# APPENDIX A

# DATA COMPILATION AND EVALUATION OF BEDROCK ELEVATIONS AND HYDRAULIC TESTS FOR NUMERICAL MODEL DEVELOPMENT IN THE VICINITY OF THE PHELPS DODGE SIERRITA TAILING IMPOUNDMENT

## TASK 2.1 OF AQUIFER CHARACTERIZATION PLAN MITIGATION ORDER ON CONSENT DOCKET NO. P-50-06

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# 1. INTRODUCTION

An evaluation of available bedrock elevation data and hydraulic test results was performed under Task 2.1 of the Aquifer Characterization plan in the Work Plan (Hydro Geo Chem, Inc. (HGC), 2006) to characterize and mitigate sulfate with respect to drinking water supplies. The purpose of the evaluation was to compile, evaluate, and verify data on the depth and hydraulic properties of the basin fill aquifer. These data are needed to develop and calibrate a numerical groundwater flow model for the site.

The goals of the evaluation were to 1) verify and, if necessary, re-evaluate previously defined bedrock elevations in the vicinity of the Phelps Dodge Sierrita Tailing Impoundment (PDSTI), 2) obtain additional bedrock elevation data to cover the anticipated area of the site numerical flow and transport model, and 3) verify existing hydraulic test interpretations to define the hydraulic properties of the basin fill and bedrock in the vicinity of the PDSTI. The methodology and results of the evaluation are discussed in the following sections.

# 2. BEDROCK EVALUATION

The purpose of the bedrock evaluation was to develop a bedrock elevation database for the southern portion of the Tucson basin using bore hole data and to construct a bedrock elevation contour map. The contour map will have several uses, including defining the lower boundary of the basin fill within the domain of the site groundwater flow model (which will be smaller than the area of the bedrock map), and development of maps showing saturated thicknesses of the basin fill. The database and contour map will be adjusted as needed based on additional data obtained during execution of the Work Plan (HGC, 2006).

## 2.1 Bedrock Elevation Database

The bedrock elevation database includes data from boreholes that are located in the southern Tucson basin area and that either penetrated bedrock or deep basin fill. Well data were obtained from the Arizona Department of Water Resources (ADWR) 35- and 55-series imaged records databases, the Phelps Dodge Sierrita Inc. (PDSI) well database, PDSI core hole data, and from Steffens Roberts and Kirsten (SRK) (1985). Data from these sources were reviewed and incorporated as appropriate. Well data compiled in the scope of the search included cadastral well location, registration number, well name (if any), completion date, collar or measuring point elevation, depth drilled, lithology, depth to bedrock if reached, any notations regarding degree of cementation within the basin fill, and Universal Transverse Mercator location coordinates (Tables A.1 and A.2).

Table A.1 lists area wells drilled to bedrock (fully penetrating with respect to basin fill) and Table A.2 lists wells that were not drilled to bedrock (non-fully penetrating). The deeper wells in Table A.2 define elevations below which the bedrock must lie. The locations of the fully penetrating wells are shown in Figures A.1 and A.2 and the locations of non-fully penetrating wells in Figure A.3. Bedrock elevation contours, plotted in Figures A.4 through A.7, are based primarily on the fully penetrating well data (Table A.1). The contours were generated using ordinary linear kriging with a linear variogram. To enhance continuity of the contours along the axis of the basin, in a manner consistent with hand contouring of the data, an anisotropy of 2:1 in the direction N 25 E was specified. In addition to the bedrock contours, Figures A.4 and A.5 show the bedrock elevations associated with the fully penetrating wells, and Figure A.6 the maximum possible bedrock elevations associated with the non-fully penetrating wells. These latter wells were used in the contouring process to constrain the maximum possible bedrock elevation in areas where there are no wells that penetrate to the bedrock. Finally, kriged contours were reconciled to topography and compared with geophysical estimates of bedrock depth as discussed in Section 2.2. Figure A.7 is a map showing bedrock elevation contours on a shaded relief map of the area topography.

Notations from drill logs regarding the degree of cementation or character of the basin fill are included in both Tables A.1 and A.2. Drill logs vary widely in quality and detail, but in most cases were deemed adequate for the purposes of this evaluation. These notations may provide information on the presence of low permeability zones within the basin fill that may coincide with lower basin fill materials such as the Pantano Formation, or that might limit vertical mixing of groundwater.

Bedrock elevation and lithologic data included in the database were compiled from four sources: 1) well logs located through searches of the ADWR 55- and 35-series imaged records databases, 2) IW-, MH-, and M-series well logs included in various hydrology reports (Errol L. Montgomery and Associates (ELMA), 1986a, 1986b, 1991, 1995, 2004a, and 2004b), 3) condemnation and exploration core holes drilled by Duval Corporation in the vicinity of the PDSTI prior to emplacement of tailing, and within an approximately five square mile area north of the PDSTI, and 4) 17 wells and borings in the Twin Buttes Mine area for which logs have not yet been obtained but lithologic, collar elevation, total depth data, and approximate bedrock elevations are available from geologic cross sections through the wells (SRK, 1985).

Surveyed collar or measurement point elevations of wells from the ADWR databases in the bedrock database were obtained from the PDSI database; ELMA (1989, 2004a); and SRK (1985) where available. Collar elevations of other wells were estimated from digital topographic data.

## 2.2 Comparison of Bedrock Depths from Well Data with Geophysical Survey Estimates

Depth to bedrock and bedrock elevation data obtained from geologic logs of wells were compared to estimated depth to bedrock and bedrock elevation based on two geophysical surveys including 1) a USGS study incorporating magnetic, seismic, and gravity methods (Rystrom, 2003), and 2) a gravity study carried out by HydroGeophysics, Inc. (HydroGeophysics, Inc, 2004). The comparisons were made in order to evaluate the level of

agreement between the geophysical estimates and borehole data, and based on the degree of agreement, to determine whether the geophysical interpretations would be useful in estimating the depth to bedrock in areas where bedrock data from boreholes is sparse or lacking.

### 2.2.1 USGS Study

Rystrom (2003) uses regional gravity, aeromagnetic and seismic reflection data constrained by surface geology and subsurface borehole data to develop an understanding of the structure of the Tucson Basin, including depth to bedrock. The study area extends from approximately the middle of the eastern margin of the PDSTI northwards towards the city of Tucson. The study area does not include the southernmost end of the PDSTI or the area south of the PDSTI.

Depths to bedrock based on geologic logs of boreholes in the vicinity of the PDSTI and adjacent portions of the southern Tucson Basin were compared to estimated depths to bedrock based on the USGS geophysical study by overlaying the geophysical contours on a depth to bedrock map based on borehole data (Figure A.8). The USGS contour map of bedrock depth below land surface (bls) is contoured in 0.2-kilometer (km) intervals. The metric values were converted to feet (ft) in order to directly compare them with the borehole data.

Reasonably good agreement between geophysical depths and borehole depths to bedrock was found close to the PDSTI. However, to the north of the PDSTI, near the Twin Buttes I-wells, the 0.2 km (656 ft) bls geophysical depth contour does not correlate well with borehole

data. There, well logs indicate the 0.2 km depth bls contour would have to lie further to the east to match known bedrock elevations in that area.

The 0.4 km (1,312 ft) bls depth contour in the Rystrom study falls between wells with bedrock less than 1,312 ft bls and AN-1 with bedrock at 1,960 ft bls, suggesting a good match between the geophysical estimation and the known bedrock depths in this area. One exception is MH-13 which has anomalously deep bedrock compared to other nearby wells.

Two wells, E-3A (D-18-13, section 24) and 74-3 (D-18-13, section 34) (Figure A.1), both located close to the Santa Cruz River channel east and southeast of the PDSTI, intercepted bedrock at 955 ft and 1,185 ft bls, respectively. The locations of these wells are between the 0.4 km (1,312 ft) bls and the 0.6 km (1,968 ft) bls geophysical bedrock depth contours, indicating bedrock is shallower than geophysical data indicates in that area (Figure A.8). The trace of the 0.4 km and 0.6 km geophysical contours indicate a substantial deepening in bedrock to the north of the Twin Buttes Mine complex. Although borehole data here also shows deepening of bedrock to the north, boreholes indicate that the deepening of bedrock occurs further north and at a shallower gradient than indicated by the geophysical depth contours.

On the east side of the basin, along the western flanks of the Santa Rita Mountains, the geophysical depth contours match poorly with borehole and other geological data. The geophysical survey suggests very deep bedrock east of the Santa Cruz River where well data indicate much shallower bedrock. For example, east of the Santa Cruz River at well E-3A, depth to bedrock is 955 ft bls based on borehole data, whereas the geophysical estimate at the location

of well E-3A is approximately 1,600 ft bls. Disparities of greater magnitude are present in the vicinity of wells USDA and 1928, where based on borehole data depth to bedrock is at 85 and 155 ft bls respectively, whereas the geophysical estimate for this area is on the order of 4,500 ft bls (Figure A.8).

### 2.2.2 HydroGeophysics, Inc. Study

A gravity study by HydroGeophysics, Inc. (2004) was also reviewed. The scope of this study focused on the area between the PDSTI and Interstate 19. Although the bedrock elevation contours reasonably match known bedrock elevations close to the Interceptor Well (IW) well-field along the downgradient (eastern) edge of the tailings, the bedrock elevation contours in the HydroGeophysics study show a greater rate of decrease in bedrock elevation from the PDSTI eastwards towards the center of the basin than is indicated by wells that penetrate bedrock in the area.

## 2.3 Conclusions

Although the HydroGeophysics study was focused on the PDSTI area and the Rystrom study was more regional in scope, the Rystrom bedrock depths agree more closely with the well data in the immediate PDSTI area. However, away from the PDSTI area, the Rystrom bedrock depths correlate poorly with geologic data from well logs. Because areas away from the PDSTI having low well density were the areas for which the geophysical data were anticipated to be most useful, and because the geophysical data do not appear to be useful in these areas, the

geophysical data were not considered further in generating the bedrock surface. Therefore, the surface presented in Figures A.4 through A.7, which was based entirely on drillhole data, will be used to define the bedrock in the numerical model.

# 3. HYDRAULIC TEST ANALYSIS AND REVIEW

Hydraulic conductivity data for wells in the vicinity of the PDSTI were compiled and reported in the Work Plan (HGC, 2006). The data and test analysis methods for the hydraulic conductivity data were evaluated for Task 2.1 as a quality assurance check. Also, pumping test data for several wells not reported in HGC (2006) were obtained and evaluated.

Pumping test and slug test data from the BW-, IW-, MH-, and PZ-series wells were obtained from various reports including: ELMA, 1986a; ELMA, 1986b; ELMA, 1991; ELMA, 1994; ELMA and Dames and Moore, 1994; ELMA,1995; ELMA, 2001; ELMA, 2004a; ELMA, 2004b; ELMA, 2006a; and ELMA, 2006b. Pumping-test data for the GV-series wells, Duval Company wells, and Farmers Investment Company (FICO) wells were obtained from additional sources including Hargis and Montgomery, 1982; Environmental Resources Consultants, 1996; and Schmidt, 2005a.

## 3.1 Hydraulic Testing Data and Analysis

Pumping and slug test data were generally available as graphs or tables showing drawdown and/or recovery as a function of time. Pumping and slug-test data were analyzed to estimate aquifer properties that included, at a minimum, transmissivity (T) or hydraulic conductivity (K). Pumping test data were analyzed using several methods, with the chosen method(s) dependant on the type of test and available data. Tables 3 and 4 provide the estimates from this evaluation.

Pumping tests were typically conducted using either a single, constant discharge rate, or using multiple, increasing discharge rates (constituting a step test). For each test, water-level drawdown and/or recovery measurements were obtained from the pumped well. Most data were available on semi-logarithmic plots showing drawdown and/or recovery versus time. The Cooper-Jacob method was used to analyze data plotted in this fashion provided a straight line could be fit to the data (Cooper and Jacob, 1946).

For cases where a single straight line did not fit all plotted data points, multiple straight lines were fit through different straight-line portions of the data and T estimated for each fit. In these cases, a range of T values, corresponding to different line segments, were then calculated. Changes in slope in the drawdown data on the semi-logarithmic plots could result from aquifer heterogeneities, aquifer boundaries, nearby pumping, or other factors that were not accounted for in the analyses.

Wells for which drawdown and/or recovery, and pumping rate data were available in tables were evaluated by entering the drawdown data into the pumping-test analysis software packages AQTESOLV (HydroSOLVE, Inc, 2000) and/or WHIP (HGC, 1988), a well hydraulics interpretation program developed and marketed by HGC. Values of T were obtained by fitting Cooper-Jacob, Theis, or other appropriate solutions to the drawdown data.

Slug tests were generally conducted at wells having low yields. These wells, which include some of the BW-, M-, MH-, and PZ- series wells, were completed primarily in bedrock

materials. Drawdown data for these tests were typically available as semi-logarithmic plots. Selected data points from straight-line portions of these plots were interpolated and imported into AQTESOLV. Values of K in feet per day were obtained in AQTESOLV by fitting the Bouwer-Rice solution to the drawdown data. Table 4 summarizes the results of slug test analyses.

