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TUCSON PHOENIX SANTIAGO LIMA

TECHNICAL MEMORANDUM

DATE: September 14, 2012 **Project 605.123**

TO: Greg Ghidotti and Heather Gluski
RESOLUTION COPPER MINING LLC

FROM: Janis Blainer-Fleming and Kate Duke
MONTGOMERY & ASSOCIATES

SUBJECT: SUMMARY OF MODIFICATIONS TO WELLS HRES-02, HRES-05, AND HRES-10

In accordance with a request from Mr. Greg Ghidotti, Resolution Copper Mining LLC (RCM), Montgomery & Associates (M&A) has prepared this Technical Memorandum to summarize modifications made to wells HRES-02, HRES-05, and HRES-10 in 2011.

INTRODUCTION

In 2011, M&A personnel provided on-site monitoring during field operations at monitor wells HRES-02, HRES-05, and HRES-10. **Figure 1** shows the locations for the wells.

Monitor well HRES-02 (ADWR#55-201850; (D-1-13)32dca) was drilled and constructed in February 2004. Well construction and pumping test details are provided in a report prepared by M&A (M&A, 2005). The well was constructed with three screened intervals separated by bentonite seals to isolate each interval. **Figure 2** is a schematic diagram showing construction details for HRES-02. In August 2006, an inflatable packer was installed at a depth of 213 meters below land surface (bls) (between the middle and lower screened intervals) to establish two distinct monitored intervals in the well; the packer deflated in the first half of 2010.

Monitor well HRES-05 (ADWR#55-201848; (D-2-13)05ccb) was drilled and constructed in March 2004. Well construction and pumping test details are provided in a report prepared by M&A (M&A, 2005). The well was constructed with three screened intervals separated by bentonite seals to isolate each interval. **Figure 3** is a schematic diagram showing construction

details for HRES-05. Results of tests conducted following well construction indicate that under pumping conditions, most of the water enters the well in the uppermost screened interval. An inflatable packer was installed at a depth of 137 meters bls (between the upper and middle screened intervals) to establish two distinct monitored intervals in the well from August 2006 through December 2007. The packer was removed in December 2007.

Monitor well HRES-10 (ADWR#55-911941; (D-2-13)12aac) was drilled and constructed in May 2010. Well construction and pumping test details are provided in a report prepared by M&A (M&A, 2011). Well HRES-10 was completed with two screened intervals separated by a bentonite seal to isolate each interval. **Figure 4** is a schematic diagram showing construction details for HRES-10. Results of tests conducted following well construction indicate that under pumping conditions, most of the water enters the well in the uppermost screened interval.

HRES-02 MODIFICATIONS

Field operations were conducted at HRES-02 on May 19 and 20, 2011. Operations at HRES-02 included removal of the packer assembly and Mini TROLL integrated transducer / datalogger and installation of a dedicated pump assembly and a Level TROLL 500 integrated transducer / datalogger. The purpose of these modifications is to equip well HRES-02 for hydraulic testing and hydrochemical sampling in addition to ongoing groundwater level monitoring.

The pump assembly was installed by Duncan Pump, of Phoenix, Arizona on May 20, 2011. The well was equipped with a Model 16S50-38 pump with a 5-horsepower, 460-volt, three-phase Grundfos electric motor (Product No. 79354509). The pump was installed on 1-1/4-inch API column pipe with galvanized steel couplings at a depth of about 215 meters bls. The well is equipped with one 1-inch PVC sounder access tube which extends from the wellhead to the top of the pump. The sounder access tube is capped on the bottom and factory slotted in the lowermost 6.1 meters. The pump, motor, and column pipe are suspended from a steel and rubber sanitary well seal installed at the wellhead. The pump was turned on for a short time interval to ensure that it functioned properly. A Level TROLL 500 integrated pressure transducer / datalogger (S/N 153957; 100 psi, vented) is currently installed at HRES-02. Depth to groundwater level was 88.64 meters bls on May 20, 2011.

HRES-05 MODIFICATIONS

Field operations were conducted at HRES-05 on May 25, 2011. Operations at HRES-05 included removal of the dedicated pump assembly and Level TROLL, installation of a plug to isolate the uppermost screened interval of the well from the lower two screened intervals, and reinstallation of the pump and Level TROLL. The purpose of this modification is to provide a partially-penetrating pumping well for use in proposed hydraulic testing of the Apache Leap Tuff (ALT) aquifer in the vicinity of HRES-05 and the PHRES-series piezometer arrays.

