trace hematite
260		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, trace tan pumice, and trace lithics; trace clear calcite, trace red siltstone (contamination?)
265		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace lithics; very trace clear quartz, very trace clear calcite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics; trace clear calcite, very trace hematite
270		APACHE LEAP TUFF (WHITE		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level
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BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		UNIT)		feldspar, quartz, and biotite, visible magnetite; very trace red siltstone; trace clear quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace pumice; trace clear calcite, trace white quartz
275		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz
280		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, trace lithics; minor white calcite, very trace clear quartz
285		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace clear calcite, trace clear quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; trace white calcite
290		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice, trace lithics; trace white calcite, very trace clear quartz
295		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice, trace lithics; very trace clear quartz; very trace hematite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice, trace lithics; very trace reddish brown siltstone; very trace hematite
300				

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R

Far West Site

Pinal County, Arizona

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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, very trace magnetite, very trace pumice; very trace clear quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; very trace clear quartz
305		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, trace hematite
310		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, very trace hematite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, very trace magnetite, very trace pumice; trace clear quartz, very trace hematite
315		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace pumice; very trace hematite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, very trace lithics; trace white calcite, very trace hematite
320		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; trace clear quartz
325		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; trace white to clear calcite, very trace clear to white quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; 5% tan weathered tuff; 2% reddish brown siltstone; very trace gypsum
330				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-1. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW3-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 344.42 meters / 606.63 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 2, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677124.66N / 472533.737E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; very trace clear calcite, very trace hematite
335		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace pumice, trace lithics; very trace hematite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, 1% lithics, trace pumice; very trace hematite
340		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, trace lithics, trace pumice; very trace gypsum, very trace calcite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; grayish-brown welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, 1% lithics, trace pumice; trace clear calcite, trace clear quartz
345				
350				
355				
360				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level DATE DRILLED: Apr. 20 - 22, 2012

CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUARTERNARY ALLUVIUM (Qal)		
0.0 - 10.0	0.0 - 3.0	**SAND AND GRAVEL, SILTY (SM)**: Brown [7.5YR4/4]; subangular to rounded, fine to coarse sand 45%, gravel 35%, silt 20%. Gravel fraction: subangular to subrounded, fine to boulders gravel up to 33.5 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Very trace white matrix chips. Very trace magnetite.
10.0 - 20.0	3.0 - 6.1	**SAND, SILTY, SOME GRAVEL (SM)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 60%, silt 25%, gravel 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Very trace white matrix chips. Trace magnetite, trace hematite.
20.0 - 30.0	6.1 - 9.1	**SAND, SILTY, TRACE GRAVEL (SM)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 70%, silt 25%, gravel 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 9 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Trace light brown to white matrix chips. Very trace magnetite, trace hematite.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
30.0 - 40.0	9.1 - 12.2	**SAND AND GRAVEL, TRACE SILT (SW)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 60%, gravel 35%, silt 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: very strong. 2% matrix chunks. Very trace magnetite.
40.0 - 50.0	12.2 - 15.2	**SAND, GRAVELLY, TRACE SILT (SW)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 70%, gravel 25%, silt 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: very strong. Trace matrix chips. Trace hematite.
50.0 - 60.0	15.2 - 18.3	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: very strong. 2% light brown well lithified matrix chips. Trace magnetite.
60.0 - 70.0	18.3 - 21.3	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Pale brown [10YR6/3]; subangular to rounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. 80% light brown tuff with aphanitic groundmass and phenocrysts of quartz, feldspar, and biotite (boulder?); 20% silty gravelly sand; trace magnetite.
70.0 - 80.0	21.3 - 24.4	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Trace carbonate chips. Trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level	DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
80.0 - 90.0	24.4 - 27.4	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to coarse sand 75%, gravel 15%, silt 10%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace magnetite.
90.0 - 100.0	27.4 - 30.5	**SAND, SILTY, SOME GRAVEL (SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to coarse sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.1 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak. Very trace calcite, trace magnetite.
100.0 - 110.0	30.5 - 33.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to coarse sand 70%, silt 25%, gravel 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.5 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace weathering, trace magnetite.
APACHE LEAP TUFF - White Unit (Talw)		
110.0 - 120.0	33.5 - 36.6	**APACHE LEAP TUFF (WHITE UNIT)**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: strong. Pinkish gray porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 3% pumice, and trace magnetite; trace basalt; trace calcite, trace quartz.
120.0 - 130.0	36.6 - 39.6	**APACHE LEAP TUFF (WHITE UNIT)**: Light brown [7.5YR6/3]. Well lithified. Reaction to acid: strong. 50% tuff with reddish brown groundmass, 50% light gray pumice, trace lithics, trace magnetite.
130.0 - 140.0	39.6 - 42.7	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [2.5YR4/3]. Well lithified. Reaction to acid: strong. Reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace lithics; very trace hematite.
140.0 - 150.0	42.7 - 45.7	**APACHE LEAP TUFF (WHITE UNIT)**: Dusky red [2.5YR3/2]. Well lithified. Reaction to acid: strong. Reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 1% lithics, trace magnetite, very trace pumice; very trace hematite.
150.0 - 160.0	45.7 - 48.8	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [2.5YR4/3]. Well lithified. Reaction to acid: very strong. Reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 1% lithics, trace magnetite, very trace pumice; very trace hematite.
160.0 - 170.0	48.8 - 51.8	**APACHE LEAP TUFF (WHITE UNIT)**: Reddish brown [2.5YR4/3]. Well lithified. Reaction to acid: strong. Reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, trace magnetite, very trace pumice; trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level	DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
PRECAMBRIAN GRANODIORITE (pCg)		
170.0 - 180.0	51.8 - 54.9	**GRANODIORITE**: Red [2.5YR4/6]. Well lithified. Reaction to acid: strong. Mafic granodiorite, 10% weathered granodiorite; trace magnetite, minor hematite.
180.0 - 190.0	54.9 - 57.9	**GRANODIORITE**: Very dark gray [7.5YR3/1], brown [7.5yr5/3]. Well lithified. Reaction to acid: moderate to strong. Mafic granodiorite, 10% granodiorite; 7% clear to white quartz, 7% clear to white calcite, trace hematite, very trace magnetite.
190.0 - 200.0	57.9 - 61.0	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: moderate to strong. Granodiorite, trace mafic granodiorite; 1% white to clear calcite, trace hematite, very trace magnetite.
200.0 - 210.0	61.0 - 64.0	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: moderate to strong. Mafic granodiorite, 20% granodiorite; trace tuff; minor hematite, trace clear calcite, very trace magnetite.
210.0 - 220.0	64.0 - 67.1	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: moderate to strong. Mafic granodiorite, 20% granodiorite, trace tuff; minor hematite, trace clear calcite, very trace magnetite.
220.0 - 230.0	67.1 - 70.1	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: moderate to strong. Granodiorite; 2% clear calcite, trace hematite, trace magnetite.
230.0 - 240.0	70.1 - 73.2	**GRANODIORITE**: Brown [10YR4/3]. Well lithified. Reaction to acid: strong. Granodiorite; 3% clear calcite, minor hematite, trace magnetite.
240.0 - 250.0	73.2 - 76.2	**GRANODIORITE**: Very dark gray [N3], dark brown [7.5yr3/2]. Well lithified. Reaction to acid: strong. Granodiorite, 5% mafic granodiorite; 2% clear calcite, common hematite, trace magnetite.
250.0 - 260.0	76.2 - 79.2	**GRANODIORITE**: Very dark gray [N3], dark brown [7.5yr3/4]. Well lithified. Reaction to acid: strong. Mafic granodiorite, trace granodiorite; 2% clear calcite, some hematite, trace clear quartz, trace magnetite.
260.0 - 270.0	79.2 - 82.3	**GRANODIORITE**: Very dark gray [N3]. Well lithified. Reaction to acid: very strong. Mafic granodiorite; 4% clear calcite, some hematite, trace limonite, trace clear quartz, trace magnetite, trace lime green secondary mineral.
270.0 - 280.0	82.3 - 85.3	**GRANODIORITE**: Very dark gray [N3]. Well lithified. Reaction to acid: very strong. Mafic granodiorite; 4% clear calcite, 1% clear quartz, some hematite, trace limonite, trace magnetite, very trace lime green secondary mineral.

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level
DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E
BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
PRECAMBRIAN GRANODIORITE (pCg)		
280.0 - 290.0	85.3 - 88.4	**GRANODIORITE**: Very dark greenish gray [10Y3/1]. Well lithified. Reaction to acid: moderate. Mafic granodiorite; trace clear calcite, trace clear quartz, some hematite, trace magnetite, some green secondary mineral.
290.0 - 300.0	88.4 - 91.4	**GRANODIORITE**: Brown [10YR4/3], very dark gray [n3]. Well lithified. Reaction to acid: moderate. Mafic granodiorite; 1% clear calcite, 1% clear quartz, minor hematite, trace magnetite, common green secondary mineral.
300.0 - 310.0	91.4 - 94.5	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: strong. Black and white granodiorite; 5% clear quartz, 1% white quartz, some hematite, very trace magnetite.
310.0 - 320.0	94.5 - 97.5	**GRANODIORITE**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: strong. Granodiorite, 60% feldspar and white quartz, 40% black biotite and pyroxene; minor hematite, trace magnetite, trace green secondary mineral.
320.0 - 330.0	97.5 - 100.6	**GRANODIORITE**: Pinkish gray [7.5YR6/2]. Well lithified. Reaction to acid: strong. Granodiorite, 75% feldspar and white quartz, 25% black biotite and pyroxene, sample is mostly pulverized rock with trace intact pieces; minor hematite, trace magnetite, very trace green secondary mineral.
330.0 - 340.0	100.6 - 103.6	**GRANODIORITE**: Pinkish gray [7.5YR6/2]. Well lithified. Reaction to acid: moderate. Granodiorite, feldspar and quartz with magnetite; trace magnetite.
340.0 - 350.0	103.6 - 106.7	**GRANODIORITE**: Dark gray [7.5YR4/1]. Well lithified. Reaction to acid: moderate. Trace hematite, trace magnetite.
350.0 - 360.0	106.7 - 109.7	**GRANODIORITE**: Brown [7.5YR5/2], gray [7.5yr5/1]. Well lithified. Reaction to acid: moderate. Minor hematite, trace magnetite.
360.0 - 370.0	109.7 - 112.8	**GRANODIORITE**: Brown [7.5YR5/2]. Well lithified. Reaction to acid: moderate. Trace hematite, trace magnetite, trace quartz.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level	DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND AND GRAVEL, SILTY (SM)	35 / 45 / 20	Non to weakly lithified; non-cohesive; slightly moist; well graded; very trace magnetite
5		SAND, SILTY, SOME GRAVEL (SM)	15 / 60 / 25	Non to weakly lithified; non-cohesive; slightly moist; well graded; trace magnetite, trace hematite
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 70 / 25	Non to weakly lithified; non-cohesive; slightly moist; well graded; very trace magnetite, trace hematite
10		SAND AND GRAVEL, TRACE SILT (SW)	35 / 60 / 5	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
15		SAND, GRAVELLY, TRACE SILT (SW)	25 / 70 / 5	Non to weakly lithified; non-cohesive; well graded; trace hematite
		SAND, GRAVELLY, SOME SILT (SW-SM)	25 / 65 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite
20		SAND, GRAVELLY, SOME SILT (SW-SM)	25 / 65 / 10	Non to weakly lithified; non-cohesive; well graded; 80% light brown tuff with aphanitic groundmass and phenocrysts of quartz, feldspar, and biotite (boulder?); 20% silty gravelly sand; trace magnetite
		SAND, GRAVELLY, SOME SILT (SW-SM)	25 / 65 / 10	Non-lithified; non-cohesive; well graded; trace magnetite
25		SAND, SOME GRAVEL, SOME SILT (SW-SM)	15 / 75 / 10	Non-lithified; non-cohesive; well graded; trace magnetite
30		SAND, SILTY, SOME GRAVEL (SM)	10 / 70 / 20	Non-lithified; non-cohesive; well graded; very trace calcite, trace magnetite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level	DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 70 / 25	Non-lithified; non-cohesive; well graded; trace weathering, trace magnetite
35		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; pinkish gray porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 3% pumice, and trace magnetite; trace basalt; trace calcite, trace quartz
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; 50% tuff with reddish brown groundmass, 50% light gray pumice, trace lithics, trace magnetite
40		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace magnetite, very trace lithics; very trace hematite
45		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 1% lithics, trace magnetite, very trace pumice; very trace hematite
		APACHE LEAP TUFF (WHITE UNIT)		Well lithified; reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, 1% lithics, trace magnetite, very trace pumice; very trace hematite
50		**APACHE LEAP TUFF (WHITE UNIT)**		Well lithified; reddish brown partially welded porphyritic tuff with aphanitic groundmass and phenocrysts of feldspar, quartz, and biotite, trace lithics, trace magnetite, very trace pumice; trace hematite
		GRANODIORITE		Well lithified; mafic granodiorite, 10% weathered granodiorite; trace magnetite, minor hematite
55		**GRANODIORITE**		Well lithified; mafic granodiorite, 10% granodiorite; 7% clear to white quartz, 7% clear to white calcite, trace hematite, very trace magnetite
60		**GRANODIORITE**		Well lithified; granodiorite, trace mafic granodiorite; 1% white to clear calcite, trace hematite,

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level DATE DRILLED: Apr. 20 - 22, 2012

CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
				very trace magnetite
		GRANODIORITE		Well lithified; mafic granodiorite, 20% granodiorite; trace tuff; minor hematite, trace clear calcite, very trace magnetite
65		GRANODIORITE		Well lithified; mafic granodiorite, 20% granodiorite, trace tuff; minor hematite, trace clear calcite, very trace magnetite
70		GRANODIORITE		Well lithified; granodiorite; 2% clear calcite, trace hematite, trace magnetite
		GRANODIORITE		Well lithified; granodiorite; 3% clear calcite, minor hematite, trace magnetite
75		GRANODIORITE		Well lithified; granodiorite, 5% mafic granodiorite; 2% clear calcite, common hematite, trace magnetite
		GRANODIORITE		Well lithified; mafic granodiorite, trace granodiorite; 2% clear calcite, some hematite, trace clear quartz, trace magnetite
80		GRANODIORITE		Well lithified; mafic granodiorite; 4% clear calcite, some hematite, trace limonite, trace clear quartz, trace magnetite, trace lime green secondary mineral
85		GRANODIORITE		Well lithified; mafic granodiorite; 4% clear calcite, 1% clear quartz, some hematite, trace limonite, trace magnetite, very trace lime green secondary mineral
		GRANODIORITE		Well lithified; mafic granodiorite; trace clear calcite, trace clear quartz, some hematite, trace magnetite, some green secondary mineral
90				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-2. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW4-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 112.78 meters / 640.27 meters above mean sea level	DATE DRILLED: Apr. 20 - 22, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677204.34N / 474817.724E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		GRANODIORITE		Well lithified; mafic granodiorite; 1% clear calcite, 1% clear quartz, minor hematite, trace magnetite, common green secondary mineral
		GRANODIORITE		Well lithified; black and white granodiorite; 5% clear quartz, 1% white quartz, some hematite, very trace magnetite
95		GRANODIORITE		Well lithified; granodiorite, 60% feldspar and white quartz, 40% black biotite and pyroxene; minor hematite, trace magnetite, trace green secondary mineral
100		GRANODIORITE		Well lithified; granodiorite, 75% feldspar and white quartz, 25% black biotite and pyroxene, sample is mostly pulverized rock with trace intact pieces; minor hematite, trace magnetite, very trace green secondary mineral
		GRANODIORITE		Well lithified; granodiorite, feldspar and quartz with magnetite; trace magnetite
105		GRANODIORITE		Well lithified; trace hematite, trace magnetite
		GRANODIORITE		Well lithified; minor hematite, trace magnetite
110		GRANODIORITE		Well lithified; trace hematite, trace magnetite, trace quartz
115				
120				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.

LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level

DATE DRILLED: Apr. 9 - 11, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E

BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 10.0	0.0 - 3.0	**SAND, SILTY, GRAVELLY (SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 55%, silt 25%, gravel 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Trace tan matrix chips (caliche). Trace magnetite.
10.0 - 20.0	3.0 - 6.1	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.3 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Very trace matrix chips. Very trace hematite, some magnetite.
20.0 - 30.0	6.1 - 9.1	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 7.0 cm. Non to weakly lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Calcareous matrix chips. Very trace hematite, very trace magnetite.
30.0 - 40.0	9.1 - 12.2	**GRAVEL, SANDY, SILTY (GM)**: Strong brown [7.5YR4/6]; gravel 45%, subangular to subrounded, fine to coarse sand 30%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. 5% fine cement grout; very trace matrix chips. Trace hematite.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
40.0 - 50.0	12.2 - 15.2	**GRAVEL, SANDY, SILTY (GM)**: Yellowish brown [10YR5/4]; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt 30%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. Trace matrix chips.
50.0 - 60.0	15.2 - 18.3	**GRAVEL AND SAND, SILTY (GM)**: Strong brown [7.5YR5/6]; gravel 40%, subangular to subrounded, fine to coarse sand 35%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chunks. Very trace magnetite.
60.0 - 70.0	18.3 - 21.3	**GRAVEL AND SAND, SILTY (GM)**: Light yellowish brown [10YR6/4]; gravel 40%, subangular to subrounded, fine to coarse sand 35%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% carbonate matrix chips. Very trace magnetite.
70.0 - 80.0	21.3 - 24.4	**GRAVEL, SANDY, SILTY (GM)**: Yellowish brown [10YR5/4]; gravel 45%, subangular to subrounded, fine to coarse sand 30%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.2 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chunks. Very trace magnetite, trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level DATE DRILLED: Apr. 9 - 11, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
80.0 - 90.0	24.4 - 27.4	**GRAVEL, SANDY, SILTY (GM)**: Light yellowish brown [10YR6/4]; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chunk.
90.0 - 100.0	27.4 - 30.5	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Light yellowish brown [10YR6/4]; subangular to subrounded, fine to coarse sand 70%, gravel 15%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace carbonate matrix chips.
100.0 - 110.0	30.5 - 33.5	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Light yellowish brown [10YR6/4]; subangular to subrounded, fine to coarse sand 70%, gravel 15%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chips. Very trace magnetite.
110.0 - 120.0	33.5 - 36.6	**SAND, SILTY, SOME GRAVEL (SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 65%, silt 20%, gravel 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chips. Very trace magnetite.
120.0 - 130.0	36.6 - 39.6	**SAND, GRAVELLY, SILTY (SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace lithified siltstone chips, very trace carbonate matrix chips. Very trace magnetite, very trace limonite.
130.0 - 140.0	39.6 - 42.7	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace carbonate matrix chips. Very trace magnetite.
140.0 - 150.0	42.7 - 45.7	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 60%, gravel 30%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% well lithified carbonate matrix chips.
150.0 - 160.0	45.7 - 48.8	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% calcareous matrix chips. Trace magnetite, trace hematite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level
DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E
BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
160.0 - 170.0	48.8 - 51.8	**GRAVEL, SANDY, SILTY (GM)**: Light yellowish brown [10YR6/4]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% calcareous matrix chips. Trace magnetite, very trace hematite.
170.0 - 180.0	51.8 - 54.9	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace calcareous matrix chips. Trace magnetite, very trace hematite.
180.0 - 190.0	54.9 - 57.9	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.3 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace calcareous matrix chips. Trace magnetite, very trace hematite.
190.0 - 200.0	57.9 - 61.0	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 35%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace calcareous matrix chips. Trace magnetite, very trace hematite.
200.0 - 210.0	61.0 - 64.0	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to subrounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace magnetite.
210.0 - 220.0	64.0 - 67.1	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to subrounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace magnetite.
220.0 - 230.0	67.1 - 70.1	**GRAVEL AND SILT, SOME SAND (GM)**: Yellowish brown [10YR5/4]; gravel 50%, silt 40%, subangular to subrounded, fine to coarse sand 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace magnetite.
230.0 - 240.0	70.1 - 73.2	**SAND AND GRAVEL, TRACE SILT (SW)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 60%, gravel 35%, silt 5%. Gravel fraction: subangular, fine to coarse gravel up to 2.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace well lithified calcareous matrix. Very trace hematite, trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level
DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E
BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
240.0 - 250.0	73.2 - 76.2	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace calcareous matrix. Very trace hematite, trace magnetite.
250.0 - 260.0	76.2 - 79.2	**GRAVEL, SANDY, SILTY (GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace hematite and limonite, very trace magnetite.
260.0 - 270.0	79.2 - 82.3	**GRAVEL AND SILT, SOME SAND (GM)**: Yellowish brown [10YR5/4]; gravel 50%, silt 40%, subangular to subrounded, fine to coarse sand 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate.
270.0 - 280.0	82.3 - 85.3	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace calcareous matrix. Trace magnetite.
280.0 - 290.0	85.3 - 88.4	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace calcareous matrix. Trace magnetite.
290.0 - 300.0	88.4 - 91.4	**GRAVEL AND SILT, SOME SAND (GM)**: Brown [10YR5/3]; gravel 50%, silt 35%, subangular to subrounded, fine to coarse sand 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Very trace calcareous matrix. Very trace magnetite, trace hematite.
300.0 - 310.0	91.4 - 94.5	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace matrix chips. Trace magnetite.
310.0 - 320.0	94.5 - 97.5	**GRAVEL AND SILT, SOME SAND (GM)**: Brown [10YR5/3]; gravel 50%, silt 35%, subangular to subrounded, fine to coarse sand 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Very trace hematite, trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
320.0 - 330.0	97.5 - 100.6	**GRAVEL AND SILT, SOME SAND (GM)**: Brown [10YR5/3]; gravel 50%, silt 35%, subangular to subrounded, fine to coarse sand 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Very trace matrix chips. Trace hematite, very trace magnetite.
330.0 - 340.0	100.6 - 103.6	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.4 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 2% matrix chips. Trace hematite and limonite, trace magnetite.
340.0 - 350.0	103.6 - 106.7	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace matrix chips. Trace magnetite.
350.0 - 360.0	106.7 - 109.7	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: very strong. Trace matrix chips. Trace magnetite, trace limonite.
360.0 - 370.0	109.7 - 112.8	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace magnetite, trace hematite.
370.0 - 380.0	112.8 - 115.8	**GRAVEL, SILTY, SANDY (GM)**: Brown [10YR5/3]; gravel 50%, silt 30%, subangular to subrounded, fine to coarse sand 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace magnetite, trace hematite.
380.0 - 390.0	115.8 - 118.9	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Trace magnetite, trace hematite.
390.0 - 400.0	118.9 - 121.9	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Trace matrix chips. Very trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level
DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E
BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
400.0 - 410.0	121.9 - 125.0	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 55%, gravel 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong to very strong. 3% matrix chips. Trace magnetite.
410.0 - 420.0	125.0 - 128.0	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 10% matrix chips. Trace magnetite.
420.0 - 430.0	128.0 - 131.1	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.1 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 3% matrix chips. Trace hematite, very trace magnetite.
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
430.0 - 440.0	131.1 - 134.1	**BASALT**: Black [N2.5], brown [7.5yr6/4]. Well lithified. Reaction to acid: strong. Black basalt, 25% peach calcareous, fine-grained silty sandstone; some magnetite, 1% white quartz.
440.0 - 450.0	134.1 - 137.2	**BASALT**: Black [N2.5], brown [7.5yr6/4]. Well lithified. Reaction to acid: strong. Brownish-gray to black basalt, 5% peach calcareous, fine-grained silty sandstone; trace limonite, some magnetite, 1% white calcite.
450.0 - 460.0	137.2 - 140.2	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: moderate. 10% brown weathered basalt; trace white calcite, trace magnetite.
460.0 - 470.0	140.2 - 143.3	**BASALT**: Brown [7.5YR4/2]. Well lithified. Reaction to acid: moderate. Brownish-gray weathered basalt, 3% peach calcareous fine-grained silty sandstone; very trace manganese oxide, trace magnetite, trace white to clear calcite vein.
470.0 - 480.0	143.3 - 146.3	**BASALT**: Brown [7.5YR4/2]. Well lithified. Reaction to acid: moderate. Grayish-black basalt; trace hematite, trace magnetite, trace clear calcite vein.
480.0 - 490.0	146.3 - 149.4	**BASALT**: Brown [10YR4/3]. Well lithified. Reaction to acid: moderate. Brownish-gray and grayish-black basalt, trace contamination peach calcareous fine-grained silty sandstone; 2% clear calcite vein, trace magnetite.
490.0 - 500.0	149.4 - 152.4	**BASALT**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: moderate. Grayish-black basalt, trace brownish gray basalt; 10% red paleosol weathering; trace hematite, trace clear calcite vein, very trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
500.0 - 510.0	152.4 - 155.4	**BASALT**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: moderate. Grayish-black and brownish-gray basalt, 2% weathered basalt; 1% clear calcite vein, trace hematite and limonite, very trace magnetite.
510.0 - 520.0	155.4 - 158.5	**BASALT**: Black [N2.5]. Well lithified. Reaction to acid: moderate. Grayish-black basalt, trace weathered basalt; trace hematite, trace clear calcite vein, very trace magnetite, very trace calcite on fractures.
520.0 - 530.0	158.5 - 161.5	**BASALT**: Very dark gray [N3]. Well lithified. Reaction to acid: strong. Grayish-black basalt; very trace manganese oxide, minor hematite, 1% clear calcite vein, very trace limonite, very trace magnetite.
530.0 - 540.0	161.5 - 164.6	**BASALT**: Very dark gray [N3]. Well lithified. Reaction to acid: strong. Grayish-black basalt; 2% clear calcite vein, very trace manganese oxide, very trace magnetite.
540.0 - 550.0	164.6 - 167.6	**BASALT**: Very dark gray [5YR3/1]. Well lithified. Reaction to acid: very strong. Grayish-black and brownish-gray basalt; trace basalt with vesicles; some fault gauge in unwashed sample, (peach rock paste - quartz and clay); 1% hematite, 1% clear calcite vein, very trace manganese oxide, very trace magnetite.
550.0 - 560.0	167.6 - 170.7	**BASALT**: Yellowish red [5YR5/6], black [n2.5]. Well lithified. Reaction to acid: strong. Grayish-black and brownish-gray basalt, trace amygdules, 3% brown tuffaceous sandstone; 1% orange weakly lithified silt (fracture-fill?); minor hematite and limonite, trace clear calcite, trace magnetite.
560.0 - 570.0	170.7 - 173.7	**BASALT**: Reddish brown [5YR4/4], black [n2.5]. Well lithified. Reaction to acid: strong. Grayish-black and brownish-gray basalt, 5% brown tuff; 1% orange weakly lithified silt (fracture-fill?); minor hematite and limonite, 1% clear calcite, trace magnetite.
570.0 - 580.0	173.7 - 176.8	**BASALT**: Brown [7.5YR4/4], black [n2.5]. Well lithified. Reaction to acid: very strong. Dark gray basalt; some disseminated hematite, 4% clear calcite, trace clear quartz, trace magnetite.
580.0 - 590.0	176.8 - 179.8	**BASALT**: Dark reddish brown [5YR3/2]. Well lithified. Reaction to acid: very strong. Dark gray basalt; common disseminated hematite, 2% clear calcite, trace clear quartz, trace magnetite, very trace calcite on fractures.
590.0 - 600.0	179.8 - 182.9	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: very strong. Dark gray basalt; common disseminated hematite, 3% clear calcite, 1% clear quartz, trace magnetite.
600.0 - 610.0	182.9 - 185.9	**BASALT**: Dark brown [7.5YR3/2]. Well lithified. Reaction to acid: very strong. Dark gray basalt, trace brownish gray basalt; some disseminated hematite, trace hematite, 2% clear calcite, trace clear quartz, trace magnetite.

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
610.0 - 620.0	185.9 - 189.0	**BASALT**: Strong brown [7.5YR4/6]. Well lithified. Reaction to acid: moderate. Grayish-black and brownish-gray basalt, 3% light brown tuffaceous sandstone; some hematite and limonite, very trace clear calcite, trace magnetite.
620.0 - 630.0	189.0 - 192.0	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Grayish-black and brownish gray basalt, 1% light brown tuffaceous sandstone; minor hematite and limonite, trace clear calcite, trace magnetite.
630.0 - 640.0	192.0 - 195.1	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark gray basalt with trace brownish gray basalt; trace hematite, trace clear calcite, trace disseminated hematite, trace magnetite.
640.0 - 650.0	195.1 - 198.1	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark gray basalt; trace disseminated hematite, 1% white calcite, 1% white quartz, trace magnetite.
650.0 - 660.0	198.1 - 201.2	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark grayish-black basalt; trace disseminated hematite, 1% white calcite, trace white quartz, very trace magnetite.
660.0 - 670.0	201.2 - 204.2	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark grayish-black basalt; 2% white calcite, 2% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite.
670.0 - 680.0	204.2 - 207.3	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark grayish-black basalt, very trace brown weathered basalt; 1% white calcite, 1% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite.
680.0 - 690.0	207.3 - 210.3	**BASALT**: Very dark gray [7.5YR3/1]. Well lithified. Reaction to acid: strong. Dark grayish-black basalt, trace brown weathered basalt; 1% white calcite, 1% white quartz, trace white gypsum trace disseminated hematite, very trace hematite and limonite, very trace magnetite.
690.0 - 700.0	210.3 - 213.4	**BASALT**: Very dark gray [N3]. Well lithified. Reaction to acid: strong. Dark grayish-black basalt, trace brown weathered basalt; 1% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite.
700.0 - 710.0	213.4 - 216.4	**BASALT**: Dusky red [10R3/3]. Well lithified. Reaction to acid: strong. Reddish-brown weathered basalt; minor hematite, 4% white calcite, very trace magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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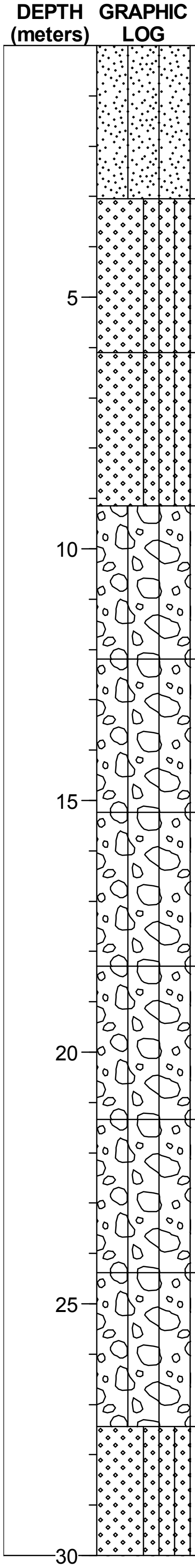
B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SAND, SILTY, GRAVELLY (SM)	20 / 55 / 25	Non to weakly lithified; non-cohesive; slightly moist; well graded; trace magnetite
SAND AND GRAVEL, SOME SILT (SW-SM)	35 / 55 / 10	Non to weakly lithified; non-cohesive; slightly moist; well graded; very trace hematite, some magnetite
SAND AND GRAVEL, SOME SILT (SW-SM)	35 / 55 / 10	Non to weakly lithified; non-cohesive; slightly moist; well graded; very trace hematite, very trace magnetite
GRAVEL, SANDY, SILTY (GM)	45 / 30 / 25	Non to weakly lithified; non-cohesive; well graded; trace hematite
GRAVEL, SANDY, SILTY (GM)	40 / 30 / 30	Non to weakly lithified; non-cohesive; well graded
GRAVEL AND SAND, SILTY (GM)	40 / 35 / 25	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
GRAVEL AND SAND, SILTY (GM)	40 / 35 / 25	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
GRAVEL, SANDY, SILTY (GM)	45 / 30 / 25	Non to weakly lithified; non-cohesive; well graded; very trace magnetite, trace hematite
GRAVEL, SANDY, SILTY (GM)	50 / 25 / 25	Non to weakly lithified; non-cohesive; well graded
SAND, SOME GRAVEL, SOME SILT (SW-SM)	15 / 70 / 15	Non to weakly lithified; non-cohesive; well graded

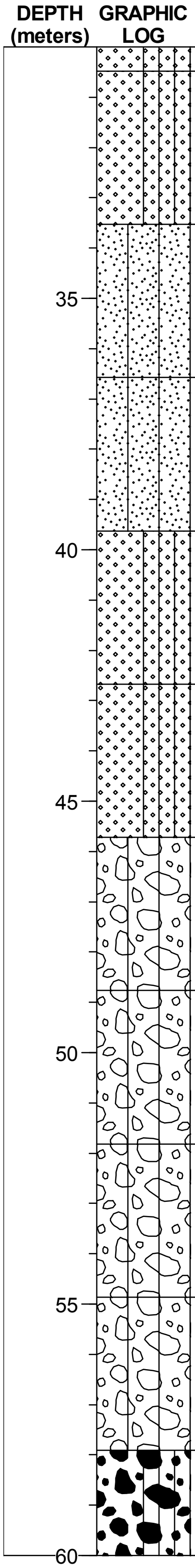
* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SAND, SOME GRAVEL, SOME SILT (SW-SM)	15 / 70 / 15	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
SAND, SILTY, SOME GRAVEL (SM)	15 / 65 / 20	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
SAND, GRAVELLY, SILTY (SM)	20 / 60 / 20	Non to weakly lithified; non-cohesive; well graded; very trace magnetite, very trace limonite
SAND, GRAVELLY, SOME SILT (SW-SM)	25 / 65 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
SAND, GRAVELLY, SOME SILT (SW-SM)	30 / 60 / 10	Non to weakly lithified; non-cohesive; well graded
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, trace hematite
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, very trace hematite
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, very trace hematite
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, very trace hematite
GRAVEL AND SAND, SOME	50 / 35 / 15	Non to weakly lithified; non-cohesive; well graded; trace magnetite, very trace hematite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.
LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level
DATE DRILLED: Apr. 9 - 11, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E
BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SILT (GW-GM)		
		GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 40 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite
65		GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 40 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite
70		GRAVEL AND SILT, SOME SAND (GM)	50 / 10 / 40	Non-lithified; non-cohesive; well graded; trace magnetite
		SAND AND GRAVEL, TRACE SILT (SW)	35 / 60 / 5	Non to weakly lithified; non-cohesive; well graded; very trace hematite, trace magnetite
75		SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 50 / 10	Non to weakly lithified; non-cohesive; well graded; very trace hematite, trace magnetite
		GRAVEL, SANDY, SILTY (GM)	50 / 25 / 25	Non to weakly lithified; non-cohesive; well graded; trace hematite and limonite, very trace magnetite
80		GRAVEL AND SILT, SOME SAND (GM)	50 / 10 / 40	Non-lithified; non-cohesive; well graded
85		GRAVEL, SANDY, SILTY (GM)	50 / 25 / 25	Non to weakly lithified; non-cohesive; well graded; trace magnetite
		SAND, GRAVELLY, SOME SILT (SW-SM)	30 / 55 / 15	Non to weakly lithified; non-cohesive; well graded; trace magnetite
90				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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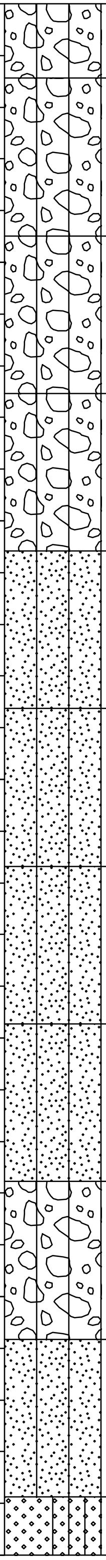
B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches



DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		GRAVEL AND SILT, SOME SAND (GM)	50 / 15 / 35	Non to weakly lithified; non-cohesive; well graded; very trace magnetite, trace hematite
		GRAVEL, SANDY, SILTY (GM)	50 / 25 / 25	Non to weakly lithified; non-cohesive; well graded; trace magnetite
95		GRAVEL AND SILT, SOME SAND (GM)	50 / 15 / 35	Non to weakly lithified; non-cohesive; well graded; very trace hematite, trace magnetite
100		GRAVEL AND SILT, SOME SAND (GM)	50 / 15 / 35	Non to weakly lithified; non-cohesive; well graded; trace hematite, very trace magnetite
		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Non to weakly lithified; non-cohesive; well graded; trace hematite and limonite, trace magnetite
105		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite
		SAND, GRAVELLY, SILTY (SM)	20 / 60 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, trace limonite
110		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, trace hematite
115		GRAVEL, SILTY, SANDY (GM)	50 / 20 / 30	Non to weakly lithified; non-cohesive; well graded; trace magnetite, trace hematite
		SAND, GRAVELLY, SILTY (SM)	25 / 55 / 20	Non to weakly lithified; non-cohesive; well graded; trace magnetite, trace hematite
120				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND AND GRAVEL, SOME SILT (SW-SM)	35 / 55 / 10	Non to weakly lithified; non-cohesive; well graded; very trace magnetite
		SAND AND GRAVEL, SOME SILT (SW-SM)	35 / 55 / 10	Non to weakly lithified; non-cohesive; well graded; trace magnetite
125		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Non to weakly lithified; non-cohesive; well graded; trace magnetite
130		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Non to weakly lithified; non-cohesive; well graded; trace hematite, very trace magnetite
		BASALT		Well lithified; black basalt, 25% peach calcareous, fine-grained silty sandstone; some magnetite, 1% white quartz
135		BASALT		Well lithified; brownish-gray to black basalt, 5% peach calcareous, fine-grained silty sandstone; trace limonite, some magnetite, 1% white calcite
140		BASALT		Well lithified; 10% brown weathered basalt; trace white calcite, trace magnetite
		BASALT		Well lithified; brownish-gray weathered basalt, 3% peach calcareous fine-grained silty sandstone; very trace manganese oxide, trace magnetite, trace white to clear calcite vein
145		BASALT		Well lithified; grayish-black basalt; trace hematite, trace magnetite, trace clear calcite vein
		BASALT		Well lithified; brownish-gray and grayish-black basalt, trace contamination peach calcareous fine-grained silty sandstone; 2% clear calcite vein, trace magnetite
150				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		BASALT		Well lithified; grayish-black basalt, trace brownish gray basalt; 10% red paleosol weathering; trace hematite, trace clear calcite vein, very trace magnetite
155		**BASALT**		Well lithified; grayish-black and brownish-gray basalt, 2% weathered basalt; 1% clear calcite vein, trace hematite and limonite, very trace magnetite
		BASALT		Well lithified; grayish-black basalt, trace weathered basalt; trace hematite, trace clear calcite vein, very trace magnetite, very trace calcite on fractures
160		**BASALT**		Well lithified; grayish-black basalt; very trace manganese oxide, minor hematite, 1% clear calcite vein, very trace limonite, very trace magnetite
		BASALT		Well lithified; grayish-black basalt; 2% clear calcite vein, very trace manganese oxide, very trace magnetite
165		**BASALT**		Well lithified; grayish-black and brownish-gray basalt; trace basalt with vesicles; some fault gauge in unwashed sample, (peach rock paste - quartz and clay); 1% hematite, 1% clear calcite vein, very trace manganese oxide, very trace magnetite
170		**BASALT**		Well lithified; grayish-black and brownish-gray basalt, trace amygdules, 3% brown tuffaceous sandstone; 1% orange weakly lithified silt (fracture-fill?); minor hematite and limonite, trace clear calcite, trace magnetite
		BASALT		Well lithified; grayish-black and brownish-gray basalt, 5% brown tuff; 1% orange weakly lithified silt (fracture-fill?); minor hematite and limonite, 1% clear calcite, trace magnetite
175		**BASALT**		Well lithified; dark gray basalt; some disseminated hematite, 4% clear calcite, trace clear quartz, trace magnetite
180		**BASALT**		Well lithified; dark gray basalt; common disseminated hematite, 2% clear calcite, trace clear quartz, trace magnetite, very trace calcite on fractures

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level DATE DRILLED: Apr. 9 - 11, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		BASALT		Well lithified; dark gray basalt; common disseminated hematite, 3% clear calcite, 1% clear quartz, trace magnetite
185		**BASALT**		Well lithified; dark gray basalt, trace brownish gray basalt; some disseminated hematite, trace hematite, 2% clear calcite, trace clear quartz, trace magnetite
		BASALT		Well lithified; grayish-black and brownish-gray basalt, 3% light brown tuffaceous sandstone; some hematite and limonite, very trace clear calcite, trace magnetite
190		**BASALT**		Well lithified; grayish-black and brownish gray basalt, 1% light brown tuffaceous sandstone; minor hematite and limonite, trace clear calcite, trace magnetite
195		**BASALT**		Well lithified; dark gray basalt with trace brownish gray basalt; trace hematite, trace clear calcite, trace disseminated hematite, trace magnetite
		BASALT		Well lithified; dark gray basalt; trace disseminated hematite, 1% white calcite, 1% white quartz, trace magnetite
200		**BASALT**		Well lithified; dark grayish-black basalt; trace disseminated hematite, 1% white calcite, trace white quartz, very trace magnetite
		BASALT		Well lithified; dark grayish-black basalt; 2% white calcite, 2% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite
205		**BASALT**		Well lithified; dark grayish-black basalt, very trace brown weathered basalt; 1% white calcite, 1% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite
210		**BASALT**		Well lithified; dark grayish-black basalt, trace brown weathered basalt; 1% white calcite, 1% white quartz, trace white gypsum trace disseminated hematite, very trace hematite and limonite, very trace magnetite