### 3.2 Discussion of Results

In general, the previous estimates of hydraulic properties reported in HGC (2006) were near or within the ranges of the HGC estimates (Tables 3 and 4). Test data that were difficult to interpret due to small drawdown or a complicated drawdown pattern were not evaluated for this review. Use of different aquifer models and various line segments in Jacob-Cooper approximations yielded a range in T and K values. The range in hydraulic property estimates is expected given the inherent uncertainties in the analytical methods and the sometimes subjective nature of aquifer test interpretation. The similarity of previously reported hydraulic properties and the hydraulic properties estimated for this data verification indicates the hydraulic property data were developed using appropriate assumptions and are suitable for use in aquifer characterization pursuant to the Work Plan (HGC, 2006).

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## 5. LIMITATIONS STATEMENT

The opinions and recommendations presented in this report are based upon the scope of services and information obtained through the performance of the services, as agreed upon by HGC and the party for whom this report was originally prepared. Results of any investigations, tests, or findings presented in this report apply solely to conditions existing at the time HGC's investigative work was performed and are inherently based on and limited to the available data and the extent of the investigation activities. No representation, warranty, or guarantee, express or implied, is intended or given. HGC makes no representation as to the accuracy or completeness of any information provided by other parties not under contract to HGC to the extent that HGC relied upon that information. This report is expressly for the sole and exclusive use of the party for whom this report was originally prepared and for the particular purpose that it was intended. Reuse of this report, or any portion thereof, for other than its intended purpose, or if modified, or if used by third parties, shall be at the sole risk of the user.

# TABLES

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-16-12** | | | | | | | | | | | | |
| 31aaa | K.Q.Ranch | 574624 | 574624 | 04/10/00 | 380 | 3587 | 100 | 3487 | unidentified | | 485960.5 | 3540199.1 |
| 32aaa | Woerner | 87398 | 87398 | 05/02/81 | 380 | 3550 | 35 | 3515 | granite | | 487546.0 | 3540207.5 |
| 33aad | Scott | 35-29405 | 35-29405 | 12/10/71 | 810 | 3502 | 12 | 3490 | granite | | 489150.5 | 3540010.3 |
| 33bbb | Kantoma | 35-29407 | 35-29407 | 03/10/80 | 490 | 3501 | 40 | 3461 | granite | | 487745.3 | 3540206.8 |
| 33ccb | Pennington | 35-29408 | 35-29408 | 08/15/79 | 300 | 3612 | 30 | 3582 | granite | | 487726.8 | 3539001.1 |
| 34aca | Machery | 35-78250 | 35-78250 | 06/24/79 | 300 | 3458 | 26 | 3432 | granite | | 490346.0 | 3539784.3 |
| 34bdb | Rogers | 35-82799 | 35-82799 | 12/07/79 | 300 | 3490 | 40 | 3450 | granite | | 489733.0 | 3539784.3 |
| 34caa | DeLeon | 35-48290 | 35-48290 | 09/28/77 | 180 | 3495 | 100 | 3395 | granite | | 489945.4 | 3539408.0 |
| 34dca | Stevens | 35-75289 | 35-75289 | 11/24/79 | 380 | 3487 | 56 | 3431 | granite | | 490341.1 | 3539005.9 |
| **D-16-13** | | | | | | | | | | | | |
| 31acb | ASARCO | Asarco PZ-6 | 567564 | 05/02/98 | 743 | 3167 | 222 | 2945 | arkose | | 494967.6 | 3539826.3 |
| 35aaa | ASARCO | Mis 11 | 35-72449, 607791 | 08/17/79 | 835 | 2910 | 820 | 2090 | andesite | | 502018.4 | 3540295.0 |
| **D-17-12** | | | | | | | | | | | | |
| 01daa | ASARCO | Asarco PZ-1 | 567567 | 04/11/98 | 981 | 3300 | 25 | 3275 | arkose | arkose reported at 25'; broken, not hard until 603' | 493963.7 | 3537811.6 |
| 16ccc | Ashton | 86774 | 86774 | 02/20/81 | 440 | 3310 | 35 | 3275 | granite | | 487729.9 | 3533972.9 |
| 33cac | Nolen | 561002 | 561002 | 12/22/97 | 200 | 3988 | 3 | 3985 | unidentified | fractured rock | 488155.0 | 3529568.8 |
| 36ada | PDSI | M-15 | 561952 | 06/11/97 | 280 | 3,485.18 | 114 | 3371 | intrusive | | 494003.7 | 3530327.5 |
| 36adc1 | PDSI | M-17 | 561953 | 05/12/97 | 160 | 3,486.28 | 96 | 3390 | intrusive | | 493849.6 | 3529974.2 |
| 36adc2 | PDSI | M-18 | 561954 | 07/07/97 | 110 | 3,486.13 | 80 | 3406 | intrusive | | 493849.6 | 3529965.8 |
| 36bac | PDSI | M-14 | 561951 | 06/10/97 | 205 | 3,539.01 | 10 | 3529 | intrusive | | 493141.1 | 3530339.5 |
| **D-17-13** | | | | | | | | | | | | |
| 02abb | Pima Mining Co. | #7 | 35-30442, 616151 | 09/25/66 | 960 | 2780e | 950 | 1830 | green volcanic | short intervals of hard conglomerate | 501400.0 | 3538662.7 |
| 06cab | ASARCO | Asarco PZ-2 | 567562 | 04/13/98 | 603 | 3,285.00 | 170 | 3115 | arkose | | 494559.3 | 3537815.9 |
| 06dba | ASARCO | Asarco PZ-3 | 567563 | 04/15/98 | 594 | 3,230.00 | 195 | 3035 | arkose | | 495154.8 | 3537821.3 |
| 10aaa | State of Arizona | #11 | 35-30446, 616154 | 05/13/69 | 600 | 2875e | 565 | 2310 | unidentified | "hard pack, sticky clay" 530-565' | 500393.3 | 3537074.5 |
| 10bba | State of Arizona | #16 | 35-30447, 616155 | Jun-70 | 502 | 2960e | 425 | 2535 | limestone | | 499180.7 | 3537057.1 |
| 13abb | FICO | S-51 | 35-39803, 624000 | 11/24/74 | 1,255 | 2710e | 1230 | 1480 | granite | cemented gravel above granite 1150-1230' | 503017.3 | 3535471.2 |
| 13cdd | Anaconda | 35-30460 | 35-30460, 608520 | 08/05/67 | 1,735 | 2742 | 1723 | 1019 | unidentified | hard sand and gravel 810-950', and 1606-1723' | 502826.6 | 3534060.2 |
| 15aaa | Cyprus Pima | 514345 | 514345 | 06/11/82 | 1,764 | 2910e | 150 | 2760 | lithic arenite | | 500393.4 | 3535481.3 |
| 15add | ASARCO | MW-1 | 531806 | 06/06/91 | 710 | 2910e | 670 | 2240 | sandstone | | 500395.1 | 3534873.3 |
| 17adc | Bentley | 211301 | 211301 | 08/08/06 | 505 | 3250e | 20 | 3230 | unidentified | | 496989.1 | 3534839.3 |
| 17add | McCouley | 516739 | 516739 | 02/13/87 | 380 | 3220e | 260 | 2960 | unidentified | gray soft rock, underlain by granite | 497190.8 | 3534842.7 |
| 17cba | Blackwell | 507102 | 507102 | 02/12/84 | 380 | 3220e | 270 | 2950 | unidentified | gray rock | 495984.4 | 3534621.9 |
| 17dcd | Goretski | 518865 | 518865 | 10/05/87 | 465 | 3200e | 450 | 2750 | unidentified | | 496797.2 | 3534034.1 |
| 18abd | Anderson | 542330 | 542330 | 02/11/94 | 405 | 3300e | 230 | 3070 | unidentified | | 495177.8 | 3535211.6 |
| 18cdb | Roberts | 516128 | 516128 | 11/30/86 | 400 | 3360e | 4 | 3356 | shale | | 494596.4 | 3534204.5 |
| 18dba | Anderson | 542329 | 542329 | 02/16/94 | 430 | 3300e | 240 | 3060 | red rock and limestone | | 495186.7 | 3534611.4 |
| 20ddc | Park Corporation | M-3 | 085305 | 08/04/80 | 700 | 3,210.20 | 397 | 2813 | sedimentary rock | Permian sediments, undifferentiated | 497000.1 | 3532375.8 |
| 21ada | Kerley Chemical | 35-30479 | 35-30479 | 03/04/70 | 668 | 3060e | 80 | 2980 | limestone | | 496989.1 | 3534839.3 |
| 21dbd | Anamax | 1782 | 506255 | 03/30/83 | 686 | 3080e | 510 | 2570 | black limestone | Permian Concha and Rain Valley Formations | 498428.2 | 3532844.8 |
| 22baa | Schilling Trust | 903933 | 903933 | 02/23/06 | 800 | 2990e | 281 | 2709 | alluvium | | 499607.1 | 3533853.6 |
| 22cad | Park Corporation | M-2 | 85304 | 07/27/80 | 647 | 2,992 | 490 | 2502 | sedimentary rock | Mesozoic, undifferentiated | 499583.2 | 3532755.7 |
| 25bab | FICO | S-46 | 35-28041 | 01/16/74 | 1,615 | 2,772 | 1580 | 1192 | granite | hard black rock layer 1520-1535' | 502575.6 | 3532292.4 |
| 25ccd | PDSI | AN-1 | 608518 | 07/12/64 | 2,786 | 2789 | 1960 | 829 | arkose | Helmet Fanglomerate above arkose 1300-1960' | 502503.0 | 3530807.6 |

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16bcc3 | PDSI | IW-19 | 545562 | 01/30/95 | 544 | 3152.40 | 497 | 2655 | arkose | layer of Pantano Formation above arkose | 497434.8 | 3525146.9 |
| 16cbb | PDSI | IW-18 | 545561 | 01/24/95 | 508 | 3168.16 | 462 | 2706 | arkose | | 497435.2 | 3524973.3 |
| 16cbc | PDSI | IW-17 | 545560 | 01/20/95 | 502 | 3157.77 | 455 | 2703 | arkose | | 497434.9 | 3524806.4 |
| 16ccb | PDSI | IW-16 | 545559 | 01/15/95 | 473 | 3159.86 | 430 | 2730 | arkose | | 497431.8 | 3524586.4 |
| 16ccc | PDSI | IW-15 | 545558 | 01/07/95 | 550 | 3149.03 | 507 | 2642 | arkose | layer of Pantano Formation above arkose | 497434.0 | 3524370.8 |
| 16daa | AZ State Land Dept. | MH-12 | 803638 | Feb-77 | 800 | 3054.07 | 780 | 2274 | limestone | | 498833.3 | 3525010.5 |
| 16ddd | AZ State Land Dept. | MH-11 | 803637 | Feb-77 | 820 | 3040.30 | 750 | 2290 | limestone | | 498810.6 | 3524267.2 |
| 17aba | AZ State Land Dept. | MH-30 | 903884 | 01/21/06 | 547 | 3166 | 460 | 2706 | arkose, siltstone | | 496750.4 | 3525913.5 |
| 21add | AZ State Land Dept. | MH-13C | 90473 | 03/06/06 | 1,447 | 3022.96 | 1395 | 1628 | calcareous claystone | | 498858.6 | 3523596.6 |
| 21bbb1 | PDSI | MH-4 | 803631 | 03/02/76 | 550 | 3,136.63 | 510 | 2627 | micritic limestone | | 497565.5 | 3524255.9 |
| 21bbb2 | PDSI | IW-14 | 545557 | 12/18/94 | 553 | 3,143.43 | 509 | 2634 | arkose | Pantano Formation 481-490' | 497428.3 | 3524176.6 |
| 21bbc | PDSI | IW-13 | 545556 | 12/12/94 | 499 | 3,140.36 | 452 | 2688 | arkose | | 497425.0 | 3523970.2 |
| 21bcc3 | PDSI | IW-6A | 545565 | 11/29/94 | 498 | 3,129.27 | 458 | 2671 | arkose | | 497442.4 | 3523512.3 |
| 21cbb | PDSI | IW-11 | 508235 | 08/24/84 | 605 | 3,124.21 | 563 | 2561 | volcanics and sandstone | | 497432.6 | 3523232.4 |
| 21cbc3 | PDSI | IW-22 | 200554 | 12/19/03 | 592 | 3125e | 550 | 2575 | conglomeratic sandstone | | 497430.7 | 3523077.1 |
| 21ccb1 | PDSI | IW-10 | 508237 | 08/15/84 | 843 | 3,126.65 | 730 | 2396 | unidentified | hard maroon and white rock | 497431.5 | 3522925.7 |
| 21ccb2 | PDSI | IW-23 | 200555 | 01/18/04 | 974 | 3130e | 960 | 2170 | volcanic | Demetrie Volcanics | 497430.4 | 3522774.3 |
| 21ccc | PDSI | IW-5 | 623133 | 06/13/79 | 956 | 3,134.66 | 550 | 2585 | volcanic | Demetrie Volcanics | 497430.7 | 3522618.4 |
| 24bcb | FICO | E-3A | 35-30226, 624011 | 07/15/75 | 1,100 | 2,718 | 955 | 1763 | unidentified | | 502295.3 | 3523738.6 |
| 28bbb2 | PDSI | MH-6 | 803633 | Apr-76 | 960 | 3,130.98 | 590 | 2540 | limestone | | 497497.9 | 3522574.0 |
| 28bbb3 | PDSI | IW-24 | 200556 | 01/03/04 | 884 | 3132e | 870 | 2262 | volcanic | decomposed granodiorite and volcanics, 410-870' | 497432.8 | 3522437.1 |
| 28bbc | PDSI | IW-4 | 623132 | 07/23/78 | 946 | 3,134.07 | 920 | 2214 | volcanic | mixed variable hard to soft Demetrie Volcanics, intrusive, sediments 490-920 | 497432.9 | 3522269.4 |
| 28bcc2 | PDSI | IW-9 | 508238 | 08/06/84 | 853 | 3,099.98 | 740 | 2247 | volcanic | Demetrie Volcanics fractured and altered to clay | 497430.9 | 3521924.3 |
| 28cbb1 | PDSI | MH-7 | 803634 | 04/01/76 | 1,100 | 3,108.24 | 1070 | 2038 | volcanic | Demetrie Volcanics | 497424.4 | 3522011.3 |
| 28cbb2 | PDSI | IW-8 | 508236 | Aug-84 | 803 | 3,119.20 | 754 | 2365 | volcanic | Demetrie Volcanics | 497429.4 | 3521824.1 |
| 28cbc2 | PDSI | IW-3A | 201732 | 02/03/04 | 1,052 | 3,117 | 1010 | 2107 | volcanic | top of Demetrie Volcanics (altered) 820-1010' | 497427.4 | 3521526.2 |
| 28ccc | PDSI | IW-2 | 623130 | 05/18/98 | 1,035 | 3,098 | 1028 | 2070 | siltstone | | 497546.6 | 3521164.1 |
| 28ccd2 | PDSI | MH-2 | 35-34590 | 11/26/75 | 1,040 | 3,097 | 1020 | 2077 | basalt | | 497702.7 | 3521113.6 |
| 29cdd1 | PDSI | MH-9 | 803635 | Jul-76 | 1,400 | 3159.58 | 1300 | 1860 | tuffaceous arkose | | 496499.4 | 3521056.2 |
| 29cdd2 | PDSI | IW-7 | 623135 | Sep-79 | 1,050 | 3161.00 | 380 | 2781 | unidentified | | 496488.7 | 3521110.1 |
| 29dcd | PDSI | IW-1 | 623129 | 07/31/78 | 855 | 3141 | 760 | 2381 | volcanic | Demetrie Volcanics | 496967.0 | 3521081.3 |
| 29ddc | PDSI | MH-8 | 35-37551 | 06/17/76 | 1,065 | 3125 | 1020 | 2105 | volcanic | Demetrie Volcanics | 497036.6 | 3521069.0 |
| 30ddd | PDSI | MH-10 | 803636 | Feb-77 | 600 | 3184.85 | 430 | 2755 | arkose | | 495778.9 | 3521040.4 |
| 34dca | FICO | W-11 | 35-26757, 624025 | 02/12/74 | 1,186 | 2900e | 1185 | 1715 | granite | | 500124.5 | 3519733.4 |