The pump removal, plug installation, and pump reinstallation operations were conducted by Duncan Pump. Following removal of the Level TROLL and pump, a plastic core rubber plug manufactured by Industrial Rubber, Inc. (IRI) of Oklahoma City, Oklahoma was installed at a depth of 134.1 meters bls. Following installation of the plug, the dedicated pump was reinstalled using the existing 1-1/4-inch galvanized steel NPT column pipe at a depth of 121.9 meters bls. The pump was turned on for a short time interval to ensure that it functioned properly. The schematic on **Figure 3** includes the modification to well HRES-05. The Level TROLL (S/N 142407) was reinstalled following pump installation. Depth to groundwater level was 97.37 meters bls on May 25, 2011.

HRES-10 MODIFICATIONS

Field operations were conducted at HRES-10 on December 6, 2011. Operations at HRES-10 included removal of the dedicated pump assembly and Level TROLL transducer / datalogger, installation of a plug to isolate the upper and lower screened intervals of the well, and reinstallation of the dedicated pump and transducer/datalogger. The purpose of this modification was to prevent hydraulic communication through the well between the upper part of the ALT aquifer that is actively being recharged and the deeper part of the ALT aquifer at this location.

The pump removal, plug installation, and pump reinstallation operations were conducted by Duncan Pump. Following removal of the Level TROLL and pump, an IRI plastic core rubber plug was installed at a depth of 140.2 meters bls. Following installation of the plug, the dedicated pump was reinstalled using the existing 1-1/2-inch galvanized steel column pipe at a depth of 51.5 meters bls. The pump was turned on for a short time interval to ensure that it functioned properly. **Figure 4** shows the modification to well HRES-10. The Level TROLL (S/N 154053) was reinstalled following pump installation. Depth to groundwater level was 21.72 meters bls on December 6, 2011.

REFERENCES CITED

Montgomery & Associates, 2005, **Results of preliminary characterization for Apache Leap Tuff aquifer system in Devils Canyon and Upper Queen Creek watersheds, Pinal and Gila Counties, Arizona:** draft report prepared for Resolution Copper Company by Errol L. Montgomery & Associates, June 3, 2005, 174 p.

_____, 2011, **Results of drilling, construction, equipping, and testing at hydrologic test wells HRES-10 and HRES-11, Resolution Copper Mining, Pinal County, Arizona:** technical memorandum prepared for Resolution Copper Mining by Montgomery & Associates, May 13, 2011, 85 p.

490,000 R. 12 E. 495,000 R. 13 E. 500,000 R. 14 E.

3,690,000 T. 1 S.

3,685,000

3,680,000 T. 2 S.

3,675,000

T. 3 S.

Top of the World
60
Corral
Middle
HRES-06
JI Ranch
HRES-14
DHRES-11
HRES-12
Queen Creek
Gila County
Pinal County
1,400
1,600
DHRES-09
Shaft No. 3
Shaft No. 9
DHRES-10
HRES-01
Oak Flat
HRES-03
HRES-15
DHRES-14
HRES-17
DHRES-03
DHRES-04
DHRES-05
DHRES-02
HRES-02
HRES-04
DHRES-01
HRES-18
A-06
DHRES-08
DHRES-07
HRES-09
HRES-16
DHRES-13
Town of Superior
HRES-05
Devils Canyon
HRES-07
MJ-11
HRES-10
Hackberry Canyon
HRES-13
Hackberry Windmill
DHRES-06
HRES-08
HRES-11
Armett Creek
177
Mineral Creek

490,000 R. 12 E. 495,000 R. 13 E. 500,000 R. 14 E.