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

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B-1-3. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM MONITOR WELL FW7-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC Hammer / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 216.41 meters / 596.96 meters above mean sea level	DATE DRILLED: Apr. 9 - 11, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560.172N / 471880.642E	BOREHOLE DIAMETER: 9-7/8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		BASALT		Well lithified; dark grayish-black basalt, trace brown weathered basalt; 1% white quartz, trace disseminated hematite, very trace hematite and limonite, very trace magnetite
215		**BASALT**		Well lithified; reddish-brown weathered basalt; minor hematite, 4% white calcite, very trace magnetite
220				
225				
230				
235				
240				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 10.0	0.0 - 3.0	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Strong brown [7.5YR5/6]; gravel 50%, subangular to subrounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.0 cm. Non-lithified. Non-cohesive. Moist. Well graded. Reaction to acid: very strong. Lost some fines due to drilling method; sand fraction partially composed of cut gravel.
10.0 - 20.0	3.0 - 6.1	**SILT AND SAND, GRAVELLY (SM)**: Brown [7.5YR5/4]; silt 40%, subangular to subrounded, fine to coarse sand 35%, gravel 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.0 cm. Non-lithified. Non-cohesive. Moist. Well graded. Reaction to acid: very strong. Lost some fines due to drilling method; sand fraction partially composed of cut gravel.
20.0 - 30.0	6.1 - 9.1	**SAND AND SILT, GRAVELLY (SM)**: Brown [7.5YR5/4]; subangular to subrounded, fine to coarse sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.7 cm. Non-lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Lost some fines due to drilling method; sand fraction partially composed of cut gravel.
30.0 - 40.0	9.1 - 12.2	**SAND AND SILT, GRAVELLY (SM)**: Yellowish brown [10YR5/4]; subangular to subrounded, fine to coarse sand 40%, silt 40%, gravel 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.9 cm. Non-lithified. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Lost some fines due to drilling method; sand fraction partially composed of cut gravel.
40.0 - 50.0	12.2 - 15.2	**SAND, GRAVELLY, SILTY (SM)**: Brown [7.5YR4/4]; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.4 cm. Non-lithified. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Lost some fines due to drilling method; sand fraction partially composed of cut gravel.
50.0 - 60.0	15.2 - 18.3	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.3 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak. Some weathering.
60.0 - 70.0	18.3 - 21.3	**SAND, GRAVELLY, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 25%, silt 25%. Gravel fraction: subangular fine gravel up to 1.3 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: none to weak.
70.0 - 80.0	21.3 - 24.4	**SAND, GRAVELLY, SILTY (SM)**: Pale brown [10YR6/3]; subangular to subrounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.1 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak. Very trace weathering.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level
DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E
BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
80.0 - 90.0	24.4 - 27.4	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Yellowish brown [10YR5/4]; gravel 50%, subangular to rounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Trace matrix chips. Some weathering.
90.0 - 100.0	27.4 - 30.5	**SAND, GRAVELLY, SILTY (SM)**: Light yellowish brown [2.5Y6/3]; subangular to rounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.4 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. 5% calcareous matrix chips. Some weathering.
100.0 - 110.0	30.5 - 33.5	**SAND, GRAVELLY, SILTY (SM)**: Pale brown [10YR6/3]; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.5 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. Some weathering.
110.0 - 120.0	33.5 - 36.6	**SAND AND SILT, GRAVELLY (SM)**: Brown [10YR5/3]; subangular to rounded, fine to coarse sand 35%, silt 35%, gravel 30%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 2.5 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. 15% well lithified, calcareous matrix chips. Very trace weathering.
120.0 - 130.0	36.6 - 39.6	**SAND AND GRAVEL, SILTY (SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak. Very trace matrix chips. Some weathering.
130.0 - 140.0	39.6 - 42.7	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.5 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak. Some weathering.
140.0 - 150.0	42.7 - 45.7	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 55%, subangular to subrounded, fine to coarse sand 30%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak to moderate. 5% well lithified, calcareous matrix chips. Some weathering.
150.0 - 160.0	45.7 - 48.8	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Brown [10YR5/3]; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 3.4 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak to moderate. Very trace calcite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
160.0 - 170.0	48.8 - 51.8	**GRAVEL, SANDY, SILTY (GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 7.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak to moderate. Some weathering.
170.0 - 180.0	51.8 - 54.9	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 55%, subangular to subrounded, fine to coarse sand 35%, silt 10%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: weak to moderate. Some weathering.
180.0 - 190.0	54.9 - 57.9	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Brown [10YR5/3]; gravel 50%, subangular to subrounded, fine to coarse sand 35%, silt 15%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 4.5 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate. Trace weathering.
190.0 - 200.0	57.9 - 61.0	**GRAVEL AND SAND, TRACE SILT (GW)**: Pale brown [10YR6/3]; gravel 60%, subangular to subrounded, fine to coarse sand 35%, silt 5%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 6.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. Trace weathering, trace calcite.
200.0 - 210.0	61.0 - 64.0	**GRAVEL, SANDY, SILTY (GM)**: Pale brown [10YR6/3]; gravel 60%, subangular to subrounded, fine to coarse sand 20%, silt 20%. Gravel fraction: subangular to subrounded, fine to coarse gravel up to 5.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate to strong. Trace weathering.
210.0 - 220.0	64.0 - 67.1	**NO SAMPLE**.
220.0 - 230.0	67.1 - 70.1	**GRAVEL AND SILT, SANDY (GM)**: Dark grayish brown [10YR4/2]; gravel 40%, silt 40%, subangular to rounded, fine to coarse sand 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace well lithified, calcareous matrix chips. Trace weathering.
230.0 - 240.0	70.1 - 73.2	**GRAVEL, SANDY, SILTY (GM)**: Dark grayish brown [10YR4/2]; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace matrix chips. Very trace weathering, very trace magnetite.
240.0 - 250.0	73.2 - 76.2	**GRAVEL, SANDY, SILTY (GM)**: Dark grayish brown [10YR4/2]; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt 30%. Gravel fraction: subangular to subrounded fine gravel up to 0.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: moderate. 10% well lithified, calcareous matrix chips.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level DATE DRILLED: Feb. 22 - Mar. 8, 2012

CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
250.0 - 260.0	76.2 - 79.2	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Grayish brown [10YR5/2]; gravel 55%, subangular to rounded, fine to coarse sand 30%, silt 15%. Gravel fraction: subangular to subrounded fine gravel up to 0.9 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: moderate. 5% well-lithified matrix chips.
260.0 - 270.0	79.2 - 82.3	**GRAVEL, SANDY, SILTY (GM)**: Grayish brown [10YR5/2]; gravel 45%, subangular to subrounded, fine to coarse sand 30%, silt 25%. Gravel fraction: subangular to subrounded fine gravel up to 1.2 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong.
270.0 - 280.0	82.3 - 85.3	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Grayish brown [10YR5/2]; gravel 50%, subangular to rounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded fine gravel up to 1.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace well lithified, calcareous matrix chips.
280.0 - 290.0	85.3 - 88.4	**SILT, GRAVELLY, SANDY (SM)**: Grayish brown [10YR5/2]; silt 40%, gravel 30%, subangular to rounded, fine to coarse sand 30%. Gravel fraction: subangular to subrounded fine gravel up to 1.3 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong.
290.0 - 300.0	88.4 - 91.4	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 35%, silt 35%, gravel 30%. Gravel fraction: subangular to subrounded fine gravel up to 1.1 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan silt; very trace moderately lithified matrix chips.
300.0 - 310.0	91.4 - 94.5	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 40%, silt 40%, gravel 20%. Gravel fraction: subangular to subrounded fine gravel up to 0.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. 5% tan silt.
310.0 - 320.0	94.5 - 97.5	**SAND, GRAVELLY, SILTY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.1 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace clayey silt.
320.0 - 330.0	97.5 - 100.6	**SAND, GRAVELLY, SILTY (SM)**: Light olive brown [2.5Y5/3]; subangular to rounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan silt; very trace tan matrix chips.
330.0 - 340.0	100.6 - 103.6	**SAND AND SILT, GRAVELLY (SM)**: Light olive brown [2.5Y5/3]; subangular to rounded, fine to coarse sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. 7% tan, calcareous clayey silt.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co. LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
340.0 - 350.0	103.6 - 106.7	**SILT AND SAND, GRAVELLY (SM)**: Grayish brown [10YR5/2]; silt 40%, subangular to rounded, fine to coarse sand 35%, gravel 25%. Gravel fraction: subangular fine gravel up to 0.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. 10% tan clayey silt.
350.0 - 360.0	106.7 - 109.7	**SAND, GRAVELLY, SILTY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular fine gravel up to 0.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace magnetite.
360.0 - 370.0	109.7 - 112.8	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular fine gravel up to 0.6 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace weakly to moderately lithified, calcareous matrix chips.
370.0 - 380.0	112.8 - 115.8	**SAND, SILTY, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 45%, silt 30%, gravel 25%. Gravel fraction: subangular fine gravel up to 0.9 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace well lithified matrix chips; very trace tan clayey silt.
380.0 - 390.0	115.8 - 118.9	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subrounded to rounded, fine to coarse sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular fine gravel up to 0.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace well lithified matrix chips.
390.0 - 400.0	118.9 - 121.9	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish brown [10YR5/2]; subangular to subrounded, fine to coarse sand 65%, silt 25%, gravel 10%. Gravel fraction: subangular to subrounded fine gravel. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan clayey silt.
400.0 - 410.0	121.9 - 125.0	**SAND AND SILT, TRACE GRAVEL (SM)**: Grayish brown [10YR5/2]; subrounded to rounded, fine to coarse sand 60%, silt 40%, trace gravel. Gravel fraction: subangular to subrounded fine gravel. Non-lithified. Non-cohesive. Poorly graded. Reaction to acid: strong.
410.0 - 420.0	125.0 - 128.0	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan clay.
420.0 - 430.0	128.0 - 131.1	**SILT AND SAND, GRAVELLY (SM)**: Grayish brown [10YR5/2]; silt 40%, subangular to rounded, fine to coarse sand 35%, gravel 25%. Gravel fraction: subangular fine gravel up to 0.7 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan clay. Very trace weathering (limonite).

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.
LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level
DATE DRILLED: Feb. 22 - Mar. 8, 2012

CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E
BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
430.0 - 440.0	131.1 - 134.1	**SAND AND SILT, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to coarse sand 40%, silt 40%, gravel 20%. Gravel fraction: subangular fine gravel up to 0.7 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan, well lithified, calcareous matrix chips.
440.0 - 450.0	134.1 - 137.2	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to medium sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan matrix chips; very trace tan clay.
450.0 - 460.0	137.2 - 140.2	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to medium sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong to very strong. Trace moderately to well lithified, calcareous matrix chips; very trace tan clay. Very trace calcite.
460.0 - 470.0	140.2 - 143.3	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to medium sand 65%, silt 20%, gravel 15%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan calcareous matrix chips. Very trace weathering.
470.0 - 480.0	143.3 - 146.3	**GRAVEL AND SAND, SILTY (SM)**: Grayish brown [10YR5/2]; gravel 40%, subangular to subrounded, fine to medium sand 40%, silt 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.2 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan weakly lithified, calcareous matrix chips. Very trace weathering.
480.0 - 490.0	146.3 - 149.4	**GRAVEL AND SAND, SILTY (GM)**: Grayish brown [10YR5/2]; gravel 40%, subangular to rounded, fine to medium sand 35%, silt 25%. Gravel fraction: subangular to subrounded fine gravel up to 1.4 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan well lithified, calcareous matrix chunks. Very trace weathering.
490.0 - 500.0	149.4 - 152.4	**SAND, GRAVELLY, SILTY (SM)**: Light brownish gray [2.5Y6/2]; subangular to rounded, fine to medium sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace tan well lithified, calcareous matrix chips. Very trace weathering.
500.0 - 510.0	152.4 - 155.4	**SAND, SILTY, GRAVELLY (SM)**: Grayish brown [10YR5/2]; subangular to rounded, fine to medium sand 55%, silt 25%, gravel 20%. Gravel fraction: subangular to subrounded fine gravel up to 0.9 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

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CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
510.0 - 520.0	155.4 - 158.5	**SAND AND GRAVEL, SILTY (SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to medium sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan moderately to well lithified, calcareous matrix chips. Trace weathering.
520.0 - 530.0	158.5 - 161.5	**SAND, SILTY, GRAVELLY (SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to medium sand 55%, silt 25%, gravel 20%. Gravel fraction: subangular to subrounded fine gravel up to 1.0 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Very trace tan calcareous clay; very trace white clay. Trace weathered tuff.
530.0 - 540.0	161.5 - 164.6	**SAND, GRAVELLY, SILTY (SM)**: Brown [7.5YR5/3]; subangular to rounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non to weakly lithified. Non-cohesive. Well graded. Reaction to acid: strong. 1% tan well lithified matrix chips; very trace tan clay. Trace weathering.
540.0 - 550.0	164.6 - 167.6	**GRAVEL AND SILT, SOME SAND (GM)**: Brown [7.5YR5/3]; gravel 45%, silt 40%, subangular to rounded, fine to coarse sand 15%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong to very strong. Very trace calcareous matrix chips; very trace brown and white clay. Some weathering.
550.0 - 560.0	167.6 - 170.7	**GRAVEL AND SAND, SILTY (GM)**: Dark grayish brown [10YR4/2]; gravel 40%, subangular to subrounded, fine to coarse sand 35%, silt 25%. Gravel fraction: subangular fine gravel up to 0.8 cm. Non-lithified. Non-cohesive. Well graded. Reaction to acid: strong. Trace weathering.
TERTIARY TUFFACEOUS VOLCANICS (Tvs)		
560.0 - 570.0	170.7 - 173.7	**TUFFACEOUS VOLCANICS**: Brown [10YR5/3]. Well lithified. Reaction to acid: strong to very strong. Green fine tuffaceous volcanics, 3% dark brown tuff, 1% orangish-brown, weathered tuff, trace basalt; some magnetite; very trace reddish-brown, calcareous, well lithified matrix chip; very trace calcite on fracture surface.
570.0 - 580.0	173.7 - 176.8	**TUFFACEOUS VOLCANICS**: Grayish brown [10YR5/2]. Well lithified. Reaction to acid: strong. Green fine tuffaceous volcanics, trace black basalt; trace quartz; trace tuff; some magnetite; very trace weathering on schist and basalt; very trace calcite.
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
580.0 - 590.0	176.8 - 179.8	**WEATHERED BASALT**: Weak red [10R4/4]. Moderately lithified. Moderately cohesive. Reaction to acid: strong to very strong. Weathered basalt, green fine tuffaceous volcanics, trace basalt, trace tuff; common weathering; some magnetite.
590.0 - 600.0	179.8 - 182.9	**WEATHERED BASALT**: Red [2.5YR4/6]. Moderately lithified. Slightly to moderately cohesive. Reaction to acid: very strong. Weathered basalt, greenish-brown to brown, tuffaceous volcanics, trace basalt; common weathering; some magnetite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.

LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level

DATE DRILLED: Feb. 22 - Mar. 8, 2012

CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E

BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
600.0 - 610.0	182.9 - 185.9	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: very strong. Brown, weathered basalt, 1% green fine tuffaceous volcanics, trace tuff; common magnetite; some weathering.
610.0 - 620.0	185.9 - 189.0	**WEATHERED BASALT**: Yellowish red [5YR4/6]. Moderately lithified. Non-cohesive. Reaction to acid: very strong. 80% brown, weathered basalt, 20% orangish-brown, highly weathered tuff; common weathering; common magnetite; very trace calcite.
620.0 - 630.0	189.0 - 192.0	**WEATHERED BASALT**: Reddish brown [2.5YR4/3]. Well lithified. Non-cohesive. Reaction to acid: very strong. 83% brown, weathered basalt, 15% orangish-brown highly weathered tuff, 1% maroon tuff, 1% green fine tuffaceous volcanics, trace schist, trace black basalt; common weathering; some magnetite; very trace calcite.
630.0 - 640.0	192.0 - 195.1	**BASALT**: Weak red [2.5YR4/2]. Well lithified. Reaction to acid: very strong. Brown, weathered basalt and siltstone, 5% green fine tuffaceous volcanics, 1% orangish-brown and brown tuff and very trace schist; common weathering; some magnetite.
640.0 - 650.0	195.1 - 198.1	**BASALT**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt; some weathering (disseminated hematite and limonite); 1% clear to white calcite veinlets; some magnetite; very trace calcite on fracture surfaces.
650.0 - 660.0	198.1 - 201.2	**BASALT**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt; some weathering (disseminated hematite and limonite); 2% white to clear calcite veinlet; trace magnetite; very trace calcite on fracture surface.
660.0 - 670.0	201.2 - 204.2	**BASALT**: Brown [7.5YR4/2]. Well lithified. Reaction to acid: weak to moderate. Dark gray to black basalt; common magnetite; trace weathering (disseminated hematite and limonite); very trace quartz; very trace calcite on fracture surface.
670.0 - 680.0	204.2 - 207.3	**BASALT**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt; common magnetite; trace weathering (disseminated hematite and limonite); trace white calcite veinlet; trace moderately cohesive reddish-brown and tan clay.
680.0 - 690.0	207.3 - 210.3	**BASALT**: Reddish brown [5YR4/4]. Moderately lithified. Reaction to acid: strong. Dark gray to black basalt; common weathering (disseminated hematite); trace magnetite.
690.0 - 700.0	210.3 - 213.4	**BASALT**: Dark reddish gray [5YR4/2]. Well lithified. Reaction to acid: weak to moderate. Dark gray to black basalt; some weathering (disseminated hematite and limonite); some magnetite; trace clear calcite veinlet; very trace brown clay.
700.0 - 710.0	213.4 - 216.4	**BASALT**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: strong. Dark gray to black basalt; common magnetite; some weathering (disseminated hematite and limonite); trace clear to white calcite veinlet; very trace calcite on fracture surfaces; very trace brown clay.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level
DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E
BOREHOLE DIAMETER: 14-3/4-inches

TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
710.0 - 720.0	216.4 - 219.5	**BASALT**: Brown [7.5YR4/2]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt; common magnetite; trace weathering (disseminated hematite); trace clear to white calcite veinlet; very trace calcite on fracture surface; very trace brown clay.
720.0 - 730.0	219.5 - 222.5	**BASALT**: Reddish brown [5YR4/4]. Non- lithified. Reaction to acid: very strong. Dark gray to black basalt and brown, weathered basalt; common magnetite.
730.0 - 740.0	222.5 - 225.6	**BASALT**: Reddish brown [5YR4/4]. Non- lithified. Reaction to acid: strong. Brownish-gray, weathered basalt; common magnetite; trace calcite.
740.0 - 750.0	225.6 - 228.6	**BASALT**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: very strong. Brown weathered basalt with milky white amygdules, trace black basalt, 1% green fine tuffaceous volcanic; trace weathering (hematite); very trace calcite;.
750.0 - 760.0	228.6 - 231.6	**BASALT**: Dark reddish gray [5YR4/2]. Well lithified. Reaction to acid: very strong. Brown weathered basalt with milky white amygdules; trace black basalt; trace weathering (disseminated hematite and limonite).
760.0 - 770.0	231.6 - 234.7	**BASALT**: Reddish brown [5YR4/4]. Well lithified. Reaction to acid: very strong. Brown weathered basalt with milky white amygdules; some weathering (hematite and limonite); trace calcite; trace quartz.
770.0 - 780.0	234.7 - 237.7	**BASALT**: Dark reddish gray [5YR4/2]. Well lithified. Reaction to acid: very strong. Brown weathered basalt with milky white amygdules; trace black basalt; trace weathering (hematite and limonite).
780.0 - 790.0	237.7 - 240.8	**BASALT**: Reddish brown [5YR4/3]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt, 5% brown weathered basalt; 1% white calcite; some weathering (disseminated hematite and limonite); very trace quartz on fracture surfaces.
790.0 - 800.0	240.8 - 243.8	**BASALT**: Yellowish red [5YR4/6]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt, 5% brown weathered basalt; 1% white calcite; 1% white quartz; common weathering (disseminated hematite and very trace limonite); very trace calcite on fracture surface.
800.0 - 810.0	243.8 - 246.9	**BASALT**: Reddish brown [5YR4/3]. Well lithified. Reaction to acid: very strong. Dark gray to black basalt, 40% brown, weathered basalt; 1% pink to white gypsum; trace calcite.
810.0 - 820.0	246.9 - 249.9	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: very strong. Brown weathered basalt, 2% black basalt; trace weathering (hematite) on black basalt; trace magnetite; trace calcite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
820.0 - 830.0	249.9 - 253.0	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Black basalt, 15% brown, weathered basalt; some weathering (disseminated hematite); common magnetite; trace white calcite veinlet; very trace white quartz on fracture surface.
830.0 - 840.0	253.0 - 256.0	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt, trace brown, weathered basalt; 1% white calcite veinlet; common magnetite; some weathering (disseminated hematite and trace limonite).
840.0 - 850.0	256.0 - 259.1	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt, trace brown, weathered basalt; 1% white calcite; some weathering (disseminated hematite); some magnetite; trace white quartz; very trace pinkish-brown gypsum.
850.0 - 860.0	259.1 - 262.1	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Brown, weathered basalt with trace milky white amygdules, 7% dark gray to black basalt; some weathering (disseminated limonite and trace hematite); some magnetite; trace white calcite; trace white quartz; very trace hematite on fracture surface.
860.0 - 870.0	262.1 - 265.2	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to brownish-gray basalt; some weathering (disseminated hematite and limonite); some magnetite; trace white calcite; very trace hematite on fracture surface; very trace gray fine tuffaceous volcanic.
870.0 - 880.0	265.2 - 268.2	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt; minor weathering (disseminated hematite and limonite); common magnetite; trace white calcite; trace white quartz.
880.0 - 890.0	268.2 - 271.3	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt, 3% brown, weathered basalt; common weathering (disseminated hematite and limonite); common magnetite; trace white quartz; very trace white to clear calcite.
890.0 - 900.0	271.3 - 274.3	**BASALT**: Weak red [2/5YR4/2]. Well lithified. Reaction to acid: strong. Reddish-brown to brown, weathered basalt, 3% black basalt; abundant weathering (disseminated hematite and limonite); some magnetite; trace white calcite; very trace white quartz.
900.0 - 910.0	274.3 - 277.4	**BASALT**: Brown [7.5YR4/4]. Well lithified. Reaction to acid: strong. Dark gray to black basalt, 5% reddish-brown to brown weathered basalt; very trace contamination (green fine tuffaceous volcanics); common weathering (disseminated hematite and limonite); common magnetite; trace hematite on fracture surfaces; trace white calcite; very trace white quartz veinlet and quartz on fracture surfaces.

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
TERTIARY YOUNGER VOLCANICS (Tvy) - BASALT		
910.0 - 915.0	277.4 - 278.9	**BASALT**: Brown [7.5YR4/3]. Well lithified. Reaction to acid: moderate. Dark gray to black basalt, 1% brown, weathered basalt, very trace brown basalt with milky white amygdules; very trace contamination (green fine tuffaceous volcanics); 1% white quartz veinlet; common weathering (disseminated hematite and limonite); common magnetite; trace hematite on fracture surfaces; trace white calcite.

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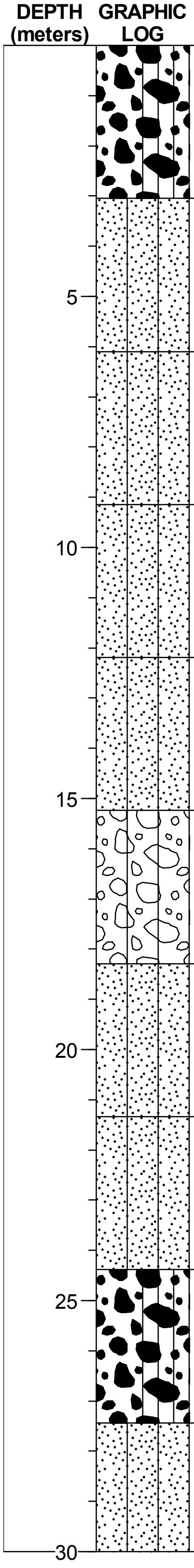
B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 40 / 10	Non-lithified; non-cohesive; moist; well graded; lost some fines due to drilling method; sand fraction partially composed of cut gravel
SILT AND SAND, GRAVELLY (SM)	25 / 35 / 40	Non-lithified; non-cohesive; moist; well graded; lost some fines due to drilling method; sand fraction partially composed of cut gravel
SAND AND SILT, GRAVELLY (SM)	25 / 40 / 35	Non-lithified; non-cohesive; slightly moist; well graded; lost some fines due to drilling method; sand fraction partially composed of cut gravel
SAND AND SILT, GRAVELLY (SM)	20 / 40 / 40	Non-lithified; very slightly cohesive; slightly moist; well graded; lost some fines due to drilling method; sand fraction partially composed of cut gravel
SAND, GRAVELLY, SILTY (SM)	25 / 55 / 20	Non-lithified; non-cohesive; slightly moist; well graded; lost some fines due to drilling method; sand fraction partially composed of cut gravel
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; well graded; some weathering
SAND, GRAVELLY, SILTY (SM)	25 / 50 / 25	Non-lithified; non-cohesive; well graded
SAND, GRAVELLY, SILTY (SM)	30 / 40 / 30	Non-lithified; non-cohesive; well graded; very trace weathering
GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 40 / 10	Non-lithified; non-cohesive; well graded; some weathering
SAND, GRAVELLY, SILTY (SM)	30 / 40 / 30	Non-lithified; non-cohesive; well graded; some weathering

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
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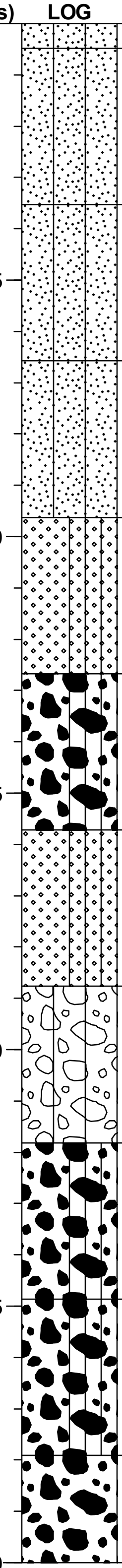

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Non-lithified; non-cohesive; well graded; some weathering
35		SAND AND SILT, GRAVELLY (SM)	30 / 35 / 35	Non to weakly lithified; non-cohesive; well graded; very trace weathering
		SAND AND GRAVEL, SILTY (SM)	35 / 40 / 25	Non-lithified; non-cohesive; well graded; some weathering
40		SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 50 / 10	Non-lithified; non-cohesive; well graded; some weathering
45		GRAVEL, SANDY, SOME SILT (GW-GM)	55 / 30 / 15	Non-lithified; non-cohesive; well graded; some weathering
		SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 50 / 10	Non-lithified; non-cohesive; well graded; very trace calcite
50		GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; well graded; some weathering
		GRAVEL AND SAND, SOME SILT (GW-GM)	55 / 35 / 10	Non-lithified; non-cohesive; well graded; some weathering
55		GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 35 / 15	Non-lithified; non-cohesive; well graded; trace weathering
60		GRAVEL AND SAND, TRACE	60 / 35 / 5	Non-lithified; non-cohesive; well graded; trace weathering, trace calcite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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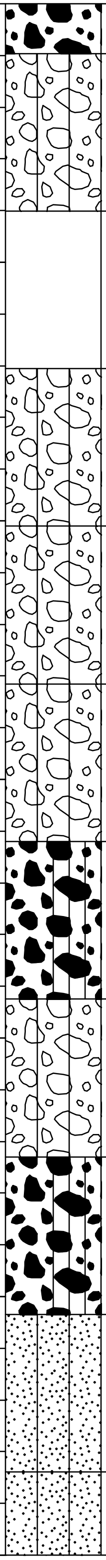
B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches



DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SILT (GW)		
		GRAVEL, SANDY, SILTY (GM)	60 / 20 / 20	Non-lithified; non-cohesive; well graded; trace weathering
65		NO SAMPLE		
		GRAVEL AND SILT, SANDY (GM)	40 / 20 / 40	Non-lithified; non-cohesive; well graded; trace weathering
70		GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; well graded; very trace weathering, very trace magnetite
75		GRAVEL, SANDY, SILTY (GM)	40 / 30 / 30	Non to weakly lithified; non-cohesive; well graded
		GRAVEL, SANDY, SOME SILT (GW-GM)	55 / 30 / 15	Non-lithified; non-cohesive; well graded
80		GRAVEL, SANDY, SILTY (GM)	45 / 30 / 25	Non-lithified; non-cohesive; well graded
		GRAVEL AND SAND, SOME SILT (GW-GM)	50 / 40 / 10	Non-lithified; non-cohesive; well graded
85		SILT, GRAVELLY, SANDY (SM)	30 / 30 / 40	Non-lithified; non-cohesive; well graded
90				

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND AND SILT, GRAVELLY (SM)	30 / 35 / 35	Non-lithified; non-cohesive; well graded
		SAND AND SILT, GRAVELLY (SM)	20 / 40 / 40	Non-lithified; non-cohesive; well graded
95		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Non-lithified; non-cohesive; well graded
100		**SAND, GRAVELLY, SILTY (SM)**	30 / 40 / 30	Non-lithified; non-cohesive; well graded
		SAND AND SILT, GRAVELLY (SM)	20 / 45 / 35	Non-lithified; non-cohesive; well graded
105		**SILT AND SAND, GRAVELLY (SM)**	25 / 35 / 40	Non-lithified; non-cohesive; well graded
		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Non-lithified; non-cohesive; well graded; very trace magnetite
110		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Non to weakly lithified; non-cohesive; well graded
115		**SAND, SILTY, GRAVELLY (SM)**	25 / 45 / 30	Non to weakly lithified; non-cohesive; well graded
		SAND AND SILT, GRAVELLY (SM)	20 / 45 / 35	Non to weakly lithified; non-cohesive; well graded
120				

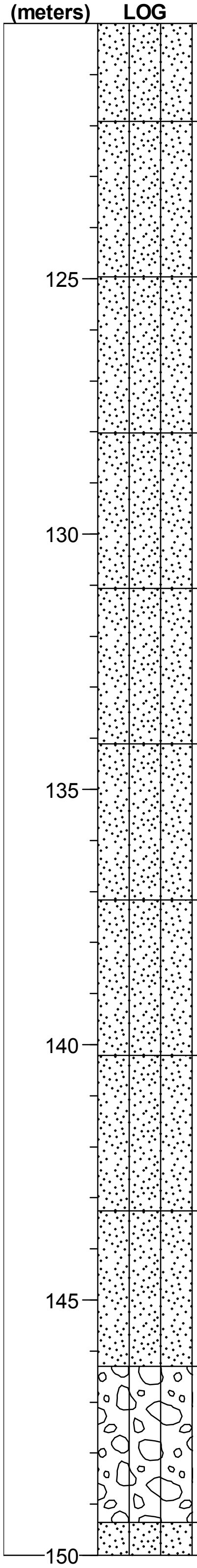
* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

DRAFT

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
SAND, SILTY, SOME GRAVEL (SM)	10 / 65 / 25	Non to weakly lithified; non-cohesive; well graded
SAND AND SILT, TRACE GRAVEL (SM)	tr / 60 / 40	Non-lithified; non-cohesive; poorly graded
SAND AND SILT, GRAVELLY (SM)	25 / 40 / 35	Non-lithified; non-cohesive; well graded
SILT AND SAND, GRAVELLY (SM)	25 / 35 / 40	Non-lithified; non-cohesive; well graded; very trace weathering (limonite)
SAND AND SILT, GRAVELLY (SM)	20 / 40 / 40	Non to weakly lithified; non-cohesive; well graded
SAND, SILTY, SOME GRAVEL (SM)	15 / 55 / 30	Non-lithified; non-cohesive; well graded
SAND, SILTY, SOME GRAVEL (SM)	10 / 60 / 30	Non-lithified; non-cohesive; well graded; very trace calcite
SAND, SILTY, SOME GRAVEL (SM)	15 / 65 / 20	Non to weakly lithified; non-cohesive; well graded; very trace weathering
GRAVEL AND SAND, SILTY (SM)	40 / 40 / 20	Non-lithified; non-cohesive; well graded; very trace weathering
GRAVEL AND SAND, SILTY (GM)	40 / 35 / 25	Non-lithified; non-cohesive; well graded; very trace weathering

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level DATE DRILLED: Feb. 22 - Mar. 8, 2012

CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Non-lithified; non-cohesive; well graded; very trace weathering
155		**SAND, SILTY, GRAVELLY (SM)**	20 / 55 / 25	Non-lithified; non-cohesive; well graded
		SAND AND GRAVEL, SILTY (SM)	35 / 40 / 25	Non-lithified; non-cohesive; well graded; trace weathering
160		**SAND, SILTY, GRAVELLY (SM)**	20 / 55 / 25	Non-lithified; non-cohesive; well graded; trace weathered tuff
		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Non to weakly lithified; non-cohesive; well graded; trace weathering
165		**GRAVEL AND SILT, SOME SAND (GM)**	45 / 15 / 40	Non-lithified; non-cohesive; well graded; some weathering
170		**GRAVEL AND SAND, SILTY (GM)**	40 / 35 / 25	Non-lithified; non-cohesive; well graded; trace weathering
		TUFFACEOUS VOLCANICS		Well lithified; green fine tuffaceous volcanics, 3% dark brown tuff, 1% orangish-brown, weathered tuff, trace basalt; some magnetite; very trace reddish-brown, calcareous, well lithified matrix chip; very trace calcite on fracture surface
175		**TUFFACEOUS VOLCANICS**		Well lithified; green fine tuffaceous volcanics, trace black basalt; trace quartz; trace tuff; some magnetite; very trace weathering on schist and basalt; very trace calcite
180		**WEATHERED BASALT**		Moderately lithified; moderately cohesive; weathered basalt, green fine tuffaceous volcanics, trace basalt, trace tuff; common weathering; some magnetite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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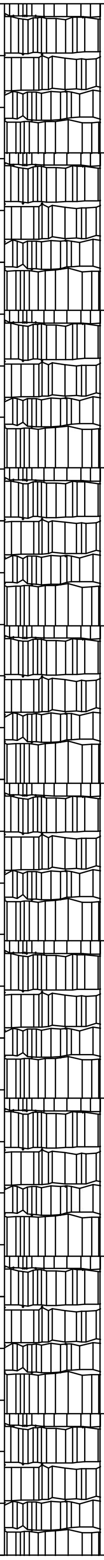
B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
		**WEATHERED BASALT**		Moderately lithified; slightly to moderately cohesive; weathered basalt, greenish-brown to brown, tuffaceous volcanics, trace basalt; common weathering; some magnetite
185		**BASALT**		Well lithified; brown, weathered basalt, 1% green fine tuffaceous volcanics, trace tuff; common magnetite; some weathering
		WEATHERED BASALT		Moderately lithified; non-cohesive; 80% brown, weathered basalt, 20% orangish-brown, highly weathered tuff; common weathering; common magnetite; very trace calcite
190		**WEATHERED BASALT**		Well lithified; non-cohesive; 83% brown, weathered basalt, 15% orangish-brown highly weathered tuff, 1% maroon tuff, 1% green fine tuffaceous volcanics, trace schist, trace black basalt; common weathering; some magnetite; very trace calcite
195		**BASALT**		Well lithified; brown, weathered basalt and siltstone, 5% green fine tuffaceous volcanics, 1% orangish-brown and brown tuff and very trace schist; common weathering; some magnetite
		BASALT		Well lithified; dark gray to black basalt; some weathering (disseminated hematite and limonite); 1% clear to white calcite veinlets; some magnetite; very trace calcite on fracture surfaces
200		**BASALT**		Well lithified; dark gray to black basalt; some weathering (disseminated hematite and limonite); 2% white to clear calcite veinlet; trace magnetite; very trace calcite on fracture surface
		BASALT		Well lithified; dark gray to black basalt; common magnetite; trace weathering (disseminated hematite and limonite); very trace quartz; very trace calcite on fracture surface
205		**BASALT**		Well lithified; dark gray to black basalt; common magnetite; trace weathering (disseminated hematite and limonite); trace white calcite veinlet; trace moderately cohesive reddish-brown and tan clay
210		**BASALT**		Moderately lithified; dark gray to black basalt; common weathering (disseminated hematite); trace magnetite

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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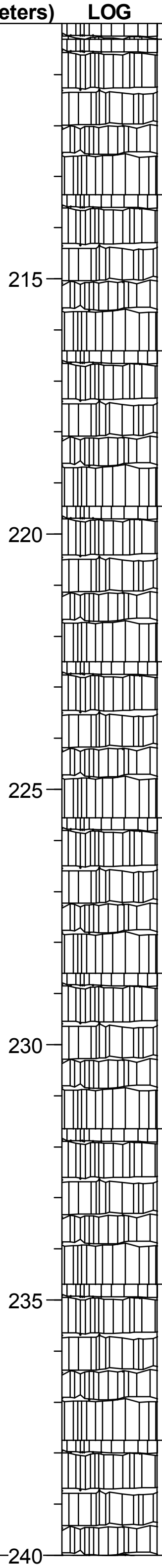
B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters) / GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
BASALT		Well lithified; dark gray to black basalt; some weathering (disseminated hematite and limonite); some magnetite; trace clear calcite veinlet; very trace brown clay
BASALT		Well lithified; dark gray to black basalt; common magnetite; some weathering (disseminated hematite and limonite); trace clear to white calcite veinlet; very trace calcite on fracture surfaces; very trace brown clay
BASALT		Well lithified; dark gray to black basalt; common magnetite; trace weathering (disseminated hematite); trace clear to white calcite veinlet; very trace calcite on fracture surface; very trace brown clay
BASALT		Non- lithified; dark gray to black basalt and brown, weathered basalt; common magnetite
BASALT		Non- lithified; brownish-gray, weathered basalt; common magnetite; trace calcite
BASALT		Well lithified; brown weathered basalt with milky white amygdules, trace black basalt, 1% green fine tuffaceous volcanic; trace weathering (hematite); very trace calcite;
BASALT		Well lithified; brown weathered basalt with milky white amygdules; trace black basalt; trace weathering (disseminated hematite and limonite)
BASALT		Well lithified; brown weathered basalt with milky white amygdules; some weathering (hematite and limonite); trace calcite; trace quartz
BASALT		Well lithified; brown weathered basalt with milky white amygdules; trace black basalt; trace weathering (hematite and limonite)
BASALT		Well lithified; dark gray to black basalt, 5% brown weathered basalt; 1% white calcite; some weathering (disseminated hematite and limonite); very trace quartz on fracture surfaces

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R

Far West Site

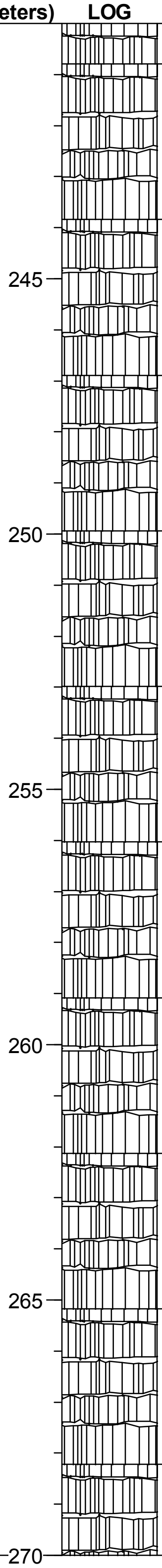
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co. LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level DATE DRILLED: Feb. 22 - Mar. 8, 2012

CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
BASALT		Well lithified; dark gray to black basalt, 5% brown weathered basalt; 1% white calcite; 1% white quartz; common weathering (disseminated hematite and very trace limonite); very trace calcite on fracture surface
BASALT		Well lithified; dark gray to black basalt, 40% brown, weathered basalt; 1% pink to white gypsum; trace calcite
BASALT		Well lithified; brown weathered basalt, 2% black basalt; trace weathering (hematite) on black basalt; trace magnetite; trace calcite
BASALT		Well lithified; black basalt, 15% brown, weathered basalt; some weathering (disseminated hematite); common magnetite; trace white calcite veinlet; very trace white quartz on fracture surface
BASALT		Well lithified; dark gray to black basalt, trace brown, weathered basalt; 1% white calcite veinlet; common magnetite; some weathering (disseminated hematite and trace limonite)
BASALT		Well lithified; dark gray to black basalt, trace brown, weathered basalt; 1% white calcite; some weathering (disseminated hematite); some magnetite; trace white quartz; very trace pinkish-brown gypsum
BASALT		Well lithified; brown, weathered basalt with trace milky white amygdules, 7% dark gray to black basalt; some weathering (disseminated limonite and trace hematite); some magnetite; trace white calcite; trace white quartz; very trace hematite on fracture surface
BASALT		Well lithified; dark gray to brownish-gray basalt; some weathering (disseminated hematite and limonite); some magnetite; trace white calcite; very trace hematite on fracture surface; very trace gray fine tuffaceous volcanic
BASALT		Well lithified; dark gray to black basalt; minor weathering (disseminated hematite and limonite); common magnetite; trace white calcite; trace white quartz
BASALT		Well lithified; dark gray to black basalt, 3% brown, weathered basalt; common weathering

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-4. LITHOLOGIC DESCRIPTIONS FOR DRILL CUTTINGS FROM WATER PRODUCTION WELL FW15-R
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: RC hammer and conv. mud rotary / Layne Christensen Co.	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 278.89 meters / 604.77 meters above mean sea level	DATE DRILLED: Feb. 22 - Mar. 8, 2012
CADASTRAL / NAD27 : (D-2-10)35bdb1 / 3675115.946N / 472469.545E	BOREHOLE DIAMETER: 14-3/4-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS
				(disseminated hematite and limonite); common magnetite; trace white quartz; very trace white to clear calcite
		BASALT		Well lithified; reddish-brown to brown, weathered basalt, 3% black basalt; abundant weathering (disseminated hematite and limonite); some magnetite; trace white calcite; very trace white quartz
275		**BASALT**		Well lithified; dark gray to black basalt, 5% reddish-brown to brown weathered basalt; very trace contamination (green fine tuffaceous volcanics); common weathering (disseminated hematite and limonite); common magnetite; trace hematite on fracture surfaces; trace white calcite; very trace white quartz veinlet and quartz on fracture surfaces
		BASALT		Well lithified; dark gray to black basalt, 1% brown, weathered basalt, very trace brown basalt with milky white amygdules; very trace contamination (green fine tuffaceous volcanics); 1% white quartz veinlet; common weathering (disseminated hematite and limonite); common magnetite; trace hematite on fracture surfaces; trace white calcite
280				
285				
290				
295				
300				