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-18-15** | | | | | | | | | | | | |
| 14aac | Santa Rita Mining Co. | SR Mining | none | 06/22/71 | 203 | 4260 | 0 | 4260 | unidentified gray rock | | 521262.8 | 3526229.3 |
| 15bac | Anamax | 1928 | 501990 | 02/09/82 | 185 | 3894 | 155 | 3739 | limestone | | 518831.7 | 3526241.2 |
| 16aad | USDA Forest Service | USDA | none | 05/15/70 | 110 | 3868 | 85 | 3783 | granite | | 518216.7 | 3526131.9 |
| 22cdb | Pallanes | 35-41917 | 35-41917, 640317 | 06/20/77 | 600 | 4218 | 35 | 4183 | granite | | 518823.2 | 3523629.0 |
| 27bbb | Lansky | 201898 | 201898 | 02/16/04 | 600 | 4155 | 150 | 4005 | granite | | 518421.4 | 3523225.5 |
| 34daa | Anamax | 1930 | 501985 | 02/14/82 | 350 | 4940 | 0 | 4940 | granite | | 519836.1 | 3520802.9 |
| **D-19-14** | | | | | | | | | | | | |
| 21ada | Kettenbach | 210526 | 210526 | 07/28/06 | 1320 | 3653 | 3 | 3650 | granite | | 508784.7 | 3514268.6 |
| 22aab | Ludwig | 594970 | 594970 | 04/23/03 | 320 | 3862 | 115 | 3747 | granite | | 510193.8 | 3514675.5 |
| 22aac | Ludwig | 594971 | 594971 | 04/25/03 | 180 | 3890 | 170 | 3720 | granite | cemented sand and gravel 118-170' | 510192.5 | 3514473.7 |
| 22aad | Ludwig | 590963 | 590963 | 06/15/02 | 200 | 3886 | 185 | 3701 | granite | broken sandstone above granite 170-185' | 510393.7 | 3514474.3 |
| 22dda | Thomasson | 540132 | 540132 | 08/24/93 | 150 | 4051 | 120 | 3931 | granite | | 510386.6 | 3513468.0 |
| 27cad | Barber | 585087 | 585087 | 10/08/01 | 210 | 4134 | 40 | 4094 | granite | | 509392.1 | 3512060.6 |
| 28dad | La Sierra Ranch | 212561 | 212561 | 07/14/06 | 200 | 4017 | 90 | 3927 | granite | | 508794.7 | 3512064.5 |
| 30ccd | Desmond | 552649 | 552649 | Jan-96 | 525 | 3420 | 0 | 3420 | granite | | 504223.2 | 3511668.1 |
| | | | | | | | | | | | | |
| **Twin Buttes Area Well Data, SRK (1985)** [1] | | | | | | | | | | | | |
| **D-18-13** | | | | | | | | | | | | |
| 3a | Park Corporation | A-462 | | | 1516 | 2981 | 1231 | 1750 | sedimentary rock | Mesozoic, undifferentiated | 499897.3 | 3528822.1 |
| 4a | Park Corporation | 1393 | | | 1363 | 3293 | 793 | 2500 | sedimentary rock | Mesozoic, undifferentiated | 498179.4 | 3528819.5 |
| 4b | Park Corporation | CH-15 | | | 1351 | 3220 | 595 | 2625 | sedimentary rock | Mesozoic, undifferentiated | 497938.7 | 3528555.7 |
| | | | | | | | | | | | | |
| **D-17-13** | | | | | | | | | | | | |
| 21c | Park Corporation | 1308 | | | 1160 | 3133.5 | 133.5 | 3000 | limestone | | 497854.7 | 3532838.2 |
| 22c | Park Corporation | 1790 | | | 620 | 3041.3 | 391.3 | 2650 | sedimentary rock | Mesozoic, undifferentiated | 498961.0 | 3532798.4 |
| 22c | Park Corporation | 1781 | | | 600 | 2982.6 | 482.6 | 2500 | sedimentary rock | Mesozoic, undifferentiated | 499667.2 | 3532748.1 |
| 22d | Park Corporation | 71-1 | | | 500 | 2958 | 408 | 2550 | sedimentary rock | Mesozoic, undifferentiated | 500015.7 | 3533084.4 |
| 22d | Park Corporation | 1789 | | | 620 | 2935.9 | 535.9 | 2400 | sedimentary rock | Mesozoic, undifferentiated | 500305.1 | 3532373.7 |
| 27c | Park Corporation | CH-8 | | | 955 | 3042 | 617 | 2425 | sedimentary rock | Mesozoic, undifferentiated | 499119.4 | 3530854.7 |
| 27d | Park Corporation | A-486 | | | 2040 | 2980 | 905 | 2075 | sedimentary rock | Mesozoic, undifferentiated | 499797.0 | 3531138.8 |
| 27d | Park Corporation | P-866 | | | 1175 | 2983.3 | 933.3 | 2050 | sedimentary rock | Mesozoic, undifferentiated | 499822.3 | 3530791.5 |
| 28b | Park Corporation | A-421 | | | 925 | 3122 | 672 | 2450 | limestone | | 498013.6 | 3532299.3 |
| 28c | Park Corporation | A-944 | | | 1430 | 3135 | 510 | 2625 | sedimentary rock | Mesozoic, undifferentiated | 498001.0 | 3531051.6 |
| 28ccc | Park Corporation | CH-2 | | | 609 | 3185 | 585 | 2600 | sedimentary rock | Permian, undifferentiated | 497334.1 | 3530797.1 |
| 28d | Park Corporation | A-952 | | | 1436 | 3081.6 | 581.6 | 2500 | sedimentary rock | Mesozoic, undifferentiated | 498601.6 | 3531023.4 |
| 28d | Park Corporation | CH-1 | | | 620 | 3107 | 557 | 2550 | sedimentary rock | Mesozoic, undifferentiated | 498320.2 | 3530840.6 |
| 33b | Park Corporation | 2118 | | | 666 | 3120 | 620 | 2500 | sedimentary rock | Mesozoic, undifferentiated | 497967.3 | 3530736.6 |
| **Altitude of Bedrock from Selected Core Holes in and Adjacent to the PDSTI (ELMA, 1989)** | | | | | | | | | | | | |
| **D-18-12** | | | | | | | | | | | | |
| 24aac | PDSI | S-1 | none | | | 3350 | 170 | 3180 | | | 493897.1 | 3523864.0 |
| 24acc | PDSI | 561 | none | | | 3400 | 25 | 3375 | | | 493369.0 | 3523459.9 |
| 24daa | PDSI | D-3 | none | | | 3350 | 330 | 3020 | | | 494022.9 | 3523276.1 |
| 24dca | PDSI | S-4 | none | | | 3350 | 95 | 3255 | | | 493534.1 | 3522832.9 |
| 25aaa | PDSI | D-14 | none | Sep-65 | | 3331 | 262 | 3069 | andesite | | 494092.0 | 3522432.0 |
| 36aa | PDSI | D-17 | none | | | 3300 | 135 | 3165 | | | 494057.0 | 3520889.0 |

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-18-13** | | | | | | | | | | | | |
| 7acc | PDSI | A-986 | none | | | 3385 | 139 | 3246 | | | 495055.1 | 3526797.0 |
| 7adc | PDSI | A-402 | none | | | 3355 | 406 | 2949 | | | 495527.1 | 3526800.9 |
| 7bcc | PDSI | A-403 | none | | | 3460 | 95 | 3365 | | | 494243.0 | 3526824.8 |
| 7cbb | PDSI | A-478 | none | | | 3420 | 103 | 3317 | | | 494280.9 | 3526593.0 |
| 7ddc | PDSI | Z-5 | none | | | 3330 | 219 | 3111 | | | 495425.9 | 3525972.1 |
| 8aba | PDSI | A-419 | none | | | 3262 | 550 | 2712 | | | 496638.1 | 3527324.1 |
| 8acb | PDSI | 166 | none | | | 3415 | 540 | 2875 | | | 496561.9 | 3526921.0 |
| 8adb | PDSI | A-407 | none | | | 3240 | 610 | 2630 | | | 496993.2 | 3526861.0 |
| 8bbb | PDSI | 288 | none | | | 3336 | 299 | 3037 | | | 495856.0 | 3527325.8 |
| 8bca | PDSI | A-454 | none | | | 3495 | 619 | 2876 | | | 496025.1 | 3526948.2 |
| 8bcd | PDSI | 165 | none | | | 3540 | 519 | 3021 | | | 496127.0 | 3526656.0 |
| 8cad | PDSI | 574-X | none | | | 3320 | 310 | 3010 | | | 496411.1 | 3526418.0 |
| 8ccb | PDSI | Z-6 | none | | | 3298 | 341 | 2957 | | | 495915.9 | 3526122.1 |
| 8ccd | PDSI | 1195 | none | | | 3303 | 300 | 3003 | | | 496026.9 | 3525949.9 |
| 9aaa | PDSI | P-7 | none | | | 3071 | 810 | 2261 | | | 498906.1 | 3527407.0 |
| 9aba | PDSI | 1226 | none | | | 3110 | 760 | 2350 | | | 498456.0 | 3527369.1 |
| 9baa | PDSI | P-2 | none | | | 3120 | 700 | 2420 | | | 498142.1 | 3527358.9 |
| 9bbb | PDSI | P-1 | none | | | 3190 | 555 | 2635 | | | 497424.9 | 3527435.1 |
| 9bca | PDSI | 1324 | none | | | 3173 | 631 | 2542 | | | 497667.1 | 3526962.9 |
| 9bdb | PDSI | 13 | none | | | 3170 | 667 | 2503 | | | 497804.1 | 3526874.0 |
| 9bdd | PDSI | 1087 | none | | | 3142 | 700 | 2442 | | | 498072.0 | 3526924.1 |
| 9cab | PDSI | 1240 | none | | | 3170 | 645 | 2525 | | | 497874.1 | 3526512.0 |
| 9dba | PDSI | 1257 | none | | | 3100 | 760 | 2340 | | | 498442.1 | 3526554.1 |
| 16aca | PDSI | P-12 | none | | | 3070 | 804 | 2266 | | | 498476.1 | 3525329.7 |
| 16baa | PDSI | P-10 | none | | | 3130 | 674 | 2456 | | | 498057.1 | 3525733.6 |
| 16bab | PDSI | P-11 | none | | | 3150 | 703 | 2447 | | | 497847.6 | 3525733.6 |
| 17aba | PDSI | D-1 | none | | | 3039 | 310 | 2729 | | | 496844.0 | 3525763.9 |
| 17bab | PDSI | 569 | none | | | 3275 | 355 | 2920 | | | 496280.0 | 3525790.0 |
| 17bcb | PDSI | CFI-3 | none | | | 3310 | 299 | 3011 | | | 495740.1 | 3525361.8 |
| 17bdd | PDSI | Z-3 | none | | | 3225 | 410 | 2815 | | | 496447.1 | 3525199.9 |
| 17ccc | PDSI | D-6 | none | | | 3267 | 448 | 2819 | | | 495781.9 | 3524246.9 |
| 17dab | PDSI | 4 | none | | | 3165 | 460 | 2705 | | | 497074.2 | 3524906.9 |
| 17dca | PDSI | 551 | none | | | 3170 | 356 | 2814 | | | 496930.1 | 3524552.0 |
| 18aab | PDSI | 572 | none | | | 3340 | 295 | 3045 | | | 495398.1 | 3525779.1 |
| 18aca | PDSI | Z-2 | none | | | 3330 | 211 | 3119 | | | 495237.0 | 3525360.0 |
| 18acb | PDSI | 26 | none | | | 3350 | 191 | 3159 | | | 495004.9 | 3525258.1 |