EXPLANATION

- Watershed Boundary
- Perennial Reach

Groundwater Monitoring Sites

- Shallow Alluvial Aquifer Monitor Well
- Apache Leap Tuff Aquifer Monitor Well
- Deep Groundwater System Monitor Well
- Shaft

Elevation Range
(meters above mean sea level)

- 1,600 - 1,800
- 1,400 - 1,600
- 1,200 - 1,400
- 1,000 - 1,200
- 800 - 1,000
- 600 - 800

N

0 0.5 1 1.5 2
Miles

Resolution Copper Mining

WELL LOCATIONS

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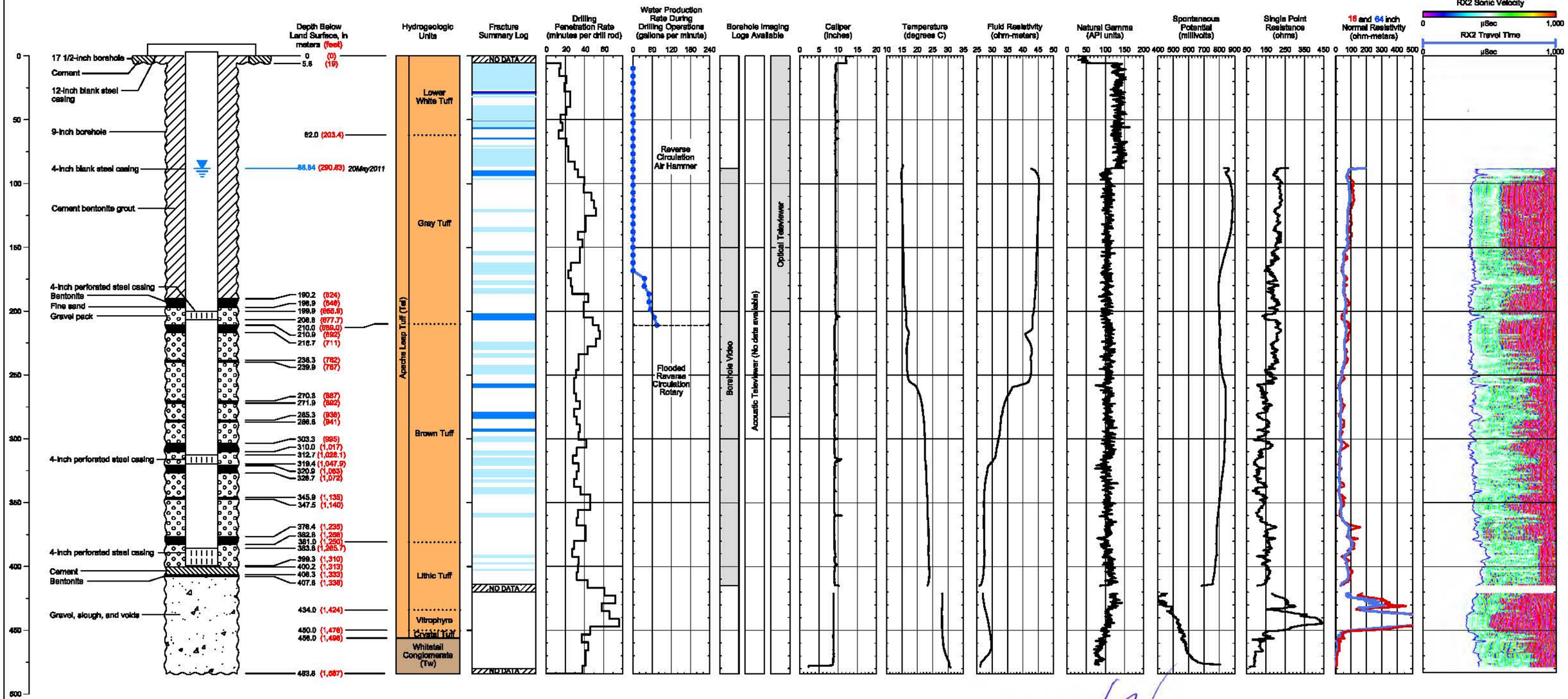
2012

FIGURE 1

\GIS-Tuc\Projects\605\605.125\Welloc_HRES2-5-10.mxd\14Sept2012



CADASTRAL: (D-1-13) 32dca	ADWR NO: 55-201850
NORTHING: 3683886.304	EASTING: 494479.323
LAND SURFACE ELEVATION: 1214.34	
DATUM: NAD 27 HORIZONTAL: UTM 12 VERTICAL: NGVD 29 METERS	

EXPLANATION

- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing
- Non-pumping Water Level

REGISTERED GEOLOGIST
CERTIFICATE NO.
25063
TODD
KEAY
Date Signed 14 SEP 2012
ARIZONA U.S.A.
Expires 06/30/2014