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 1.8	0.0 - 0.5	**GRAVEL, SANDY, SILTY (GM)**: Reddish-brown; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded boulders gravel including <10% cobbles up to 9.1 cm. Non-lithified. Loose. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
1.8 - 4.5	0.5 - 1.4	**GRAVEL, SANDY, SILTY (GM)**: Light reddish-gray; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 9.1 cm. Non-lithified. Loose. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
4.5 - 5.0	1.4 - 1.5	**SILT, SANDY, SOME GRAVEL (ML)**: Orangish-brown; silt and clay 60%, subrounded, fine to medium sand 25%, gravel 15%. Gravel fraction: subrounded gravel up to 4.0 cm. Weakly lithified. Compact. Very slightly to slightly cohesive. Dry. Gap graded. Reaction to acid: moderate. Matrix chips.
5.0 - 5.5	1.5 - 1.7	**SILT, SANDY, GRAVELLY (ML)**: Light gray; silt 55%, subrounded, fine to medium sand 25%, gravel 20%. Gravel fraction: subrounded gravel up to 5.5 cm. Non-lithified. Compact. Non-cohesive. Dry. Gap graded. Reaction to acid: very weak.
5.5 - 6.5	1.7 - 2.0	**SILT, SANDY, SOME GRAVEL (ML)**: Light orangish-gray; silt 60%, subrounded, fine to medium sand 25%, gravel 15%. Gravel fraction: subrounded gravel up to 1.8 cm. Weakly lithified. Compact. Very slightly cohesive. Dry. Gap graded. Reaction to acid: weak. Matrix chips.
6.5 - 8.5	2.0 - 2.6	**SILT, GRAVELLY, SANDY (SM)**: Light gray; silt 40%, gravel 30%, subrounded, fine to coarse sand 30%. Gravel fraction: subrounded gravel up to 5.2 cm. Non-lithified. Compact. Non-cohesive. Dry. Gap graded. Reaction to acid: very strong.
8.5 - 13.0	2.6 - 4.0	**SILT, SANDY, TRACE GRAVEL (ML)**: Light orangish-gray; silt 65%, subrounded, very fine to medium sand 30%, gravel 5%. Gravel fraction: subrounded gravel including trace cobbles up to 8.5 cm. Non-lithified. Compact. Very slightly cohesive. Dry. Gap graded. Reaction to acid: strong to very strong.
13.0 - 14.0	4.0 - 4.3	**GRAVEL, SANDY, SILTY (GM)**: Light gray; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 9.1 cm. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
14.0 - 15.7	4.3 - 4.8	**SILT, GRAVELLY, SANDY (ML)**: Light orangish-gray; silt 60%, gravel 20%, subangular to subrounded, very fine to medium sand 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 3.0 cm. Non-lithified. Dense. Non-cohesive. Dry. Gap graded. Reaction to acid: strong to very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
15.7 - 16.6	4.8 - 5.1	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Light gray; gravel 55%, subangular to subrounded, fine to coarse sand 30%, silt 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 9.1 cm. Non-lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate.
16.6 - 19.5	5.1 - 5.9	**GRAVEL AND SAND, SILTY (SM)**: Very light pinkish-gray; gravel 40%, subangular to subrounded, fine to coarse sand 40%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.4 cm. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
19.5 - 21.3	5.9 - 6.5	**SILT AND SAND, SOME GRAVEL (SM)**: Orangish-brown; silt and clay 50%, subangular to subrounded, fine to medium sand 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 3.0 cm. Weakly lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: weak to moderate. Matrix chips.
21.3 - 23.4	6.5 - 7.1	**GRAVEL, SANDY, SILTY (GM)**: Light orangish-gray; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 13.1 cm. Non-lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very weak.
23.4 - 24.0	7.1 - 7.3	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Light gray; gravel 60%, subangular to subrounded, fine to coarse sand 25%, silt 15%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 10.4 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
24.0 - 24.6	7.3 - 7.5	**SILT, SANDY, GRAVELLY (SM)**: Light orangish-gray; silt and clay 50%, subangular to subrounded, fine to coarse sand 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 4.6 cm. Non-lithified. Very dense. Slightly cohesive. Dry. Gap graded. Reaction to acid: weak to moderate.
24.6 - 29.0	7.5 - 8.8	**GRAVEL, SANDY, SILTY (GM)**: Very light pinkish-gray to white; gravel 55%, subangular to subrounded, fine to coarse sand 25%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 10.4 cm. Weakly lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
29.0 - 39.0	8.8 - 11.9	**GRAVEL, SANDY, SILTY (GM)**: Very light gray to white; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt 30%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.8 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cementation and chunks of caliche.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
39.0 - 42.5	11.9 - 13.0	**GRAVEL, SANDY, SILTY (GM)**: Very light pinkish-gray to white; gravel 50%, subangular to subrounded, fine to coarse sand 25%, silt 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.5 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cementation and chunks of caliche.
42.5 - 45.0	13.0 - 13.7	**SILT, GRAVELLY, SANDY (SM)**: Very light pinkish-gray; silt 40%, gravel 30%, subangular to subrounded, fine to coarse sand 30%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.4 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Gap graded. Reaction to acid: very strong. Abundant carbonate cementation and chunks of caliche ; 44.5-45.0 ft - zone of white silt.
45.0 - 51.9	13.7 - 15.8	**GRAVEL, SANDY, SILTY (GM)**: Very light gray; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.5 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cementation and chunks of caliche.
51.9 - 52.9	15.8 - 16.1	**GRAVEL AND SAND, SILTY (GM)**: Light orangish-gray; gravel 45%, subangular to subrounded, fine to coarse sand 35%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel up to 5.5 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: strong. Some carbonate cemented matrix chips.
52.9 - 57.0	16.1 - 17.4	**GRAVEL, SANDY, SILTY (GM)**: Very light gray to white; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt 20%. Gravel fraction: subangular to subrounded gravel up to 7.0 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Some chunks of caliche.
57.0 - 58.0	17.4 - 17.7	**GRAVEL, SANDY, SILTY (GM)**: Light orangish-gray; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt and clay 30%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Some carbonate cementation and chunks of caliche.
58.0 - 65.0	17.7 - 19.8	**SILT, SANDY, GRAVELLY (SM)**: Very light yellowish-gray to white; silt and clay 50%, subangular to subrounded, fine to medium sand 30%, gravel 20%. Gravel fraction: gravel including trace cobbles up to 10.0 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Gap graded. Reaction to acid: very strong. Some carbonate cementation and chunks of caliche; 58.0-58.2 ft - zone of gray silt.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
65.0 - 85.2	19.8 - 26.0	**GRAVEL, SANDY, SILTY (GM)**: Very light yellowish-gray to white; gravel 45%, subangular to subrounded, fine to coarse sand 30%, silt and clay 25%. Gravel fraction: gravel including <10% cobbles up to 11.6 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Some chunks of caliche. 75.5-75.7 ft - small zone of altered diabase clasts with serpentine and epidote.
85.2 - 89.7	26.0 - 27.3	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Very light gray; gravel 55%, subangular to subrounded, fine to coarse sand 30%, silt 15%. Gravel fraction: gravel including <10% cobbles up to 11.6 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong to very strong. Some chunks of caliche.
89.7 - 90.5	27.3 - 27.6	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Light greenish-gray to very light brown; gravel 50%, subangular, fine to coarse sand 35%, silt and clay 15%. Gravel fraction: subangular gravel up to 3.0 cm. Weakly lithified. Very dense. Slightly cohesive. Slightly moist (contaminated?). Well graded. Reaction to acid: weak to moderate. Very thin (1mm) dark clay layer seen on a couple of chips.
90.5 - 92.4	27.6 - 28.2	**GRAVEL AND SAND, SILTY (GM)**: Very light gray to light orangish-brown; gravel 40%, subangular to subrounded, fine to coarse sand 35%, silt 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 11.9 cm. Non to weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very weak.
92.4 - 95.2	28.2 - 29.0	**SILT, SANDY, GRAVELLY (SM)**: Grayish-brown; silt 40%, subangular to subrounded, fine to coarse sand 32%, gravel 28%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very weak. 93.1 to 93.5 ft - orangish-brown color.
95.2 - 100.7	29.0 - 30.7	**SILT, SANDY, SOME GRAVEL (ML)**: Very light gray to white; silt and clay 60%, subangular to subrounded, fine to coarse sand 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.5 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
100.7 - 107.0	30.7 - 32.6	**SAND AND SILT, GRAVELLY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 40%, silt and clay 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.3 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
107.0 - 111.1	32.6 - 33.9	**GRAVEL, SANDY, SILTY (GM)**: Very light gray; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 13.1 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
111.1 - 112.5	33.9 - 34.3	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: strong.
112.5 - 115.4	34.3 - 35.2	**SAND AND SILT, GRAVELLY (SM)**: Very light yellowish-gray to light gray; subangular to subrounded, fine to coarse sand 45%, silt and clay 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.7 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
115.4 - 121.0	35.2 - 36.9	**GRAVEL, SANDY, SILTY (GM)**: Very light yellowish-gray; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt and clay 30%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 13.7 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
121.0 - 123.9	36.9 - 37.8	**SAND, GRAVELLY, SILTY (SM)**: Very light yellowish-gray; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
123.9 - 124.8	37.8 - 38.0	**SILT, SANDY, TRACE GRAVEL (ML)**: Very light gray; silt and clay 65%, subangular to subrounded, fine to coarse sand 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
124.8 - 126.9	38.0 - 38.7	**GRAVEL, SANDY, SILTY (GM)**: Very light gray; gravel 45%, subangular to subrounded, fine to coarse sand 30%, silt and clay 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.8 cm. Non-lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
126.9 - 127.5	38.7 - 38.9	**SILT AND SAND, TRACE GRAVEL (ML)**: Orangish-brown; silt and clay 55%, subangular to subrounded, fine to coarse sand 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 11.6 cm. Weakly lithified. Very dense. Slightly cohesive. Dry. Gap graded. Reaction to acid: very strong.
127.5 - 130.4	38.9 - 39.7	**GRAVEL, SANDY, SILTY (GM)**: Very light yellowish-gray; gravel 40%, subangular to subrounded, fine to coarse sand 30%, silt 30%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 10.4 cm. Non-lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong to very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
130.4 - 133.9	39.7 - 40.8	**SILT AND SAND, TRACE GRAVEL (ML)**: Grayish-brown; silt 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.6 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cemented chips and some caliche chunks; white layer of powdered caliche 131.3 - 131.5 ft.
133.9 - 140.6	40.8 - 42.9	**SAND AND SILT, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 45%, silt 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.1 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cemented chips.
140.6 - 143.5	42.9 - 43.7	**SAND AND SILT, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 8.2 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant carbonate cemented chips.
143.5 - 149.8	43.7 - 45.7	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.8 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Gap graded. Reaction to acid: strong. Abundant carbonate cemented chips.
149.8 - 155.0	45.7 - 47.2	**SAND AND SILT, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 8.5 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong. Abundant carbonate cemented chips.
155.0 - 156.6	47.2 - 47.7	**GRAVEL AND SILT, SANDY (GM)**: Light brownish-gray; gravel 35%, silt 35%, subangular to subrounded, fine to coarse sand 30%. Gravel fraction: subangular to subrounded gravel including cobbles up to 10.1 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: moderate. Some carbonate cemented chips.
156.6 - 166.4	47.7 - 50.7	**SAND AND SILT, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 45%, silt and clay 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Abundant carbonate cemented chip.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level — DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E — BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
166.4 - 167.2	50.7 - 51.0	**SILT AND SAND, GRAVELLY (SM)**: Light gray; silt and clay 40%, subangular to subrounded, fine to coarse sand 35%, gravel 25%. Gravel fraction: subrounded gravel including 10% cobbles up to 9.7 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Gap graded. Reaction to acid: very strong. Abundant carbonate cemented chip.
167.2 - 168.9	51.0 - 51.5	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 2.4 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong.
168.9 - 175.7	51.5 - 53.6	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray to light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. 172.0 - 172.5 more carbonate; sand composed mostly of decomposed granodiorite.
175.7 - 177.2	53.6 - 54.0	**SAND, GRAVELLY, SILTY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt and clay 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 10.7 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong.
177.2 - 189.8	54.0 - 57.9	**SAND AND SILT, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 45%, silt and clay 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 14.0 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong to very strong. 179.5 - 180.0 ft - basalt boulder; sample from 186.5 - 190.0 ft was disturbed and possibly homogenized due to recovery issues.
189.8 - 191.6	57.9 - 58.4	**SAND, GRAVELLY, SILTY (SM)**: Very light grayish-brown; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 11.6 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Some well cemented chunks - not carbonate; sand fraction mostly decomposed granodiorite. Sample from 186.5 - 190.0 ft was disturbed and possibly homogenized due to recovery issues.
191.6 - 192.2	58.4 - 58.6	**SILT AND GRAVEL, SANDY (GM)**: White; silt and clay 40%, gravel 35%, subangular to subrounded, very fine to medium sand 25%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 14.3 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Slightly moist. Gap graded. Reaction to acid: very strong. Some well cemented chunks - not carbonate; sand fraction mostly decomposed granodiorite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
192.2 - 200.0	58.6 - 61.0	**SAND, SILTY, GRAVELLY (SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 11.3 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate. Sand fraction mostly decomposed granodiorite.
200.0 - 220.2	61.0 - 67.1	**SAND, GRAVELLY, SILTY (SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 9.4 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate. White powdered carbonate 213.1 - 213.8 ft; mm-scale fine layer with more clay at ~220.0 ft; sand fraction mostly decomposed granodiorite. Granodiorite boulder 204.5 - 205.0 ft; large cobble of amygdaloidal scoria at 215.7 ft.
220.2 - 225.9	67.1 - 68.9	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray to very light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 22.3 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong to very strong. Some carbonate cemented chips; sand fraction mostly decomposed granodiorite.
225.9 - 226.5	68.9 - 69.0	**SAND AND SILT, GRAVELLY (SM)**: Very light pinkish-gray; subangular to subrounded, fine to coarse sand 35%, silt and clay 35%, gravel 30%. Gravel fraction: subangular to subrounded gravel including 10% cobbles. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Carbonate cementation; well cemented solid core 225.5 - 226.2 ft; sand fraction mostly decomposed granodiorite.
226.5 - 228.0	69.0 - 69.5	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light brownish-gray; subangular to subrounded, fine to coarse sand 60%, silt and clay 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 2.7 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Some carbonate cementation; sand fraction mostly decomposed granodiorite.
228.0 - 229.8	69.5 - 70.0	**SILT, SANDY, GRAVELLY (SM)**: Very light gray; silt and clay 50%, subangular to subrounded, fine to coarse sand 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 19.2 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Some carbonate cementation; sand fraction mostly decomposed granodiorite. Boulder of schist at 229.8 ft.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear | LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level | DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E | BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
229.8 - 244.7	70.0 - 74.6	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 12.5 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. White powdered carbonate 231.1 - 231.4 ft; some carbonate cemented chips; sand fraction mostly decomposed granodiorite. Boulder of granodiorite at 243.3 ft; more silt around boulders (could just be rock-flour).
244.7 - 253.4	74.6 - 77.2	**SAND, GRAVELLY, SILTY (SM)**: Very light brownish-gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 13.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Well cemented chunks; sand fraction mostly decomposed granodiorite.
253.4 - 254.1	77.2 - 77.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 60%, silt and clay 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 6.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Well cemented chunks; sand fraction mostly decomposed granodiorite.
254.1 - 255.3	77.4 - 77.8	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 14.3 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Well cemented chunks; sand fraction mostly decomposed granodiorite.
255.3 - 256.6	77.8 - 78.2	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 70%, silt 30%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Abundant well cemented chunks; sand fraction mostly decomposed granodiorite.
256.6 - 258.3	78.2 - 78.7	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 60%, silt 25%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 21.6 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant moderately and well cemented chunks; sand fraction mostly decomposed granodiorite.
258.3 - 260.9	78.7 - 79.5	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 55%, silt 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 17.7 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks; sand fraction mostly decomposed granodiorite.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
260.9 - 263.0	79.5 - 80.2	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 65%, silt 25%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 3.4 cm. Well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand fraction mostly decomposed granodiorite.
263.0 - 268.3	80.2 - 81.8	**SAND, SILTY, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt 25%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 9.4 cm. Well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks; sand fraction mostly decomposed granodiorite.
268.3 - 270.6	81.8 - 82.5	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light brownish-gray; subangular to subrounded, fine to coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 15.2 cm. Well lithified. Very dense. Very slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks; sand fraction mostly decomposed granodiorite.
270.6 - 281.8	82.5 - 85.9	**SAND AND SILT, SOME GRAVEL (SM)**: Very light gray to white; subangular to subrounded, fine to coarse sand 50%, silt and clay 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.1 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Some moderately to well cemented chips. Boulder of granodiorite at 271.4 and 276.5 ft, large cobble of tuff at 279.0 ft; sand fraction mostly decomposed granodiorite.
281.8 - 293.4	85.9 - 89.4	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 50%, silt and clay 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.4 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate. Abundant moderately cemented chips; sand fraction mostly decomposed granodiorite.
293.4 - 294.5	89.4 - 89.8	**SILT AND GRAVEL, SANDY (GM)**: Very light gray to white; silt and clay 45%, gravel 35%, subangular to subrounded, fine to coarse sand 20%. Gravel fraction: subangular to subrounded gravel including 35% cobbles up to 15.2 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Gap graded. Reaction to acid: very strong.
294.5 - 297.1	89.8 - 90.6	**SAND, SILTY, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate. Some moderately cemented chips.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
297.1 - 298.5	90.6 - 91.0	**SAND AND SILT, TRACE GRAVEL (SM)**: Light pinkish-gray to light brownish-gray; subangular to subrounded, fine to coarse sand 60%, silt and clay 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Some moderately and well cemented chips.
298.5 - 299.7	91.0 - 91.3	**SAND AND SILT, SOME GRAVEL (SM)**: Light yellowish-brown; subangular to subrounded, fine to coarse sand 50%, silt and clay 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: weak. Abundant chips with mm-scale fines layer with more clay.
299.7 - 307.2	91.3 - 93.6	**SAND, SILTY, SOME GRAVEL (SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 60%, silt and clay 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.0 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: weak to moderate. Light gray color 301.0 - 301.4 ft; abundant moderately cemented chips; light gray color and increase in fine-fraction usually around boulders (rock flour).
307.2 - 318.5	93.6 - 97.1	**SAND, SILTY, GRAVELLY (SM)**: Very light yellowish-gray to white; subangular to subrounded, fine to coarse sand 45%, silt and clay 30%, gravel 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Some moderately cemented chunks; sand composed mostly of decomposed granodiorite. Boulder of granodiorite at 311.31 and 316.5 ft.
318.5 - 329.2	97.1 - 100.3	**SAND AND SILT, SOME GRAVEL (SM)**: Very light gray to light grayish-brown; subangular to subrounded, fine to coarse sand 50%, silt and clay 40%, gravel 10%. Gravel fraction: subrounded gravel including 10% cobbles up to 18.6 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Gap graded. Reaction to acid: moderate to strong. Some moderately to well cemented chunks; sand composed mostly of decomposed granodiorite. Boulder of granodiorite at 325.6 ft.
329.2 - 330.0	100.3 - 100.6	**SILT AND SAND, TRACE GRAVEL (SM)**: Very light gray; silt and clay 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: subrounded gravel up to 3.7 cm. Moderately lithified. Very dense. Slightly cohesive. Slightly moist. Gap graded. Reaction to acid: very strong. Sand composed mostly of decomposed granodiorite.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
330.0 - 339.5	100.6 - 103.5	**SAND AND SILT, SOME GRAVEL (SM)**: Very light gray to very light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 15.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite. Boulder of granodiorite at 333.2 and 335.0 ft.
339.5 - 343.8	103.5 - 104.8	**GRAVEL AND SILT, SANDY (GM)**: Light gray; gravel 35%, silt and clay 35%, subangular to subrounded, fine to coarse sand 30%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 13.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite. Boulder of altered diorite with well cemented matrix on it.
348.3 - 349.7	106.2 - 106.6	**SAND AND SILT, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 11.0 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite.
349.7 - 356.7	106.6 - 108.7	**SAND, SILTY, GRAVELLY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 11.6 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite. Boulder of granodiorite at 352.8 ft.
356.7 - 359.6	108.7 - 109.6	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray to pinkish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 10.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite.
359.6 - 360.3	109.6 - 109.8	**SAND, GRAVELLY, SILTY (SM)**: Pinkish-brown; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel up to 6.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks; sand composed mostly of decomposed granodiorite.
360.3 - 363.9	109.8 - 110.9	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray to pinkish-gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 14.0 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Sand composed mostly of decomposed granodiorite. Boulder of granodiorite at 360.3 ft.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
363.9 - 364.6	110.9 - 111.1	**SILT, SANDY, TRACE GRAVEL (ML)**: Gray; silt and clay 70%, subangular to subrounded, very fine to medium sand 30%, trace gravel. Gravel fraction: subrounded gravel up to 2.4 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Slightly moist. Poorly graded. Reaction to acid: weak.
364.6 - 370.5	111.1 - 112.9	**SAND, SILTY, GRAVELLY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt and clay 25%, gravel 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 8.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong.
370.5 - 389.7	112.9 - 118.8	**SAND, SILTY, GRAVELLY (SM)**: Light brownish-gray to light gray; subangular to subrounded, fine to coarse sand 45%, silt and clay 30%, gravel 25%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 12.8 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks. Boulder of tuff at 372.5; boulder of granodiorite at 373.8, 375.7, 377.1, 380.9, 383.0, 389.0, and from 385.8 - 387.0 ft.
389.7 - 399.5	118.8 - 121.8	**SAND, SILTY, GRAVELLY (SM)**: Pinkish-gray to light gray; subangular to subrounded coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 12.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Some well cemented chunks; sand composed mostly of granodiorite and some tuff. Boulder of granodiorite 390.9 - 392.2 ft.
399.5 - 401.5	121.8 - 122.4	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 15.2 cm. Very Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Very well cemented solid core. More iron oxide on clasts.
401.5 - 419.3	122.4 - 127.8	**SAND, SILTY, GRAVELLY (SM)**: Very light brownish-gray to white; subangular to subrounded coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 11.0 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant very well cemented chunks and zone from 407.0 - 407.5 ft; a lot of silt could be rock flour.
419.3 - 420.2	127.8 - 128.1	**SAND, SILTY, TRACE GRAVEL (SM)**: Very light gray; subangular coarse sand 65%, silt 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 1.5 cm. Very Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Very well cemented solid core; fine-fraction almost all carbonate.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
420.2 - 424.1	128.1 - 129.3	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray to very light gray; subangular coarse sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks.
424.1 - 425.0	129.3 - 129.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Very light gray; subangular coarse sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.1 cm. Very Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Very well cemented solid core; fine-fraction mostly carbonate.
425.0 - 429.1	129.5 - 130.8	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray to very light gray; subangular coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.5 cm. Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks.
429.1 - 431.8	130.8 - 131.6	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray to white; subangular coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 13.4 cm. Very Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Mostly very well cemented solid core; fine-fraction almost all powdered carbonate.
431.8 - 434.0	131.6 - 132.3	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brownish-gray; subangular coarse sand 65%, silt 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 5.8 cm. Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks.
434.0 - 436.0	132.3 - 132.9	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray; subangular coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.2 cm. Well to very well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Mostly very well cemented solid core.
436.0 - 437.8	132.9 - 133.4	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brownish-gray; subangular coarse sand 70%, silt 30%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 2.7 cm. Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks.
437.8 - 443.4	133.4 - 135.1	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray; subangular coarse sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 11.0 cm. Very Well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: strong. Mostly very well cemented solid core; fine-fraction mostly carbonate.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
443.4 - 461.1	135.1 - 140.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Very light brownish-gray to very light gray; subangular coarse sand 65%, silt 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 19.2 cm. Well to very well lithified. Very dense. Non-cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Abundant well cemented chunks and occasional zones of very well cemented solid core (447.0 - 447.5, 450 - 451, 456.8 - 452.5 ft); much more actual silt in fine-fraction. Boulder of granodiorite at 451.2, 454.0, and 458.3 ft; boulder of schist at 448.3 ft.
461.1 - 470.2	140.5 - 143.3	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brown; subangular, fine to medium sand 50%, silt and clay 45%, gravel 5%. Gravel fraction: subangular gravel including trace cobbles up to 10.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Uniformly graded. Reaction to acid: moderate to strong. Abundant well cemented chunks and occasional zones of very well cemented solid core.
470.2 - 480.0	143.3 - 146.3	**SAND, SILTY, SOME GRAVEL (SM)**: Very light brown to very light gray; subangular, fine to coarse sand 60%, silt and clay 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional zones of very well cemented solid core. Boulder of granodiorite at 473.9 and 478.9 ft.
480.0 - 485.5	146.3 - 148.0	**SAND AND SILT, GRAVELLY (SM)**: Very light brown to very light gray; subangular, fine to coarse sand 40%, silt and clay 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 16.2 cm. Very Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Very well cemented solid core. Common granodiorite boulders.
485.5 - 490.3	148.0 - 149.4	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brownish-gray; subangular, fine to coarse sand 45%, silt and clay 45%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks.
490.3 - 495.1	149.4 - 150.9	**SAND AND SILT, TRACE GRAVEL (SM)**: Brown and light brown; subangular, fine to coarse sand 60%, silt and clay 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 6.4 cm. Well lithified. Very dense. Slightly cohesive. Very moist. Well graded. Reaction to acid: moderate to strong. Abundant well cemented chunks.
495.1 - 498.7	150.9 - 152.0	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brown; subangular, fine to coarse sand 45%, silt and clay 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 15.8 cm. Moderately to well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Some well cemented chunks. Some granodiorite boulders.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
498.7 - 500.0	152.0 - 152.4	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brown; subangular, fine to coarse sand 65%, silt and clay 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: moderate to strong. Abundant well cemented chunks.
500.0 - 509.7	152.4 - 155.4	**SILT AND SAND, SOME GRAVEL (SM)**: Brown to light brown; silt and clay 45%, subangular, fine to coarse sand 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 18.6 cm. Well to very well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional very well cemented solid core. Common granodiorite boulders.
509.7 - 520.0	155.4 - 158.5	**SILT AND SAND, SOME GRAVEL (SM)**: Pinkish-brown; silt and clay 50%, subangular, fine to coarse sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 5.5 cm. Very Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional very well cemented solid core.
520.0 - 532.5	158.5 - 162.3	**GRAVEL, SILTY, SOME SAND (GM)**: Light brown to brown; gravel 55%, silt and clay 30%, subangular, fine to coarse sand 15%. Gravel fraction: subangular to subrounded gravel including 50% boulders and cobbles up to 64.0 cm. Well to very well lithified. Very dense. Slightly cohesive. Slightly moist to moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks and occasional very well cemented solid core. Broken up basalt boulder with calcite amygdules from 525.0-526.6 ft.
532.5 - 533.7	162.3 - 162.7	**SILT AND SAND, TRACE GRAVEL (SM)**: Brown; silt and clay 50%, subangular, fine to coarse sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 2.4 cm. Moderately lithified. Very dense. Slightly cohesive. Wet. Well graded. Reaction to acid: very strong.
533.7 - 538.5	162.7 - 164.1	**SAND AND SILT, TRACE GRAVEL (SM)**: Reddish-brown; subangular, fine to coarse sand 55%, silt and clay 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 3.3 cm. Well to very well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks and occasional very well cemented solid core.
538.5 - 544.8	164.1 - 166.1	**SILT AND SAND, GRAVELLY (SM)**: Pinkish-brown; silt and clay 40%, subangular, fine to coarse sand 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including 20% boulders and cobbles up to 14.0 cm. Well to very well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks and occasional very well cemented solid core. Iron oxide and calcite amygdules common on basalt.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
544.8 - 562.9	166.1 - 171.6	**SAND AND SILT, TRACE GRAVEL (SM)**: Pinkish-brown; subangular, fine to coarse sand 55%, silt and clay 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: very strong. Abundant well cemented chunks.
562.9 - 568.1	171.6 - 173.2	**GRAVEL, SANDY, SILTY (GM)**: Pinkish-brown to brown; gravel 50%, subangular to subrounded, fine to coarse sand 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including 40% boulders and cobbles up to 54.9 cm. Well lithified. Very dense. Slightly to moderately cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional very well cemented solid core. Abundant boulders of mostly basalt.
568.1 - 574.7	173.2 - 175.2	**SAND AND SILT, GRAVELLY (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 35%, silt and clay 35%, gravel 30%. Gravel fraction: subangular to subrounded gravel including 10% boulders and cobbles up to 18.6 cm. Well to very well lithified. Very dense. Slightly to moderately cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional very well cemented solid core.
574.7 - 583.5	175.2 - 177.9	**SAND AND SILT, TRACE GRAVEL (SM)**: Reddish-brown to brown; subangular to subrounded, fine to coarse sand 50%, silt and clay 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 6.1 cm. Well lithified. Very dense. Slightly to moderately cohesive. Disturbed - wet. Well graded. Reaction to acid: strong. Abundant well cemented chunks. Amygdaloidal basalt boulder from 579.1-581.0 ft.
583.5 - 597.5	177.9 - 182.1	**SAND, SILTY, SOME GRAVEL (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 55%, silt and clay 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 14.6 cm. Well to very well lithified. Very dense. Slightly cohesive. Slightly moist. Well graded. Reaction to acid: strong. Abundant well cemented chunks and occasional very well cemented solid core.

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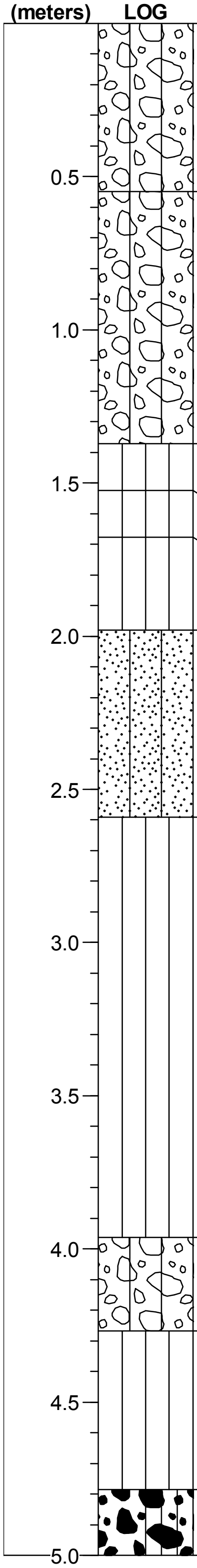
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; dry; well graded; loose	
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; dry; well graded; loose	
SILT, SANDY, SOME GRAVEL (ML)	15 / 25 / 60	Weakly lithified; very slightly to slightly cohesive; dry; gap graded; compact	
SILT, SANDY, GRAVELLY (ML)	20 / 25 / 55	Non-lithified; non-cohesive; dry; gap graded; compact	4 / 24 / 50 (2")
SILT, SANDY, SOME GRAVEL (ML)	15 / 25 / 60	Weakly lithified; very slightly cohesive; dry; gap graded; compact	
SILT, GRAVELLY, SANDY (SM)	30 / 30 / 40	Non-lithified; non-cohesive; dry; gap graded; compact	
SILT, SANDY, TRACE GRAVEL (ML)	5 / 30 / 65	Non-lithified; very slightly cohesive; dry; gap graded; compact	1 / 5 / 9 / 9 / 11 / 9 (3")
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Non-lithified; non-cohesive; dry; well graded; compact	
SILT, GRAVELLY, SANDY (ML)	20 / 20 / 60	Non-lithified; non-cohesive; dry; gap graded; dense	7 / 10 / 13 / 18 / 16 / 19 (3")
GRAVEL, SANDY, SOME	55 / 30 / 15	Non-lithified; non-cohesive; dry; well graded; dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
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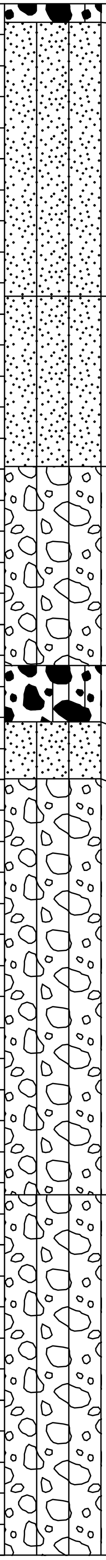
BOREHOLE DIAMETER: 8-inches



DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT (GW-GM)			
5.5		GRAVEL AND SAND, SILTY (SM)	40 / 40 / 20	Non-lithified; non-cohesive; dry; well graded; compact	
6.0		SILT AND SAND, SOME GRAVEL (SM)	15 / 35 / 50	Weakly lithified; slightly cohesive; dry; well graded; very dense	9 / 14 / 13 / 20 / 19 / 30 (3")
6.5 7.0		GRAVEL, SANDY, SILTY (GM)	50 / 25 / 25	Non-lithified; very slightly cohesive; dry; well graded; very dense	
		GRAVEL, SANDY, SOME SILT (GW-GM)	60 / 25 / 15	Non-lithified; non-cohesive; dry; well graded; very dense	
		SILT, SANDY, GRAVELLY (SM)	20 / 30 / 50	Non-lithified; slightly cohesive; dry; gap graded; very dense	
7.5 8.0 8.5		GRAVEL, SANDY, SILTY (GM)	55 / 25 / 20	Weakly lithified; slightly cohesive; dry; well graded; very dense	5 / 34 (0.5")
9.0 9.5 10.0					2 / 4 / 11 / 27 (0.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5 11.0 11.5		**GRAVEL, SANDY, SILTY (GM)**	40 / 30 / 30	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	50 (3")
12.0 12.5		**GRAVEL, SANDY, SILTY (GM)**	50 / 25 / 25	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	5 / 50 (1")
13.0 13.5		**SILT, GRAVELLY, SANDY (SM)**	30 / 30 / 40	Moderately to well lithified; very slightly cohesive; dry; gap graded; very dense	
14.0 14.5 15.0		**GRAVEL, SANDY, SILTY (GM)**	50 / 30 / 20	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	50 (2.75")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5					37 (3")
16.0		**GRAVEL AND SAND, SILTY (GM)**	45 / 35 / 20	Moderately lithified; slightly cohesive; dry; well graded; very dense	
16.5 17.0		**GRAVEL, SANDY, SILTY (GM)**	50 / 30 / 20	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	2 / 37 (3")
17.5		**GRAVEL, SANDY, SILTY (GM)**	40 / 30 / 30	Moderately to well lithified; slightly cohesive; dry; well graded; very dense	
18.0 18.5 19.0 19.5		**SILT, SANDY, GRAVELLY (SM)**	20 / 30 / 50	Moderately to well lithified; slightly cohesive; dry; gap graded; very dense	33 (2")
20.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
20.5					
21.0					
					37 (3")
21.5					
22.0					
22.5					
23.0		**GRAVEL, SANDY, SILTY (GM)**	45 / 30 / 25	Moderately to well lithified; slightly cohesive; dry; well graded; very dense; 75.5-75.7 ft - small zone of altered diabase clasts with serpentine and epidote	
23.5					
24.0					
					50 (2.75")
24.5					
25.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5					
26.0 26.5 27.0		**GRAVEL, SANDY, SOME SILT (GW-GM)**	55 / 30 / 15	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
27.5		**GRAVEL AND SAND, SOME SILT (GW-GM)**	50 / 35 / 15	Weakly lithified; slightly cohesive; slightly moist (contaminated?); well graded; very dense	7 / 39 (2.75")
28.0		**GRAVEL AND SAND, SILTY (GM)**	40 / 35 / 25	Non to weakly lithified; non-cohesive; dry; well graded; very dense	
28.5		**SILT, SANDY, GRAVELLY (SM)**	28 / 32 / 40	Non-lithified; non-cohesive; dry; well graded; very dense	
29.0 29.5 30.0		**SILT, SANDY, SOME GRAVEL (ML)**	10 / 30 / 60	Moderately to well lithified; slightly cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
30.5					
31.0 31.5 32.0 32.5		**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Moderately lithified; slightly cohesive; dry; well graded; very dense	
33.0 33.5		**GRAVEL, SANDY, SILTY (GM)**	50 / 30 / 20	Moderately lithified; slightly cohesive; dry; well graded; very dense	36 (2.8")
34.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 55 / 35	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
34.5 35.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

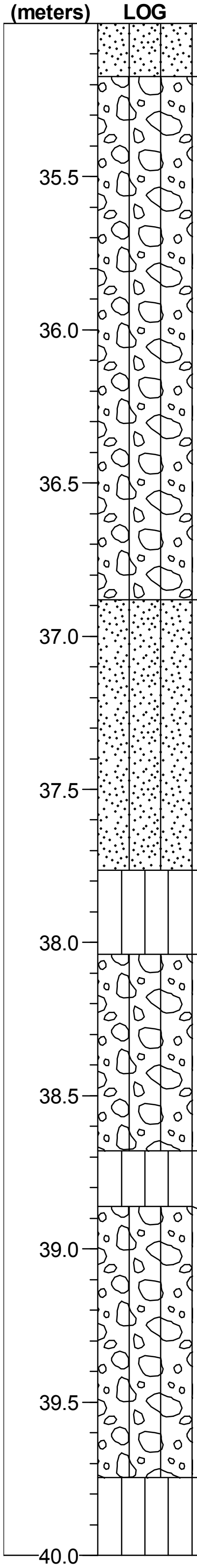
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
GRAVEL, SANDY, SILTY (GM)	40 / 30 / 30	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
SILT, SANDY, TRACE GRAVEL (ML)	5 / 30 / 65	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
GRAVEL, SANDY, SILTY (GM)	45 / 30 / 25	Non-lithified; slightly cohesive; dry; well graded; very dense	
SILT AND SAND, TRACE GRAVEL (ML)	5 / 40 / 55	Weakly lithified; slightly cohesive; dry; gap graded; very dense	
GRAVEL, SANDY, SILTY (GM)	40 / 30 / 30	Non-lithified; very slightly cohesive; dry; well graded; very dense	3 / 6 / 35 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
40.5	▥	**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 35 / 60	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
41.0 41.5 42.0 42.5	░	**SAND AND SILT, SOME GRAVEL (SM)**	15 / 45 / 40	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
43.0 43.5	░	**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
44.0 44.5 45.0	░	**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 50 / 45	Moderately to well lithified; very slightly cohesive; dry; gap graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
45.5					
46.0 46.5 47.0		**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	11 / 18 / 34 (1")
47.5		**GRAVEL AND SILT, SANDY (GM)**	35 / 30 / 35	Moderately lithified; very slightly cohesive; dry; well graded; very dense	
48.0 48.5 49.0 49.5 50.0		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 45 / 40	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
50.5					
		SILT AND SAND, GRAVELLY (SM)	25 / 35 / 40	Moderately to well lithified; slightly cohesive; slightly moist; gap graded; very dense	
51.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 50 / 45	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
51.5 52.0 52.5 53.0 53.5		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	39 (2.5")
		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
54.0 54.5 55.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
55.5 56.0 56.5 57.0 57.5		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Weakly to moderately lithified; slightly cohesive; slightly moist; well graded; very dense; 179.5 - 180.0 ft - basalt boulder; sample from 186.5 - 190.0 ft was disturbed and possibly homogenized due to recovery issues	
58.0		**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; sample from 186.5 - 190.0 ft was disturbed and possibly homogenized due to recovery issues	
58.5		**SILT AND GRAVEL, SANDY (GM)**	35 / 25 / 40	Weakly to moderately lithified; slightly cohesive; slightly moist; gap graded; very dense	
59.0 59.5 60.0		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Moderately lithified; slightly cohesive; slightly moist; well graded; very dense	25 (1.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
60.5					
61.0					
61.5					
62.0					
62.5					
63.0					
63.5					
64.0		**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; granodiorite boulder 204.5 - 205.0 ft; large cobble of amygdaloidal scoria at 215.7 ft	
64.5					
65.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
65.5					
					31 (2")
66.0					
66.5					
67.0					
67.5					
68.0		SAND, SILTY, SOME GRAVEL (SM)	15 / 55 / 30	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
68.5					
69.0		SAND AND SILT, GRAVELLY (SM)	30 / 35 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
		SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
69.5					
		SILT, SANDY, GRAVELLY (SM)	20 / 30 / 50	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of schist at 229.8 ft	
70.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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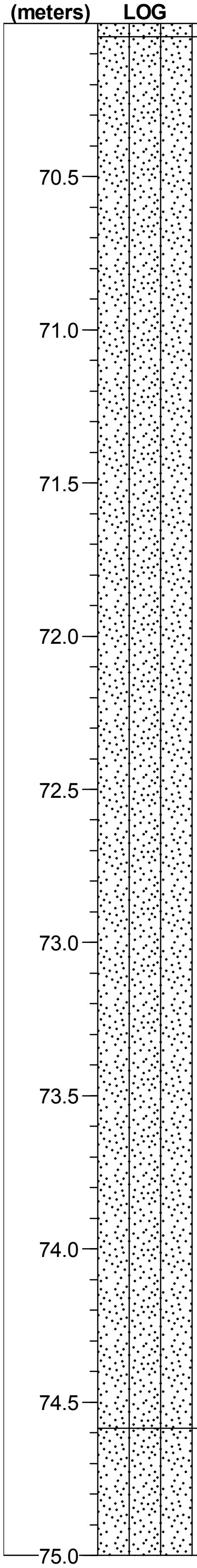
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level — DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E — BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND, SILTY, SOME GRAVEL (SM)	15 / 55 / 30	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 243.3 ft; more silt around boulders (could just be rock-flour)	27 (1.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
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BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
75.5 76.0 76.5 77.0		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
		SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
77.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense	27 (1.75")
78.0		**SAND, SILTY, TRACE GRAVEL (SM)**	tr / 70 / 30	Well lithified; very slightly cohesive; slightly moist; well graded; very dense	
78.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 60 / 25	Moderately to well lithified; very slightly cohesive; slightly moist; well graded; very dense	
79.0 79.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 55 / 40	Moderately to well lithified; very slightly cohesive; slightly moist; well graded; very dense	
80.0		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 65 / 25	Well lithified; very slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
80.5 81.0 81.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 55 / 25	Well lithified; very slightly cohesive; slightly moist; well graded; very dense	
82.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Well lithified; very slightly cohesive; slightly moist; well graded; very dense	
82.5 83.0 83.5 84.0 84.5 85.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 271.4 and 276.5 ft, large cobble of tuff at 279.0 ft; sand fraction mostly decomposed granodiorite	47 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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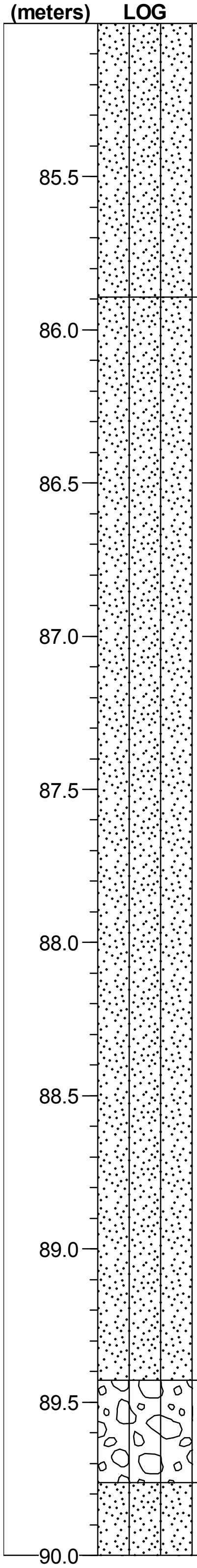
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
SILT AND GRAVEL, SANDY (GM)	35 / 20 / 45	Moderately lithified; slightly cohesive; slightly moist; gap graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
90.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Moderately lithified; slightly cohesive; slightly moist; well graded; very dense	50 (2.5")
		SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
91.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Moderately lithified; slightly cohesive; slightly moist; well graded; very dense	
91.5 92.0 92.5 93.0 93.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Moderately lithified; slightly cohesive; slightly moist; well graded; very dense	
94.0 94.5 95.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
95.5		**SAND, SILTY, GRAVELLY (SM)**	25 / 45 / 30	Moderately lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 311.31 and 316.5 ft	
96.0					
96.5					
97.0					
97.5					
98.0					
98.5					
		SAND AND SILT, SOME GRAVEL (SM)	10 / 50 / 40	Moderately to well lithified; slightly cohesive; slightly moist; gap graded; very dense; boulder of granodiorite at 325.6 ft	
99.0					
99.5					
100.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