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18cdb | PDSI | 16 | none | | | 3350 | 225 | 3125 | | | 494609.1 | 3524389.1 |
| 18cdd | PDSI | D-5 | none | | | 3350 | 225 | 3125 | | | 494871.1 | 3524250.0 |
| 19abc | PDSI | 25 | none | | | 3300 | 207 | 3093 | | | 495024.1 | 3523821.0 |
| 19acc | PDSI | 10 | none | | | 3300 | 260 | 3040 | | | 494969.1 | 3523549.9 |
| 19acd | PDSI | D-2 | none | | | 3280 | 234 | 3046 | | | 495216.9 | 3523415.9 |
| 19ada | PDSI | 558 | none | | | 3250 | 263 | 2987 | | | 495709.9 | 3523667.1 |
| 19bac | PDSI | 36 | none | | | 3320 | 232 | 3088 | | | 494670.0 | 3523888.8 |
| 19bbc | PDSI | 8 | none | | | 3350 | 200 | 3150 | | | 494293.1 | 3523853.9 |
| 19bda | PDSI | 557 | none | | | 3300 | 263 | 3037 | | | 494779.0 | 3523627.1 |
| 19cac | PDSI | 28 | none | | | 3300 | 206 | 3094 | | | 494582.1 | 3523069.0 |
| 19cbb | PDSI | 563 | none | | | 3350 | 323 | 3027 | | | 494325.1 | 3523379.9 |
| 19cdb | PDSI | 560 | none | | | 3310 | 200 | 3110 | | | 494615.9 | 3522853.9 |
| 19dcb | PDSI | 18 | none | | | 3275 | 210 | 3065 | | | 495020.0 | 3523185.1 |
| 19dbd | PDSI | 2 | none | | | 3260 | 353 | 2907 | | | 495343.1 | 3523057.1 |
| 19dcb | PDSI | 11 | none | | | 3280 | 215 | 3065 | | | 495010.1 | 3522953.0 |
| 19dcc1 | PDSI | 12 | none | | | 3272 | 228 | 3044 | | | 495140.9 | 3522596.9 |
| 19dda | PDSI | 20 | none | | | 3225 | 281 | 2944 | | | 495780.1 | 3522920.0 |
| 19ddd | PDSI | 19 | none | | | 3219 | 258 | 2961 | | | 495762.1 | 3522626.1 |
| 20adc | PDSI | 7 | none | | | 3150 | 445 | 2705 | | | 497084.1 | 3523493.1 |
| 20bbc | PDSI | 30 | none | | | 3250 | 265 | 2985 | | | 495799.0 | 3523892.1 |
| 20bca | PDSI | 6 | none | | | 3240 | 300 | 2940 | | | 495979.9 | 3523674.9 |
| 20bda | PDSI | 37 | none | | | 3200 | 335 | 2865 | | | 496441.1 | 3523696.9 |
| 20cac | PDSI | D-20 | none | | | 3190 | 316 | 2874 | | | 496277.0 | 3523098.0 |
| 20cca | PDSI | D-4 | none | | | 3210 | 300 | 2910 | | | 496067.9 | 3522906.0 |
| 20cda | PDSI | 23 | none | | | 3175 | 337 | 2838 | | | 496492.1 | 3522843.0 |
| 20daa | PDSI | 553 | none | | | 3110 | 613 | 2497 | | | 497286.8 | 3523331.0 |
| 29baa | PDSI | 3 | none | | | 3200 | 376 | 2824 | | | 496498.1 | 3522541.0 |
| 29bbd | PDSI | 38 | none | | | 3200 | 330 | 2870 | | | 496150.9 | 3522412.0 |
| 29bca | PDSI | D-7 | none | | | 3200 | 331 | 2869 | | | 496032.1 | 3522124.1 |
| 29bda | PDSI | D-21 | none | | | 3150 | 331 | 2819 | | | 496521.0 | 3522188.0 |
| 29cdb | PDSI | 555 | none | | | 3190 | 700 | 2490 | | | 496343.0 | 3521379.9 |
| 29dbb | PDSI | 39 | none | | | 3140 | 400 | 2740 | | | 496803.1 | 3521745.9 |
| 29ddb | PDSI | D-18 | none | | | 3120 | 1197 | 1923 | | | 497100.4 | 3521313.2 |
| 30aab | PDSI | 31 | none | | | 3250 | 237 | 3013 | | | 495446.9 | 3522540.1 |
| 30aad | PDSI | 22 | none | | | 3220 | 263 | 2957 | | | 495797.0 | 3522287.9 |
| 30abb | PDSI | 9 | none | | | 3270 | 184 | 3086 | | | 494978.9 | 3522580.9 |
| 30bda | PDSI | 556 | none | | | 3275 | 253 | 3022 | | | 494870.9 | 3522097.1 |
| 30bcc | PDSI | 559 | none | | | 3280 | 373 | 2907 | | | 494268.1 | 3521820.0 |
| 30cda | PDSI | 14 | none | | | 3250 | 168 | 3082 | | | 494953.1 | 3521324.9 |
| 30dad | PDSI | D-8 | none | | | 3200 | 345 | 2855 | | | 495659.9 | 3521498.1 |
| 30dbc | PDSI | 565 | none | | | 3250 | 373 | 2877 | | | 495171.1 | 3521597.9 |
| 31aaa | PDSI | D-9 | none | | | 3200 | 330 | 2870 | | | 495720.0 | 3520921.1 |

*Notes:*

*ft bls = feet below surface*

*ft amsl = feet above mean sea level. Measuring point elevations are reported for some PDSI wells.*

*[1] bedrock elevations estimated to the nearest 25' based on cross sections by SRK (1985)*

**TABLE A.2**
**Selected Wells Completed in Basin Fill in the Vicinity of PDSTI (Not Drilled to Bedrock)**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth Drilled (ft bls) | Altitude of Land Surface (ft amsl) | Maximum Elevation of Bedrock (ft amsl) | Lithology at Total Depth | Selected Notes from Well Completion Reports | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-16-13** | | | | | | | | | | | |
| 26aaa | ASARCO | SX-1 | 35-67750, 55-607792 | 03/01/76 | 825 | 2688 | < 1863 | clay | | 502014.9 | 3541911.5 |
| 26add | ASARCO | SX-2 | 35-66751, 55-607793 | 07/12/76 | 744 | 2701 | < 1957 | clay | | 502016.9 | 3541305.5 |
| 26caa | ASARCO | SX-3 | 35-67752, 55-607794 | 10/01/75 | 739 | 2743 | < 2004 | conglomerate | | 501209.3 | 3541105.8 |
| 34aab | ASARCO | ASARCO M-5 | 607785 | 10/16/71 | 935 | 2820 | < 1885 | hard clay and gravel | cemented conglomerate and hard clay and gravel 674-933' | 500201.2 | 3540291.3 |
| 35bbb | ASARCO | ASARCO M-6 | 35-67755, 55-607787 | 03/09/60 | 500 | 2790 | < 2290 | conglomerate | 265-420'; conglomerate 420-500' | 500603.4 | 3540297.4 |
| 35bdd | ASARCO | ASARCO M-10 | 607790 | 10/02/72 | 835 | 2771 | < 1936 | conglomerate with clay layers | | 501205.1 | 3539682.2 |
| 35bab | ASARCO | ASARCO M-7 | 35-67754, 55-607788 | 04/28/60 | 500 | 2770 | < 2270 | gravel and clay | cemented, caliche 330-445', tight clay and gravel, 445-500' | 501007.9 | 3540297.1 |
| 36baa | ASARCO | 529538 | 529538 | 01/17/91 | 860 | 2725 | < 1865 | sand and gravel | | 502815.0 | 3540298.2 |
| 36bdc | ASARCO | ASARCO M-14 | 532046 | 08/17/91 | 900 | 2710 | < 1810 | basin fill | | 502615.6 | 3539686.8 |
| **D-16-14** | | | | | | | | | | | |
| 30dbd | Lee Moore Ranch | 35-29585 | 35-29585 | Apr-71 | 251 | 2650 | < 2599 | red sandy clay | cemented sand intervals 165-235' | 504799.8 | 3540893.8 |
| 30ccc | ASARCO | 35-32068 | 35-32068, 55-607797 | 04/23/76 | 397 | 2657 | < 2260 | sticky clay | hard conglomerate 270-290' | 503805.6 | 3540505.5 |
| 30ccd | ASARCO | 35-29580 | 3529580 | 10/2/1972 | 835 | 2656 | < 1821 | conglomerate with clay layers | | 504002.6 | 3540506.0 |
| 31dcd | FICO | Sah. #6 | 35-29598 | Jul-1914 | 248 | 2670 | < 2422 | hard, dry clay | hard clay w/gravel 228-248' | 504799.8 | 3538876.0 |
| 31aad | Roisland Farms | 35-29589 | 35-29589, 55-607815 | Feb-61 | 475 | 2660 | < 2185 | red sticky clay | cemented gravel 185-200; 295-315' | 505189.7 | 3540106.7 |
| 31cda | Rancho Oro Verde | 35-29596 | 35-29596 | Jul-1914 | 346 | 2667 | < 2321 | loose sand | interbedded clay and cemented sand 215-334' | 504408.7 | 3539077.8 |
| 31ddd | FICO | Sah. #5 | 35-29599 | Jul-1914 | 462 | 2673 | < 2211 | clay | | 505190.9 | 3538876.0 |
| 32abd | Levis | 35-29300 | 35-29600 | 01/12/58 | 355 | 2671 | < 2316 | sticky red clay | sticky red clay 240-300' | 506396.2 | 3540107.9 |
| 32bdd | Griffen | 35-29603 | 35-29303 | Sep-47 | 253 | 2667 | < 2414 | sticky red clay | | 505996.4 | 3539683.2 |
| 33bdd | City of Tucson | 35-29610 | 35-29610 | 04/03/73 | 826 | 2696 | < 1870 | sticky red clay | sticky clay with occasional gypsum 620-826' | 507614.3 | 3539683.2 |
| **D-16-15** | | | | | | | | | | | |
| 06bbb | MUM Agency | SE 13-75 | 35-29615 | 10/17/75 | 932 | 2819 | < 1887 | clay | soft to dense to chippy clay 566-932' | 513415.9 | 3548509.1 |
| 08ccc | MUM Agency | SE 5-75 | 35-29617 | 11/12/75 | 1,103 | 2869 | < 1766 | clay | soft to dense to chippy clay 712-1103' | 514988.9 | 3545741.7 |
| 09bbb | City of Tucson | 35-29618 | 35-29618, 55-619870 | 10/12/67 | 1,000 | 2911 | < 1911 | clay, sand and gravel | | 516673.9 | 3547165.8 |
| 10ccc | City of Tucson | 35-29619 | 35-29619 | 05/02/66 | 2,998 | 2969 | < 29 | well cemented multi-lithic conglomerate | | 518192.1 | 3545723.3 |
| 13ccc | MUM Agency | SE 7-75 | 35-40029 | 02/10/76 | 1,020 | 3082 | < 2062 | sandy clay | | 521384.8 | 3544092.9 |
| 14cab | So. Ariz. International Livestock Association | 35-29622 | 35-29622 | 05/31/66 | 905 | 3040 | < 2135 | sticky clay | | 520188.2 | 3544721.1 |
| 16bbb | MUM Agency | SE 6-75 | 35-29623 | 11/29/75 | 870 | 2921 | < 2051 | clay | dense clay and fine sand 550-736', mostly well-cemented; soft to dense clay w/ minor sand 736-870', strongly cemented towards bottom of well | 516577.4 | 3545542.2 |
| 22bbb | MUM Agency | SE 9-75 | 35-33978 | 12/10/75 | 892 | 2983 | < 2091 | clayey conglomerate | tightly cemented clayey sandy conglomerate 535-892' | 518186.9 | 3543937.2 |
| 23bbb | MUM Agency | SE 10-75 | 35-33969 | 09/09/75 | 1,055 | 3031 | < 1976 | well-cemented gravelly sand | tightly cemented with no production capacity below 580' | 519783.3 | 3543937.2 |
| 26ddd | MUM Agency | SE 14-75 | 35-29629 | 02/19/75 | 1,117 | 3137 | < 2020 | conglomerate | water production from loose conglomerate 357-560'; polylithic tight conglomerate 560-1116' | 521184.6 | 3540957.1 |
| 28ddd | MUM Agency | SE 8-75 | 35-33977 | 03/19/76 | 1,015 | 3003 | < 1988 | clayey sand | clayey sand 747-1015' | 517984.4 | 3540945.2 |
| 29aaa | MUM Agency | SE 11-75 | 35-40030 | 01/16/76 | 843 | 2933 | < 2090 | clay and gravelly sand | | 516383.2 | 3542334.0 |
| 30ddd | MUM Agency | SE 12-75 | 35-40032 | 03/12/76 | 1,007 | 2890 | < 1883 | dense to sandy clay | strongly cemented dense to sandy clay 970-1007' | 514782.0 | 3540945.2 |
| 34aaa | Spring Valley Water Co. | 35-29635 | 35-29635, 55-619865 | 01/31/63 | 704 | 3080 | < 2376 | firm conglomerate | firm conglomerate 690-703' | 519681.8 | 3540721.7 |