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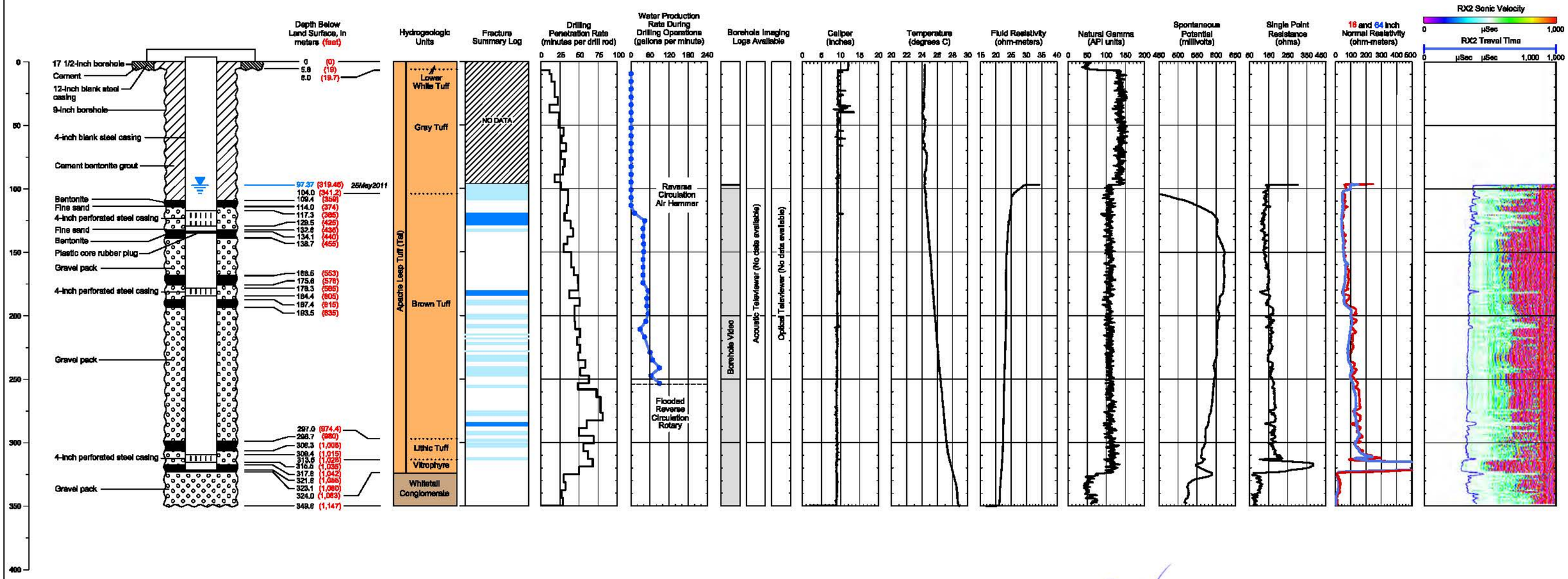
HRES-02
SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: September 14, 2012

FIGURE 2

805\WellSchematics_2009\HRES-2-WS-LOGS-Rev5/14Sept2012



CADASTRAL: (D-2-13) 05cdb	ADWR NO: 55-201848
NORTHING: 3682274.632	EASTING: 495523.291
LAND SURFACE ELEVATION: 1218.30	
DATUM: NAD 27 HORIZONTAL: UTM 12 VERTICAL: NGVD 29 METERS	

EXPLANATION

- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing
- Non-pumping Water Level

REGISTERED GEOLOGIST
CERTIFICATE NO.
25063
TODD
KEAY
Date Signed 14 SEP 2012
ARIZONA U.S.A.
Expires 09/30/2014