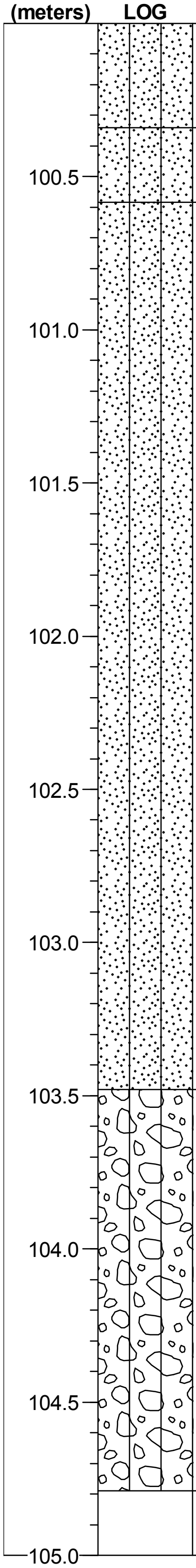
Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level — DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E — BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SILT AND SAND, TRACE GRAVEL (SM)	5 / 45 / 50	Moderately lithified; slightly cohesive; slightly moist; gap graded; very dense	
SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 333.2 and 335.0 ft	
GRAVEL AND SILT, SANDY (GM)	35 / 30 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of altered diorite with well cemented matrix on it	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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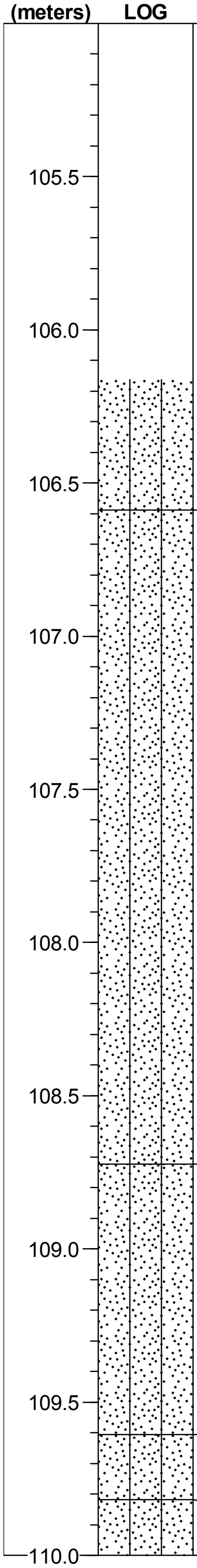
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND AND SILT, SOME GRAVEL (SM)	10 / 55 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 352.8 ft	
SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
SAND, GRAVELLY, SILTY (SM)	25 / 55 / 20	Well lithified; slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
110.5		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 50 / 35	Well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 360.3 ft	
111.0		**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 30 / 70	Weakly to moderately lithified; slightly cohesive; slightly moist; poorly graded; very dense	
111.5 112.0 112.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 55 / 25	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense	
113.0 113.5 114.0 114.5 115.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
115.5 116.0 116.5 117.0 117.5 118.0 118.5	▨	**SAND, SILTY, GRAVELLY (SM)**	25 / 45 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of tuff at 372.5; boulder of granodiorite at 373.8, 375.7, 377.1, 380.9, 383.0, 389.0, and from 385.8 - 387.0 ft	
119.0 119.5 120.0	▨				

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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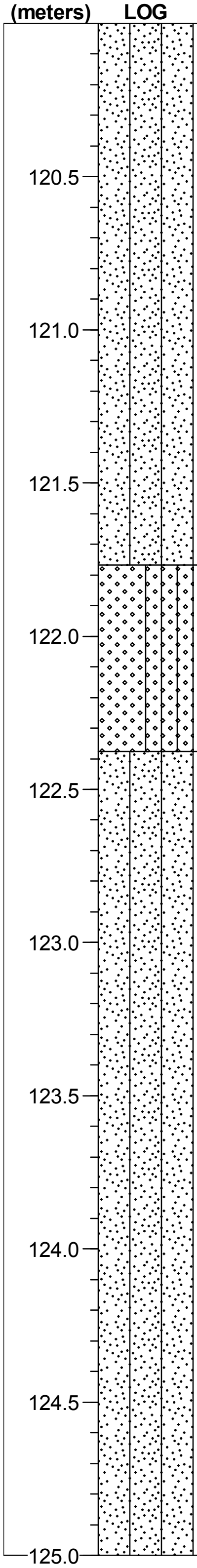
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite 390.9 - 392.2 ft	
SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 50 / 10	Very well lithified; non-cohesive; slightly moist; well graded; very dense; more iron oxide on clasts	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
125.5 126.0 126.5 127.0 127.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
128.0		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 65 / 30	Very well lithified; non-cohesive; slightly moist; well graded; very dense	
128.5 129.0		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Well lithified; non-cohesive; slightly moist; well graded; very dense	
129.5		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 75 / 20	Very well lithified; non-cohesive; slightly moist; well graded; very dense	
130.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
130.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Well lithified; non-cohesive; slightly moist; well graded; very dense	
131.0 131.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Very well lithified; non-cohesive; slightly moist; well graded; very dense	
132.0		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 65 / 30	Well lithified; non-cohesive; slightly moist; well graded; very dense	
132.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Well to very well lithified; non-cohesive; slightly moist; well graded; very dense	
133.0		**SAND, SILTY, TRACE GRAVEL (SM)**	tr / 70 / 30	Well lithified; non-cohesive; slightly moist; well graded; very dense	
133.5 134.0 134.5 135.0		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Very well lithified; non-cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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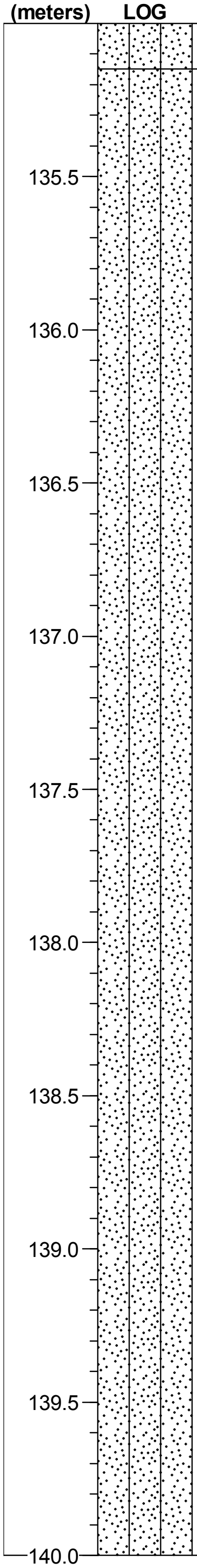
B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches



DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 65 / 30	Well to very well lithified; non-cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 451.2, 454.0, and 458.3 ft; boulder of schist at 448.3 ft	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
140.5					
141.0 141.5 142.0 142.5 143.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 50 / 45	Well lithified; slightly cohesive; slightly moist; uniformly graded; very dense	
143.5 144.0 144.5 145.0		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense; boulder of granodiorite at 473.9 and 478.9 ft	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
145.5 146.0					
146.5 147.0 147.5		**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Very well lithified; slightly cohesive; slightly moist; well graded; very dense; common granodiorite boulders	
148.0 148.5 149.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 45 / 45	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
149.5 150.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
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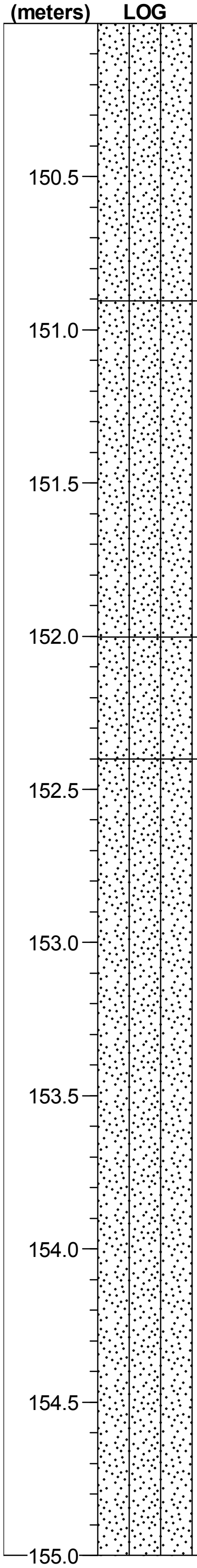
DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Well lithified; slightly cohesive; very moist; well graded; very dense	
SAND AND SILT, SOME GRAVEL (SM)	15 / 45 / 40	Moderately to well lithified; slightly cohesive; slightly moist; well graded; very dense; some granodiorite boulders	
SAND, SILTY, TRACE GRAVEL (SM)	5 / 65 / 30	Well lithified; slightly cohesive; slightly moist; well graded; very dense	
SILT AND SAND, SOME GRAVEL (SM)	15 / 40 / 45	Well to very well lithified; slightly cohesive; slightly moist; well graded; very dense; common granodiorite boulders	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level — DATE DRILLED: Mar. 6 - 25, 2012

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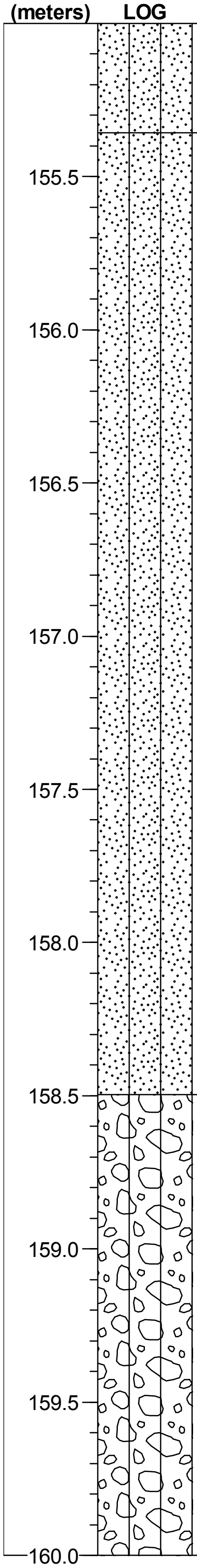

GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SILT AND SAND, SOME GRAVEL (SM)	10 / 40 / 50	Very well lithified; slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

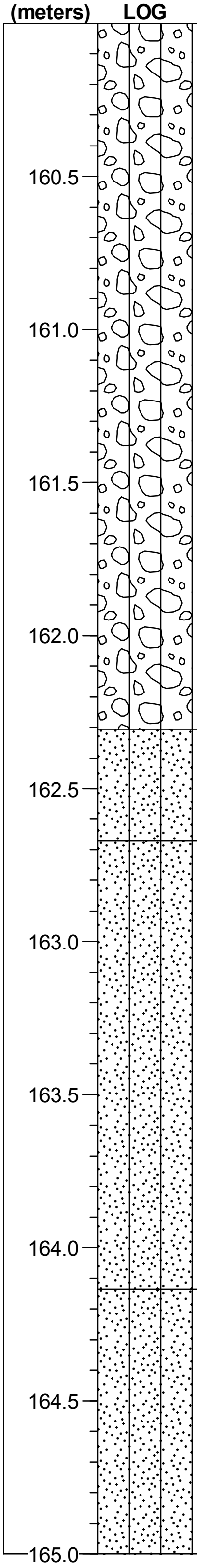
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level

DATE DRILLED: Mar. 6 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters) | GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
GRAVEL, SILTY, SOME SAND (GM)	55 / 15 / 30	Well to very well lithified; slightly cohesive; slightly moist to moist; well graded; very dense; broken up basalt boulder with calcite amygdules from 525.0-526.6 ft	
SILT AND SAND, TRACE GRAVEL (SM)	5 / 45 / 50	Moderately lithified; slightly cohesive; wet; well graded; very dense	
SAND AND SILT, TRACE GRAVEL (SM)	5 / 55 / 40	Well to very well lithified; slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
165.5 166.0		**SILT AND SAND, GRAVELLY (SM)**	25 / 35 / 40	Well to very well lithified; slightly cohesive; slightly moist; well graded; very dense; iron oxide and calcite amygdules common on basalt	
166.5 167.0 167.5 168.0 168.5 169.0 169.5 170.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 55 / 40	Well lithified; slightly cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
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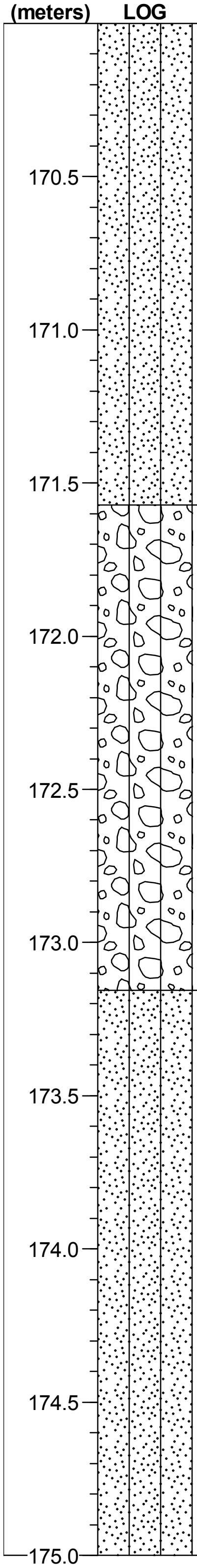
BOREHOLE DIAMETER: 8-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
GRAVEL, SANDY, SILTY (GM)	50 / 30 / 20	Well lithified; slightly to moderately cohesive; slightly moist; well graded; very dense; abundant boulders of mostly basalt	
SAND AND SILT, GRAVELLY (SM)	30 / 35 / 35	Well to very well lithified; slightly to moderately cohesive; slightly moist; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level
DATE DRILLED: Mar. 6 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)36aaa / 3675504.62N / 475028.649E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
175.5					
176.0					
176.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 50 / 45	Well lithified; slightly to moderately cohesive; disturbed - wet; well graded; very dense; amygdaloidal basalt boulder from 579.1-581.0 ft	
177.0					
177.5					
178.0					
178.5					
179.0					
179.5					
180.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-1-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM MONITOR WELL FW9-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 182.12 meters / 646.93 meters above mean sea level	DATE DRILLED: Mar. 6 - 25, 2012
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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
180.5 181.0 181.5 182.0	▒	**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Well to very well lithified; slightly cohesive; slightly moist; well graded; very dense	
182.5 183.0 183.5 184.0 184.5 185.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates & M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.45 meters / 641.61 meters above mean sea level	DATE DRILLED: Apr. 23 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches

QUATERNARY ALLUVIUM (Qal)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
0.0 - 1.1	0.0 - 0.3	**SILT, SANDY, GRAVELLY (ML)**: Light brown; silt 50%, subangular to subrounded, fine to coarse sand 30%, gravel 20%. Gravel fraction: angular to subrounded gravel. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Disturbed interval.
1.1 - 1.6	0.3 - 0.5	**SILT, SANDY, SOME GRAVEL (ML)**: Reddish-brown; silt and clay 55%, subangular to subrounded, fine to coarse sand 30%, gravel 15%. Gravel fraction: angular to subrounded gravel. Weakly lithified. Compact. Slightly cohesive. Dry. Well graded. Reaction to acid: weak. Soil horizon.
1.6 - 3.2	0.5 - 1.0	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 45%, silt 40%, gravel 15%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly lithified. Compact. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
3.2 - 14.0	1.0 - 4.3	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light brown; subangular to subrounded, fine to coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: angular to subrounded gravel including 5% cobbles up to 3.7 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
14.0 - 15.0	4.3 - 4.6	**SILT, SANDY, TRACE GRAVEL (ML)**: White; silt 65%, subangular to subrounded, fine to coarse sand 30%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly lithified. Compact to very dense. Very slightly cohesive. Dry. Reaction to acid: very strong.

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
15.0 - 35.0	4.6 - 10.7	**SAND, GRAVELLY, SILTY (SM)**: Light brown; subangular to subrounded, fine to coarse sand 45%, gravel 30%, silt 25%. Gravel fraction: angular to subrounded gravel including 5% cobbles up to 15.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
35.0 - 39.4	10.7 - 12.0	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: angular to rounded gravel including trace cobbles up to 13.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong.
39.4 - 40.5	12.0 - 12.3	**SILT AND SAND, TRACE GRAVEL (ML)**: Light gray; silt 55%, subangular to subrounded, fine to coarse sand 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Very dense. Non-cohesive. Dry. Reaction to acid: moderate to strong.
40.5 - 44.5	12.3 - 13.6	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 25%, silt 15%. Gravel fraction: angular to subrounded gravel including 5% cobbles. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates & M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.45 meters / 641.61 meters above mean sea level — DATE DRILLED: Apr. 23 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E — BOREHOLE DIAMETER: 7-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
44.5 - 47.5	13.6 - 14.5	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; angular to subrounded, fine to coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
47.5 - 51.0	14.5 - 15.5	**SAND, SILTY, GRAVELLY (SM)**: Light brown; angular to subrounded, fine to coarse sand 50%, silt and clay 30%, gravel 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
51.0 - 52.8	15.5 - 16.1	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light gray; angular to subrounded, fine to coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
52.8 - 56.0	16.1 - 17.1	**SAND, SILTY, GRAVELLY (SM)**: Light brown; angular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.1 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
56.0 - 60.0	17.1 - 18.3	**SAND AND SILT, GRAVELLY (SM)**: Very light brown; angular to subrounded, fine to coarse sand 45%, silt and clay 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: none to very strong. Carbonate chunks.
60.0 - 61.0	18.3 - 18.6	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Brown; angular to subrounded, fine to coarse sand 70%, gravel 15%, silt 15%. Gravel fraction: angular to subrounded gravel including trace cobbles. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
61.0 - 61.5	18.6 - 18.7	**SILT AND CLAY, SANDY, TRACE GRAVEL (CH)**: Reddish-brown; silt and clay 75%, angular to subrounded, fine to coarse sand 25%, trace gravel. gravel. Non-lithified. Very dense. Very cohesive. Dry. Reaction to acid: very strong. Soil horizon.
61.5 - 75.3	18.7 - 23.0	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Light gray to light brown; angular to subrounded, fine to coarse sand 50%, gravel 35%, silt 15%. Gravel fraction: angular to rounded gravel including trace cobbles. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks. Conglomerate core.
75.3 - 80.4	23.0 - 24.5	**SAND, SILTY, SOME GRAVEL (SW-SM)**: Very light brown; angular to subrounded, fine to coarse sand 60%, silt 25%, gravel 15%. Gravel fraction: angular to rounded gravel including trace cobbles up to 11.6 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: B. Bates & M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.45 meters / 641.61 meters above mean sea level
DATE DRILLED: Apr. 23 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E
BOREHOLE DIAMETER: 7-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
80.4 - 86.0	24.5 - 26.2	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light gray; angular to subrounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 13.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to very strong. Carbonate chunks.
86.0 - 90.0	26.2 - 27.4	**SAND, GRAVELLY, SILTY (SM)**: Very light gray; angular to subrounded, fine to coarse sand 50%, gravel 30%, silt and clay 20%. Gravel fraction: subangular to subrounded gravel including cobbles. Well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Conglomerate core.
90.0 - 91.5	27.4 - 27.9	**SILT AND CLAY, SANDY (CH)**: Reddish brown; silt and clay 75%, angular to subrounded, fine to coarse sand 25%. Well lithified. Very dense. Very cohesive. Dry. Reaction to acid: moderate to strong. Grades into more sand; core.
91.5 - 104.1	27.9 - 31.7	**SAND, SOME SILT (SP-SM)**: Very light brown; subangular to subrounded, fine to medium sand 90%, silt 10%. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Reaction to acid: very weak.
104.1 - 110.0	31.7 - 33.5	**SAND, SOME SILT (SM)**: Very light brown; subangular to subrounded, fine to medium sand 80%, silt 20%. Well lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: weak. Trace clay; some core.
110.0 - 120.9	33.5 - 36.9	**SAND, SILTY (SM)**: Very light brown; subangular to subrounded, fine to medium sand 75%, silt 25%. Well lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: very strong. Sand core.
120.9 - 128.3	36.9 - 39.1	**SAND, SILTY (SM)**: Very light brown; subangular to subrounded, fine to medium sand 70%, silt 30%. Well lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: very strong. Entire sample is sand core.
128.3 - 131.0	39.1 - 39.9	**SAND, SOME SILT (SM)**: Light brown; subangular to rounded, fine to medium sand 80%, silt and clay 20%. Moderately lithified. Very dense. Slightly cohesive. Dry. Reaction to acid: weak to moderate. Some core.
131.0 - 135.2	39.9 - 41.2	**SAND, SILTY (SM)**: Light brown; subangular to rounded, fine to medium sand 75%, silt and clay 25%. Well lithified. Very dense. Slightly cohesive. Dry. Reaction to acid: very strong. Core.
135.2 - 136.0	41.2 - 41.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Light grayish-brown; subangular to rounded, fine to coarse sand 75%, silt 25%, trace gravel. Gravel fraction: angular to subangular gravel up to 4.6 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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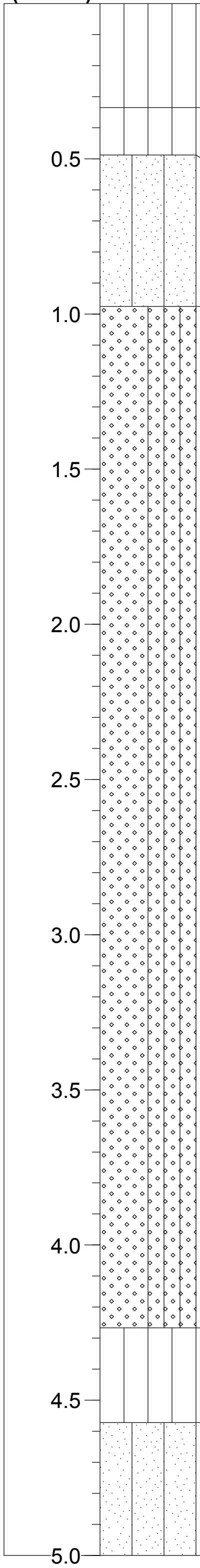
B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates & M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.45 meters / 641.61 meters above mean sea level	DATE DRILLED: Apr. 23 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SILT, SANDY, GRAVELLY (ML)	20 / 30 / 50	Non-lithified; non-cohesive; dry; well graded; compact; disturbed interval	
SILT, SANDY, SOME GRAVEL (ML)	15 / 30 / 55	Weakly lithified; slightly cohesive; dry; well graded; compact; soil horizon	
SAND AND SILT, SOME GRAVEL (SM)	15 / 45 / 40	Weakly lithified; very slightly cohesive; dry; well graded; compact	
SAND, GRAVELLY, SOME SILT (SW-SM)	30 / 55 / 15	Weakly lithified; non-cohesive; dry; well graded; compact	1 / 2 / 3 / 5 / 6 / 8 (3") 4 / 5 / 5 / 12 / 18 / 25 (1.5")
SILT, SANDY, TRACE GRAVEL (ML)	5 / 30 / 65	Weakly lithified; very slightly cohesive; dry; compact to very dense	
			5 / 11 / 31 (1.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

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DATE DRILLED: Apr. 23 - 25, 2012
CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E
BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5					
6.0					
6.5					
					32 / 27 (1.5")
7.0					
7.5					
		SAND, GRAVELLY, SILTY (SM)	30 / 45 / 25	Weakly lithified; non-cohesive; dry; well graded; very dense	50 (1.25")
8.0					
8.5					
9.0					
					3 / 12 / 50 (2.25")
9.5					
10.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S
Far West Site
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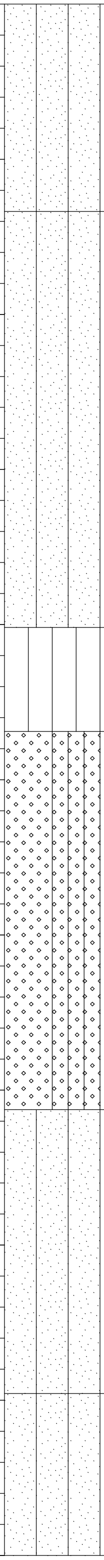

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5					
11.0 11.5 12.0		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 50 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	13 / 15 / 50 (1")
		SILT AND SAND, TRACE GRAVEL (ML)	5 / 40 / 55	Weakly lithified; non-cohesive; dry; very dense	
12.5 13.0 13.5		**SAND, GRAVELLY, SOME SILT (SW-SM)**	25 / 60 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	4 / 16 / 15 / 22 / 20 / 22 (3")
14.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	45 (3")
14.5 15.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates & M. Rheaume
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CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5	·	SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	7 / 50 (2")
16.0	∘	SAND, GRAVELLY, SOME SILT (SW-SM)	30 / 55 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
16.5 17.0	·	SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	50 (1.5")
17.5 18.0	·	SAND AND SILT, GRAVELLY (SM)	20 / 45 / 35	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
18.5	∘	SAND, SOME GRAVEL, SOME SILT (SW-SM)	15 / 70 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	51 (1.5")
	▨	SILT AND CLAY, SANDY, TRACE GRAVEL (CH)	tr / 25 / 75	Non-lithified; very cohesive; dry; very dense; soil horizon	
19.0 19.5 20.0	∘				42 (1.25")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

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CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
20.5					
21.0		**SAND AND GRAVEL, SOME SILT (SW-SM)**	35 / 50 / 15	Well lithified; non-cohesive; dry; well graded; very dense; conglomerate core	
21.5					
22.0					
22.5					
23.0					40 (2")
23.5					
24.0		**SAND, SILTY, SOME GRAVEL (SW-SM)**	15 / 60 / 25	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
24.5					
25.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S
Far West Site
Pinal County, Arizona

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CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5 26.0		**SAND, GRAVELLY, SOME SILT (SW-SM)**	25 / 65 / 10	Moderately to well lithified; non-cohesive; dry; well graded; very dense	13 / 45 (2.5")
26.5 27.0		**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Well lithified; slightly cohesive; dry; well graded; very dense; conglomerate core	
27.5		**SILT AND CLAY, SANDY (CH)**	0 / 25 / 75	Well lithified; very cohesive; dry; very dense; grades into more sand; core	
28.0 28.5 29.0 29.5 30.0		**SAND, SOME SILT (SP-SM)**	0 / 90 / 10	Weakly to moderately lithified; non-cohesive; dry; very dense	22 / 27 / 43 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates & M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.45 meters / 641.61 meters above mean sea level

DATE DRILLED: Apr. 23 - 25, 2012

CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E

BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
30.5 31.0 31.5					
32.0 32.5 33.0 33.5		**SAND, SOME SILT (SM)**	0 / 80 / 20	Well lithified; very slightly cohesive; dry; very dense; trace clay; some core	50 (1.5")
34.0 34.5 35.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S
Far West Site
Pinal County, Arizona

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LOGGED BY: B. Bates & M. Rheaume
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BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
35.5 36.0 36.5		**SAND, SILTY (SM)**	0 / 75 / 25	Well lithified; very slightly cohesive; dry; very dense; sand core	50 (1.75")
37.0 37.5 38.0 38.5 39.0		**SAND, SILTY (SM)**	0 / 70 / 30	Well lithified; very slightly cohesive; dry; very dense; entire sample is sand core	
39.5		**SAND, SOME SILT (SM)**	0 / 80 / 20	Moderately lithified; slightly cohesive; dry; very dense; some core	
40.0					

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B-2-1. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW2-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates & M. Rheaume
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CADASTRAL / NAD27 : (D-2-10)24aab / 3678765.313N / 474664.865E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
40.5 41.0		**SAND, SILTY (SM)**	0 / 75 / 25	Well lithified; slightly cohesive; dry; very dense; core	
		SAND, SILTY, TRACE GRAVEL (SM)	tr / 75 / 25	Moderately to well lithified; very slightly cohesive; dry; very dense	
41.5					50 (2.75")
42.0					
42.5					
43.0					
43.5					
44.0					
44.5					
45.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level

DATE DRILLED: Apr. 26 - May 1, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E

BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 1.0	0.0 - 0.3	**SILT AND SAND, TRACE GRAVEL (ML)**: Medium brown; silt 60%, very fine to fine, subangular to subrounded sand 40%, trace gravel. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Non-lithified. Compact. Non-cohesive. Dry. Uniformly graded. Reaction to acid: moderate.
1.0 - 3.2	0.3 - 1.0	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 50%, fine to coarse, subangular to subrounded sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 6.1 cm. Non-lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: weak.
3.2 - 7.5	1.0 - 2.3	**SAND, SILTY, GRAVELLY (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 45%, silt 30%, gravel 25%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 12.2 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
7.5 - 8.5	2.3 - 2.6	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 45%, gravel 40%, silt 15%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 12.8 cm. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
8.5 - 10.4	2.6 - 3.2	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; fine to coarse, subangular to subrounded sand 60%, silt 25%, gravel 15%. Gravel fraction: angular to subrounded gravel including very trace cobbles up to 12.2 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none.
10.4 - 15.7	3.2 - 4.8	**SAND, GRAVELLY, SILTY (SM)**: Light gray; fine to coarse, subangular to subrounded sand 55%, gravel 25%, silt 20%. Gravel fraction: angular to subrounded gravel up to 6.7 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
15.7 - 18.6	4.8 - 5.7	**SAND AND GRAVEL, SILTY (SM)**: Light brown; fine to coarse, subangular to subrounded sand 40%, gravel 35%, silt 25%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.1 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
18.6 - 21.2	5.7 - 6.5	**SAND AND SILT, TRACE GRAVEL (SM)**: White; fine to coarse, subangular to subrounded sand 60%, silt 35%, gravel 5%. Gravel fraction: angular to subrounded gravel up to 3.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace weak matrix chunks.
21.2 - 23.5	6.5 - 7.2	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 9.1 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level
DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
23.5 - 25.9	7.2 - 7.9	**SAND AND SILT, TRACE GRAVEL (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 12.2 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
25.9 - 28.5	7.9 - 8.7	**SILT, SANDY, TRACE GRAVEL (ML)**: Light reddish-brown and light gray; silt 75%, fine to medium, subangular to subrounded sand 25%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Abundant matrix chunks.
28.5 - 29.0	8.7 - 8.8	**SILT, SANDY (ML)**: Medium gray; silt 80%, fine, subangular to subrounded sand 20%. Moderately lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Abundant caliche.
29.0 - 31.4	8.8 - 9.6	**SILT AND SAND, TRACE GRAVEL (ML)**: Grayish-brown; silt 65%, fine to medium, subangular to subrounded sand 35%, trace gravel. Gravel fraction: angular to subrounded gravel up to 24.4 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Common matrix chunks, some carbonate nodules.
31.4 - 32.5	9.6 - 9.9	**SAND AND SILT, TRACE GRAVEL (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 60%, silt 40%, trace gravel. Gravel fraction: angular to subangular gravel up to 27.4 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Some matrix chunks.
32.5 - 34.5	9.9 - 10.5	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; fine to medium, subangular to subrounded sand 45%, silt 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 8.5 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
34.5 - 35.0	10.5 - 10.7	**SAND AND SILT, TRACE GRAVEL (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
35.0 - 36.9	10.7 - 11.2	**SILT AND SAND, SOME GRAVEL (SM)**: Reddish-gray; silt 50%, fine to coarse, subangular to subrounded sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including very trace cobbles up to 9.1 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
36.9 - 39.6	11.2 - 12.1	**SAND AND SILT, TRACE GRAVEL (SM)**: Red and gray; fine to coarse, subangular to subrounded sand 60%, silt and clay 35%, gravel 5%. Gravel fraction: subrounded gravel including 4% cobbles up to 9.1 cm. Non-lithified. Very dense. Low cohesive. Dry. Well graded. Reaction to acid: very weak to weak.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

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LOGGED BY: M. Rheaume
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CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
39.6 - 41.0	12.1 - 12.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Reddish-brown; fine to coarse, subangular to subrounded sand 70%, silt 25%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.5 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
41.0 - 44.5	12.5 - 13.6	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brown; fine to coarse, subangular to subrounded sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 12.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
44.5 - 47.0	13.6 - 14.3	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brown; fine to coarse, subangular to subrounded sand 75%, silt 25%, trace gravel. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Some matrix chunks.
47.0 - 53.3	14.3 - 16.2	**SAND, GRAVELLY, SILTY (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 45%, gravel 30%, silt 25%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 15.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
53.3 - 55.0	16.2 - 16.8	**SILT AND SAND (ML)**: Light grayish-brown; silt 60%, fine, subangular to subrounded sand 40%. Non to weakly lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Some matrix chunks.
55.0 - 60.0	16.8 - 18.3	**SILT, SANDY, GRAVELLY (SM)**: Light grayish-brown to light brown; silt 50%, fine to medium, subangular to subrounded sand 30%, gravel 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong. Some matrix chunks, progressively becoming well cemented.
60.0 - 65.0	18.3 - 19.8	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt and clay 55%, fine to coarse, angular to subrounded sand 45%, trace gravel. Gravel fraction: angular to subangular gravel up to 3.0 cm. Weakly to moderately lithified. Very dense. Low cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Abundant matrix chunks, trace manganese oxide.
65.0 - 67.3	19.8 - 20.5	**SILT AND SAND (ML)**: Grayish-brown; silt 65%, fine to coarse, angular to subrounded sand 35%. Well lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Abundant matrix chunks.
67.3 - 70.5	20.5 - 21.5	**SAND AND SILT, GRAVELLY (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 45%, silt 35%, gravel 20%. Gravel fraction: angular to subrounded gravel including 2% cobbles up to 12.2 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR
SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level	DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
70.5 - 71.0	21.5 - 21.6	**SAND, SILTY, SOME GRAVEL (SM)**: Light reddish-brown; fine to coarse, subangular to subrounded sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular gravel including very trace cobbles up to 8.8 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
71.0 - 73.0	21.6 - 22.3	**SILT, SANDY, TRACE GRAVEL (ML)**: Light brown; silt 65%, fine to coarse, subangular to subrounded sand 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.6 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
73.0 - 75.7	22.3 - 23.1	**SILT, SANDY, TRACE GRAVEL (ML)**: White; silt 80%, fine to coarse, subangular to subrounded sand 20%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 4.0 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
75.7 - 83.2	23.1 - 25.4	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brown; fine to coarse, subangular to subrounded sand 70%, silt 30%, trace gravel. Gravel fraction: angular to subrounded gravel up to 2.7 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace carbonate chunks, trace carbonate nodules.
83.2 - 85.0	25.4 - 25.9	**SAND, SILTY, SOME GRAVEL (SM)**: Brownish-gray; fine to coarse, subangular to subrounded sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
85.0 - 87.0	25.9 - 26.5	**SAND, SOME SILT, TRACE GRAVEL (SP-SM)**: Gray; fine to coarse, subangular to subrounded sand 80%, silt 15%, gravel 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 7.6 cm. Non-lithified. Compact. Non to very slightly cohesive. Dry. Uniformly graded. Reaction to acid: none to very weak. Trace carbonate chunks.
87.0 - 92.8	26.5 - 28.3	**SAND AND SILT, TRACE GRAVEL (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 60%, silt 40%, trace gravel. Gravel fraction: angular to subangular gravel up to 2.1 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace carbonate chunks.
92.8 - 94.6	28.3 - 28.8	**SILT, SANDY, GRAVELLY (SM)**: Light grayish-brown; silt 45%, fine to coarse, angular to subrounded sand 30%, gravel 25%. Gravel fraction: angular to subrounded gravel including 2% cobbles up to 15.5 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

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BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
94.6 - 98.5	28.8 - 30.0	**SAND AND SILT, GRAVELLY (SM)**: Light reddish-brown and gray; fine to coarse, subangular to subrounded sand 40%, silt 40%, gravel 20%. Gravel fraction: subangular to subrounded gravel up to 6.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
98.5 - 99.9	30.0 - 30.4	**SILT, SANDY, TRACE GRAVEL (ML)**: Light gray; silt 70%, fine, subangular to subrounded sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel up to 4.6 cm. Non-lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: weak to strong.
99.9 - 105.0	30.4 - 32.0	**SAND AND SILT, GRAVELLY (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 12.8 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to strong. Some matrix chunks.
105.0 - 109.1	32.0 - 33.3	**SAND, SILTY, GRAVELLY (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 55%, silt 25%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 11.9 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to very weak.
109.1 - 112.5	33.3 - 34.3	**SAND, SILTY, GRAVELLY (SM)**: Light grayish-brown; fine to coarse, subangular to subrounded sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 7.9 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
112.5 - 114.4	34.3 - 34.9	**SAND, SOME SILT, SOME GRAVEL (SW-SM)**: Light brown; fine to coarse, subangular to subrounded sand 75%, silt 15%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 6.1 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to moderate.
114.4 - 115.6	34.9 - 35.2	**SAND AND SILT, SOME GRAVEL (SM)**: White; fine to coarse, subangular to subrounded sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Common matrix chunks, trace partial core.
115.6 - 116.8	35.2 - 35.6	**SAND AND SILT, GRAVELLY (SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 40%, silt 35%, gravel 25%. Gravel fraction: subangular to subrounded gravel up to 6.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

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LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level
DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
116.8 - 118.0	35.6 - 36.0	**SAND, SILTY, TRACE GRAVEL (SM)**: Brownish-gray; fine to coarse, angular to subrounded sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 7.6 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very weak.
118.0 - 122.0	36.0 - 37.2	**SAND AND SILT, GRAVELLY (SM)**: Light brown; fine to coarse, angular to subrounded sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 9.8 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
122.0 - 122.9	37.2 - 37.5	**SAND, SOME SILT, TRACE GRAVEL (SM)**: Brown; fine to medium, subangular to subrounded sand 80%, silt 20%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 4.3 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none.
122.9 - 124.0	37.5 - 37.8	**SAND, SILTY, TRACE GRAVEL (SM)**: Brownish-gray; fine to coarse, subangular to subrounded sand 65%, silt 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.3 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
124.0 - 124.9	37.8 - 38.1	**SAND, SOME SILT (SP-SM)**: Brown; fine to medium, subangular to subrounded sand 85%, silt 15%. Non-lithified. Compact. Non-cohesive. Dry. Uniformly graded. Reaction to acid: none.
124.9 - 127.0	38.1 - 38.7	**SILT AND SAND, TRACE GRAVEL (SM)**: Light brown; silt 50%, fine to coarse, subangular to subrounded sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.6 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Minor matrix chunks.
127.0 - 130.0	38.7 - 39.6	**SILT, SANDY, SOME GRAVEL (ML)**: Grayish-brown; silt 55%, fine to coarse, subangular to subrounded sand 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel up to 6.7 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
130.0 - 132.0	39.6 - 40.2	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Grayish-brown; fine to coarse, subangular to subrounded sand 50%, gravel 35%, silt 15%. Gravel fraction: subangular to subrounded gravel up to 5.5 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
132.0 - 136.5	40.2 - 41.6	**SILT, SANDY, TRACE GRAVEL (ML)**: Brownish-gray and grayish-brown; silt 70%, fine to coarse, subangular to subrounded sand 30%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT AND SAND, TRACE GRAVEL (ML)	tr / 40 / 60	Non-lithified; non-cohesive; dry; uniformly graded; compact	
0.5		**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 45 / 50	Non-lithified; non-cohesive; dry; uniformly graded; very dense	
1.0 1.5 2.0		**SAND, SILTY, GRAVELLY (SM)**	25 / 45 / 30	Non-lithified; non-cohesive; dry; well graded; very dense	2 / 7 / 5 / 5 / 5 / 6 (3")
2.5		**SAND AND GRAVEL, SOME SILT (SW-SM)**	40 / 45 / 15	Non-lithified; non-cohesive; dry; well graded; compact	
3.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 60 / 25	Non-lithified; non-cohesive; dry; well graded; very dense	3 / 9 / 21 / 32 / 25 (2")
3.5 4.0 4.5		**SAND, GRAVELLY, SILTY (SM)**	25 / 55 / 20	Non-lithified; non-cohesive; dry; well graded; very dense	
5.0					4 / 7 / 33 / 23 (1")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

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DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5	▨	SAND AND GRAVEL, SILTY (SM)	35 / 40 / 25	Non-lithified; non-cohesive; dry; well graded; very dense	
6.0	▨	SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	
6.5 7.0	▨	SAND, SILTY, SOME GRAVEL (SM)	10 / 70 / 20	Non-lithified; non-cohesive; dry; well graded; very dense	2 / 2 / 4 / 1 / 8 / 14 (3")
7.5	▨	SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Non-lithified; non-cohesive; dry; well graded; very dense	50 / 5 (0.5")
8.0 8.5	▥	SILT, SANDY, TRACE GRAVEL (ML)	tr / 25 / 75	Moderately lithified; non-cohesive; dry; uniformly graded; very dense	
	▥	SILT, SANDY (ML)	0 / 20 / 80	Moderately lithified; non-cohesive; dry; uniformly graded; very dense	
9.0 9.5	▥	SILT AND SAND, TRACE GRAVEL (ML)	tr / 35 / 65	Moderately lithified; very slightly cohesive; dry; uniformly graded; very dense	45 / 13 (1")
	▨	SAND AND SILT, TRACE GRAVEL (SM)	tr / 60 / 40	Moderately lithified; non-cohesive; dry; uniformly graded; very dense	
10.0	▨				

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Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level	DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5	▒	**SAND AND SILT, SOME GRAVEL (SM)**	15 / 45 / 40	Moderately lithified; non-cohesive; dry; well graded; very dense	
	▒	**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Non-lithified; non-cohesive; dry; well graded; very dense	
11.0	▒	**SILT AND SAND, SOME GRAVEL (SM)**	10 / 40 / 50	Non-lithified; non-cohesive; dry; well graded; very dense	18 / 36 (1.75")
11.5 12.0	▒	**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Non-lithified; low cohesive; dry; well graded; very dense	
	▒	**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 70 / 25	Weakly lithified; non-cohesive; dry; well graded; very dense	
12.5 13.0 13.5	▒	**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 75 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	9 / 50 (2")
14.0	▒	**SAND, SILTY, TRACE GRAVEL (SM)**	tr / 75 / 25	Weakly lithified; non-cohesive; dry; uniformly graded; very dense	50 / 50 (2.5")
14.5 15.0	▒				