**TABLE A.1**
**Selected Wells and Borings Drilled to Bedrock in the Vicinity of PDSTI**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth of Boring (ft bls) | Altitude of Land Surface (ft amsl) | Depth to Bedrock (ft bls) | Bedrock Elevation (ft amsl) | Bedrock Lithology | Notes | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27aab | Park Corporation | M-12 | 504722 | 04/19/83 | 582 | 2947 | 570 | 2377 | unidentified | | 500185.4 | 3532296.9 |
| 27baa | Park Corporation | 1758 | 634392 | 02/15/78 | 650 | 2985 | 385e | 2600 | sedimentary rock | Mesozoic, undifferentiated | 499677.5 | 3532099.0 |
| 27dcc2 | Park Corporation | RT-1 | 504946 | 12/08/80 | 985 | 2980 | 930 | 2050 | arkose | | 499872.0 | 3530774.6 |
| 31bcd | PDSI | M-16 | 561955 | 06/12/97 | 205 | 3454.89 | 130 | 3325 | intrusive | | 494368.1 | 3529903.5 |
| 33aaa | Park Corporation | M-13 | 508428 | 08/04/84 | 753 | 3077.00 | 735 | 2342 | sedimentary rock | Mesozoic, undifferentiated | 498789.3 | 3530814.2 |
| 33cac | Park Corporation | 511894 | 511894 | Sep-85 | 664 | 3160e | 618 | 2542 | limestone | | 497833.2 | 3529618.6 |
| 34bdd2 | Park Corporation | M-10 | 501653 | 11/21/1981 | 1,050 | 3004.39 | 1030 | 1974 | arkose | | 499720.4 | 3529946.6 |
| **D-18-12** | | | | | | | | | | | | |
| 10cdb | PDSI | PZ-6 | 561867 | 06/04/97 | 80 | 3765.56 | 20 | 3745 | intrusive | Ruby Star Granodiorite | 489716.9 | 3526192.0 |
| 10dad | PDSI | PZ-5 | 561868 | 06/02/97 | 70 | 3602.31 | 0 | 3602 | intrusive | Ruby Star Granodiorite | 490931.3 | 3526148.0 |
| 10ddc | PDSI | PZ-4 | 561869 | 05/30/97 | 70 | 3612.68 | 0 | 3613 | intrusive | Ruby Star Granodiorite | 490637.0 | 3525902.4 |
| 11bbc | PDSI | MH-21 | 561881 | 06/03/97 | 100 | 3693.67 | 0 | 3694 | intrusive | Ruby Star Granodiorite | 491083.2 | 3527233.7 |
| 11dda | PDSI | PZ-7 | 561870 | 06/05/97 | 155 | 3546.48 | 110 | 3436 | intrusive | Ruby Star Granodiorite | 492594.4 | 3526161.0 |
| 13bda | PDSI | PZ-9 | 561859 | 06/16/97 | 230 | 3505.08 | 210 | 3295 | intrusive | Ruby Star Granodiorite | 493241.1 | 3525372.2 |
| 14bdb1 | PDSI | BW-3 | 528095 | 06/05/90 | 95 | 3540.29 | 25 | 3515 | intrusive | Ruby Star Granodiorite | 491456.7 | 3525376.8 |
| 14bdb2 | PDSI | BW-4 | 537576 | 07/01/93 | 20 | 3530.04 | 7 | 3523 | unidentified | | 491386.4 | 3525323.9 |
| 14cdd1 | PDSI | MH-22 | 561872 | 06/06/97 | 20 | 3511.65 | 17 | 3495 | andesite | Demetrie Volcanics | 491572.2 | 3525144.1 |
| 14cdd2 | PDSI | MH-23 | 561871 | 06/17/97 | 80 | 3515.28 | 7 | 3508 | andesite | Demetrie Volcanics | 491575.4 | 3525167.2 |
| 15ada | PDSI | PZ-3 | 561860 | 05/29/97 | 100 | 3592.89 | 0 | 3592 | intrusive | Ruby Star | 490873.0 | 3525368.9 |
| 15caa | PDSI | PZ-2 | 561861 | 05/28/97 | 110 | 3759.69 | 10 | 3749 | intrusive | Ruby Star | 489939.4 | 3524863.0 |
| 16dbb | PDSI | PZ-10 | 561862 | 07/08/97 | 150 | 4011.73 | 80 | 3931 | volcanic | Ox Frame Volcanics | 488613.4 | 3524969.6 |
| 16dbc | PDSI | PZ-11 | none | 07/11/97 | 275 | 4039.23 | 200 | 3839 | intrusive | quartz latite | 488604.1 | 3524765.3 |
| 16ddd | PDSI | BW-1 | 528096 | 05/31/90 | 125 | 3813.54 | 6 | 3807 | volcanic | Demetrie Volcanics | 489188.4 | 3524385.4 |
| 17cda | PDSI | PZ-12 | 561846 | 07/15/97 | 200 | 4110.79 | 40 | 4070 | volcanic | Ox Frame Volcanics | 486741.4 | 3524523.1 |
| 19bab | PDSI | MH-17 | 561873 | 05/18/97 | 110 | 4137.55 | 0 | 4137 | intrusive | Harris Ranch | 484966.7 | 3524090.6 |
| 20dda | PDSI | PZ-16 | 580712 | 05/31/00 | 81 | 3723.6 | 12 | 3711 | volcanic | Demetrie Volcanics | 487637.9 | 3522945.1 |
| 21acc1 | PDSI | PZ-13 | 561875 | 06/26/97 | 30 | 3701.75 | 0 | 3701.75 | volcanic | Demetrie Volcanics | 488613.0 | 3523631.6 |
| 21acc2 | PDSI | PZ-14 | 561876 | 06/30/97 | 84 | 3711.81 | 0 | 3711.81 | volcanic | Demetrie Volcanics | 488625.0 | 3523638.6 |
| 21acc3 | PDSI | PZ-15 | 561877 | 06/25/97 | 130 | 3719.32 | 0 | 3719.32 | volcanic | Demetrie Volcanics | 488641.7 | 3523643.3 |
| 21dac | PDSI | BW-2 | 528097 | 06/01/90 | 300 | 3636.47 | 12 | 3624 | volcanic | Demetrie Volcanics | 489039.7 | 3523082.0 |
| 21dda | PDSI | MH-20 | 561880 | 05/23/97 | 180 | 3609.39 | 7 | 3602 | volcanic | Demetrie Volcanics | 489214.0 | 3522907.7 |
| 24bac | PDSI | PZ-8 | 561866 | 06/06/97 | 280 | 3477.37 | 10 | 3467 | volcanic | Demetrie Volcanics | 493033.9 | 3523999.7 |
| **D-18-13** | | | | | | | | | | | | |
| 01aab | Robson Ranch | 608521 | 35-25944, 608521 | 07/27/74 | 1,800 | 2564 | 1705 | 859 | unidentified | first rock reported @1635', | 503460.8 | 3528992.3 |
| 04acc2 | Park Corporation | I-12 | 608523 | 08/11/78 | 1,019 | 3327.80 | 945 | 2383 | porphyry | | 498171.0 | 3528381.0 |
| 04acc3 | Park Corporation | I-13 | 87309 | 08/26/82 | 1,167 | 3226 | 937 | 2289 | unidentified | "rock" @ 937'; "hard rock" @ 1127' | 498256.6 | 3528308.0 |
| 04bdc1 | Park Corporation | I-6 | 608529 | 10/16/75 | 950 | 3110.50 | 770 | 2340 | arkose | | 497690.0 | 3528238.0 |
| 04bdc2 | Park Corporation | I-7 | 608528 | 05/07/76 | 980 | 3204.10 | 780 | 2424 | intrusive | | 497868.0 | 3528335.0 |
| 04bdc3 | Park Corporation | I-9 | 608526 | 05/20/76 | 900 | 3207 | 690 | 2517 | arkose | | 497884.0 | 3528476.0 |
| 04caa | Park Corporation | I-11 | 608524 | 01/18/77 | 1,045 | 3327 | 924 | 2403 | arkose | | 497981.0 | 3528289.0 |
| 04cab1 | Park Corporation | I-8 | 608527 | 04/28/76 | 954 | 3207 | 730 | 2477 | arkose and quartzite | | 497840.3 | 3528190.0 |
| 04cab2 | Park Corporation | I-10 | 608525 | 11/27/76 | 932 | 3203.20 | 763 | 2440 | intrusive | | 497859.0 | 3528272.0 |
| 09aaa | AZ State Land Dept. | MH-26C | 208428 | 05/17/06 | 922 | 3062 | 810 | 2252 | arkose and quartzite | | 498926.4 | 3527610.3 |
| 09dda | AZ State Land Dept. | MH-25C | 208426 | 11/10/05 | 1,121 | 3069.28 | 940 | 2129 | sedimentary rock | Mesozoic, undifferentiated | 498935.8 | 3526294.6 |
| 16bbb | PDSI | MH-1 | 803629 | 11/19/75 | 524 | 3176.28 | 520 est. | 2625 | arkose | log indicates transition from basin fill to arkose by 520' | 497433.6 | 3525676.4 |
| 16bbc | PDSI | IW-21 | 545564 | 02/12/95 | 620 | 3168.38 | 520 | 2648 | arkose | layer of Pantano Formation above arkose | 497435.7 | 3525576.8 |
| 16bcb | PDSI | IW-20 | 545563 | 02/05/95 | 506 | 3161.22 | 470 | 2691 | arkose | layer of Pantano Formation above arkose | 497425.9 | 3525372.3 |
| 16bcc2 | PDSI | MH-14 | 528098 | 06/12/90 | 561 | 3150.77 | 540 | 2611 | arkose | layer of Pantano Formation above arkose | 497578.8 | 3525072.9 |