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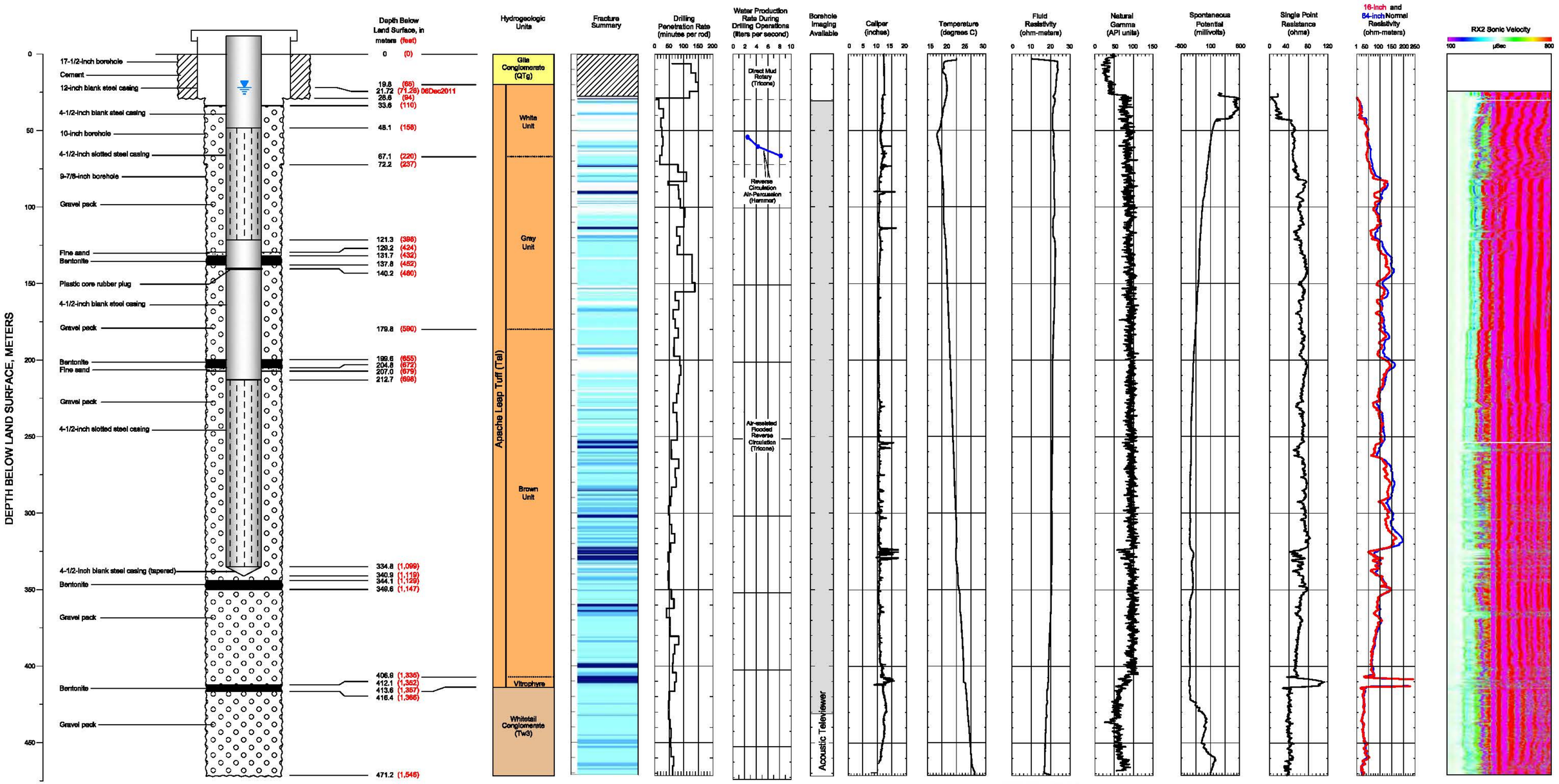
HRES-05
SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: September 14, 2012

FIGURE 3

808\Well Schematics_2009\HRES-5-WS-LOGS-Rev4\14Sept2012



CADASTRAL: (D-2-13) 12aac	ADWR NO: 55-911941
NORTHING: 3681673.233	EASTING: 503194.911
LAND SURFACE ELEVATION: 893.85	
DATUM: UTM12N, NAD27, meters VERTICAL: NGVD 29 METERS	

EXPLANATION

- No Data
- No Fracturing Evident
- Minor Fracturing
- Moderate Fracturing
- Major Fracturing
- Non-pumping Water Level

REGISTERED GEOLOGIST
CERTIFICATE NO.
25063
TODD
KEAY
Date Signed 4/30/2014
ARIZONA U.S.A.
Expires 06/30/2014

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HRES-10
SCHEMATIC DIAGRAM OF WELL CONSTRUCTION

Version: September 14, 2012

FIGURE 4

605\WellSchematics_2010\HRES-10wsLOGS-rev3\14Sept2012