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level	DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5 16.0		**SAND, GRAVELLY, SILTY (SM)**	30 / 45 / 25	Weakly lithified; non-cohesive; dry; well graded; very dense	13 / 40 (2")
16.5		**SILT AND SAND (ML)**	0 / 40 / 60	Non to weakly lithified; non-cohesive; dry; uniformly graded; very dense	
17.0 17.5 18.0		**SILT, SANDY, GRAVELLY (SM)**	20 / 30 / 50	Weakly to well lithified; non-cohesive; dry; well graded; very dense	35 / 20 (0.75")
18.5 19.0 19.5		**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 45 / 55	Weakly to moderately lithified; low cohesive; dry; uniformly graded; very dense	50 (2.75")
20.0					30 / 25 (1")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level
DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT AND SAND (ML)	0 / 35 / 65	Well lithified; non-cohesive; dry; uniformly graded; very dense	
20.5 21.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
21.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	
22.0		**SILT, SANDY, TRACE GRAVEL (ML)**	5 / 30 / 65	Weakly lithified; non-cohesive; dry; well graded; very dense	
22.5 23.0		**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 20 / 80	Weakly lithified; non-cohesive; dry; well graded; very dense	9 / 20 / 30 (2")
23.5 24.0 24.5 25.0		**SAND, SILTY, TRACE GRAVEL (SM)**	tr / 70 / 30	Moderately lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level
DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 70 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
26.0 26.5		**SAND, SOME SILT, TRACE GRAVEL (SP-SM)**	5 / 80 / 15	Non-lithified; non to very slightly cohesive; dry; uniformly graded; compact	33 / 16 / 13 / 13 / 12 / 13 (3")
27.0 27.5 28.0		**SAND AND SILT, TRACE GRAVEL (SM)**	tr / 60 / 40	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
28.5		**SILT, SANDY, GRAVELLY (SM)**	25 / 30 / 45	Weakly lithified; non-cohesive; dry; well graded; very dense	
29.0 29.5 30.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 40 / 40	Weakly lithified; non-cohesive; dry; well graded; very dense	35 / 15 (1.25")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level	DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT, SANDY, TRACE GRAVEL (ML)	5 / 25 / 70	Non-lithified; very slightly cohesive; dry; well graded; very dense	
30.5 31.0 31.5		**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
32.0 32.5 33.0		**SAND, SILTY, GRAVELLY (SM)**	20 / 55 / 25	Non-lithified; non-cohesive; dry; well graded; very dense	22 / 30 (2.5")
33.5 34.0		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Well lithified; non-cohesive; dry; well graded; very dense	
34.5		**SAND, SOME SILT, SOME GRAVEL (SW-SM)**	10 / 75 / 15	Non-lithified; non-cohesive; dry; well graded; very dense	
35.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: M. Rheaume

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level — DATE DRILLED: Apr. 26 - May 1, 2012

CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E — BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Well lithified; non-cohesive; dry; well graded; very dense	5 / 12 / 26 / 25 (1.25")
35.5		**SAND AND SILT, GRAVELLY (SM)**	25 / 40 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 75 / 20	Non-lithified; non-cohesive; dry; well graded; very dense	
36.0 36.5 37.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Non-lithified; non-cohesive; dry; well graded; very dense	
		SAND, SOME SILT, TRACE GRAVEL (SM)	tr / 80 / 20	Non-lithified; non-cohesive; dry; well graded; very dense	
37.5		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 65 / 30	Non-lithified; non-cohesive; dry; well graded; very dense	
38.0		**SAND, SOME SILT (SP-SM)**	0 / 85 / 15	Non-lithified; non-cohesive; dry; uniformly graded; compact	
38.5		**SILT AND SAND, TRACE GRAVEL (SM)**	5 / 45 / 50	Weakly lithified; non-cohesive; dry; well graded; very dense	5 / 10 / 15 / 19 / 20 / 15 (3")
39.0 39.5		**SILT, SANDY, SOME GRAVEL (ML)**	15 / 30 / 55	Non-lithified; non-cohesive; dry; well graded; very dense	
40.0		**SAND AND GRAVEL, SOME**	35 / 50 / 15	Non-lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-2. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW3-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: M. Rheaume
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.61 meters / 606.92 meters above mean sea level	DATE DRILLED: Apr. 26 - May 1, 2012
CADASTRAL / NAD27 : (D-2-10)26baa / 3677139.944N / 472535.91E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT (SW-SM)			
40.5 41.0 41.5		**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 30 / 70	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	4 / 20 / 30 (2.75")
42.0					
42.5					
43.0					
43.5					
44.0					
44.5					
45.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level
DATE DRILLED: May 4, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E
BOREHOLE DIAMETER: 6-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 1.2	0.0 - 0.4	**SILT, SOME SAND, TRACE GRAVEL (ML)**: Brown; silt 80%, angular to subrounded, fine to coarse sand 20%, trace gravel. gravel. Non-lithified. Dense. Non-cohesive. Dry. Reaction to acid: none.
1.2 - 9.8	0.4 - 3.0	**SAND, GRAVELLY, SILTY (SM)**: Light reddish-brown; angular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: angular to subrounded gravel including 3% cobbles up to 10.7 cm. Non to weakly lithified. Dense to very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to very strong. Trace matrix chunks.
9.8 - 11.5	3.0 - 3.5	**SAND AND SILT, GRAVELLY (SM)**: Light brown; angular to subrounded, fine to coarse sand 40%, silt 40%, gravel 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 7.6 cm. Non to weakly lithified. Dense to very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
11.5 - 14.0	3.5 - 4.3	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light brown; angular to subrounded, fine to coarse sand 60%, gravel 25%, silt 15%. Gravel fraction: angular to subrounded gravel including 3% cobbles up to 10.7 cm. Non to weakly lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
14.0 - 16.0	4.3 - 4.9	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; angular to subrounded, fine to coarse sand 60%, silt 30%, gravel 10%. Gravel fraction: angular to subrounded gravel. Non to weakly lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
16.0 - 16.5	4.9 - 5.0	**SILT, SANDY, TRACE GRAVEL (ML)**: Reddish-brown; silt 70%, angular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly lithified. Dense. Very slightly cohesive. Dry. Reaction to acid: very strong.
16.5 - 18.7	5.0 - 5.7	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; angular to subrounded, fine to coarse sand 50%, silt 40%, gravel 10%. Gravel fraction: angular to subrounded gravel. Non to weakly lithified. Loose. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate matrix.
18.7 - 22.0	5.7 - 6.7	**SILT AND SAND, TRACE GRAVEL (ML)**: White; silt 55%, angular to subrounded, fine to coarse sand 40%, gravel 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Loose. Non-cohesive. Dry. Reaction to acid: very strong.
22.0 - 25.5	6.7 - 7.8	**SAND AND SILT, SOME GRAVEL (SM)**: White; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level	DATE DRILLED: May 4, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E	BOREHOLE DIAMETER: 6-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
25.5 - 35.0	7.8 - 10.7	**SAND, GRAVELLY, SILTY (SM)**: Very light brown; angular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
35.0 - 40.8	10.7 - 12.4	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Very light gray; angular to subrounded, fine to coarse sand 60%, gravel 25%, silt 15%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 12.2 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
40.8 - 48.0	12.4 - 14.6	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Very light gray; angular to subrounded, fine to coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: angular to subrounded gravel including 3% cobbles up to 15.2 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
48.0 - 56.0	14.6 - 17.1	**SAND, SOME SILT, TRACE GRAVEL (SW-SM)**: Very light gray; angular to subrounded, fine to coarse sand 80%, silt 15%, gravel 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Reaction to acid: very strong. Some matrix chunks.
56.0 - 65.0	17.1 - 19.8	**SILT AND CLAY, TRACE GRAVEL, TRACE SAND (CH)**: Light reddish-brown; silt and clay 100%, trace gravel, trace angular to subrounded, fine to coarse sand. Gravel fraction: angular to subrounded gravel. Weakly lithified. Dense. Very cohesive. Dry to moist. Reaction to acid: weak to very strong. Clay contains carbonate stringers.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level	DATE DRILLED: May 4, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E	BOREHOLE DIAMETER: 6-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT, SOME SAND, TRACE GRAVEL (ML)	tr / 20 / 80	Non-lithified; non-cohesive; dry; dense	
0.5 1.0 1.5 2.0 2.5		**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Non to weakly lithified; non-cohesive; dry; well graded; dense to very dense	4 / 7 / 10 / 10 / 14 / 26 (3")
3.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 40 / 40	Non to weakly lithified; non-cohesive; dry; well graded; dense to very dense	2 / 16 / 39 / 25 (3")
3.5 4.0		**SAND, GRAVELLY, SOME SILT (SW-SM)**	25 / 60 / 15	Non to weakly lithified; non-cohesive; dry; well graded; dense	
4.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 60 / 30	Non to weakly lithified; non-cohesive; dry; well graded; dense	2 / 4 / 8 / 21 / 35 / 15 (1.25")
5.0		**SILT, SANDY, TRACE**	5 / 25 / 70	Weakly lithified; very slightly cohesive; dry; dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level — DATE DRILLED: May 4, 2012

CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E — BOREHOLE DIAMETER: 6-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		GRAVEL (ML)			
5.5		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Non to weakly lithified; non-cohesive; dry; well graded; loose	
6.0 6.5		**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 40 / 55	Weakly lithified; non-cohesive; dry; loose	1 / 1 / 2 / 2 / 2 / 1 (3")
7.0 7.5		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 50 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	45 (0.5")
8.0 8.5 9.0 9.5 10.0		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	40 (2")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level

DATE DRILLED: May 4, 2012

CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E

BOREHOLE DIAMETER: 6-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5					
11.0 11.5 12.0		**SAND, GRAVELLY, SOME SILT (SW-SM)**	25 / 60 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	50 (3") 4 / 48 (3")
12.5 13.0 13.5 14.0 14.5		**SAND, GRAVELLY, SOME SILT (SW-SM)**	30 / 55 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	7 / 40 (1.75")
15.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-3. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW4-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 640.11 meters above mean sea level	DATE DRILLED: May 4, 2012
CADASTRAL / NAD27 : (D-2-10)25aab / 3677217.842N / 474820.242E	BOREHOLE DIAMETER: 6-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5 16.0 16.5 17.0	⁘	**SAND, SOME SILT, TRACE GRAVEL (SW-SM)**	5 / 80 / 15	Weakly lithified; non-cohesive; dry; very dense	45 (1.75") 35 (1")
17.5 18.0 18.5 19.0 19.5 20.0	▨	**SILT AND CLAY, TRACE GRAVEL, TRACE SAND (CH)**	tr / tr / 100	Weakly lithified; very cohesive; dry to moist; dense	5 / 9 / 17 / 18 / 25 / 26 (3") 5 / 9 / 12 / 16 / 26 / 48 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-4. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW5-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 10.67 meters / 690.29 meters above mean sea level	DATE DRILLED: Apr. 20 - 21, 2012
CADASTRAL / NAD27 : (D-2-11)30aaa / 3677122.925N / 476685.549E	BOREHOLE DIAMETER: 7-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 3.3	0.0 - 1.0	**SILT, SANDY, SOME GRAVEL (ML)**: Reddish-brown; silt and clay 60%, sand 30%, gravel 10%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 12.2 cm. Non-lithified. Loose. Slightly cohesive. Dry. Well graded. Reaction to acid: none. 0 - 1.8 ft is disturbed.
3.3 - 3.8	1.0 - 1.2	**GRAVEL, SANDY, TRACE SILT (GW)**: Reddish-brown; gravel 75%, sand 20%, silt 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Non-lithified. Loose. Non-cohesive. Dry. Well graded. Reaction to acid: none.
3.8 - 5.4	1.2 - 1.6	**SAND, GRAVELLY, SILTY (SM)**: Brown; sand 40%, gravel 30%, silt 30%. Gravel fraction: angular to subrounded gravel. Weakly lithified. Loose. Non-cohesive. Dry. Well graded. Reaction to acid: none to moderate.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
5.4 - 10.0	1.6 - 3.0	**SILT AND SAND, TRACE GRAVEL (SM)**: Light brown; silt 50%, sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Non to weakly lithified. Loose. Non-cohesive. Dry. Reaction to acid: very strong. Carbonate chunks.
10.0 - 11.5	3.0 - 3.5	**SAND, SILTY, TRACE GRAVEL (SM)**: Brown; sand 75%, silt 20%, gravel 5%. Gravel fraction: angular to subrounded gravel. Non-lithified. Compact. Non-cohesive. Dry. Reaction to acid: none to moderate.
11.5 - 15.0	3.5 - 4.6	**SAND, SILTY, GRAVELLY (SM)**: Light brown; sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: none to moderate.
15.0 - 16.0	4.6 - 4.9	**SAND, SOME SILT, SOME GRAVEL (SW-SM)**: Brown; sand 75%, silt 15%, gravel 10%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 15.2 cm. Non-lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: none.
16.0 - 24.5	4.9 - 7.5	**SAND AND GRAVEL, SILTY (SM)**: Light brown to light gray; sand 45%, gravel 35%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: none to weak.
PINAL SCHIST (pCpi)		
24.5 - 35.0	7.5 - 10.7	**PINAL SCHIST**: Very light gray. Well lithified. Dry. Reaction to acid: none. Schist core.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

DRAFT

B-2-4. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW5-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 10.67 meters / 690.29 meters above mean sea level	DATE DRILLED: Apr. 20 - 21, 2012
CADASTRAL / NAD27 : (D-2-11)30aaa / 3677122.925N / 476685.549E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
0.5		**SILT, SANDY, SOME GRAVEL (ML)**	10 / 30 / 60	Non-lithified; slightly cohesive; dry; well graded; loose; 0 - 1.8 ft is disturbed	
1.0		**GRAVEL, SANDY, TRACE SILT (GW)**	75 / 20 / 5	Non-lithified; non-cohesive; dry; well graded; loose	
1.5		**SAND, GRAVELLY, SILTY (SM)**	30 / 40 / 30	Weakly lithified; non-cohesive; dry; well graded; loose	9 / 50 (2")
2.0 2.5 3.0		**SILT AND SAND, TRACE GRAVEL (SM)**	5 / 45 / 50	Non to weakly lithified; non-cohesive; dry; loose	
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 75 / 20	Non-lithified; non-cohesive; dry; compact	6 / 10 / 7 / 9 / 8 / 14 (3")
3.5 4.0 4.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Non-lithified; non-cohesive; dry; well graded; compact	
		SAND, SOME SILT, SOME GRAVEL (SW-SM)	10 / 75 / 15	Non-lithified; non-cohesive; dry; well graded; compact	16 / 21 / 17 / 20 / 27 / 20 (3")
5.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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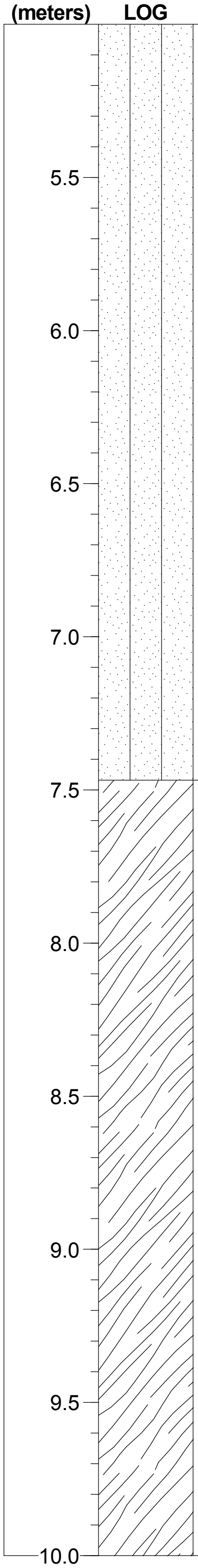
B-2-4. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW5-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 10.67 meters / 690.29 meters above mean sea level	DATE DRILLED: Apr. 20 - 21, 2012
CADASTRAL / NAD27 : (D-2-11)30aaa / 3677122.925N / 476685.549E	BOREHOLE DIAMETER: 7-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND AND GRAVEL, SILTY (SM)	35 / 45 / 20	Weakly lithified; non-cohesive; dry; well graded; compact	7 / 19 / 21 / 23 / 29 / 33 (1.75")
PINAL SCHIST		Well lithified; dry; schist core	50 (2") 9 / 25 (0.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-4. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW5-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 10.67 meters / 690.29 meters above mean sea level

DATE DRILLED: Apr. 20 - 21, 2012

CADASTRAL / NAD27 : (D-2-11)30aaa / 3677122.925N / 476685.549E

BOREHOLE DIAMETER: 7-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5	▨				
11.0					
11.5					
12.0					
12.5					
13.0					
13.5					
14.0					
14.5					
15.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level
DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 3.6	0.0 - 1.1	**SAND AND SILT, TRACE GRAVEL (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 55%, silt and clay 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.9 cm. Non-lithified. Loose. Slightly cohesive. Dry. Well graded. Reaction to acid: very weak. Trace organic root material.
3.6 - 5.3	1.1 - 1.6	**SAND, GRAVELLY, SILTY (SM)**: Light reddish-gray; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subrounded gravel including trace cobbles up to 11.2 cm. Non to weakly lithified. Loose. Very slightly cohesive. Dry. Gap graded. Reaction to acid: none.
5.3 - 8.3	1.6 - 2.5	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 12.8 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
8.3 - 10.7	2.5 - 3.3	**SAND, SILTY, TRACE GRAVEL (SM)**: Very light yellowish-gray to light gray; subangular to subrounded, fine to coarse sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.5 cm. Weakly to moderately lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
10.7 - 13.4	3.3 - 4.1	**SAND AND GRAVEL, SILTY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded gravel including 15% cobbles up to 11.9 cm. Weakly lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
13.4 - 15.2	4.1 - 4.6	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 65%, silt 25%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 11.0 cm. Weakly lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
15.2 - 17.4	4.6 - 5.3	**SAND, SILTY, SOME GRAVEL (SM)**: Light orangish-gray; subangular to subrounded, fine to coarse sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Moderately lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Trace moderately cemented chunks.
17.4 - 24.7	5.3 - 7.5	**SILT AND SAND, TRACE GRAVEL (ML)**: Light orangish-brown; silt 55%, subangular to subrounded, fine to coarse sand 45%, trace gravel. Gravel fraction: subrounded gravel up to 2.7 cm. Moderately lithified. Dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: moderate. Abundant moderately cemented chunks. 21.0 - 21.3 ft white calcite chunks, very strong reaction.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level — DATE DRILLED: Apr. 8 - 9, 2012

CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
24.7 - 27.1	7.5 - 8.3	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: subrounded gravel up to 3.6 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to strong. 26.8 - 27.1 ft white calcite chunks, very strong reaction.
27.1 - 30.5	8.3 - 9.3	**SAND AND SILT, TRACE GRAVEL (SM)**: Light orangish-brown; subangular to subrounded, fine to coarse sand 50%, silt 50%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 2.1 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong. Abundant moderately cemented chunks.
30.5 - 34.1	9.3 - 10.4	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 10.7 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
34.1 - 38.2	10.4 - 11.6	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light orangish-gray; subangular to subrounded, fine to coarse sand 50%, silt 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 3.3 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong. Common moderately cemented chunks.
38.2 - 41.6	11.6 - 12.7	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong. Some chunks moderately cemented matrix.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
41.6 - 46.3	12.7 - 14.1	**SAND, SILTY, SOME GRAVEL (SM)**: Very light yellowish-gray; subangular to subrounded, fine to coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 16.8 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
46.3 - 57.2	14.1 - 17.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light yellowish-gray; subangular to subrounded, fine to coarse sand 50%, silt 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some moderately cemented chunks.
57.2 - 62.1	17.4 - 18.9	**SAND AND SILT, TRACE GRAVEL (SM)**: Very light yellowish-gray; subangular to subrounded, fine to coarse sand 50%, silt 50%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 1.5 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some moderately cemented chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level
DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E
BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
62.1 - 65.0	18.9 - 19.8	**SAND, SILTY, SOME GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 12.2 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. 63.0 - 63.5 ft green very altered schist clasts.
65.0 - 66.8	19.8 - 20.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt 45%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.3 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Some weakly to moderately cemented chunks.
66.8 - 82.6	20.4 - 25.2	**SAND AND SILT, SOME GRAVEL (SM)**: Light orangish-gray to very light gray; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 14.6 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
82.6 - 87.1	25.2 - 26.5	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.0 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace moderately cemented chunks.
87.1 - 88.9	26.5 - 27.1	**SAND AND SILT, GRAVELLY (SM)**: Very light yellowish-gray; subangular to subrounded, fine to coarse sand 35%, silt 35%, gravel 30%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 15.5 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace moderately cemented chunks.
88.9 - 91.5	27.1 - 27.9	**SILT AND SAND, TRACE GRAVEL (ML)**: Very light gray; silt 55%, subangular to subrounded, fine to coarse sand 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.2 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
91.5 - 92.7	27.9 - 28.3	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 3.7 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very weak.
92.7 - 94.6	28.3 - 28.8	**GRAVEL, SANDY, SOME SILT (GW-GM)**: Very light gray; gravel 55%, subangular to subrounded, fine to coarse sand 30%, silt 15%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 11.0 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
94.6 - 96.8	28.8 - 29.5	**SILT AND SAND, SOME GRAVEL (ML)**: Very light brownish-gray to white; silt 55%, subangular to subrounded, fine to coarse sand 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.8 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace moderately cemented chunks.
96.8 - 100.8	29.5 - 30.7	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 60%, subangular to subrounded, fine to coarse sand 40%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 2.4 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant moderately cemented chunks.
100.8 - 104.6	30.7 - 31.9	**SAND AND GRAVEL, SILTY (SM)**: Light orangish-gray; subangular to subrounded, fine to coarse sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 16.1 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
104.6 - 107.2	31.9 - 32.7	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 60%, subangular to subrounded, fine to coarse sand 40%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.0 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant moderately cemented chunks.
107.2 - 109.8	32.7 - 33.5	**SILT AND SAND, SOME GRAVEL (SM)**: Very light yellowish-gray; silt 50%, subangular to subrounded, fine to coarse sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 6.4 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Trace moderately cemented chunks.
109.8 - 111.0	33.5 - 33.8	**SAND, GRAVELLY, SILTY (SM)**: Very light yellowish-gray to very light gray; subangular to subrounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded gravel including 15% cobbles up to 13.7 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
111.0 - 113.0	33.8 - 34.4	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 50%, gravel 35%, silt 15%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 15.2 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
113.0 - 115.3	34.4 - 35.1	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 65%, silt 20%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.7 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
115.3 - 118.0	35.1 - 36.0	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, gravel 40%, silt 10%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 10.7 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
118.0 - 120.0	36.0 - 36.6	**SAND, SILTY, GRAVELLY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: moderate.
120.0 - 128.1	36.6 - 39.0	**SAND AND GRAVEL, SOME SILT (SW-SM)**: Light yellowish-gray; subangular to subrounded, fine to coarse sand 55%, gravel 35%, silt 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. 126 ft gravel layer.
128.1 - 130.7	39.0 - 39.8	**SAND, SILTY, GRAVELLY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 45%, silt 30%, gravel 25%. Gravel fraction: subangular to subrounded gravel up to 7.6 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
130.7 - 133.9	39.8 - 40.8	**SAND, GRAVELLY, TRACE SILT (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 70%, gravel 25%, silt 5%. Gravel fraction: subangular to subrounded gravel including 2% cobbles. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong.
133.9 - 135.0	40.8 - 41.1	**SAND AND SILT, SOME GRAVEL (SM)**: Light yellowish-gray; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 4.6 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: weak.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
0.5 1.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 55 / 40	Non-lithified; slightly cohesive; dry; well graded; loose; trace organic root material	
1.5		**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Non to weakly lithified; very slightly cohesive; dry; gap graded; loose	16 / 34 / 25 (2.75")
2.0 2.5		**SAND, GRAVELLY, SILTY (SM)**	30 / 40 / 30	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
3.0		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 75 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; dense	7 / 14 / 17 / 18 / 16 / 16 (3")
3.5 4.0		**SAND AND GRAVEL, SILTY (SM)**	35 / 40 / 25	Weakly lithified; non-cohesive; dry; well graded; dense	
4.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 65 / 25	Weakly lithified; non-cohesive; dry; well graded; dense	
5.0		**SAND, SILTY, SOME**	10 / 60 / 30	Moderately lithified; non-cohesive; dry; well graded; dense	2 / 15 / 24 / 41 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

DRAFT

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear | LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level | DATE DRILLED: Apr. 8 - 9, 2012

CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E | BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		GRAVEL (SM)			
5.5 6.0 6.5 7.0 7.5		SILT AND SAND, TRACE GRAVEL (ML)	tr / 45 / 55	Moderately lithified; very slightly cohesive; dry; well graded; dense; 21.0 - 21.3 ft white calcite chunks, very strong reaction	1 / 2 / 2 / 7 / 16 / 19 (3")
8.0		SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense; 26.8 - 27.1 ft white calcite chunks, very strong reaction	25 / 22 / 27 / 28 / 25 / 38 (3")
8.5 9.0		SAND AND SILT, TRACE GRAVEL (SM)	tr / 50 / 50	Moderately lithified; very slightly cohesive; dry; well graded; very dense	45 / 20 (1")
9.5 10.0		SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

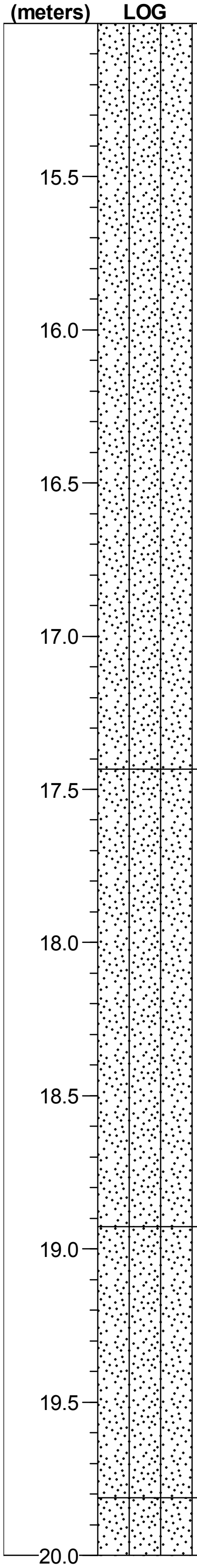
DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5 11.0 11.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 50 / 45	Moderately lithified; very slightly cohesive; dry; well graded; very dense	9 / 21 / 40 (1.75")
12.0 12.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	41 / 21 (1")
13.0 13.5 14.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Moderately lithified; non-cohesive; dry; well graded; very dense	50 (2.75")
14.5 15.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters) GRAPHIC LOG



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SAND AND SILT, TRACE GRAVEL (SM)	5 / 50 / 45	Moderately lithified; non-cohesive; dry; well graded; very dense	28 / 30 (1.25") 50 (3")
SAND AND SILT, TRACE GRAVEL (SM)	tr / 50 / 50	Moderately lithified; non-cohesive; dry; well graded; very dense	7 / 35 / 41 / 9 (0.5")
SAND, SILTY, SOME GRAVEL (SM)	15 / 55 / 30	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense; 63.0 - 63.5 ft green very altered schist clasts	
			5 / 6 / 7 / 10 / 14 / 44 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SAND AND SILT, TRACE GRAVEL (SM)	tr / 55 / 45	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
20.5					
21.0					
21.5					
22.0					
22.5					
		SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	7 / 36 / 30 (1.75")
23.0					
23.5					
24.0					
24.5					
25.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level
DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5 26.0 26.5		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 55 / 35	Moderately lithified; non-cohesive; dry; well graded; very dense	2 / 2 / 7 / 29 / 30 (0.75")
27.0		**SAND AND SILT, GRAVELLY (SM)**	30 / 35 / 35	Moderately lithified; non-cohesive; dry; well graded; very dense	
27.5		**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 40 / 55	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
28.0		**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 75 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
28.5		**GRAVEL, SANDY, SOME SILT (GW-GM)**	55 / 30 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
29.0 29.5		**SILT AND SAND, SOME GRAVEL (ML)**	10 / 35 / 55	Moderately lithified; non-cohesive; dry; well graded; very dense	1 / 2 / 50 (2.75")
30.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
30.5		**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 40 / 60	Moderately lithified; very slightly cohesive; dry; well graded; very dense	
31.0 31.5		**SAND AND GRAVEL, SILTY (SM)**	35 / 40 / 25	Moderately lithified; very slightly cohesive; dry; well graded; very dense	
32.0 32.5		**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 40 / 60	Moderately lithified; very slightly cohesive; dry; well graded; very dense	9 / 21 / 30 / 26 / 21 / 26 (3")
33.0		**SILT AND SAND, SOME GRAVEL (SM)**	10 / 40 / 50	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
33.5		**SAND, GRAVELLY, SILTY (SM)**	30 / 40 / 30	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
34.0		**SAND AND GRAVEL, SOME SILT (SW-SM)**	35 / 50 / 15	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
34.5 35.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 65 / 20	Moderately lithified; very slightly cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

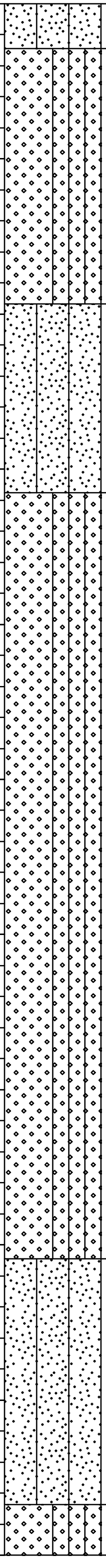
LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level

DATE DRILLED: Apr. 8 - 9, 2012

CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E

BOREHOLE DIAMETER: 8-inches



DEPTH (meters)	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
				3 / 20 / 48 (3")
35.5	SAND AND GRAVEL, SOME SILT (SW-SM)	40 / 50 / 10	Moderately lithified; very slightly cohesive; dry; well graded; very dense	
36.0	SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
36.5 37.0 37.5 38.0 38.5 39.0	SAND AND GRAVEL, SOME SILT (SW-SM)	35 / 55 / 10	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense; 126 ft gravel layer	8 / 50 (3")
39.5	SAND, SILTY, GRAVELLY (SM)	25 / 45 / 30	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
40.0				

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-2-5. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW8-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 618.39 meters above mean sea level	DATE DRILLED: Apr. 8 - 9, 2012
CADASTRAL / NAD27 : (D-2-10)26bcb / 3675118.161N / 473460.249E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
40.5		**SAND, GRAVELLY, TRACE SILT (SW-SM)**	25 / 70 / 5	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
41.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 55 / 35	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	4 / 26 / 30 (2.75")
41.5					
42.0					
42.5					
43.0					
43.5					
44.0					
44.5					
45.0					

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* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 1.4	0.0 - 0.4	**SILT AND CLAY, SANDY, TRACE GRAVEL (MH)**: Dark reddish-brown; silt and clay 65%, subangular to subrounded, fine to coarse sand 30%, gravel 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Loose. Very cohesive. Dry. Reaction to acid: none. Some roots.
1.4 - 6.2	0.4 - 1.9	**SAND, SILTY, GRAVELLY (SM)**: White; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 14.9 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Chunks of carbonate matrix (caliche).
6.2 - 7.4	1.9 - 2.3	**GRAVEL, SANDY, TRACE SILT (GW)**: Very light brown; gravel 60%, subangular to subrounded, fine to coarse sand 35%, silt 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
7.4 - 10.3	2.3 - 3.1	**SAND, GRAVELLY, SILTY (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, gravel 25%, silt 25%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 13.7 cm. Weakly to moderate lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Chunks of carbonate matrix.
10.3 - 11.8	3.1 - 3.6	**SAND AND GRAVEL, SOME SILT (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, gravel 35%, silt 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.7 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
11.8 - 13.9	3.6 - 4.2	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly lithified. Compact. Very slightly cohesive. Dry. Reaction to acid: very strong.
13.9 - 15.0	4.2 - 4.6	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray to light brown; subangular to subrounded, fine to coarse sand 50%, silt 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 15.2 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
15.0 - 15.7	4.6 - 4.8	**SILT, SANDY, TRACE GRAVEL (ML)**: Very light gray; silt 75%, subangular to subrounded, fine to coarse sand 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Compact. Very slightly cohesive. Dry. Reaction to acid: very strong.
15.7 - 23.0	4.8 - 7.0	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light gray to light brown; subangular to subrounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to rounded gravel including 3% cobbles. Weakly lithified. Very dense to compact. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level — DATE DRILLED: Apr. 10 - 12, 2012

CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
23.0 - 26.0	7.0 - 7.9	**SAND AND SILT, GRAVELLY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 40%, silt 40%, gravel 20%. Gravel fraction: subangular to rounded gravel including 5% cobbles. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Tuff boulder at 24.3 ft.
26.0 - 30.0	7.9 - 9.1	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Light gray to light brown; gravel 50%, subangular to subrounded, fine to coarse sand 40%, silt 10%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 12.2 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong.
30.0 - 30.4	9.1 - 9.3	**SILT AND SAND, TRACE GRAVEL (ML)**: Light gray; silt 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel including 2% cobbles up to 9.1 cm. Weakly lithified. Compact. Non-cohesive. Dry. Reaction to acid: very strong.
30.4 - 34.3	9.3 - 10.5	**SAND AND GRAVEL, SOME SILT (SM)**: Light brown; subangular to subrounded, fine to coarse sand 45%, gravel 40%, silt 15%. Gravel fraction: subangular to rounded gravel including trace cobbles. Weakly to moderately lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
34.3 - 35.0	10.5 - 10.7	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 55%, subangular to subrounded, fine to coarse sand 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Compact. Non-cohesive. Dry. Reaction to acid: very strong.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
35.0 - 37.8	10.7 - 11.5	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 65%, gravel 25%, silt 10%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 12.2 cm. Moderately to well lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Small chunks of carbonate matrix.
37.8 - 41.4	11.5 - 12.6	**SILT AND SAND, SOME GRAVEL (ML)**: Light gray; silt 50%, subangular to subrounded, fine to coarse sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 10.7 cm. Well lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Small chunks of carbonate matrix.
41.4 - 43.5	12.6 - 13.3	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 13.7 cm. Well lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Chunks of carbonate matrix.
43.5 - 49.5	13.3 - 15.1	**SILT, SANDY, TRACE GRAVEL (ML)**: Light brown to white; silt and clay 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Well lithified. Compact. Slightly to moderately cohesive. Dry. Reaction to acid: very strong. Some chunks of carbonate matrix.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

DRAFT

B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
49.5 - 72.0	15.1 - 21.9	**SAND, SILTY, GRAVELLY (SM)**: White; subangular to subrounded, fine to coarse sand 45%, silt and clay 30%, gravel 25%. Gravel fraction: angular to subrounded gravel including 5% cobbles. Well lithified. Compact. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Chunks of carbonate matrix, pieces of matrix core. 64-70 feet disturbed sample, 57-61 feet cobble rich zone up to 0.35 feet, gradual transition to next interval.
72.0 - 77.0	21.9 - 23.5	**SAND, GRAVELLY, TRACE SILT (SW)**: White to very light gray; subangular to subrounded, fine to coarse sand 60%, gravel 35%, silt and clay 5%. Gravel fraction: angular to subrounded gravel including 5% cobbles. Well lithified. Compact. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Chunks of carbonate matrix, core.
PINAL SCHIST (pCpi)		
77.0 - 80.3	23.5 - 24.5	**FRACTURED SCHIST**: Very light gray. Well lithified. Dry. Reaction to acid: weak to very strong. Highly fractured schist with carbonate fracture fill and quartz veining.
80.3 - 95.0	24.5 - 29.0	**SCHIST**: Gray. Well lithified. Dry. Reaction to acid: weak to moderate. Moderately fractured schist with carbonate fracture fill and quartz veining.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SILT AND CLAY, SANDY, TRACE GRAVEL (MH)	5 / 30 / 65	Weakly lithified; very cohesive; dry; loose; some roots	
0.5 1.0 1.5		SAND, SILTY, GRAVELLY (SM)	20 / 50 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	50 (2.75")
2.0		GRAVEL, SANDY, TRACE SILT (GW)	60 / 35 / 5	Weakly lithified; non-cohesive; dry; well graded; compact	
2.5 3.0		SAND, GRAVELLY, SILTY (SM)	25 / 50 / 25	Weakly to moderate lithified; non-cohesive; dry; well graded; compact	13 / 20 / 32 / 45 (3")
3.5		SAND AND GRAVEL, SOME SILT (SM)	35 / 50 / 15	Weakly lithified; non-cohesive; dry; well graded; compact	
4.0		SILT AND SAND, TRACE GRAVEL (ML)	5 / 45 / 50	Weakly lithified; very slightly cohesive; dry; compact	
4.5		SAND AND SILT, SOME GRAVEL (SM)	10 / 50 / 40	Weakly lithified; non-cohesive; dry; well graded; compact	
		SILT, SANDY, TRACE GRAVEL (ML)	5 / 20 / 75	Weakly lithified; very slightly cohesive; dry; compact	7 / 12 / 10 / 16 / 13 / 12 (3")
5.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

MONTGOMERY & ASSOCIATES

B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5 6.0 6.5		**SAND, GRAVELLY, SOME SILT (SW-SM)**	25 / 65 / 10	Weakly lithified; non-cohesive; dry; well graded; compact to very dense	11 / 17 / 18 / 14 / 13 / 15 (3")
7.0 7.5		**SAND AND SILT, GRAVELLY (SM)**	20 / 40 / 40	Weakly lithified; non-cohesive; dry; well graded; very dense; tuff boulder at 24.3 ft	
8.0 8.5 9.0		**GRAVEL AND SAND, SOME SILT (GW-GM)**	50 / 40 / 10	Weakly lithified; non-cohesive; dry; well graded; very dense	12 / 20 / 40 (2")
		SILT AND SAND, TRACE GRAVEL (ML)	5 / 45 / 50	Weakly lithified; non-cohesive; dry; very dense	20 / 45 (3")
9.5 10.0		**SAND AND GRAVEL, SOME SILT (SM)**	40 / 45 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level
DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E
BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5		SILT AND SAND, TRACE GRAVEL (ML)	5 / 40 / 55	Weakly lithified; non-cohesive; dry; very dense	
11.0 11.5		SAND, GRAVELLY, SOME SILT (SW-SM)	25 / 65 / 10	Moderately to well lithified; non-cohesive; dry; well graded; very dense	1 / 17 / 50 (0.25")
12.0 12.5		SILT AND SAND, SOME GRAVEL (ML)	10 / 40 / 50	Well lithified; non-cohesive; dry; well graded; very dense	4 / 36 / 25 (0.25")
13.0		SAND, GRAVELLY, SILTY (SM)	20 / 60 / 20	Well lithified; non-cohesive; dry; well graded; very dense	
13.5 14.0 14.5 15.0		SILT, SANDY, TRACE GRAVEL (ML)	5 / 35 / 60	Well lithified; slightly to moderately cohesive; dry; very dense	53 (1")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level

DATE DRILLED: Apr. 10 - 12, 2012

CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
					55 (2.5")
15.5					
16.0					
16.5					
17.0					
					51 (0.5")
17.5					
18.0					
					53 (2.5")
18.5		SAND, SILTY, GRAVELLY (SM)	25 / 45 / 30	Well lithified; slightly cohesive; dry; well graded; very dense; 64-70 feet disturbed sample, 57-61 feet cobble rich zone up to 0.35 feet, gradual transition to next interval	
19.0					
19.5					
20.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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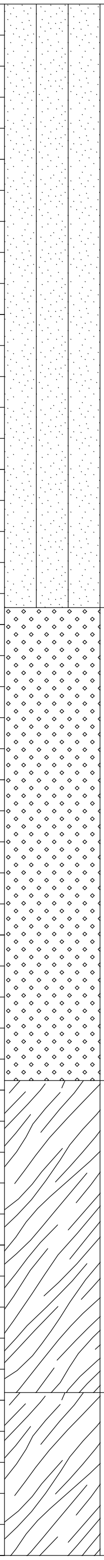
B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches



DEPTH (meters)	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
20.5				
21.0				50 (1.5")
21.5				
22.0 – 23.5	**SAND, GRAVELLY, TRACE SILT (SW)**	35 / 60 / 5	Well lithified; slightly cohesive; dry; well graded; very dense	50 (1")
23.5 – 24.5	**FRACTURED SCHIST**		Well lithified; dry; highly fractured schist with carbonate fracture fill and quartz veining	
24.5 – 25.0				

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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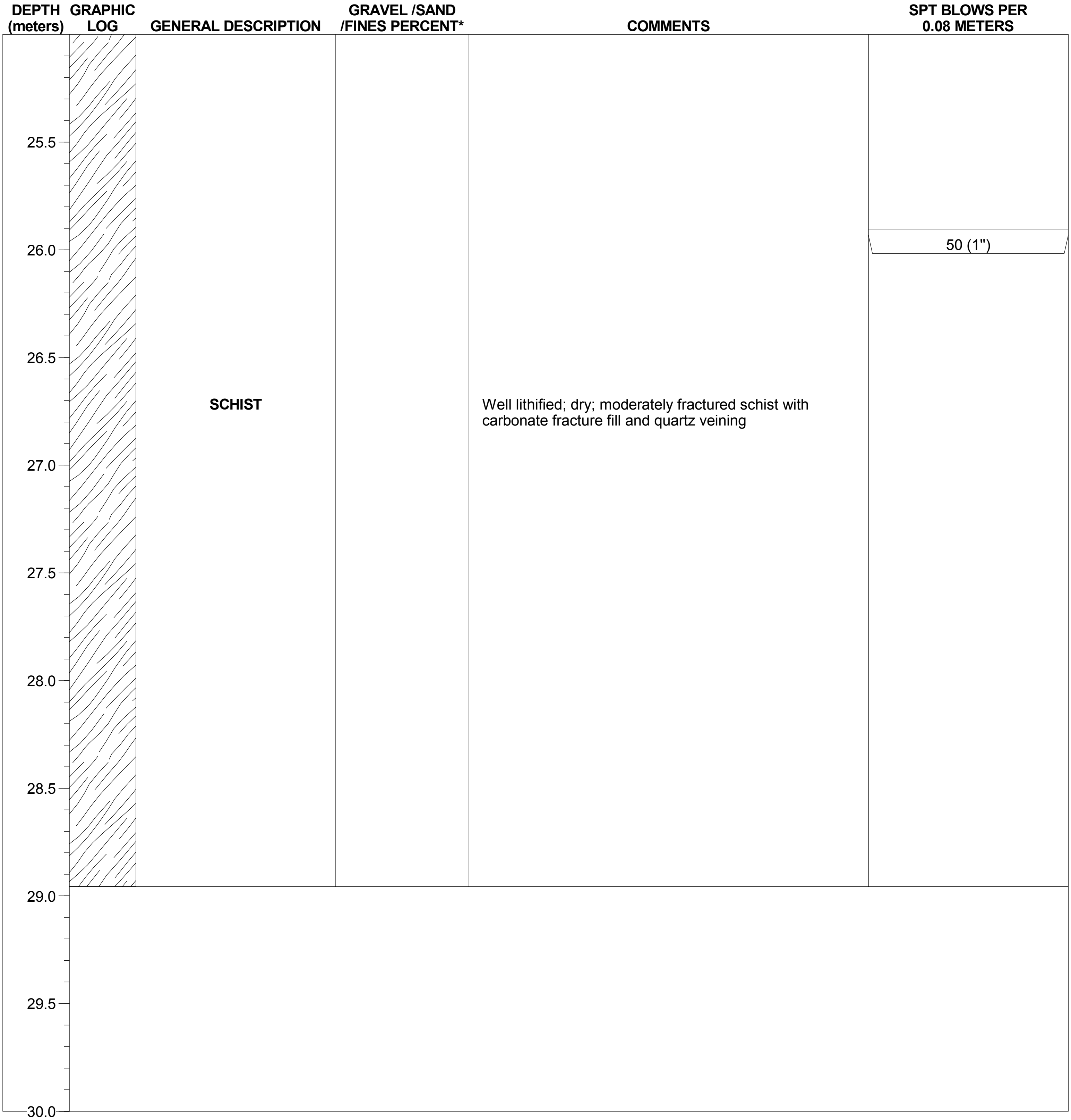
B-2-6. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW10-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 28.96 meters / 694.84 meters above mean sea level	DATE DRILLED: Apr. 10 - 12, 2012
CADASTRAL / NAD27 : (D-2-11)32cbc / 3674535.939N / 476886.919E	BOREHOLE DIAMETER: 8-inches