**TABLE A.2**
**Selected Wells Completed in Basin Fill in the Vicinity of PDSTI (Not Drilled to Bedrock)**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth Drilled (ft bls) | Altitude of Land Surface (ft amsl) | Maximum Elevation of Bedrock (ft amsl) | Lithology at Total Depth | Selected Notes from Well Completion Reports | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-17-12** | | | | | | | | | | | |
| 24dcc | Sombrero Land & Cattle | 571048 | 571048 | 01/21/99 | 1,300 | 3483 | < 2183 | basin fill | | 493413.6 | 3532405.2 |
| 26b | Las Quintas Serenas | na | | | 407 | 3672 | < 3265 | | | 491308.8 | 3531892.4 |
| 33dac | Nolen | 561002 | 561002 | 12/22/97 | 350 | 3952 | < 3602 | clay conglomerate | | 488155.0 | 3529568.8 |
| **D-17-13** | | | | | | | | | | | |
| 01acc | Pima Mining Co. | PMC #14 | 611142 | 10/09/70 | 1,135 | 2700 | < 1565 | hard conglomerate | hard conglomerate 1133-1135' | 503413.8 | 3536870.3 |
| 02aaa | Pima Mining Co. | PMC #6 | 35-30441, 55-616150 | 07/07/66 | 1,000 | 2,749 | < 1749 | basin fill | cemented gravel 975-990' | 502007.3 | 3538664.8 |
| 02add | Pima Mining Co. | PMC #8 | 35-30443, 55-616152 | 12/15/66 | 1,154 | 2,760 | < 1606 | hard conglomerate | 13-15' intervals of cemented sand/gravel @ 280-305' and 560-573'; hard conglomerate 1140-1154' | 502009.0 | 3538070.1 |
| 02ddd | Pima Mining Co. | PMC #9 | 35-30444, 55-616153 | 04/26/68 | 1,256 | 2,775 | < 1519 | clay | rock layer 1240-1241' | 502011.2 | 3537277.5 |
| 03cad | | 1788 | | | 600 | 2,997 | < 2397 | Pantano Formation | Pantano Formation ~ 500' | | |
| 11dcd | Rancho Sahuarita Water | 562962 | 562962 | 09/26/97 | 500 | 2820 | < 2320 | basin fill | | 501619.6 | 3535675.2 |
| 11dd | Sahuarita School District | 605342 | 35-84499, 55-605342 | 06/01/80 | 808 | 2785 | < 1977 | basin fill | | 501924.2 | 3535773.5 |
| 20cdd | Park Corporation | M-4 | 085306 | 08/08/80 | 609 | 3257 | < 2648 | basin fill | alluvium 0-325'; conglomerate w/water 305-609'; top of Pantano Formation ~350' | 496424.0 | 3532387.3 |
| 22aaa | Graham | 635296 | 35-30482, 55-635296 | 11/09/73 | 447 | 2927 | < 2480 | basin fill | gravel 355-447' | 500399.1 | 3533862.8 |
| 24acc | FICO | S-25A | 623985 | 01/14/76 | 1,100 | 2725 | < 1625 | basin fill | hard conglomerate layers 600-800' and 1002-1090' | 503037.2 | 3533247.8 |
| 24ddb | FICO | S-53 | 35-30017, 55-624002 | 12/02/74 | 2,000 | 2733 | < 733 | conglomerate | lightly cemented 660-1280' and 1740-2000' | 503453.0 | 3532634.9 |
| 25add | FICO | S-22A | 35-30230, 55-623983 | 03/19/75 | 1,175 | 2742 | < 1567 | conglomerate | | 503659.8 | 3531620.7 |
| 25bcc | FICO | S-55 | 35-81631, 55-624004 | 06/09/80 | 1,495 | 2792 | < 1297 | conglomerate | cemented 530-680' | 502244.8 | 3531635.5 |
| 25dcd | FICO | S-54 | 35-41208, 55-624003 | 09/28/77 | 1,300 | 2762 | < 1462 | conglomerate | | 503256.0 | 3530815.8 |
| 26cad | LQS Water Co. | ST-6 | 806901 | 07/20/71 | 837 | 2853 | < 2016 | sand and gravel | alluvial sand and gravel | 501309.5 | 3531156.2 |
| 26cbd | Perry | 582748 | 582748 | 08/02/01 | 500 | 2890 | < 2390 | basin fill | | 500832.7 | 3531245.3 |
| 26ccd2 | LQS Water Co. | ST-7 | 566940 | 05/14/98 | 922 | 2885 | < 1963 | basin fill | moderately lithified 900-916' | 500839.6 | 3530839.1 |
| 27caa | Park Corporation | 1759 | 634393 | 02/21/78 | 650 | 2987 | < 2337 | basin fill | | 499491.5 | 3531309.8 |
| 27dca | Park Corporation | M-1 | 85228 | 06/02/05 | 932 | 2958 | < 2026 | basin fill | alluvium 0-932' | 500116.0 | 3530966.7 |
| 34aab | Park Corporation | M-11 | 501654 | 07/09/82 | 635 | 2938.40 | < 2303 | basin fill | | 500328.7 | 3530561.2 |
| 34acd2 | Park Corporation | M-9 | 501652 | 11/30/81 | 660 | 2970.96 | < 2311 | basin fill | | 500045.5 | 3530107.4 |
| 34baa | Park Corporation | M-5 | 087387 | 07/25/81 | 665 | 2996 | < 2331 | basin fill | formation becomes denser 450' -TD with localized caliche and cementation | 499701.8 | 3530602.7 |
| 34bad | Park Corporation | 1225 | 634394 | 02/06/70 | 650 | 2998 | < 2348 | basin fill | | 499727.2 | 3530408.5 |
| 34bdd1 | Park Corporation | M-6 | 87388 | 07/23/81 | 660 | 3003 | < 2343 | basin fill | lightly cemented 505-660' | 499720.8 | 3530105.4 |
| 34caa | Park Corporation | M-7 | 87389 | 07/15/81 | 670 | 3008 | < 2338 | basin fill | dense and cemented 550-670' | 499720.4 | 3529800.6 |
| 34cda | Park Corporation | M-8 | 87390 | 07/02/81 | 670 | 2998 | < 2328 | basin fill | | 499720.3 | 3529495.7 |
| **D-17-14** | | | | | | | | | | | |
| 01baa | City of Tucson | 619904 | 35-30534, 55-619904 | 01/08/73 | 1,545 | 2831 | < 1286 | basin fill, clay with gypsum | Fort Lowell Formation 0-434'; Tinaja Formation 434-1460'; Pantano Formation 1460-1545' | 512465.4 | 3538683.7 |
| 03baa | City of Tucson | 619902 | 35-30538, 55-619902 | 04/10/73 | 655 | 2740 | < 2085 | basin fill, dense clay, trace gypsum | | 509226.8 | 3538699.2 |
| 06abb | FICO | S-50 | 35-39804, 55-623999 | 11/01/74 | 2,000 | 2670 | < 670 | basin fill | lightly cemented basaltic boulders 1390-2000' | 504990.6 | 3538694.9 |
| 06acd | FICO | S-49 | 35-27989, 55-623998 | 08/08/74 | 1,200 | 2681 | < 1481 | basin fill | "tight" 1100-1200' | 504793.4 | 3538083.2 |
| 18acd | FICO | 534922 | 534922 | 04/05/93 | 1,500 | 2706 | < 1206 | basin fill | cemented clay and gravel 795-959' | 504806.1 | 3534852.5 |
| 18adc | FICO | 623991 | 35-30589, 55-623991 | 02/15/58 | 1,525 | 2713 | < 1188 | sand | | 505004.3 | 3534850.7 |
| 19dbd | FICO | S-45 | 35-30601, 55-623995 | 10/01/74 | 2,000 | 2737 | < 737 | basin fill | | 504834.3 | 3532831.3 |
| 30ccc | FICO | S-44 | 35-30645, 55-623994 | 06/08/74 | 1,200 | 2762 | <1562 | conglomerate | cemented sand and gravel 845-985' | 503858.6 | 3530810.6 |

**TABLE A.2**
**Selected Wells Completed in Basin Fill in the Vicinity of PDSTI (Not Drilled to Bedrock)**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth Drilled (ft bls) | Altitude of Land Surface (ft amsl) | Maximum Elevation of Bedrock (ft amsl) | Lithology at Total Depth | Selected Notes from Well Completion Reports | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-17-15** | | | | | | | | | | | |
| 02dcd | Spring Valley Water Co. | SVW Co | none | 09/20/62 | 849 | 3195 | <2346 | sand and gravel | | 521046.6 | 3537856.8 |
| 06dda | Sanders | 588266 | 588266 | 10/31/01 | 435 | 2930 | <2495 | sand and gravel | | 514995.3 | 3538041.5 |
| 07bdb | Grady | 505121 | 505121 | 07/21/83 | 400 | 2898 | <2498 | clay | | 513915.2 | 3537257.8 |
| 09aad | Hansen | 560251 | 560251 | 12/13/96 | 600 | 3080 | <2480 | conglomerate | fractured conglomerate 560-600' | 518210.7 | 3537471.3 |
| 09acb | Torzala | 556737 | 556737 | 12/29/96 | 585 | 3058 | <2473 | conglomerate | fractured conglomerate 560-585' | 517608.5 | 3537266.4 |
| 23daa | Breaw | 203396 | 203396 | 01/25/06 | 760 | 3485 | <2725 | conglomerate | hard conglomerate 500-760' | 521455.5 | 3533643.6 |
| 23adb | Gerard and Sons Custom Homes | 206094 | 206094 | 03/05/05 | 975 | 3400 | <2425 | conglomerate | cemented conglomerate 0-300'; soft rock 300-700'; cemented sand and rocks w/ fractures 700-975' | 521253.4 | 3534041.1 |
| 30ddd | Scattini | 206340 | 206340 | 02/02/05 | 570 | 3178 | <2608 | conglomerate | clay conglomerate 20-480'; conglomerate 480-570' | 515012.3 | 3531425.8 |
| **D-18-12** | | | | | | | | | | | |
| 19cdb | PDSI | PZ-1 | 561865 | 05/14/97 | 255 | 4068 | <3813 | sandy gravel, gravelly sand | Formation of Tinaja Peak | 485077.7 | 3522800.3 |
| 21ccc | PDSI | MH-19 | 561878 | 05/22/97 | 75 | 3650 | <3575 | sandy gravel w/ tuffaceous layers | Formation of Tinaja Peak | 487726.5 | 3522636.5 |
| **D-18-13** | | | | | | | | | | | |
| 01cbc | Robson Ranch/Anaconda | AN-2 | 1/24/3566 | 05/26/67 | 2,060 | 2802 | < 742 | hard sand and gravel | hard sand and gravel 1836-2064' | 502257.0 | 3527993.5 |
| 01ccc | Community Water Co. | CW-5 | 627484 | 11/29/73 | 800 | 2800 | < 2000 | basin fill | | 502260.4 | 3527589.8 |
| 02aac | Community Water Co. | CW-4 | none | 04/01/64 | 501 | 2835 | <2334 | conglomerate | very hard conglomeate 488-501' | 501849.1 | 3528776.9 |
| 02bdd | Community Water Co. | CW-9 | 588121 | 12/15/01 | 1,000 | 2860 | < 1860 | basin fill | | 501133.2 | 3528544.3 |
| 02dca | Country Club of Green Valley | 501760 | 501760 | 08/27/82 | 955 | 2590 | <1635 | alluvium | cemented 390-430, 660-700' | 501655.5 | 3527792.9 |
| 03dcb | Community Water Co. | CW-7 | 502546 | 06/28/82 | 1,065 | 2980 | < 1915 | conglomerate | well cemented conglomerate 1056-1060' | 499721.0 | 3527897.7 |
| 09aaa | AZ State Land Dept. | MH-26 | 201527 | 12/18/03 | 545 | 3063 | < 2518 | | | 498850.7 | 3527387.5 |
| 09dda | AZ State Land Dept. | MH-25 | 201528 | 12/17/03 | 545 | 3068 | < 2523 | | | 498841.3 | 3526165.8 |
| 10aac | PDSI | ESP-3 | 623104 | 11/30/56 | 1,043 | 2932 | < 1889 | Helmet Fanglomerate | | 500295.2 | 3527180.8 |
| 10adc | PDSI | ESP-2 | 623103 | 11/30/57 | 1,044 | 2934 | < 1890 | basin fill | | 500302.8 | 3526728.2 |
| 10dca | PDSI | ESP-1 | 632102 | Feb-57 | 1020 | 2953 | < 1933 | Helmet Fanglomerate | | 500030.9 | 3526252.2 |
| 10dcd | PDSI | ESP-4 | 623105 | 03/15/67 | 1045 | 2955.61 | < 1911 | sandstone | sandstone at bottom of well is logged as Helmet Fanglomerate (Pantano Formation) | 499978.0 | 3525936.6 |
| 11dcd | Green Valley Investors | 504970 | 504970 | 03/30/83 | 800 | 2650 | < 1850 | basin fill | cemented sand and gravel 570-750'; hard conglomerate 700-730' | 502069.0 | 3525941.1 |
| 11add | PDSI | ESP-5 | 623106 | 02/28/70 | 950 | 2817.06 | < 1867 | Helmet Fanglomerate | | 502069.0 | 3526885.8 |
| 12dac | FICO | E12A | 35-28660 | 06/29/74 | 1110 | 2815.00 | < 1705 | conglomerate | | 503499.0 | 3526356.0 |
| 13aac | FICO | E-13 | 35-30228, 55-624020 | 04/12/75 | 1100 | 2819 | < 1719 | conglomerate | | 503490.1 | 3525557.9 |
| 14acd | FICO | C-4 | 35-30227, 55-624010 | 02/28/75 | 1200 | 2825.00 | < 1625 | conglomerate | lightly cemented boulders and gravel 1120'-TD | 501679.9 | 3525137.5 |
| 14bdb2 | Community Water Co. | CW-6 | 627485 | 05/09/77 | 837 | 2670 | < 1833 | conglomerate | | 500952.2 | 3525579.8 |
| 15acc2 | Community Water Co. | CW-8 | 543600 | 06/21/94 | 1200 | 2970 | < 1770 | basin fill | | 499859.7 | 3525464.7 |
| 18cca | PDSI | EMW-1 | 807584 | 05/30/05 | 310 | 3361 | < 3051 | Pantano Formation | | 494455.7 | 3524503.9 |
| 21bcb | PDSI | IW-12 | 545555 | 12/06/94 | 625 | 3,135.19 | < 2510.19 | Pantano Formation | | 497426.1 | 3523773.4 |
| 21bcc1 | PDSI | MH-5 | 803632 | Mar-76 | 640 | 3,120.48 | < 2480.48 | basin fill | | 497538.5 | 3523528.9 |
| 21cbd1 | PDSI | MH-15W | 528093 | 06/15/90 | 466 | 3,114.08 | < 2648.08 | basin fill | rock layers logged within basin fill | 497585.3 | 3523078.6 |
| 21cbd2 | PDSI | MH-15E | 528094 | 06/22/90 | 467 | 3,108.38 | < 2641.38 | basin fill | | 497646.0 | 3523077.9 |
| 22aca | Community Water Co. | CW-3 | 627483 | 03/16/64 | 501 | 2,943 | < 2442 | conglomerate | hard conglomerate 456'-TD | 500092.8 | 3523516.9 |
| 23aaa | FICO | FICO | na | 05/01/59 | 520 | 2861 | < 2341 | gravel | hard cemented gravel 500-520' | 500591.9 | 3524141.8 |
| 23bad | FICO | W-9 | 35-30229, 55-624024 | 05/01/75 | 1,175 | 2,854 | < 1679 | conglomerate | | 501332.4 | 3523935.8 |
| 23cac | Community Water Co. | CW-10 | 207982 | 08/18/05 | 1,140 | 2,840 | < 1700 | basin fill | | 500974.5 | 3523259.1 |
| 26dbd | FICO | E-16 | 35-30225, 55-210420 | 03/19/75 | 1,200 | 2,890 | < 1690 | alluvium | cemented sand and boulders 730'-TD | 501715.3 | 3521517.8 |
| 27acc | Green Valley Water | GV-1 | 603428 | 09/23/77 | 645 | 2,940 | < 2295 | basin fill | hard conglomerate 623'-TD | 499874.0 | 3522057.9 |
| 27cad | Green Valley Water | GV-2 | 603429 | 09/20/77 | 560 | 2,940 | < 2380 | conglomerate | | 499859.1 | 3521654.0 |
| 27daa | FICO | W-12 | 35-30223, 55-624026 | 02/16/75 | 1,300 | 2,890 | < 1590 | conglomerate | tight and cemented 828-1300' | 500508.0 | 3521713.8 |
| 27ddc | Par for the Course/FICO | 543409 | 543409 | 12/09/94 | 840 | 2,884 | < 2044 | conglomerate | hard conglomerate 540'-TD | 500313.6 | 3521115.8 |
| 28cba | PDSI | MH-16E | 528100 | 07/01/90 | 460 | 3,094.73 | < 2634.73 | basin fill | | 497637.9 | 3521673.8 |
| 28cbb3 | PDSI | MH-16W | 528099 | 06/29/90 | 460 | 3,097.25 | < 2637.25 | basin fill | | 497577.3 | 3521674.4 |
| 35cba | FICO | E-11A | 35-40364, 55-624018 | 11/24/76 | 1,000 | 2875 | < 1875 | conglomerate | | 500924.0 | 3520130.8 |

**TABLE A.2**
**Selected Wells Completed in Basin Fill in the Vicinity of PDSTI (Not Drilled to Bedrock)**

| Location (Cadastral) | Owner | Well Name | ADWR Registration Number | Date Completed | Depth Drilled (ft bls) | Altitude of Land Surface (ft amsl) | Maximum Elevation of Bedrock (ft amsl) | Lithology at Total Depth | Selected Notes from Well Completion Reports | UTME | UTMN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **D-18-14** | | | | | | | | | | | |
| 06dba | Anamax | 35-28659 | 35-28659, 55-608522 | 08/12/74 | 2,004 | 2,656 | < 652 | basin fill | | 504848.9 | 3528183.3 |
| 08add | Bull | 608598 | 608598 | 02/15/62 | 565 | 2,976 | < 2411 | red sticky clay | cemented gravel 300-325' | 506851.5 | 3526787.1 |
| 08bba | Bull | 608597 | 608597 | Sep-52 | 502 | 2,926 | < 2424 | red sticky clay | hard cemented gravel 375-382' | 505848.3 | 3526980.8 |
| 17ccc | Bull | 616213 | 616213 | May-62 | 350 | 3,000 | < 2650 | red sandy clay | | 505468.4 | 3524366.8 |
| 19ccd | Continental School Dist | 35-83512 | 35-83512, 55-601769 | May-80 | 505 | 3,005 | < 2500 | soft sandstone | 470-505' soft sandstone | 504110.3 | 3522745.1 |
| 26dbc | Green Valley Water Co. | 35-46805 | 35-46805 | 09/26/77 | 645 | 3,455 | < 2810 | conglomerate | hard conglomerate 623-645'; small cemented intervals 550-611' | 511039.9 | 3521585.9 |
| 26cdd | Green Valley Water Co. | 35-46804 | 35-46904 | 09/26/77 | 560 | 3,460 | < 2900 | conglomerate | cemented conglomerate 540-550'; hard conglomerate 550-560' | 510810.6 | 3521193.9 |
| 30baa | University of Arizona | 540451 | 540451 | 10/10/1993 | 500 | 3030 | <2530 | granite? | "hard cemented sand or weathered granite" 360-500'; bedrock uncertain | 504490.1 | 3522551.6 |
| **D-19-12** | | | | | | | | | | | |
| 36cda | Wriglesworth | 527712 | 527712 | 05/18/90 | 240 | 3,126 | < 2886 | basin fill | | 493116.6 | 3510180.7 |
| 36caa | Ybarra | 533386 | 533386 | 12/06/91 | 230 | 3,115 | < 2885 | basin fill | cemented gravel 180-230' | 493321.3 | 3510580.9 |
| 36cac | Amado | 35-83004 | 35-83004 | 01/04/90 | 240 | 3120 | < 2880 | basin fill | cemented gravel 200-240' | 493116.2 | 3510381.1 |
| 36cca | Stewart Title and Trust | 35-82900 | 35-82900, 55-630904 | 12/12/79 | 240 | 3133 | < 2893 | basin fill | cemented gravel 182-240' | 492910.8 | 3510181.2 |
| 36ddd | Kinsley | 63ddd | none | 01/21/47 | 500 | 3072 | < 2572 | basin fill | conglomerate 180-500' | 494145.8 | 3509978.0 |
| **D-19-13** | | | | | | | | | | | |
| 03adc | FICO | E-15 | 35-30224, 55-624022 | 04/09/75 | 1,200 | 2913 | < 1713 | basin fill | | 500333.3 | 3518794.1 |
| 03acc | PDSI | Sierrita 1 | 623111 | 09/01/68 | 783 | 2916 | < 2133 | basin fill | | 499797.8 | 3518888.6 |
| 05cbc | Sagers | 35-47764 | 35-47764, 55-602180 | 10/3/77 | 424 | 3150 | < 2726 | basin fill | | 495920.2 | 3518399.9 |
| 05dbd | Green Valley Water Co. | GV-7 | 603504 | 06/14/72 | 1,060 | 3087 | < 2027 | conglomerate | well-cemented conglomerate 1050-1060' | 496938.9 | 3518513.7 |
| 06aaa | Swerney | 35-82543 | 35-82543, 55-635288 | 12/28/79 | 401 | 3115 | < 2714 | basin fill | | 495720.6 | 3519311.3 |
| 07dbc | Higuera | 35-83299 | 35-83299, 55-604209 | 02/20/80 | 400 | 3144 | < 2744 | basin fill | | 495141.7 | 3516829.3 |
| 09acc | PDSI | 35-44176 | 35-44176, 55-623117 | 05/07/77 | 400 | 2941 | < 2541 | basin fill | "concrete rock" 252-260' | 498328.4 | 3517255.8 |
| 10bcb | PDSI | Sierrita 2 | 632112 | 05/31/69 | 793 | 2938 | < 2145 | conglomerate | | 499023.7 | 3517379.4 |
| 16bad | PDSI | Sierrita 3 | 623113 | 07/19/79 | 811 | 2,944 | < 2133 | basin fill | | 498184.2 | 3516092.6 |
| 22aad | Stewart | 35-23478 | 35-32478 | 08/29/75 | 400 | 3,088 | < 2688 | basin fill | | 500555.8 | 3514429.1 |
| 23acb | Allen | 35-45127 | 35-45127, 55-633967 | 02/14/78 | 385 | 3,147 | < 2762 | basin fill | | 501564.8 | 3514224.8 |
| 24cbb | Johnson-Hoye | 35-71983 | 35-71983, 55-635317 | 12/14/79 | 447 | 3,192 | < 2745 | basin fill | | 502373.1 | 3513818.2 |
| 29cba | PDSI | Sierrita 6 | 35-32479, 55-623116 | 11/16/68 | 900 | 3,001 | < 2101 | basin fill | | 496324.4 | 3512172.4 |
| **D-19-14** | | | | | | | | | | | |
| 21bbd | Kettenbach | 210529 | 210529 | 08/17/06 | 1,170 | 3860 | < 2690 | basin fill | well-cemented throughout | 507581.2 | 3514459.0 |

*Notes:*

*ft bls = feet below surface*

*ft amsl = feet above mean sea level. Measuring point elevations are reported for some PDSI wells.*

# TABLE A.3
# Pumping Test Analyses

| Well | Range of Estimated Transmissivity ($ft^2/d$) | Saturated Thickness* (ft) | Range of Horizontal Hydraulic Conductivity (ft/day) | Hydraulic Conductivity in Appendix B of HGC (2006) (ft/day) |
|---|---|---|---|---|
| **Basin Fill** | | | | |
| IW-2 | 4968 - 24839 | 710 | 6.9 - 34 | 16 |
| IW-3A | 3168 - 4862 | 488 | 6.5 - 10 | 13.4 |
| IW-4 | 3776 - 6567 | 564 | 6.5 -11 | 13.3 |
| IW-5 | 4249 - 6675 | 585 | 6.8 - 11 | 9.4 |
| IW-6 | 822 - 7399 | 132 | 5.7 - 51 | 67 |
| IW-6A | 1669 - 2140 | 144 | 12 - 15 | 13 |
| IW-10 | 3470 | 332 | 9 | 12 |
| IW-12 | 1371 - 2057 | 193 | 7.1 - 11 | 11 |
| IW-13 | 1333 - 1556 | 131 | 10 - 12 | 11 |
| IW-14 | 791 - 1450 | 142 | 5.6 - 10 | 9.4 |
| IW-15 | 242 - 695 | 169 | 1.4 - 4.1 | 6.3 |
| IW-16 | 224 - 1174 | 95 | 2.4 - 12 | 13 |
| IW-17 | 1007 - 2013 | 98 | 10 -21 | 22 |
| IW-18 | 881 - 1298 | 96 | 9.2 - 14 | 17 |
| IW-19 | 1177- 5138 | 150 | 7.9 - 34 | 21 |
| IW-20 | 783 - 1879 | 104 | 7.5 - 18 | 21 |
| IW-21 | 829 - 2349 | 164 | 5.1 - 14 | 12 |
| MH-13A | 3312 - 16560 | 630 | 5.3 - 26 | 17.4 |
| MH-13B | 7190 - 9310 | 630 | 11 - 15 | 13.4 |
| MH-13C | 6.7 - 11.2 | 300 | 0.02 - 0.04 | 0.023 |
| MH-15W | 2020 - 7575 | 95 | 21 - 80 | 56 |
| MH-16W | 4850 - 23556 | 119 | 41 - 198 | 100 |
| MH-19 | 75 - 312 | 46 | 1.6 - 6.8 | 1.71 |
| MH-25A | 1914 - 37100 | 450 | 4.3 - 82 | 53.5 |
| MH-25C | 16200 - 18321 | 450 | 36 - 41 | 50.8 |
| MH-26A | 2114 - 16912 | 410 | 5.2 - 41 | 41.4 |
| MH-26B | 6201 - 31005 | 410 | 15 - 76 | 64.2 |
| MH-30 | 395 - 658 | 24 | 17 - 26 | 38.8 |
| Duval #7 | 27360 | 765 | 36 | 35 |
| FICO E6 | 11140 | 685 | 16 | 19 |
| GV Golf | 14100 | 388 | 36 | 59.6 |
| GV-1 | 6824 - 7773 | 458 | 15 - 17 | NAV |
| GV-2 | 13740 | 395 | 35 | NAV |
| GV-3 | 5038 - 5936 | 400 | 13 - 15 | NAV |
| GV-7 (CW-7) | 29562 - 56437 | 630 | 47 - 90 | 99 |
| **Granodiorite** | | | | |
| BW-3 | 5 - 92 | 63 | 0.08 - 1.5 | 0.08 - 1.1 |