SCHIST

Well lithified; dry; moderately fractured schist with carbonate fracture fill and quartz veining

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 0.8	0.0 - 0.2	**SAND, SILTY, SOME GRAVEL (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 55%, silt and clay 30%, gravel 15%. Gravel fraction: angular to subrounded gravel. Non-lithified. Compact. Slightly cohesive. Dry. Well graded. Reaction to acid: none. 0 - 0.8 ft is disturbed.
0.8 - 9.5	0.2 - 2.9	**SAND, GRAVELLY, SILTY (SM)**: Very light brown; angular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly lithified. Compact to dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
9.5 - 17.0	2.9 - 5.2	**SAND, SILTY, GRAVELLY (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Moderately to well lithified. Compact to dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
17.0 - 21.0	5.2 - 6.4	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 45%, silt and clay 45%, gravel 10%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 10.5 cm. Moderately to well lithified. Compact to dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
21.0 - 30.0	6.4 - 9.1	**SAND, GRAVELLY, SILTY (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 40%, gravel 30%, silt 30%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
30.0 - 36.3	9.1 - 11.1	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Carbonate chunks.
36.3 - 40.3	11.1 - 12.3	**SAND, SILTY, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 15.2 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
40.3 - 42.5	12.3 - 13.0	**SILT AND SAND, TRACE GRAVEL (SM)**: White; silt 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Moderately to well lithified. Very dense. Non-cohesive. Dry. Reaction to acid: very strong. Carbonate chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear | LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level | DATE DRILLED: Apr. 17 - 19, 2012

CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E | BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
42.5 - 43.0	13.0 - 13.1	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
43.0 - 43.6	13.1 - 13.3	**SAND, SILTY, TRACE GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Reaction to acid: weak.
43.6 - 46.0	13.3 - 14.0	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.6 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
46.0 - 49.2	14.0 - 15.0	**SAND, SILTY, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate. Carbonate chunks.
49.2 - 52.5	15.0 - 16.0	**SAND, SILTY, SOME GRAVEL (SM)**: Light gray to light brown; subangular to subrounded, fine to coarse sand 60%, silt 25%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to strong. Carbonate chunks.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
52.5 - 62.5	16.0 - 19.1	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, silt and clay 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.7 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
62.5 - 69.5	19.1 - 21.2	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Very light gray; subangular to subrounded, fine to coarse sand 65%, gravel 20%, silt 15%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 13.7 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
69.5 - 72.0	21.2 - 21.9	**SAND, SILTY, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong.
72.0 - 78.5	21.9 - 23.9	**SAND, SILTY, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 60%, silt 25%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 13.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
78.5 - 80.5	23.9 - 24.5	**SAND, SOME SILT, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 75%, silt 15%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
80.5 - 85.2	24.5 - 26.0	**SILT, SANDY, SOME GRAVEL (CL)**: Very light brown; silt and clay 55%, angular to subrounded, fine to coarse sand 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
85.2 - 88.0	26.0 - 26.8	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 70%, gravel 15%, silt 15%. Gravel fraction: subangular to rounded gravel including trace cobbles up to 12.2 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong. Carbonate chunks. Silt increases with depth.
88.0 - 91.0	26.8 - 27.7	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: subangular to rounded gravel including trace cobbles up to 13.7 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
91.0 - 92.3	27.7 - 28.1	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 65%, silt 20%, gravel 15%. Gravel fraction: subangular to rounded gravel. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong.
92.3 - 94.3	28.1 - 28.7	**GRAVEL AND SAND, SILTY (GM)**: Light gray; gravel 45%, subangular to subrounded, fine to coarse sand 35%, silt 20%. Gravel fraction: subangular to rounded gravel including 5% cobbles up to 12.2 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
94.3 - 96.0	28.7 - 29.3	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 50%, silt 40%, gravel 10%. Gravel fraction: subangular to rounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
96.0 - 97.5	29.3 - 29.7	**SAND, GRAVELLY, SILTY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to rounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
97.5 - 103.5	29.7 - 31.5	**SAND, SILTY, SOME GRAVEL (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: subangular to rounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Carbonate chunks.
103.5 - 111.0	31.5 - 33.8	**SAND, GRAVELLY, SILTY (SM)**: Very light brown; angular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to strong.
111.0 - 118.5	33.8 - 36.1	**SAND, SOME SILT, SOME GRAVEL (SW-SM)**: Light gray; subangular to subrounded, fine to coarse sand 75%, silt 15%, gravel 10%. Gravel fraction: subangular to rounded gravel. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to weak.
118.5 - 127.0	36.1 - 38.7	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 65%, silt 20%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 10.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong. Carbonate chunks.
127.0 - 129.0	38.7 - 39.3	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 45%, silt 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
129.0 - 135.0	39.3 - 41.1	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 13.7 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to very strong. Carbonate chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SAND, SILTY, SOME GRAVEL (SM)	15 / 55 / 30	Non-lithified; slightly cohesive; dry; well graded; loose; 0 - 0.8 ft is disturbed	
0.5 1.0 1.5 2.0 2.5		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Weakly lithified; non-cohesive; dry; well graded; compact to dense	10 / 22 / 15 / 19 / 21 / 24 (3")
3.0 3.5 4.0 4.5 5.0		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Moderately to well lithified; non-cohesive; dry; well graded; compact to dense	13 / 20 / 21 / 28 / 35 / 50 (3") 16 / 50 (2")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5 6.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 45 / 45	Moderately to well lithified; slightly cohesive; dry; well graded; compact to dense	8 / 13 / 21 / 18 / 26 / 25 (3")
6.5 7.0 7.5 8.0 8.5 9.0		**SAND, GRAVELLY, SILTY (SM)**	30 / 40 / 30	Well lithified; non-cohesive; dry; well graded; very dense	25 / 45 (1.5")
9.5 10.0					50 (2")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level — DATE DRILLED: Apr. 17 - 19, 2012

CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E — BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5 11.0		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	8 / 47 (1.5")
11.5 12.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 50 / 35	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
12.5		**SILT AND SAND, TRACE GRAVEL (SM)**	5 / 45 / 50	Moderately to well lithified; non-cohesive; dry; very dense	1 / 7 / 50 (1.5")
13.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 50 / 35	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 75 / 20	Moderately to well lithified; non-cohesive; dry; very dense	
13.5 14.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 50 / 35	Moderately to well lithified; non-cohesive; dry; well graded; very dense	45 (1")
14.5 15.0		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 70 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level

DATE DRILLED: Apr. 17 - 19, 2012

CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5 16.0	░	**SAND, SILTY, SOME GRAVEL (SM)**	15 / 60 / 25	Moderately to well lithified; non-cohesive; dry; well graded; very dense	10 / 50 (2")
16.5 17.0 17.5 18.0 18.5 19.0	░	**SAND, SILTY, SOME GRAVEL (SM)**	15 / 50 / 35	Moderately to well lithified; slightly cohesive; dry; well graded; very dense	50 (2.75")
19.5 20.0	∘				55 (1.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level — DATE DRILLED: Apr. 17 - 19, 2012

CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E — BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
20.5 21.0		SAND, GRAVELLY, SOME SILT (SW-SM)	20 / 65 / 15	Well lithified; non-cohesive; dry; well graded; very dense	4 / 33 / 28 (0.75")
21.5		SAND, SILTY, SOME GRAVEL (SM)	15 / 50 / 35	Well lithified; non-cohesive; dry; well graded; very dense	
22.0 22.5 23.0 23.5		SAND, SILTY, SOME GRAVEL (SM)	15 / 60 / 25	Moderately to well lithified; non-cohesive; dry; well graded; very dense	1 / 7 / 3 / 3 / 50 (2.5")
24.0 24.5		SAND, SOME SILT, SOME GRAVEL (SM)	10 / 75 / 15	Moderately lithified; non-cohesive; dry; well graded; very dense	
25.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5		**SILT, SANDY, SOME GRAVEL (CL)**	10 / 35 / 55	Moderately to well lithified; slightly cohesive; dry; well graded; very dense	
26.0 26.5		**SAND, SOME GRAVEL, SOME SILT (SW-SM)**	15 / 70 / 15	Well lithified; non-cohesive; dry; well graded; very dense; silt increases with depth	4 / 13 / 19 / 19 / 50 (1")
27.0 27.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 55 / 35	Well lithified; non-cohesive; dry; well graded; very dense	
28.0		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 65 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
28.5		**GRAVEL AND SAND, SILTY (GM)**	45 / 35 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
29.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
29.5		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	1 / 2 / 3 / 20 / 32 / 29
30.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
30.5		**SAND, SILTY, SOME GRAVEL (SM)**	10 / 55 / 35	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
31.0					
31.5					
32.0					7 / 27 / 35 (1.5")
32.5		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
33.0					
33.5					
34.0					
34.5					
35.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
		SAND, SOME SILT, SOME GRAVEL (SW-SM)	10 / 75 / 15	Moderately lithified; non-cohesive; dry; well graded; very dense	
35.5					
36.0					
36.5					
37.0					
37.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 65 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
38.0					
38.5					
39.0		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 45 / 40	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
39.5					
40.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-7. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW13-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 646.09 meters above mean sea level	DATE DRILLED: Apr. 17 - 19, 2012
CADASTRAL / NAD27 : (D-2-10)36dda / 3674201.751N / 475018.924E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
40.5 41.0	░	**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
41.5					
42.0					
42.5					
43.0					
43.5					
44.0					
44.5					
45.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 1.9	0.0 - 0.6	**SILT, SANDY, TRACE GRAVEL (CL)**: Reddish-brown; silt 70%, subangular to subrounded, very fine to medium sand 30%, trace gravel. Gravel fraction: subrounded gravel including very trace cobbles up to 10.7 cm. Non to weakly lithified. Loose. Very slightly cohesive. Dry. Uniformly graded. Reaction to acid: very weak. Abundant weak chunks of matrix. Trace organic material (plant roots).
1.9 - 6.0	0.6 - 1.8	**SAND, GRAVELLY, SILTY (SM)**: Light reddish-brown; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subrounded gravel including <10% cobbles up to 8.8 cm. Weakly to moderately lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to moderate.
6.0 - 9.4	1.8 - 2.9	**GRAVEL AND SAND, SILTY (GM)**: Light gray to light brownish-gray; gravel 45%, subangular to subrounded, fine to coarse sand 35%, silt 20%. Gravel fraction: subangular to subrounded gravel including 20% cobbles up to 10.4 cm. Weakly to moderately lithified. Dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
9.4 - 11.0	2.9 - 3.4	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 7.0 cm. Weakly to moderately lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
11.0 - 12.8	3.4 - 3.9	**GRAVEL AND SAND, SOME SILT (GW-GM)**: Very light pinkish-gray to very light gray; gravel 45%, subangular to subrounded, fine to coarse sand 40%, silt 15%. Gravel fraction: subangular to subrounded gravel including 35% cobbles up to 8.8 cm. Weakly to moderately lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to strong.
12.8 - 14.4	3.9 - 4.4	**SAND, SILTY, TRACE GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 75%, silt 20%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 4.0 cm. Weakly lithified. Compact. Non-cohesive. Dry. Well graded. Reaction to acid: very weak. Some weakly cemented matrix chips.
14.4 - 18.9	4.4 - 5.8	**SAND AND GRAVEL, SILTY (SM)**: Light gray to white; subangular to subrounded, fine to coarse sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 13.7 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some chunks of caliche.
18.9 - 22.5	5.8 - 6.9	**SILT, SANDY, TRACE GRAVEL (ML)**: Light brown; silt and clay 75%, subangular to subrounded very fine sand 25%, trace gravel. Gravel fraction: angular to subangular gravel including very trace cobbles up to 12.2 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Uniformly graded. Reaction to acid: strong to very strong. Carbonate stringers in matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
22.5 - 24.1	6.9 - 7.3	**SILT AND SAND (ML)**: Very light brown; silt 65%, subangular to subrounded, very fine to fine sand 35%. Moderately lithified. Very dense. Very slightly cohesive. Dry. Uniformly graded. Reaction to acid: very strong. More carbonate in matrix.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
24.1 - 29.2	7.3 - 8.9	**SAND AND SILT, GRAVELLY (SM)**: White; subangular to subrounded, fine to coarse sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 14.6 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some caliche chunks.
29.2 - 30.0	8.9 - 9.1	**SILT AND SAND, TRACE GRAVEL (ML)**: White; silt 55%, subangular to subrounded very fine sand 40%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 5.5 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
30.0 - 30.9	9.1 - 9.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: angular to subangular gravel including trace cobbles up to 12.2 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some caliche chunks.
30.9 - 32.5	9.4 - 9.9	**SAND, SILTY, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong.
32.5 - 33.5	9.9 - 10.2	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 70%, silt 20%, gravel 10%. Gravel fraction: subangular to subrounded gravel up to 3.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak.
33.5 - 37.0	10.2 - 11.3	**SILT AND SAND, TRACE GRAVEL (ML)**: Very light brown; silt and clay 60%, subrounded very fine sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 12.2 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Uniformly graded. Reaction to acid: very strong.
37.0 - 44.4	11.3 - 13.5	**SILT AND SAND, SOME GRAVEL (SM)**: Very light brown to white; silt and clay 50%, subangular to subrounded, fine to coarse sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 15.2 cm. Moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
44.4 - 52.0	13.5 - 15.8	**SILT AND SAND, TRACE GRAVEL (ML)**: Very light brown to white; silt and clay 60%, subangular to subrounded, fine to coarse sand 40%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.3 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Moderately to well cemented matrix chips from 50-51 ft.
52.0 - 52.8	15.8 - 16.1	**SAND, SILTY, GRAVELLY (SM)**: Very light brown; subangular to subrounded, fine to coarse sand 45%, silt 30%, gravel 25%. Gravel fraction: subangular to subrounded gravel including 1% cobbles up to 10.7 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
52.8 - 57.5	16.1 - 17.5	**SILT, SANDY, SOME GRAVEL (CL)**: Very light brown; silt and clay 55%, subangular to subrounded, fine to coarse sand 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong.
57.5 - 61.0	17.5 - 18.6	**SAND, SILTY, GRAVELLY (SM)**: Light gray to light brown; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
61.0 - 62.0	18.6 - 18.9	**SILT, SANDY, TRACE GRAVEL (ML)**: Very light brown; silt 70%, subangular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: subrounded gravel including trace cobbles up to 0.3 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
62.0 - 67.2	18.9 - 20.5	**SAND AND SILT, SOME GRAVEL (SM)**: Light orangish-brown; subangular to subrounded, fine to coarse sand 50%, silt 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 15.5 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Trace well cemented matrix chunks.
67.2 - 73.5	20.5 - 22.4	**SILT AND SAND, TRACE GRAVEL (SM)**: Very light gray; silt 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: subrounded gravel including trace cobbles up to 11.0 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Trace well cemented matrix chunks.
73.5 - 75.5	22.4 - 23.0	**SAND AND SILT, SOME GRAVEL (SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.4 cm. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong to very strong. Trace well cemented matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
75.5 - 79.7	23.0 - 24.3	**SAND AND SILT, GRAVELLY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 45%, silt 35%, gravel 20%. Gravel fraction: subangular to subrounded gravel including 10% cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Common caliche chunks.
79.7 - 82.6	24.3 - 25.2	**SAND, GRAVELLY, SILTY (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 50%, gravel 25%, silt and clay 25%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: strong.
82.6 - 91.4	25.2 - 27.9	**SAND, SILTY, GRAVELLY (SM)**: Very light gray; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Moderately to well lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Common to abundant caliche chunks.
91.4 - 94.9	27.9 - 28.9	**SILT, SANDY (ML)**: Light orangish-brown to light gray; silt and clay 70%, subangular to subrounded, very fine to medium sand 30%. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant chips of sandy siltstone.
94.9 - 96.3	28.9 - 29.4	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 55%, gravel 30%, silt 15%. Gravel fraction: angular to subangular gravel including 20% cobbles up to 13.4 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some caliche chunks.
96.3 - 108.9	29.4 - 33.2	**SAND AND SILT, SOME GRAVEL (SM)**: Very light brown to very light gray; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 8.2 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant caliche chunks.
108.9 - 119.4	33.2 - 36.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 50%, silt 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 16.5 cm. Moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Abundant moderately cemented chips.
119.4 - 135.0	36.4 - 41.1	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light brownish-gray; subangular to subrounded, fine to coarse sand 65%, gravel 20%, silt 15%. Gravel fraction: subangular to subrounded gravel including <10% cobbles up to 11.9 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Some moderately cemented sandstone chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level

DATE DRILLED: Mar. 28 - Apr. 6, 2012

CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E

BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
0.5	▨	**SILT, SANDY, TRACE GRAVEL (CL)**	tr / 30 / 70	Non to weakly lithified; very slightly cohesive; dry; uniformly graded; loose; trace organic material (plant roots)	
1.0 1.5	░	**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; dense	3 / 9 / 10 / 11 / 21 / 18 (3")
2.0 2.5	◯	**GRAVEL AND SAND, SILTY (GM)**	45 / 35 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; dense	
3.0	░	**SAND AND SILT, SOME GRAVEL (SM)**	10 / 55 / 35	Weakly to moderately lithified; non-cohesive; dry; well graded; compact	2 / 2 / 3 / 7 / 10 / 11 (3")
3.5	●	**GRAVEL AND SAND, SOME SILT (GW-GM)**	45 / 40 / 15	Weakly to moderately lithified; non-cohesive; dry; well graded; compact	
4.0	░	**SAND, SILTY, TRACE GRAVEL (SM)**	5 / 75 / 20	Weakly lithified; non-cohesive; dry; well graded; compact	
4.5 5.0	░				1 / 2 / 6 / 50 (2")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5		**SAND AND GRAVEL, SILTY (SM)**	35 / 40 / 25	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
6.0 6.5		**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 25 / 75	Moderately lithified; slightly cohesive; dry; uniformly graded; very dense	1 / 2 / 7 / 18 / 27 / 36 (3")
7.0		**SILT AND SAND (ML)**	0 / 35 / 65	Moderately lithified; very slightly cohesive; dry; uniformly graded; very dense	
7.5 8.0 8.5		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Moderately lithified; non-cohesive; dry; well graded; very dense	19 / 44 (1")
9.0		**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 40 / 55	Moderately lithified; non-cohesive; dry; well graded; very dense	
		SAND AND SILT, TRACE GRAVEL (SM)	5 / 60 / 35	Moderately lithified; non-cohesive; dry; well graded; very dense	50 (2.75")
9.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Moderately lithified; non-cohesive; dry; well graded; very dense	
10.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level

DATE DRILLED: Mar. 28 - Apr. 6, 2012

CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E

BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
	░	**SAND, SILTY, SOME GRAVEL (SM)**	10 / 70 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
10.5 11.0	▥	**SILT AND SAND, TRACE GRAVEL (ML)**	5 / 35 / 60	Moderately lithified; slightly cohesive; dry; uniformly graded; very dense	50 (2")
11.5 12.0 12.5 13.0 13.5	░	**SILT AND SAND, SOME GRAVEL (SM)**	10 / 40 / 50	Moderately lithified; slightly cohesive; dry; well graded; very dense	1 / 1 / 50 (2.5")
14.0 14.5 15.0	▥	**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 40 / 60	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	50 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear
LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level
DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E
BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5	▥				28 / 39 (2.5")
16.0	░	**SAND, SILTY, GRAVELLY (SM)**	25 / 45 / 30	Moderately lithified; non-cohesive; dry; well graded; very dense	
16.5 17.0 17.5	▨	**SILT, SANDY, SOME GRAVEL (CL)**	15 / 30 / 55	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
18.0 18.5	░	**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Moderately lithified; non-cohesive; dry; well graded; very dense	7 / 50 (1.75")
	▥	**SILT, SANDY, TRACE GRAVEL (ML)**	5 / 25 / 70	Moderately lithified; non-cohesive; dry; well graded; very dense	
19.0 19.5 20.0	░	**SAND AND SILT, SOME GRAVEL (SM)**	10 / 50 / 40	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR
SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
20.5 21.0 21.5 22.0		**SILT AND SAND, TRACE GRAVEL (SM)**	5 / 45 / 50	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	24 / 30 (3")
22.5		**SAND AND SILT, SOME GRAVEL (SM)**	15 / 50 / 35	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	
23.0 23.5 24.0		**SAND AND SILT, GRAVELLY (SM)**	20 / 45 / 35	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	
24.5 25.0		**SAND, GRAVELLY, SILTY (SM)**	25 / 50 / 25	Moderately to well lithified; slightly cohesive; dry; well graded; very dense	50 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level

DATE DRILLED: Mar. 28 - Apr. 6, 2012

CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E

BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
25.5 26.0 26.5 27.0 27.5		**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Moderately to well lithified; very slightly cohesive; dry; well graded; very dense	39 / 19 (3")
28.0 28.5		**SILT, SANDY (ML)**	0 / 30 / 70	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	
29.0		**SAND, GRAVELLY, SOME SILT (SW-SM)**	30 / 55 / 15	Moderately lithified; non-cohesive; dry; well graded; very dense	22 / 35 (3")
29.5 30.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level

DATE DRILLED: Mar. 28 - Apr. 6, 2012

CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E

BOREHOLE DIAMETER: 9-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
30.5					14 / 19 / 25 / 34 (1.5")
31.0		SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
31.5					
32.0					
32.5					
33.0					
33.5					17 / 44 (2")
34.0					
34.5		SAND AND SILT, TRACE GRAVEL (SM)	5 / 50 / 45	Moderately lithified; very slightly cohesive; dry; well graded; very dense	
35.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

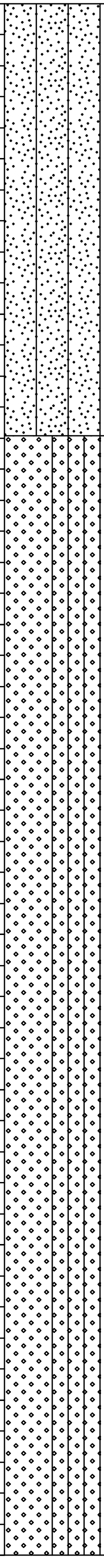
LOGGED BY: C. King

DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level

DATE DRILLED: Mar. 28 - Apr. 6, 2012

CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E

BOREHOLE DIAMETER: 9-inches



DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
35.5					
36.0					
36.5					11 / 22 / 50 (2.75")
37.0					
37.5					
38.0					
38.5		**SAND, GRAVELLY, SOME SILT (SW-SM)**	20 / 65 / 15	Moderately lithified; non-cohesive; dry; well graded; very dense	
39.0					
39.5					18 / 45 (1.5")
40.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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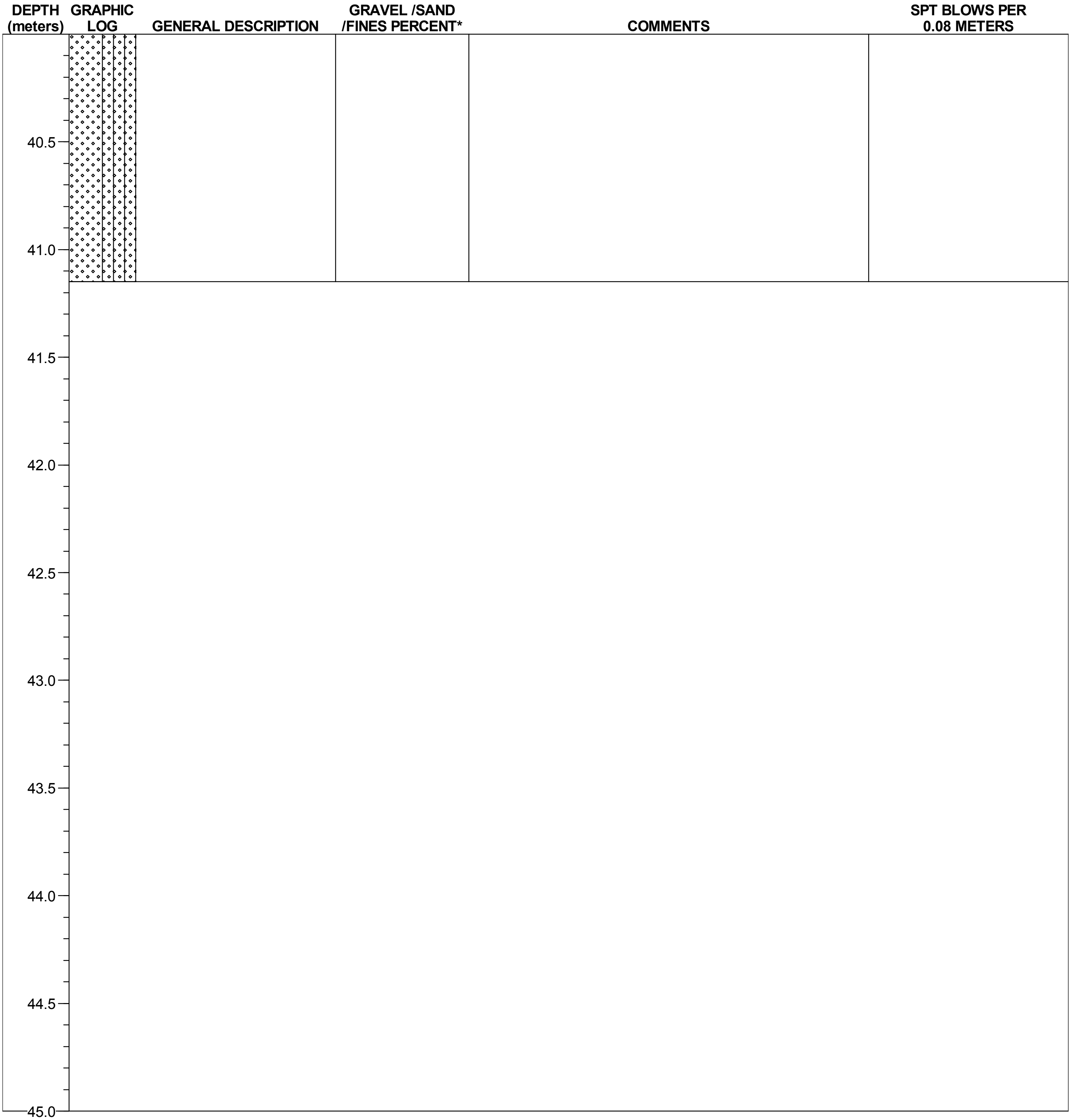
B-2-8. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM VADOSE ZONE PIEZOMETER FW14-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: C. King
DEPTH DRILLED / LAND SURFACE ELEVATION: 41.15 meters / 619.46 meters above mean sea level	DATE DRILLED: Mar. 28 - Apr. 6, 2012
CADASTRAL / NAD27 : (D-2-10)24cbc / 3677653.982N / 473471.087E	BOREHOLE DIAMETER: 9-inches



* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level — DATE DRILLED: May 3, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 2.0	0.0 - 0.6	**SILT AND CLAY, SANDY, TRACE GRAVEL (CH)**: Reddish-brown; silt and clay 70%, angular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel. Non-lithified. Very dense. Very cohesive. Dry. Reaction to acid: none.
2.0 - 4.7	0.6 - 1.4	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Top gradational contact, some matrix chunks.
4.7 - 7.5	1.4 - 2.3	**SAND, SILTY, GRAVELLY (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to moderate. Some matrix chunks.
7.5 - 9.4	2.3 - 2.9	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 10.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
9.4 - 14.5	2.9 - 4.4	**SAND, SILTY, GRAVELLY (SM)**: Brown; subangular to subrounded, fine to coarse sand 50%, silt 30%, gravel 20%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 13.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: moderate to strong.
14.5 - 17.5	4.4 - 5.3	**SILT, SANDY, TRACE GRAVEL (ML)**: Brown; silt 80%, subangular to subrounded, fine to coarse sand 20%, trace gravel. Gravel fraction: gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: very strong.
17.5 - 20.0	5.3 - 6.1	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 10.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Trace matrix chunks.
20.0 - 24.7	6.1 - 7.5	**SAND, GRAVELLY, SOME SILT (SW-SM)**: Light brown to light gray; subangular to subrounded, fine to coarse sand 70%, gravel 20%, silt 10%. Gravel fraction: subangular to subrounded gravel including some cobbles. Non to weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none.
24.7 - 26.5	7.5 - 8.1	**SAND AND SILT, SOME GRAVEL (SM)**: Reddish-brown; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 12.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to moderate.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level — DATE DRILLED: May 3, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
26.5 - 28.3	8.1 - 8.6	**SAND, SILTY, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 60%, silt 30%, gravel 10%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong to very strong.
28.3 - 29.0	8.6 - 8.8	**SILT, SANDY, TRACE GRAVEL (ML)**: White; silt 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 10.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Reaction to acid: very strong. Trace matrix chunks.
29.0 - 40.0	8.8 - 12.2	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 12.2 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
40.0 - 42.0	12.2 - 12.8	**SILT, SANDY, TRACE GRAVEL (ML)**: Light brown; silt 65%, subangular to subrounded, fine to coarse sand 30%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Moderately lithified. Very dense. Very slightly cohesive. Dry. Reaction to acid: very strong. Some matrix chunks.
42.0 - 43.4	12.8 - 13.2	**SILT AND SAND, SOME GRAVEL (ML)**: Light brown; silt 50%, subangular to subrounded, fine to coarse sand 40%, gravel 10%. Gravel fraction: subangular to subrounded gravel. Moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
43.4 - 46.0	13.2 - 14.0	**SILT, SANDY, TRACE GRAVEL (CL)**: Light gray; silt 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Moderately lithified. Very dense. Non-cohesive. Dry. Reaction to acid: very strong. Some matrix chunks.
46.0 - 46.5	14.0 - 14.2	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
46.5 - 47.5	14.2 - 14.5	**SILT, SANDY (ML)**: Light gray; silt 80%, subangular to subrounded, fine to medium sand 20%. Weakly lithified. Very dense. Non-cohesive. Dry. Reaction to acid: weak.
47.5 - 53.0	14.5 - 16.2	**SAND, GRAVELLY, SILTY (SM)**: Light brown to light gray; subangular to subrounded, fine to coarse sand 55%, gravel 25%, silt 20%. Gravel fraction: angular to subrounded gravel including 3% cobbles up to 15.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

DRAFT

B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level	DATE DRILLED: May 3, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
53.0 - 58.5	16.2 - 17.8	**SILT AND CLAY, SANDY, TRACE GRAVEL (CL)**: Brown; silt and clay 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly to moderately lithified. Very dense. Moderately cohesive. Dry. Reaction to acid: very strong.
58.5 - 60.0	17.8 - 18.3	**SAND, SILTY, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 55%, silt 30%, gravel 15%. Gravel fraction: subangular to subrounded gravel. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
60.0 - 62.3	18.3 - 19.0	**SILT AND CLAY, SANDY, TRACE GRAVEL (CL)**: Brown; silt and clay 60%, subangular to subrounded, fine to coarse sand 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly to moderately lithified. Very dense. Moderately cohesive. Dry. Reaction to acid: very strong.
62.3 - 65.0	19.0 - 19.8	**SAND, SILTY, SOME GRAVEL (SM)**: Light gray; subangular to subrounded, fine to coarse sand 50%, silt 35%, gravel 15%. Gravel fraction: subangular to subrounded gravel including trace cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

DRAFT

B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level

DATE DRILLED: May 3, 2012

CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
0.5	▨	**SILT AND CLAY, SANDY, TRACE GRAVEL (CH)**	5 / 25 / 70	Non-lithified; very cohesive; dry; very dense	
1.0	⁘	**SAND, GRAVELLY, SILTY (SM)**	30 / 50 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
1.5 2.0	⁘	**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	24 / 35 (0.5")
2.5	⁘	**SAND, GRAVELLY, SILTY (SM)**	25 / 55 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
3.0 3.5 4.0	⁘	**SAND, SILTY, GRAVELLY (SM)**	20 / 50 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	11 / 12 / 16 / 16 / 25 (1.5")
4.5 5.0	‖	**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 20 / 80	Weakly lithified; very slightly cohesive; dry; very dense	10 / 17 / 20 / 25 / 30 / 32 (3")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level	DATE DRILLED: May 3, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5 6.0		SAND, GRAVELLY, SILTY (SM)	25 / 55 / 20	Weakly lithified; non-cohesive; dry; uniformly graded; very dense	
6.5 7.0 7.5		SAND, GRAVELLY, SOME SILT (SW-SM)	20 / 70 / 10	Non to weakly lithified; non-cohesive; dry; well graded; very dense	9 / 18 / 42 / 42 (3")
8.0		SAND AND SILT, SOME GRAVEL (SM)	15 / 50 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	6 / 48 (1.75")
8.5		SAND, SILTY, SOME GRAVEL (SM)	10 / 60 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	
		SILT, SANDY, TRACE GRAVEL (ML)	5 / 35 / 60	Weakly lithified; non-cohesive; dry; very dense	
9.0 9.5 10.0					11 / 28 / 34 (1")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level	DATE DRILLED: May 3, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5 11.0 11.5 12.0		SAND, GRAVELLY, SILTY (SM)	25 / 55 / 20	Well lithified; non-cohesive; dry; well graded; very dense	30 / 32 (2.75")
12.5		SILT, SANDY, TRACE GRAVEL (ML)	5 / 30 / 65	Moderately lithified; very slightly cohesive; dry; very dense	12 / 21 / 37 (2.5")
13.0		SILT AND SAND, SOME GRAVEL (ML)	10 / 40 / 50	Moderately lithified; non-cohesive; dry; well graded; very dense	
13.5		SILT, SANDY, TRACE GRAVEL (CL)	5 / 35 / 60	Moderately lithified; non-cohesive; dry; very dense	9 / 22 (3")
14.0		SAND, GRAVELLY, SILTY (SM)	20 / 60 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
		SILT, SANDY (ML)	0 / 20 / 80	Weakly lithified; non-cohesive; dry; very dense	
14.5 15.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

B-2-9. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW7-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 597.41 meters above mean sea level	DATE DRILLED: May 3, 2012
CADASTRAL / NAD27 : (D-2-10)35bbb / 3675560N / 471885E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5 16.0	⋯	**SAND, GRAVELLY, SILTY (SM)**	25 / 55 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	18 / 40 (1.5")
16.5 17.0 17.5	▨	**SILT AND CLAY, SANDY, TRACE GRAVEL (CL)**	5 / 35 / 60	Weakly to moderately lithified; moderately cohesive; dry; very dense	12 / 43 / 25 / 24 / 38 (2")
18.0	⋯	**SAND, SILTY, SOME GRAVEL (SM)**	15 / 55 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	
18.5	▨	**SILT AND CLAY, SANDY, TRACE GRAVEL (CL)**	5 / 35 / 60	Weakly to moderately lithified; moderately cohesive; dry; very dense	14 / 20 / 21 / 36 (2.5")
19.0 19.5	⋯	**SAND, SILTY, SOME GRAVEL (SM)**	15 / 50 / 35	Weakly lithified; non-cohesive; dry; well graded; very dense	50 (1.5")
20.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level	DATE DRILLED: May 2 - 3, 2012
CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E	BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
0.0 - 3.4	0.0 - 1.0	**SILT AND CLAY AND SAND, TRACE GRAVEL (CL)**: Light brown; silt and clay 55%, subangular to subrounded, fine to coarse sand 45%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 4.3 cm. Non to weakly lithified. Very dense. Moderately cohesive. Dry. Well graded. Reaction to acid: very weak to moderate. Trace matrix chunks towards bottom, trace carbonate stringers.
3.4 - 5.0	1.0 - 1.5	**SILT, SANDY, TRACE GRAVEL (ML)**: White; silt 65%, subangular to subrounded, fine to coarse sand 30%, gravel 5%. Gravel fraction: angular to subrounded gravel including very trace cobbles up to 7.6 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
5.0 - 6.6	1.5 - 2.0	**SAND, SILTY, GRAVELLY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 45%, silt 30%, gravel 25%. Gravel fraction: subangular to subrounded gravel up to 4.0 cm. Weakly to moderate lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
6.6 - 9.1	2.0 - 2.8	**SAND, GRAVELLY, SILTY (SM)**: Light grayish-brown; subangular to subrounded, fine to coarse sand 50%, gravel 30%, silt 20%. Gravel fraction: angular to subrounded gravel including 3% cobbles up to 8.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
9.1 - 10.0	2.8 - 3.0	**SILT, SANDY, TRACE GRAVEL (ML)**: White; silt 70%, subangular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel up to 6.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
10.0 - 16.2	3.0 - 4.9	**SAND AND GRAVEL, SILTY (SM)**: Light brown and grayish-brown; subangular to subrounded, fine to coarse sand 40%, gravel 35%, silt 25%. Gravel fraction: subangular to subrounded gravel including 5% cobbles up to 9.1 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks, trace carbonate stringers.
16.2 - 20.0	4.9 - 6.1	**SILT AND SAND, TRACE GRAVEL (ML)**: Light grayish-brown; silt 60%, subangular to subrounded, fine to medium sand 40%. Gravel fraction: subangular to subrounded including very trace cobbles up to 10.7 cm. Moderately lithified. Very dense. Non-cohesive. Dry. Uniformly graded. Reaction to acid: very strong. Common matrix chunks with carbonate.
20.0 - 21.3	6.1 - 6.5	**SILT AND SAND, TRACE GRAVEL (SM)**: Grayish-brown; silt 50%, subangular to subrounded, fine to coarse sand 45%, gravel 5%. Gravel fraction: subangular to subrounded gravel up to 5.5 cm. Non-lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level — DATE DRILLED: May 2 - 3, 2012

CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY ALLUVIUM (Qal)		
21.3 - 24.0	6.5 - 7.3	**SILT AND SAND, TRACE GRAVEL (ML)**: Light brown; silt 65%, subangular to subrounded, fine to coarse sand 35%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 4.0 cm. Moderately to well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Minor matrix chunks, cementation increasing downward, very trace manganese oxide.
24.0 - 25.0	7.3 - 7.6	**SILT AND SAND, TRACE GRAVEL (ML)**: Light grayish-brown; silt 60%, subangular to subrounded, fine to coarse sand 40%, trace gravel. Gravel fraction: subangular to subrounded gravel up to 3.7 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
25.0 - 26.0	7.6 - 7.9	**SAND, SILTY, TRACE GRAVEL (SM)**: Brown; subangular to subrounded, fine to coarse sand 65%, silt 30%, gravel 5%. Gravel fraction: angular to subrounded gravel up to 3.0 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Trace matrix chunks.
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
26.0 - 27.5	7.9 - 8.4	**SAND AND SILT, TRACE GRAVEL (SM)**: Brownish-gray; subangular to subrounded, fine to coarse sand 55%, silt 40%, gravel 5%. Gravel fraction: angular to subrounded gravel up to 3.0 cm. Well lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
27.5 - 29.5	8.4 - 9.0	**SAND, SILTY, SOME GRAVEL (SM)**: Grayish-brown; subangular to subrounded, fine to coarse sand 65%, silt 20%, gravel 15%. Gravel fraction: angular to subrounded gravel up to 3.0 cm. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong. Trace matrix chunks.
29.5 - 35.0	9.0 - 10.7	**SILT, SANDY, TRACE GRAVEL (CL)**: Light brown; silt and clay 70%, subangular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Slightly cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
35.0 - 42.0	10.7 - 12.8	**SILT AND CLAY, SOME SAND, TRACE GRAVEL (CL)**: Light brown; silt and clay 80%, subangular to subrounded, fine to coarse sand 15%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Moderately cohesive. Dry. Well graded. Reaction to acid: very strong. Some matrix chunks.
42.0 - 43.5	12.8 - 13.3	**SILT, SANDY, TRACE GRAVEL (ML)**: Yellowish-brown; silt 70%, subangular to subrounded, fine to coarse sand 25%, gravel 5%. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: strong. Some matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S
Far West Site
Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear — LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level — DATE DRILLED: May 2 - 3, 2012

CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E — BOREHOLE DIAMETER: 8-inches

DEPTH INTERVAL (feet)	DEPTH INTERVAL (meters)	DESCRIPTION
QUATERNARY AND TERTIARY BASIN-FILL DEPOSITS (QTg)		
43.5 - 51.7	13.3 - 15.8	**SAND AND SILT, SOME GRAVEL (SM)**: Light gray to light brown; subangular to subrounded, fine to coarse sand 45%, silt 40%, gravel 15%. Gravel fraction: subangular to subrounded gravel including 3% cobbles up to 15.2 cm. Weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to weak. Trace matrix chunks.
51.7 - 53.5	15.8 - 16.3	**SAND AND SILT, SOME GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 55%, silt 35%, gravel 10%. Gravel fraction: angular to subrounded gravel including trace cobbles up to 12.2 cm. Non to weakly lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none to moderate.
53.5 - 56.3	16.3 - 17.2	**SAND, SOME GRAVEL, SOME SILT (SW-SM)**: Light gray; subangular to rounded, fine to coarse sand 80%, gravel 10%, silt 10%. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: none.
56.3 - 61.3	17.2 - 18.7	**SILT, SANDY, TRACE GRAVEL (ML)**: Brown; silt 75%, subangular to subrounded, fine to coarse sand 25%, trace gravel. Gravel fraction: angular to subrounded gravel. Weakly to moderately lithified. Very dense. Very slightly cohesive. Dry. Well graded. Reaction to acid: strong. Trace matrix chunks.
61.3 - 62.5	18.7 - 19.1	**SAND, GRAVELLY, SILTY (SM)**: Light gray; subangular to subrounded, fine to coarse sand 60%, gravel 20%, silt 20%. Gravel fraction: subangular to subrounded gravel. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: very strong.
62.5 - 65.0	19.1 - 19.8	**SAND AND SILT, TRACE GRAVEL (SM)**: Light brown; subangular to subrounded, fine to coarse sand 60%, silt 35%, gravel 5%. Gravel fraction: subangular to subrounded gravel. Weakly to moderately lithified. Very dense. Non-cohesive. Dry. Well graded. Reaction to acid: weak to moderate. Trace matrix chunks.

Grain size based on USCS. Silt and clay content estimated using manual field methods.
Size fractions rounded to the nearest five percent.

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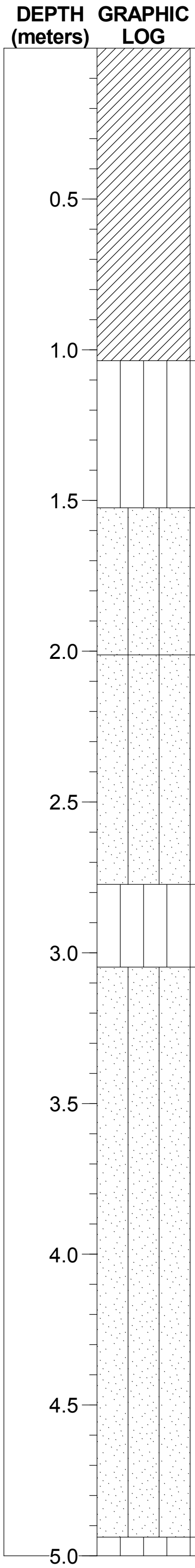
B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level	DATE DRILLED: May 2 - 3, 2012
CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E	BOREHOLE DIAMETER: 8-inches



GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
SILT AND CLAY AND SAND, TRACE GRAVEL (CL)	tr / 45 / 55	Non to weakly lithified; moderately cohesive; dry; well graded; very dense	
SILT, SANDY, TRACE GRAVEL (ML)	5 / 30 / 65	Weakly lithified; non-cohesive; dry; well graded; very dense	
SAND, SILTY, GRAVELLY (SM)	25 / 45 / 30	Weakly to moderate lithified; non-cohesive; dry; well graded; very dense	21 / 18 / 29 / 21 (1.75")
SAND, GRAVELLY, SILTY (SM)	30 / 50 / 20	Weakly lithified; non-cohesive; dry; well graded; very dense	
SILT, SANDY, TRACE GRAVEL (ML)	5 / 25 / 70	Weakly lithified; non-cohesive; dry; well graded; very dense	
SAND AND GRAVEL, SILTY (SM)	35 / 40 / 25	Weakly lithified; non-cohesive; dry; well graded; very dense	9 / 23 / 22 / 28 (3") 8 / 21 / 30 (1.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear

LOGGED BY: B. Bates

DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level

DATE DRILLED: May 2 - 3, 2012

CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E

BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
5.5 6.0		**SILT AND SAND, TRACE GRAVEL (ML)**	0 / 40 / 60	Moderately lithified; non-cohesive; dry; uniformly graded; very dense	
		SILT AND SAND, TRACE GRAVEL (SM)	5 / 45 / 50	Non-lithified; non-cohesive; dry; well graded; very dense	18 / 17 / 22 / 28 (2.75")
6.5 7.0		**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 35 / 65	Moderately to well lithified; non-cohesive; dry; well graded; very dense	
7.5		**SILT AND SAND, TRACE GRAVEL (ML)**	tr / 40 / 60	Weakly lithified; non-cohesive; dry; well graded; very dense	
		SAND, SILTY, TRACE GRAVEL (SM)	5 / 65 / 30	Weakly lithified; non-cohesive; dry; well graded; very dense	15 / 21 / 29 (2.75")
8.0		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 55 / 40	Well lithified; non-cohesive; dry; well graded; very dense	
8.5		**SAND, SILTY, SOME GRAVEL (SM)**	15 / 65 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
9.0 9.5 10.0		**SILT, SANDY, TRACE GRAVEL (CL)**	5 / 25 / 70	Weakly to moderately lithified; slightly cohesive; dry; well graded; very dense	25 / 25 (2.5")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level	DATE DRILLED: May 2 - 3, 2012
CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
10.5	▨				
11.0 11.5 12.0 12.5	▨	**SILT AND CLAY, SOME SAND, TRACE GRAVEL (CL)**	5 / 15 / 80	Weakly to moderately lithified; moderately cohesive; dry; well graded; very dense	35 / 25 (0.25") 10 / 14 / 26 / 32 / 28 (3")
13.0	▥	**SILT, SANDY, TRACE GRAVEL (ML)**	5 / 25 / 70	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
13.5 14.0 14.5 15.0	░	**SAND AND SILT, SOME GRAVEL (SM)**	15 / 45 / 40	Weakly lithified; non-cohesive; dry; well graded; very dense	17 / 40 (1")

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

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B-2-10. LITHOLOGIC DESCRIPTIONS FOR SONIC CORE SAMPLES FROM GEOTECHNICAL BOREHOLE FW12-S

Far West Site

Pinal County, Arizona

DRILLING METHOD / COMPANY: Sonic / Boart Longyear	LOGGED BY: B. Bates
DEPTH DRILLED / LAND SURFACE ELEVATION: 19.81 meters / 590.70 meters above mean sea level	DATE DRILLED: May 2 - 3, 2012
CADASTRAL / NAD27 : (D-2-10)35ccc / 3673989N / 471851E	BOREHOLE DIAMETER: 8-inches

DEPTH (meters)	GRAPHIC LOG	GENERAL DESCRIPTION	GRAVEL /SAND /FINES PERCENT*	COMMENTS	SPT BLOWS PER 0.08 METERS
15.5					14 / 36 / 32 (2.25")
16.0		**SAND AND SILT, SOME GRAVEL (SM)**	10 / 55 / 35	Non to weakly lithified; non-cohesive; dry; well graded; very dense	
16.5 17.0		**SAND, SOME GRAVEL, SOME SILT (SW-SM)**	10 / 80 / 10	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	13 / 33 / 45 (3")
17.5 18.0 18.5		**SILT, SANDY, TRACE GRAVEL (ML)**	tr / 25 / 75	Weakly to moderately lithified; very slightly cohesive; dry; well graded; very dense	16 / 36 / 48 (3")
19.0		**SAND, GRAVELLY, SILTY (SM)**	20 / 60 / 20	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	
19.5		**SAND AND SILT, TRACE GRAVEL (SM)**	5 / 60 / 35	Weakly to moderately lithified; non-cohesive; dry; well graded; very dense	15 / 27 / 43 (3")
20.0					

* Grain size based on USCS. Silt and clay content estimated using manual field methods. Size fractions rounded to the nearest five percent. Trace represented by "tr".

APPENDIX D

AQTESOLV PLOTS FOR PUMPING TESTS

APPENDIX D

CONTENTS

Figure

CONTENTS – continued

Figure

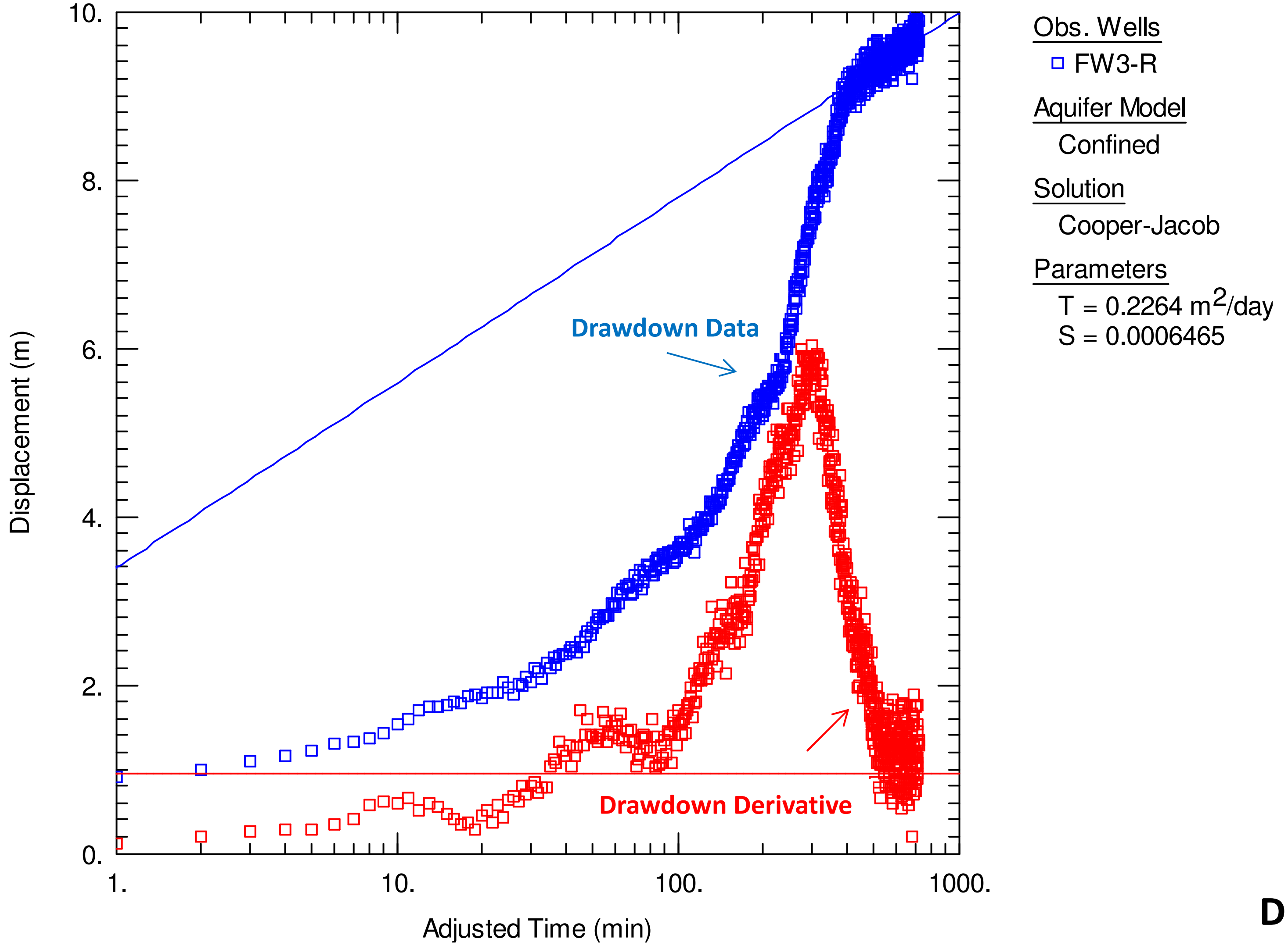

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FIGURE D-1. SEMI-LOG DRAWDOWN PLOT FOR PUMPING WELL FW3-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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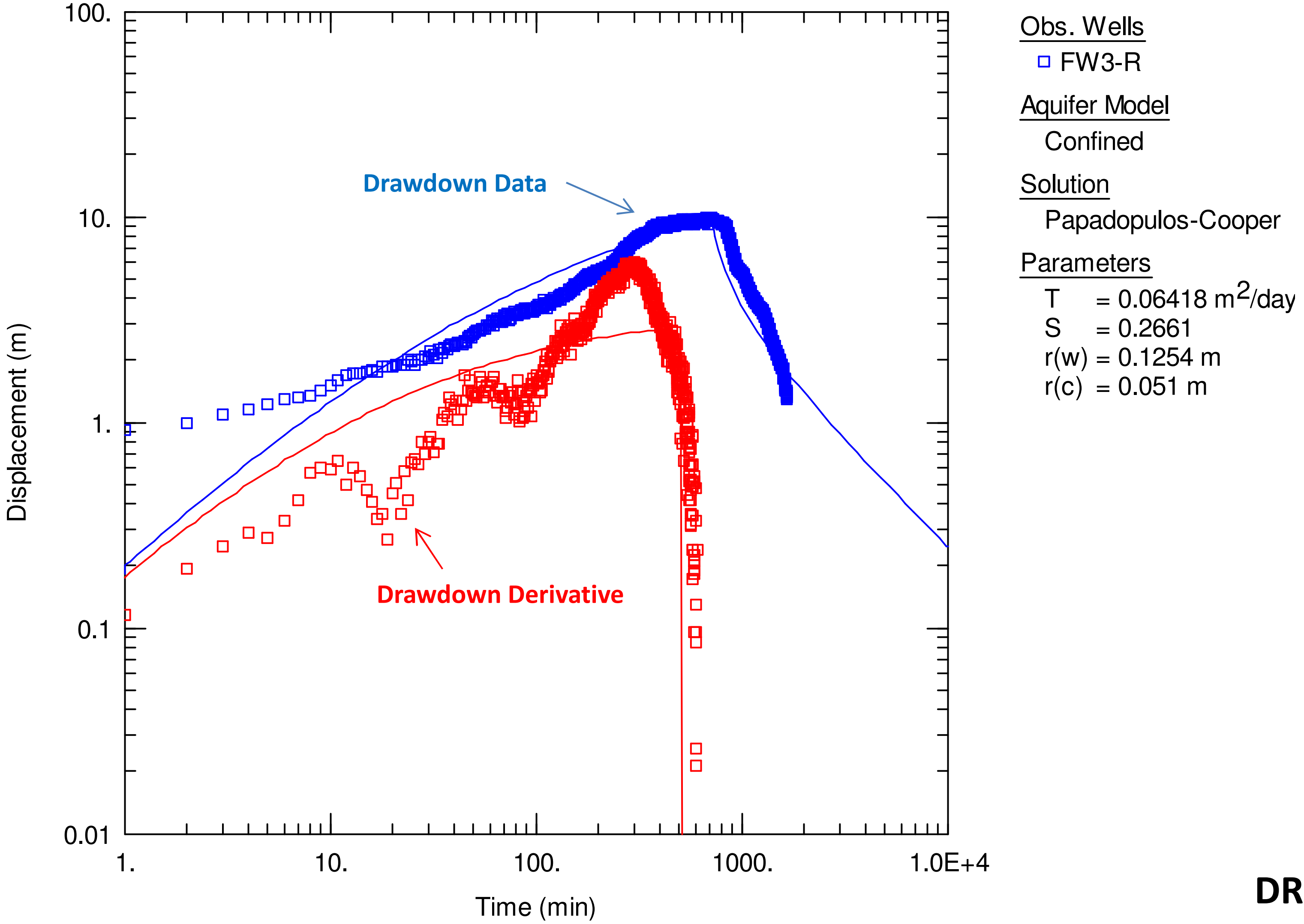

FIGURE D-2. LOG-LOG PLOT FOR PUMPING WELL FW3-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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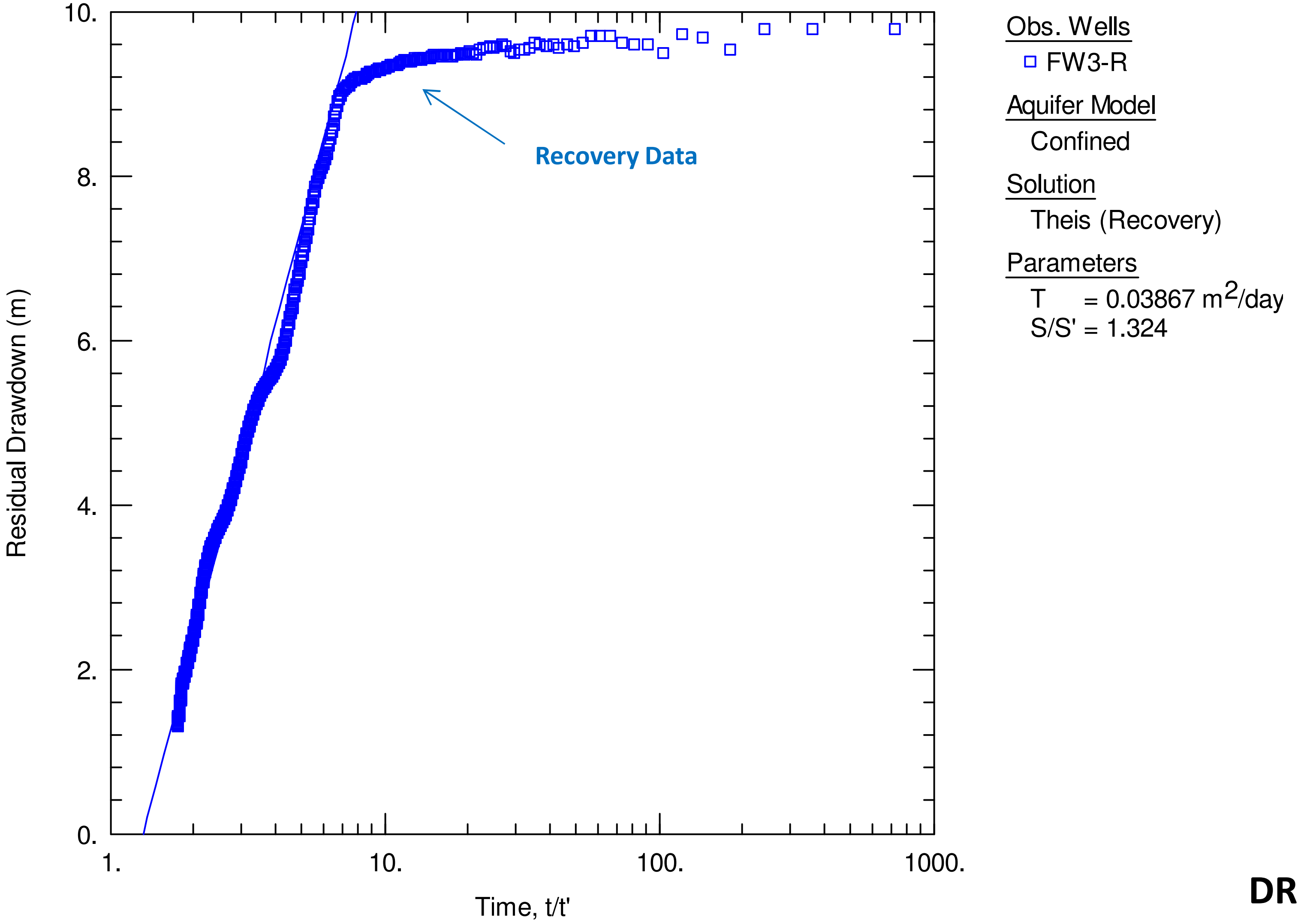

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FIGURE D-3. SEMI-LOG RECOVERY PLOT FOR PUMPING WELL FW3-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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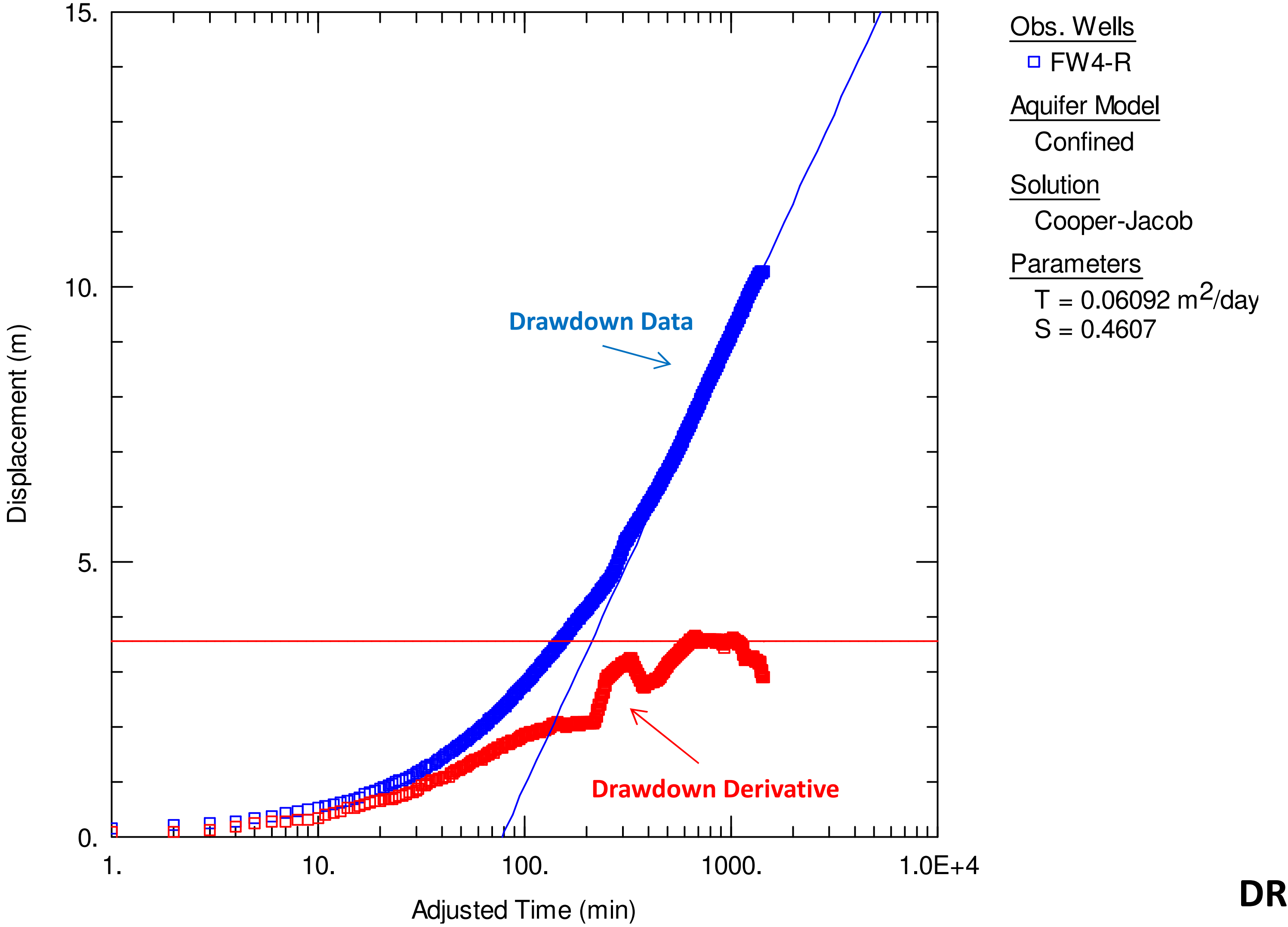

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FIGURE D-4. SEMI-LOG DRAWDOWN PLOT FOR PUMPING WELL FW4-R DURING 24-HOUR CONSTANT-RATE PUMPING TEST

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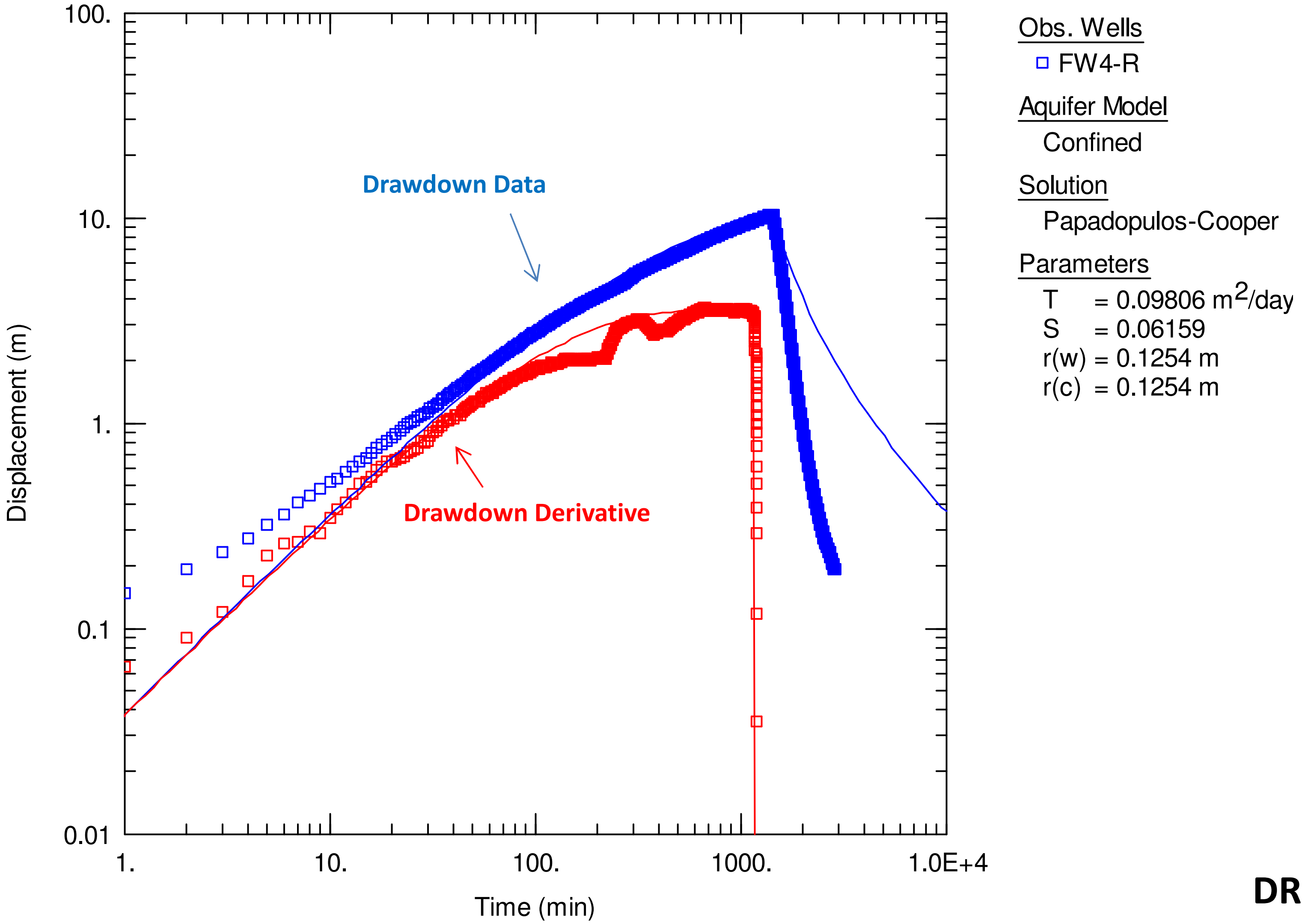

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FIGURE D-5. LOG-LOG PLOT FOR PUMPING WELL FW4-R DURING 24-HOUR CONSTANT-RATE PUMPING TEST

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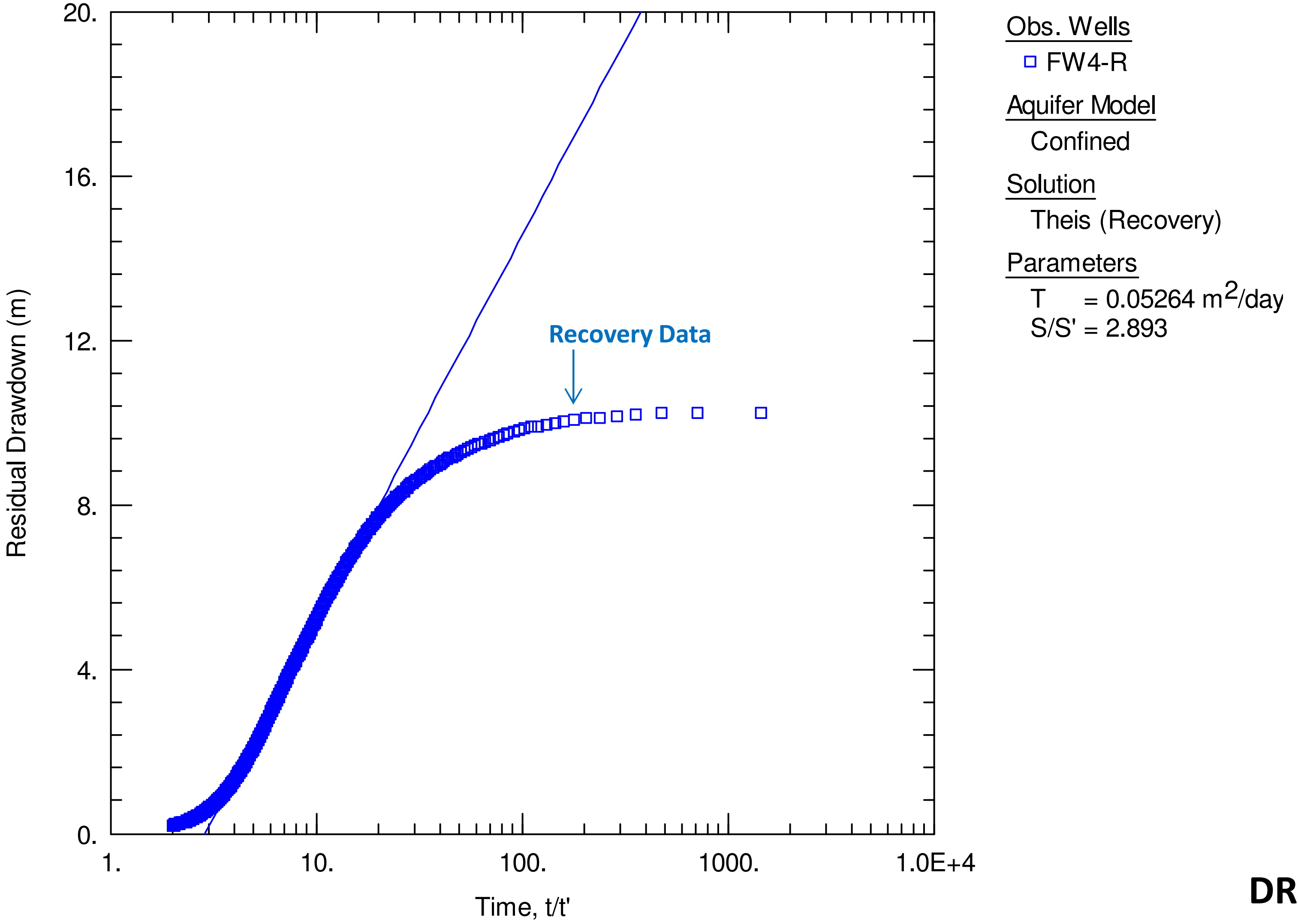

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FIGURE D-6. SEMI-LOG RECOVERY PLOT FOR PUMPING WELL FW4-R DURING 24-HOUR CONSTANT-RATE PUMPING TEST

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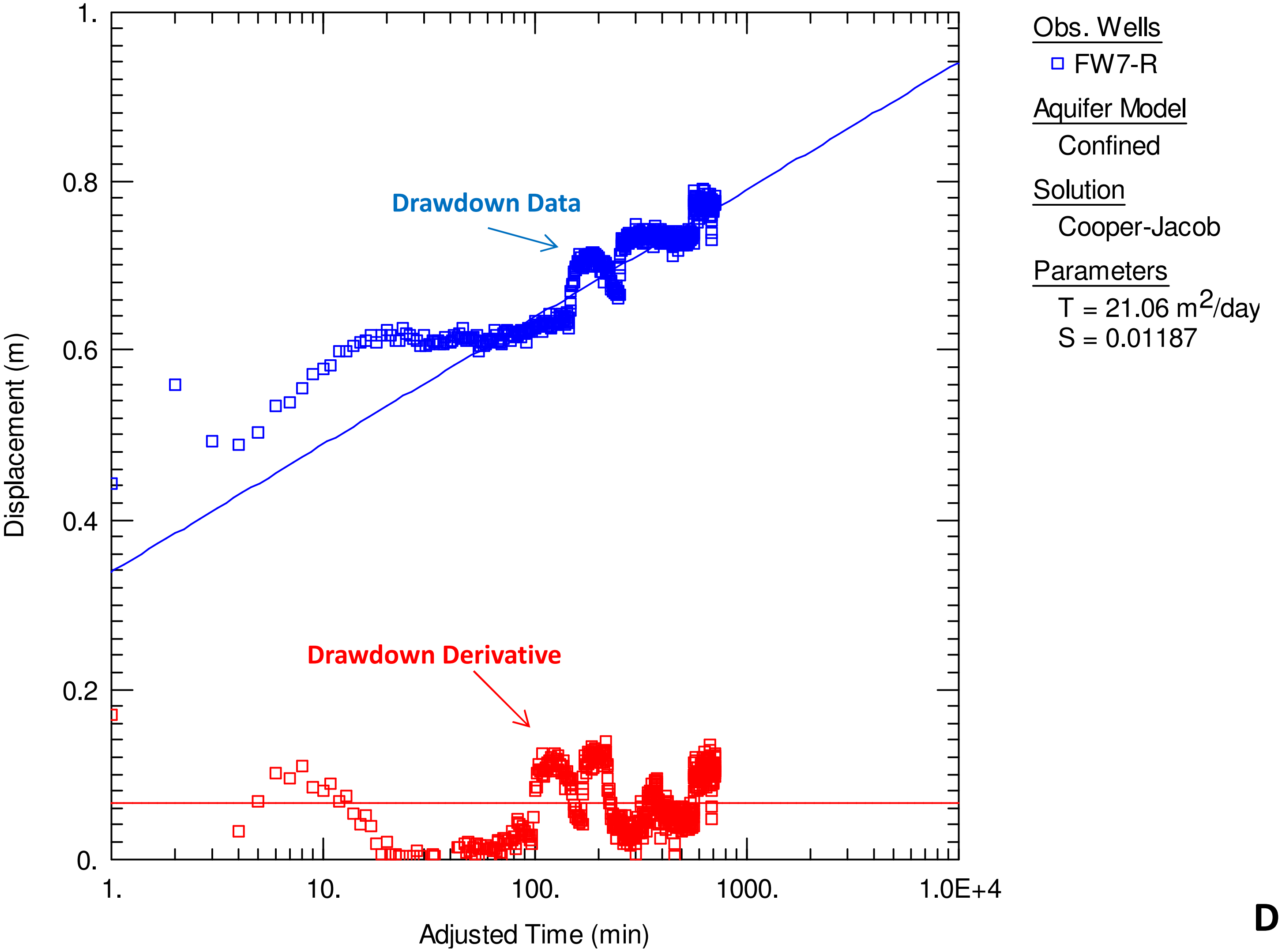

Drawdown Data

Drawdown Derivative

DRAFT

FIGURE D-7. SEMI-LOG DRAWDOWN PLOT FOR PUMPING WELL FW7-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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S:\projects\605\605.7 Misc Investigations\605.7156 - Pumping Tests_Far West\Report\FigD-7_FW7Rsemilog_AQT.ppt

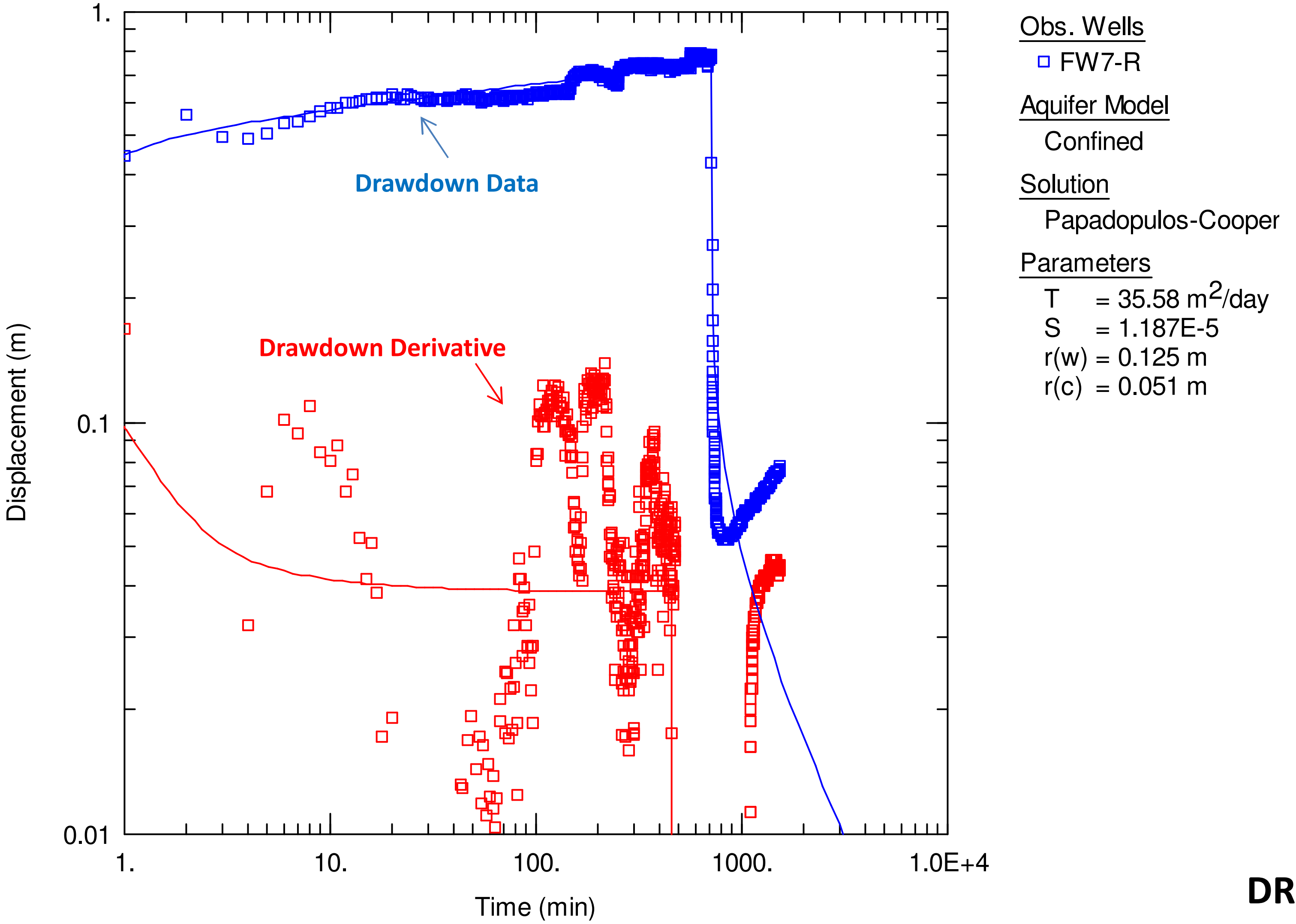

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FIGURE D-8. LOG-LOG PLOT FOR PUMPING WELL FW7-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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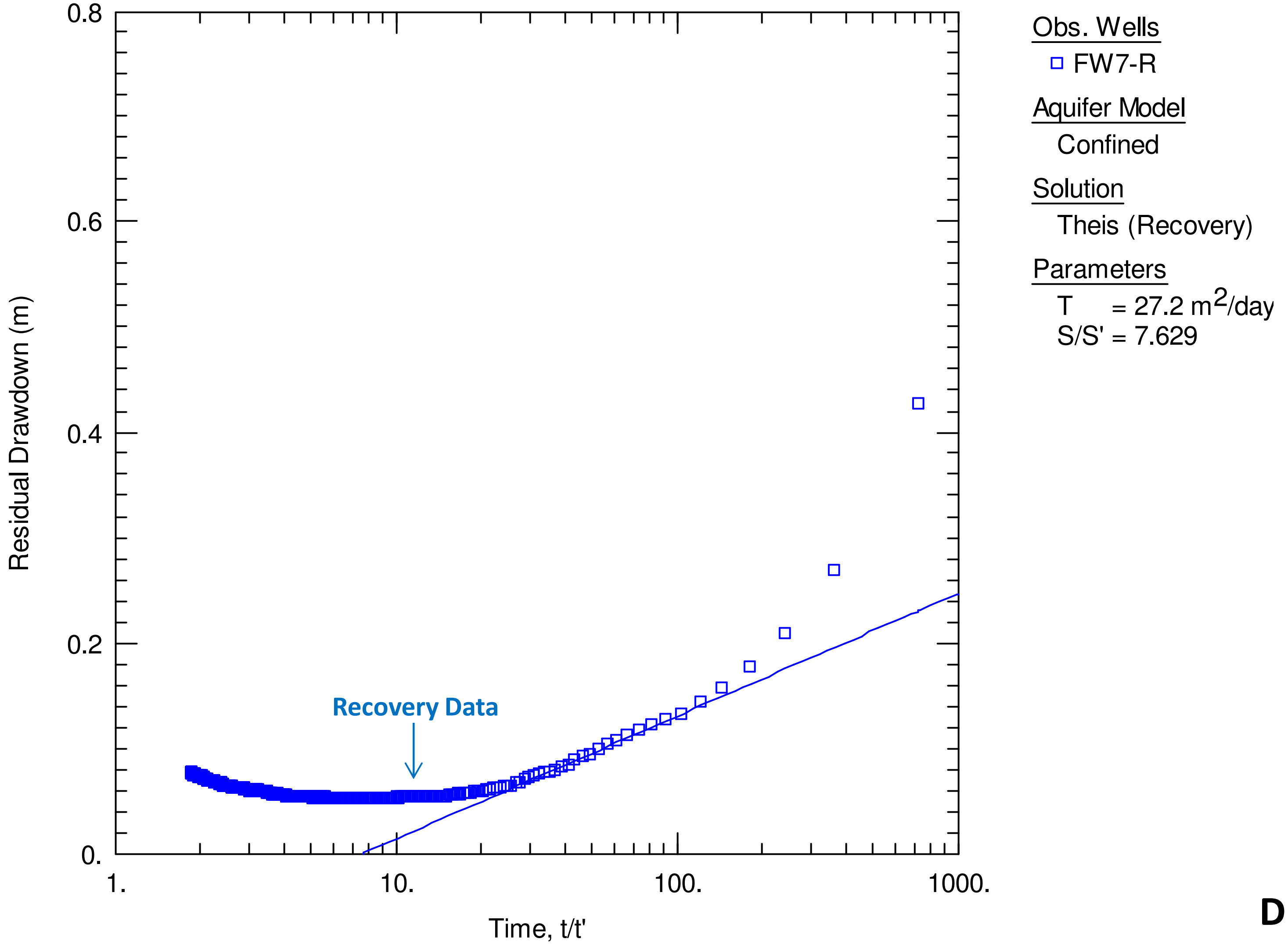

DRAFT

FIGURE D-9. SEMI-LOG RECOVERY PLOT FOR PUMPING WELL FW7-R DURING 12-HOUR CONSTANT-RATE PUMPING TEST

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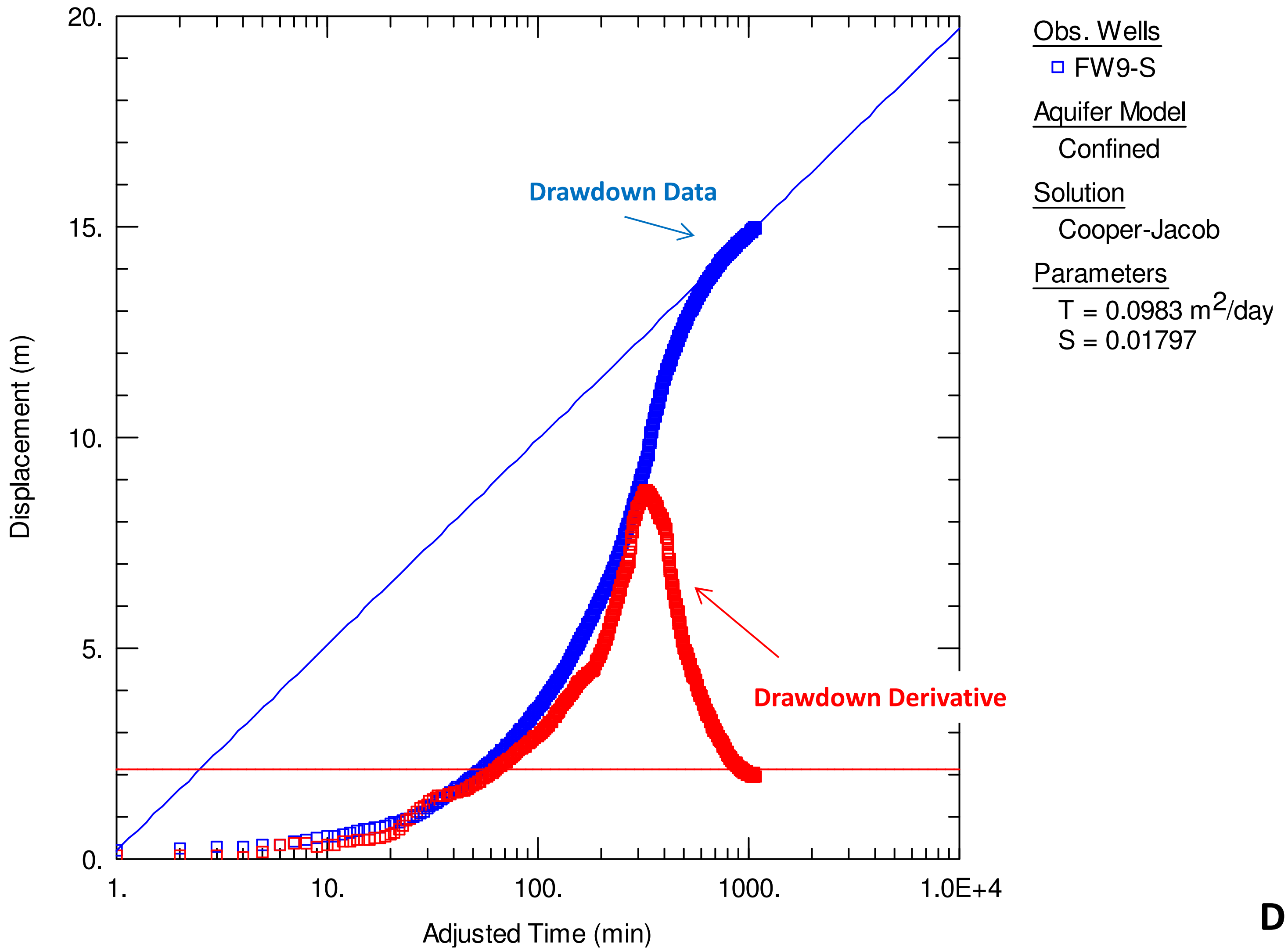

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FIGURE D-10. SEMI-LOG DRAWDOWN PLOT FOR PUMPING WELL FW9-S DURING 18-HOUR CONSTANT-RATE PUMPING TEST

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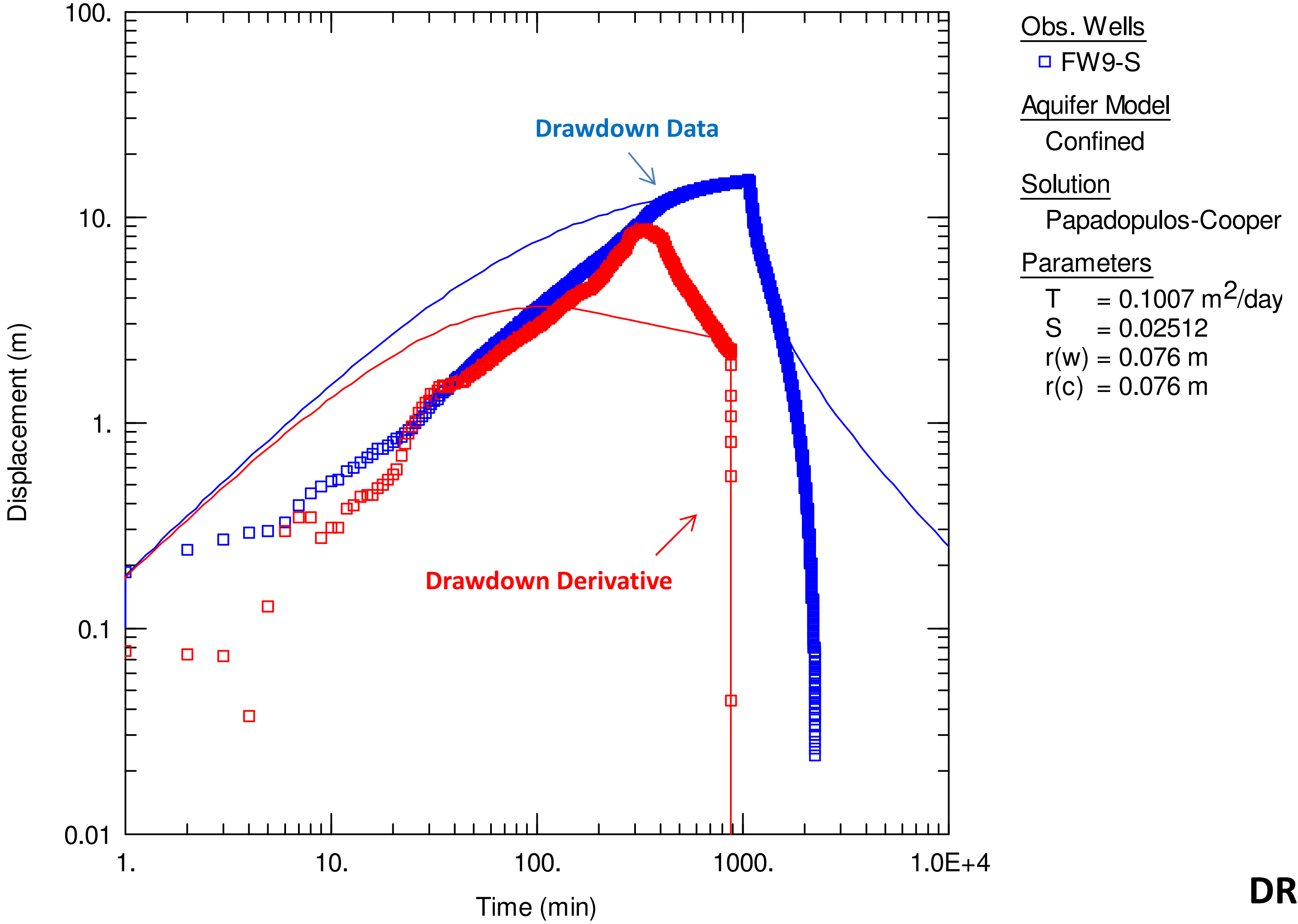

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FIGURE D-11. LOG-LOG PLOT FOR PUMPING WELL FW9-S DURING 18-HOUR CONSTANT-RATE PUMPING TEST

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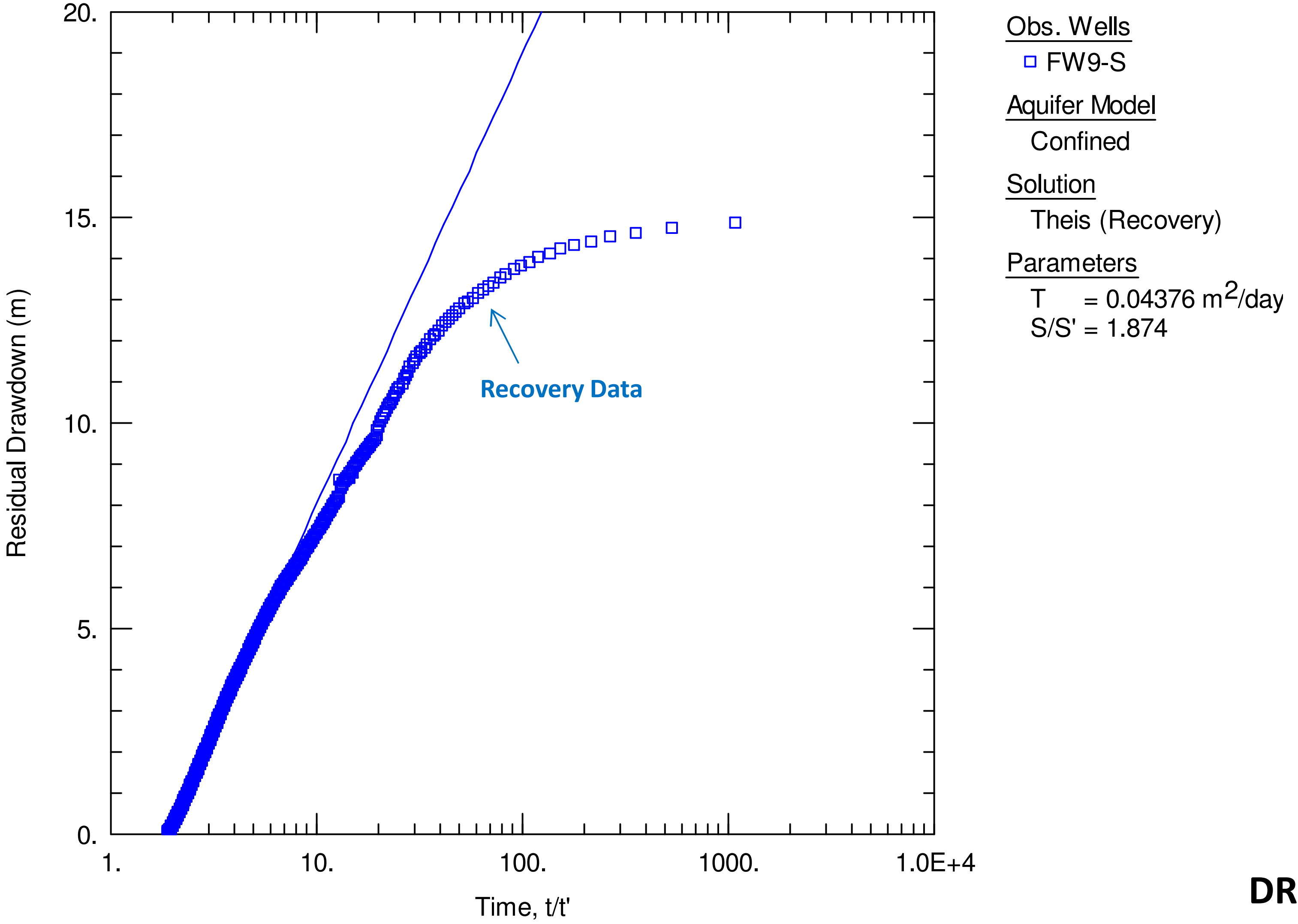

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FIGURE D-12. SEMI-LOG RECOVERY PLOT FOR PUMPING WELL FW9-S DURING 18-HOUR CONSTANT-RATE PUMPING TEST

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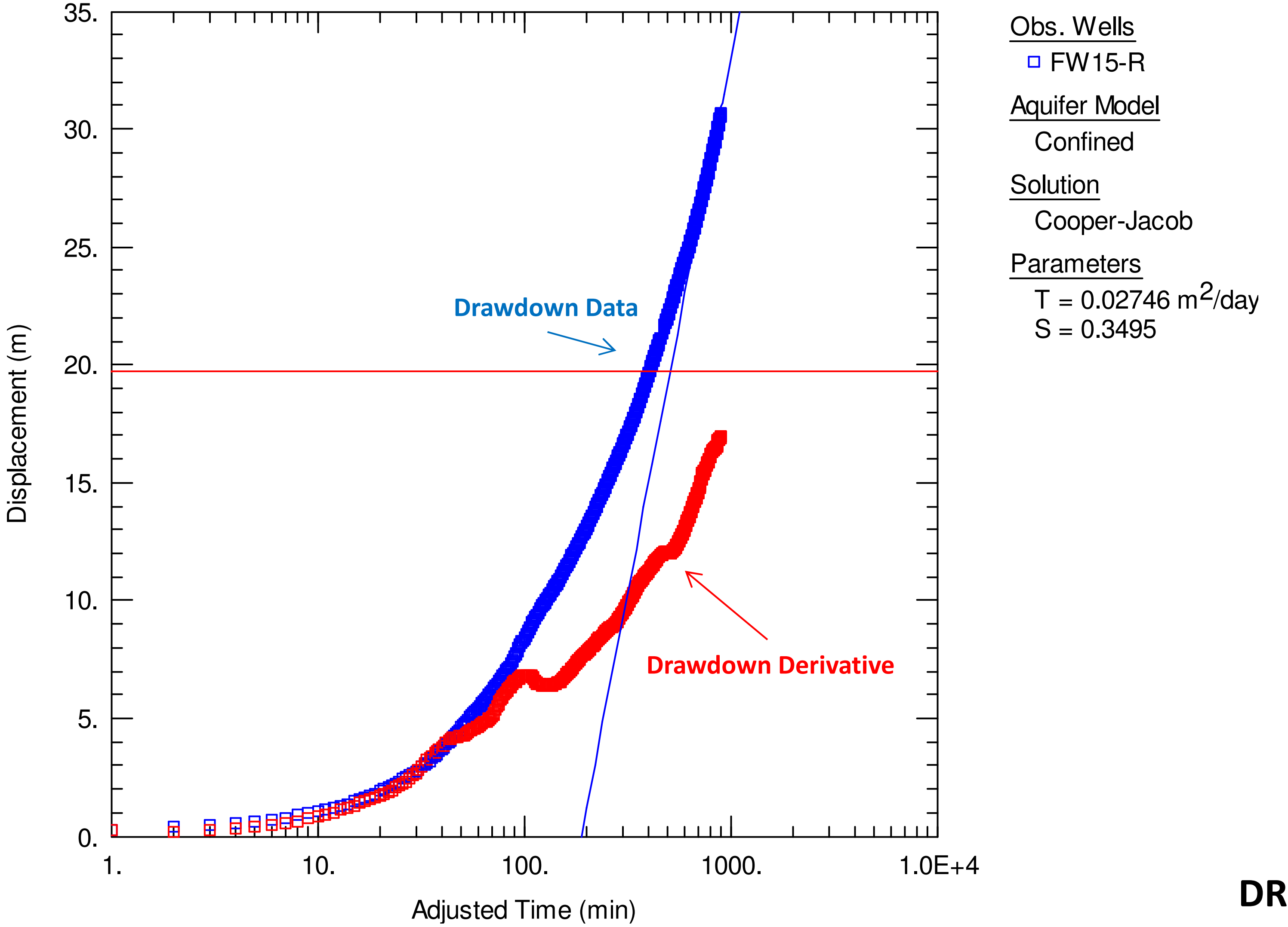

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FIGURE D-13. SEMI-LOG DRAWDOWN PLOT FOR PUMPING WELL FW15-R DURING 15-HOUR CONSTANT-RATE PUMPING TEST

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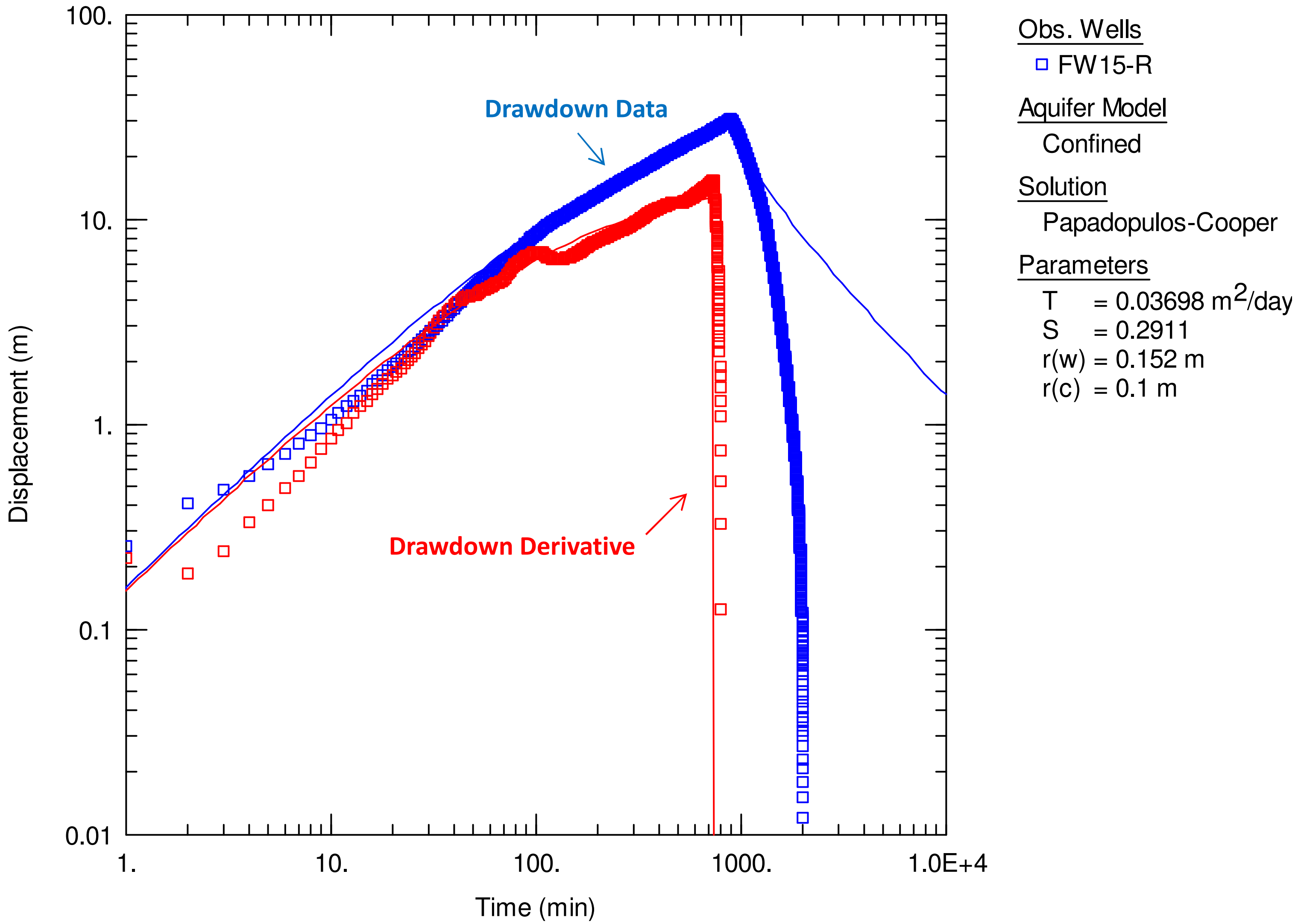

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FIGURE D-14. LOG-LOG PLOT FOR PUMPING WELL FW15-R DURING 15-HOUR CONSTANT-RATE PUMPING TEST

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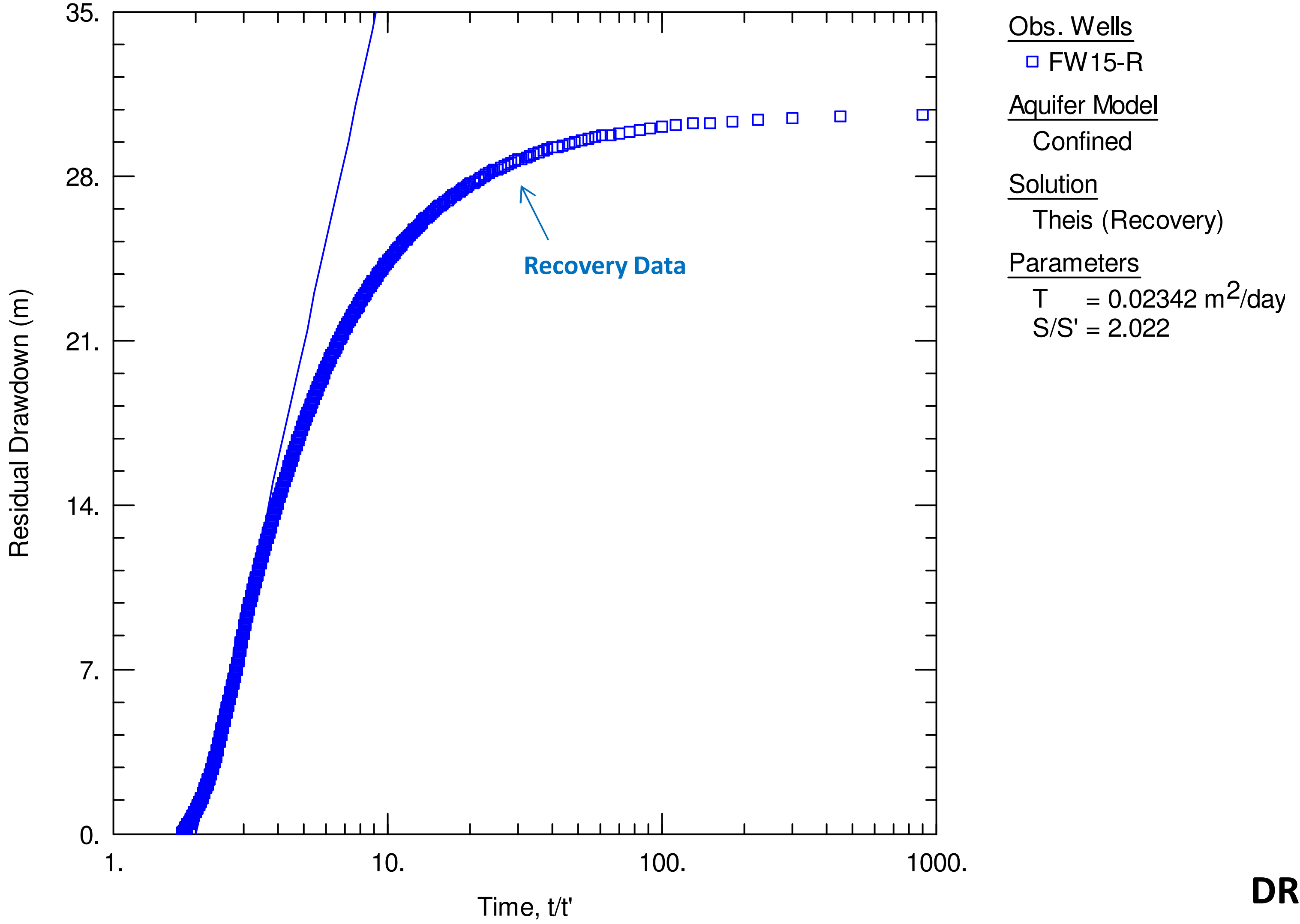

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FIGURE D-15. SEMI-LOG RECOVERY PLOT FOR PUMPING WELL FW15-R DURING 15-HOUR CONSTANT-RATE PUMPING TEST

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APPENDIX E

PHOTOGRAPHS OF INFILTRATION TEST

INFILTRATION TEST METHODS

Double-ring infiltrometer tests conducted in Test Pit 32 (left photo) and Test Pit 8 (right photo) on shallow benches.

Double ring-infiltrometer with float valves to maintain constant hydraulic head during the test.

Single-ring infiltrometer (0.61-meter diameter ring) test conducted in Test Pit 2 (1.65-meter depth) in moderately to weakly cemented caliche; the ring was able to be driven into the caliche surface.

Single-ring (0.30-meter diameter ring), falling-head infiltration test conducted in Test Pit 28 (0.61-meter depth) on strongly cemented caliche surface; hydrated bentonite was used to seal edges of ring in shallow groove on test surface.

Constant-head permeameter test conducted in strongly-cemented caliche at Test Pit 8 (0.76-meter depth).

Double-ring infiltrometer, single-ring infiltrometer, and constant-head permeameter tests conducted in Test Pit 15.

SEDIMENT AND PROFILE TYPES IN TEST PITS

The sediment profile in the upper 1.5 meters of Test Pit 24 consisted entirely of unconsolidated poorly-sorted sediments, which is the 1st profile type. Test Pit 24 is located within mapped surficial geologic unit Ql, “moderately dissected alluvial fan and terrace deposits” (Late Pleistocene) (Spencer and others, 1998).

The sediment profile in the upper 1.5 meters of Test Pit 10 consisted of unconsolidated poorly-sorted sediments overlying variably-cemented (mostly strongly cemented) caliche, which is the 2nd profile type. Test Pit 10 is located within mapped surficial geologic unit Qo, “deeply dissected alluvial fan remnants” (Early Pleistocene) (Spencer and others, 1998).

The sediment profile in the upper 1.5 meters of Test Pit 28 consisted of unconsolidated poorly-sorted sediments overlying variably-cemented (mostly strongly cemented) caliche, which is the 2nd profile type. Test Pit 28 is located within mapped surficial geologic unit Qm, “dissected alluvial fan and terrace deposits” (Middle Pleistocene) (Spencer and others, 1998).

The sediment profile in the upper 1.5 meters of Test Pit 36 consisted entirely of unconsolidated/loose gravel/cobbles with some sand, which are channel deposits within an active drainage, the 3rd profile type. Test Pit 36 is located within mapped surficial geologic unit Qyc, “active alluvium” (Holocene) (Spencer and others, 1998).

POST-TEST WETTING PATTERNS

Cross-sectional wetting pattern below surface of double-ring test conducted in Test Pit 8 (0.37-meter depth). Test was conducted in unconsolidated poorly-sorted sediments; the “bulb-shaped” wetting pattern is typical of many tested sediment intervals that were not underlain by caliche (some lateral flow but not substantial).

Cylindrical cross-sectional wetting pattern (only slight lateral flow) below surface of double-ring test conducted in Test Pit 30 (0.37-meter depth). Test was conducted in unconsolidated poorly-sorted sediments with no occurrence of underlying caliche.

Cross-sectional wetting pattern below surface of single-ring falling-head test conducted in Test Pit 4 (0.46-meter depth) in very gravelly unconsolidated sediments (channel deposits); infiltration was very rapid and chiefly vertical.

Cross-sectional wetting pattern below surface of double-ring test conducted in Test Pit 24 (0.46–meter depth). Test was conducted in unconsolidated, poorly-sorted sediments and exhibited substantial lateral flow (even in the absence of an underlying caliche layer) due to small-scale heterogeneities.

Cross-sectional wetting pattern below surface of double-ring test conducted in Test Pit 22 (0.46-meter depth); the wetting pattern indicates substantial lateral flow above the underlying caliche contact, with little infiltration into it.

Cross-sectional wetting pattern below surface of double-ring test conducted in Test Pit 8 (0.58-meter depth); the wetting pattern indicates notable lateral flow above the underlying caliche contact, with little infiltration into it.

Cross-sectional wetting pattern below surface of single-ring falling-head test conducted in Test Pit 19 (0.91-meter depth) on strongly-cemented caliche surface (tape measure indicates width of ring footprint); significant vertical infiltration occurred with some lateral flow.

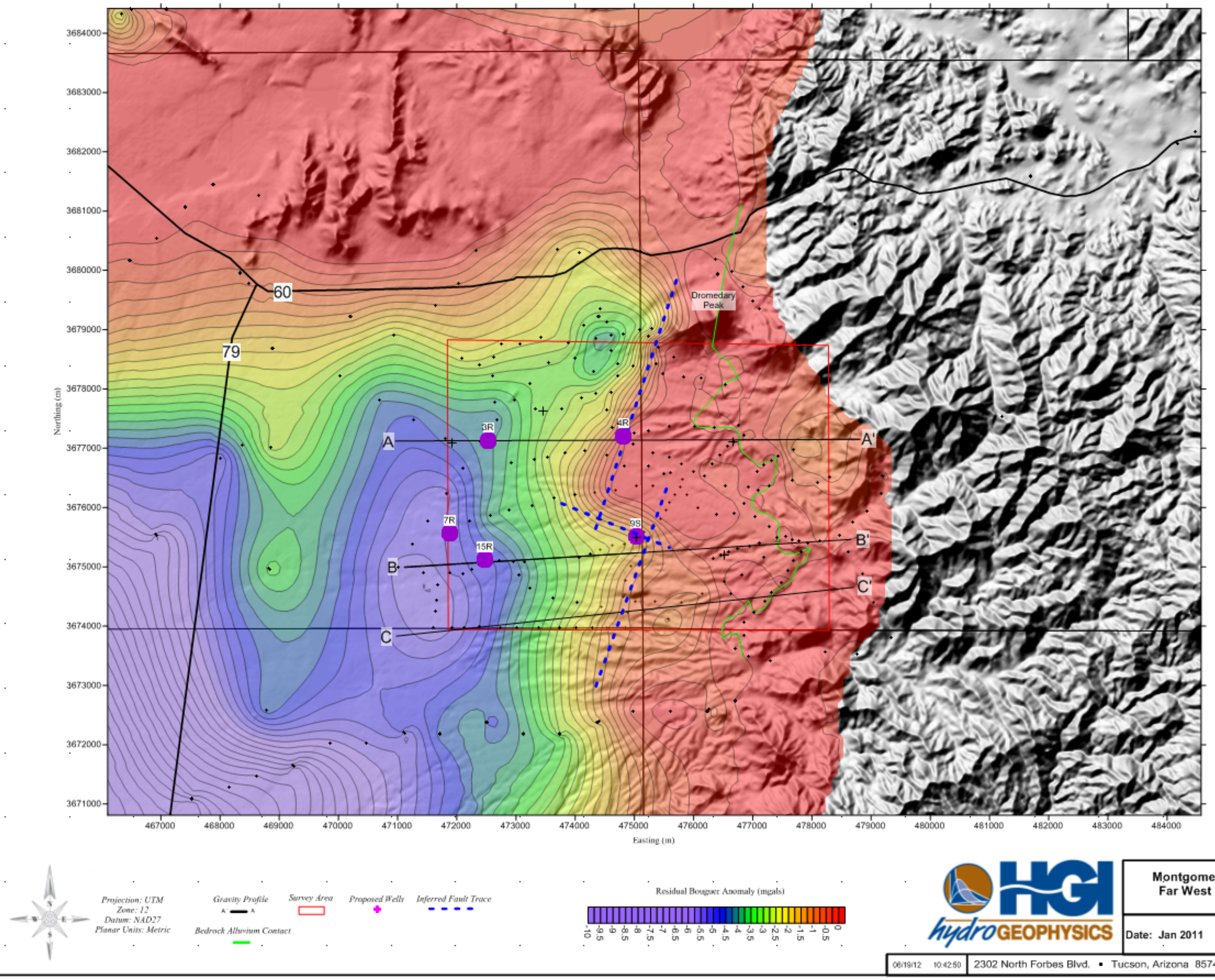
APPENDIX G

FOCUSED RESIDUAL BOUGER ANOMALY MAP AND REVISED GRAVITY PROFILES PROVIDED BY HYDROGEOPHYSICS, INC.

APPENDIX G

CONTENTS

Figure 4: Focused Residual Bouguer Anomaly Map



Montgomery & Associates
Far West Gravity Survey

Date: Jan 2011

Fig.: 4

hydroGEOPHYSICS

06/19/12 10:42:50

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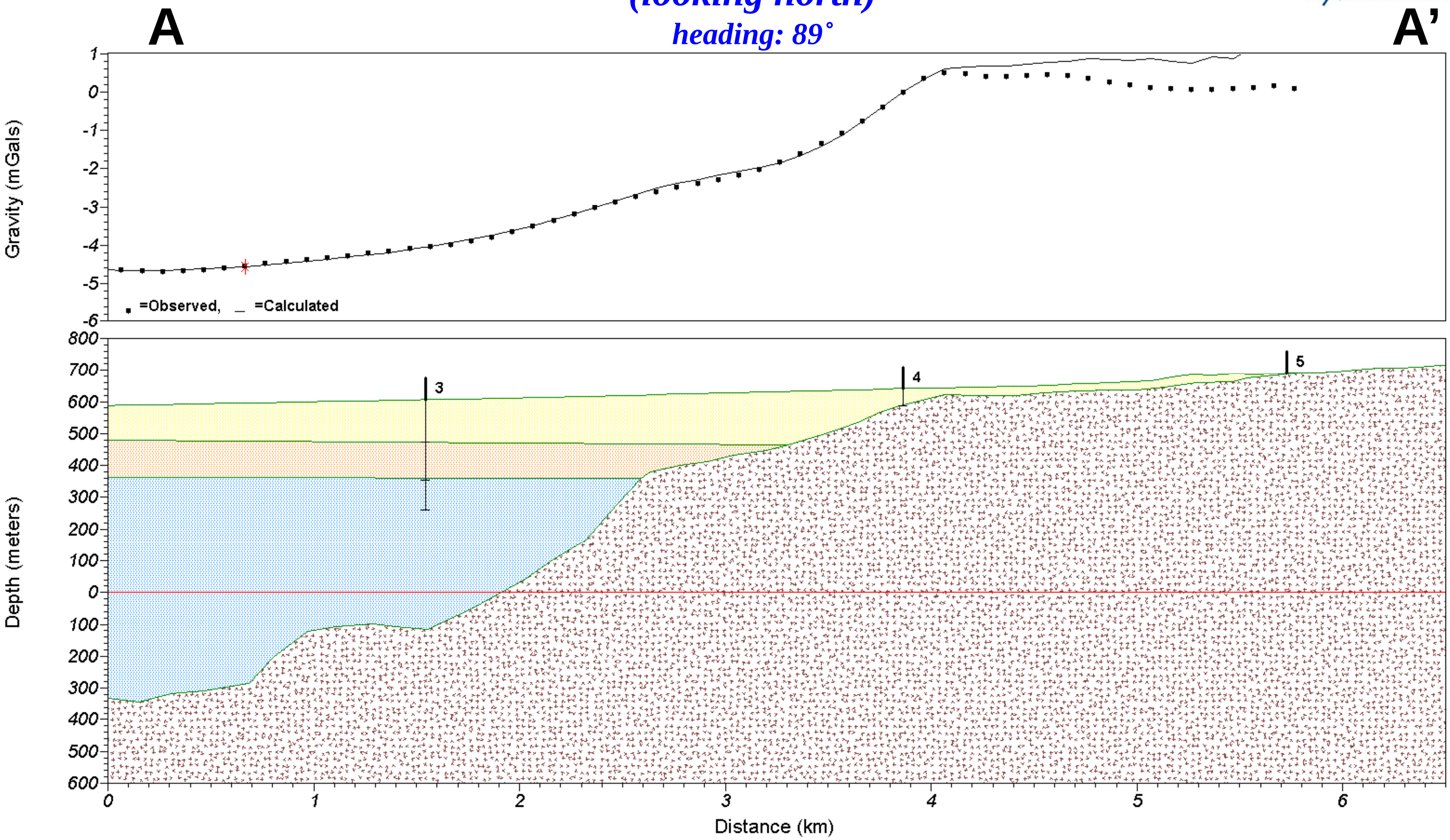
Figure B-1

A-A' Gravity Profile
(looking north)
heading: 89˚



🟨 Alluvium = 2.20 g/cc

🟧 Basalt = 2.60 g/cc

🟦 Apache Leap Tuff = 2.50 g/cc

⬚ Bedrock = 2.67 g/cc

Vertical Exaggeration: 1.55

Geophysical Survey

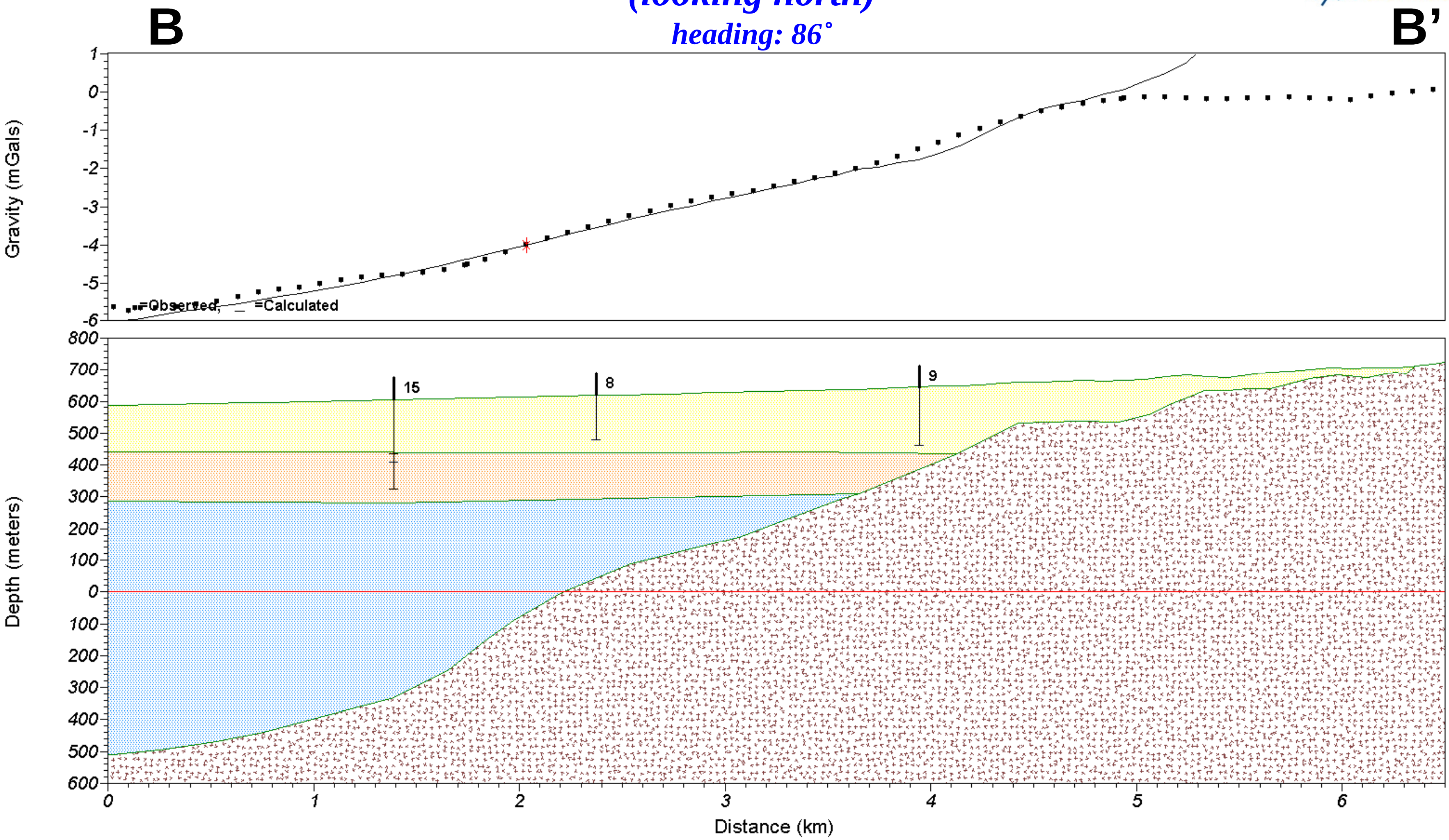
Montgomery & Associates
Resolution Copper Mining
Far West Gravity Survey

Date: *July 2012* **Fig:** B-1

Job #: 2010-051

Figure B-2

B-B' Gravity Profile
(looking north)
heading: 86°



🟨 Alluvium = 2.20 g/cc

🟧 Basalt = 2.60 g/cc

🟦 Apache Leap Tuff = 2.50 g/cc

▨ Bedrock = 2.67 g/cc

Vertical Exaggeration: 1.55

Geophysical Survey

Montgomery & Associates
Resolution Copper Mining
Far West Gravity Survey

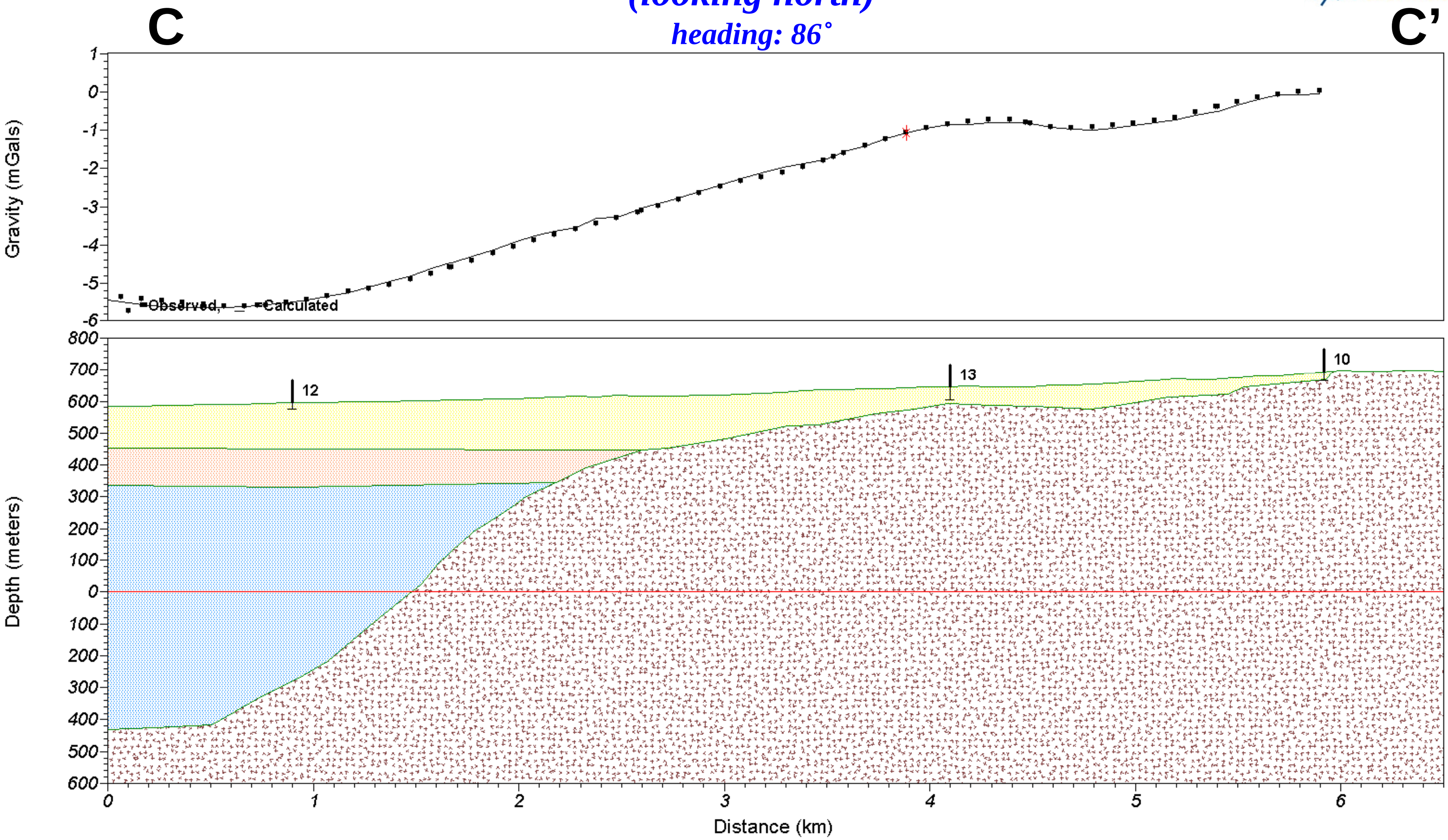
Date: *July 2012* **Fig: B-2**

Job #: 2010-051

Figure B-3

C-C' Gravity Profile
(looking north)

heading: 86˚



🟨 Alluvium = 2.20 g/cc

🟧 Basalt = 2.60 g/cc

🟦 Apache Leap Tuff = 2.50 g/cc

▨ Bedrock = 2.67 g/cc

Vertical Exaggeration: 1.55

Geophysical Survey

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Date: *July 2012* **Fig B-3**

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