*Notes:*

*ft = feet*

*$ft^2/d$ = $feet^2/day$*

*ft/d = feet/day*

*NAV = Not Available for HGC (2006)*

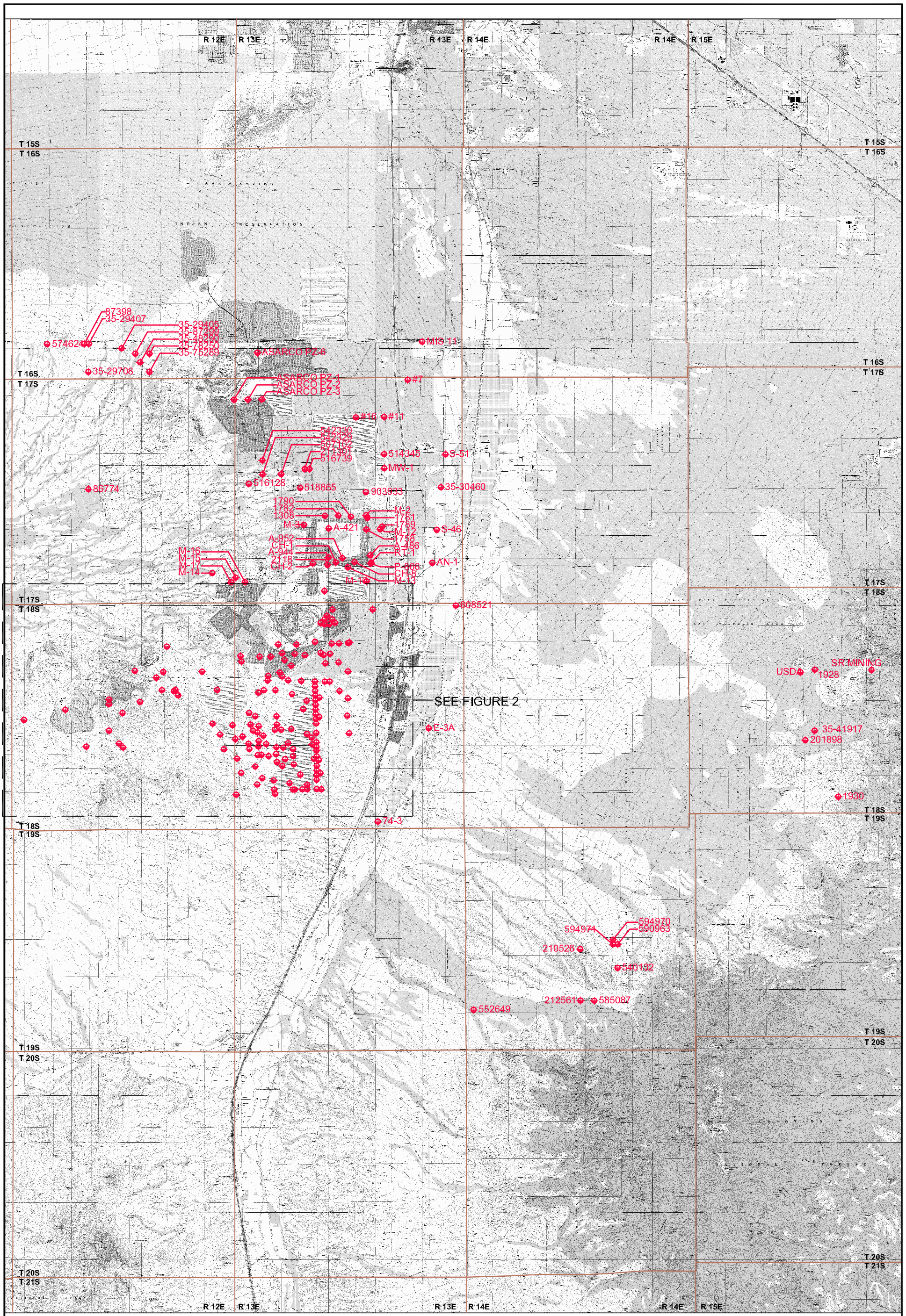
**Saturated thickness based on information in original data source cited by HGC (2006)*

**TABLE A.4**
**Slug Test Analyses**

| Well | Estimated Hydraulic Conductivity (ft/d) | Hydraulic Conductivity in Appendix B of HGC (2006) (ft/day) |
|---|---|---|
| **Demetrie Volcanics** | | |
| BW-1 | 0.04 | 0.04 - 0.08 |
| BW-2 | 0.13 | 0.16 - 0.21 |
| MH-20 | 0.0001 | 0.000007 - 0.000013 |
| MH-23 | 0.004 | 0.001 - 0.002 |
| PZ-13 | 0.003 | 0.003 |
| PZ-15 | 0.0003 | 0.00008 - 0.0008 |
| PZ-16 | 0.003 | 0.002 |
| **Granodiorite** | | |
| M-14 | 0.00011 | 0.00007 |
| M-15 | 0.01 | 0.007 - 0.011 |
| M-17 | 0.001 | 0.001 - 0.002 |
| MH-21 | 0.01 | 0.009 - 0.011 |
| PZ-3 | 0.02 | 0.006 - 0.009 |
| PZ-7 | 0.82 | 0.45 - 0.51 |
| PZ-9 | 0.53 | 0.32 - 0.47 |

*Notes:*
*$ft^2/d$ = $feet^2/day$*
*K = hydraulic conductivity*

# FIGURES




LEGEND

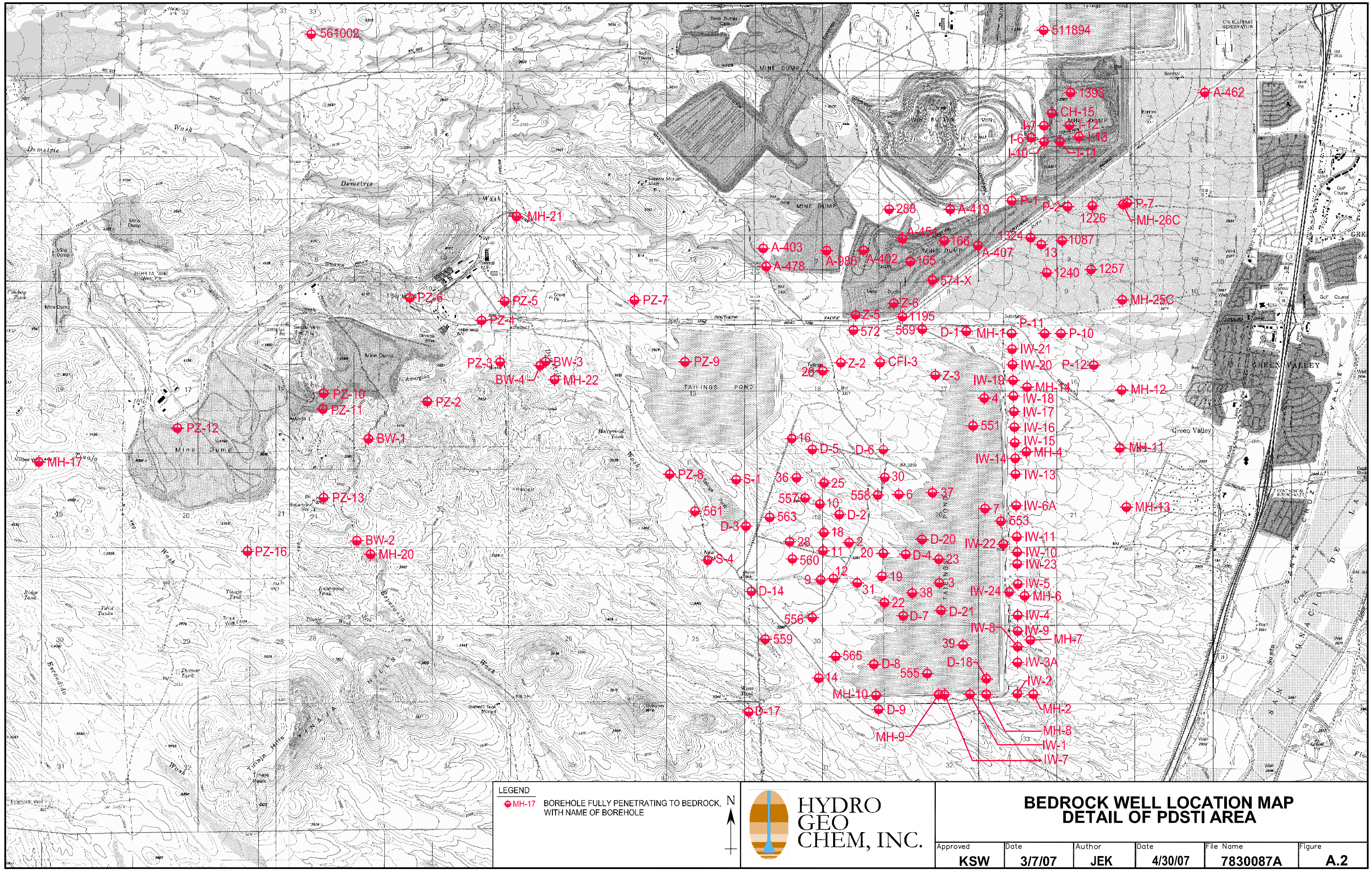
MH-17 BOREHOLE FULLY PENETRATING TO BEDROCK

N

HYDRO GEO CHEM, INC.

# BEDROCK WELL LOCATION MAP PDSTI REGION

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 05/29/07 | RAM | 05/29/07 | 7830085A | A.1 |




LEGEND

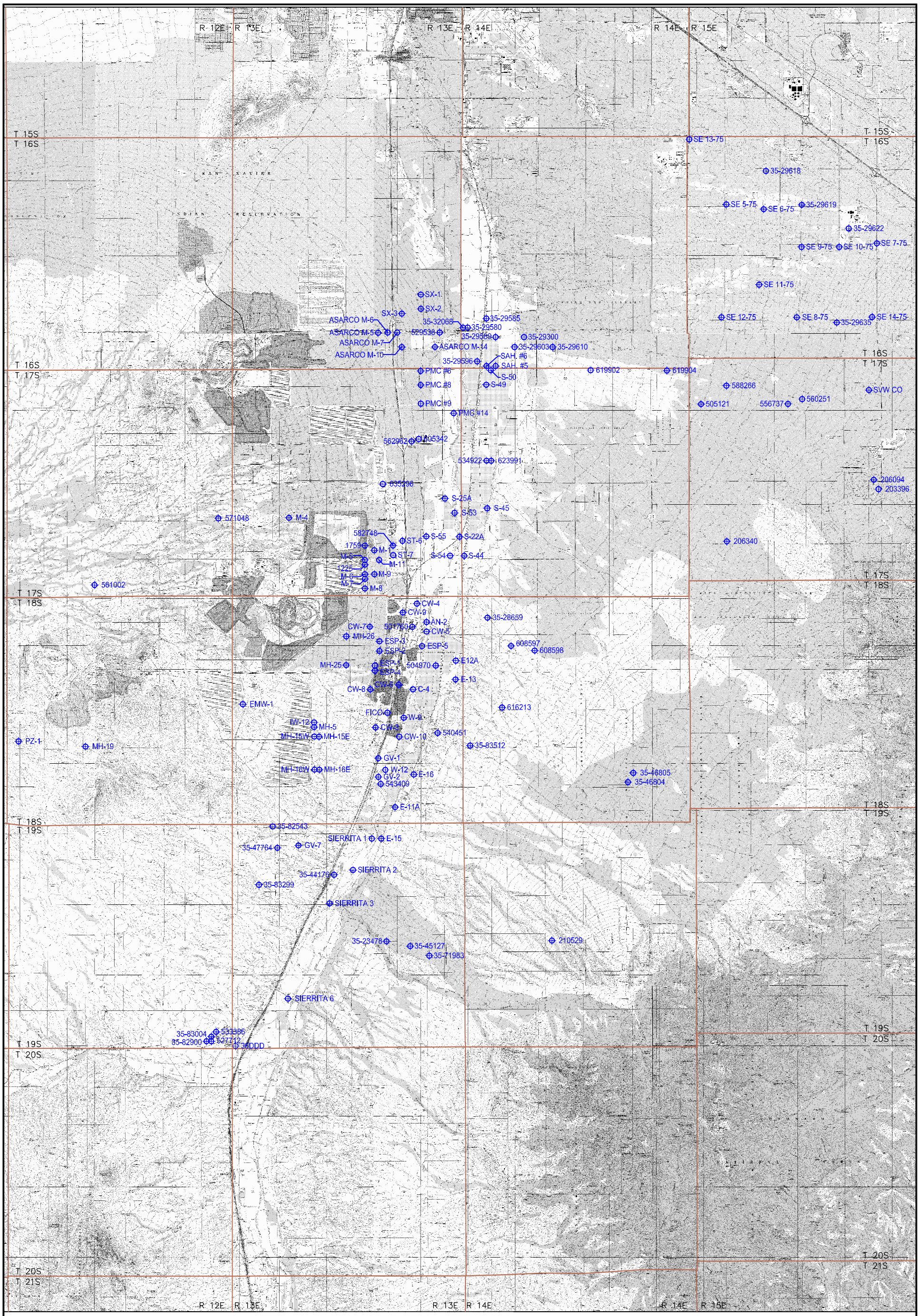
MH-17 BOREHOLE FULLY PENETRATING TO BEDROCK, WITH NAME OF BOREHOLE

N

HYDRO GEO CHEM, INC.

# BEDROCK WELL LOCATION MAP DETAIL OF PDSTI AREA

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 3/7/07 | JEK | 4/30/07 | 7830087A | A.2 |




LEGEND

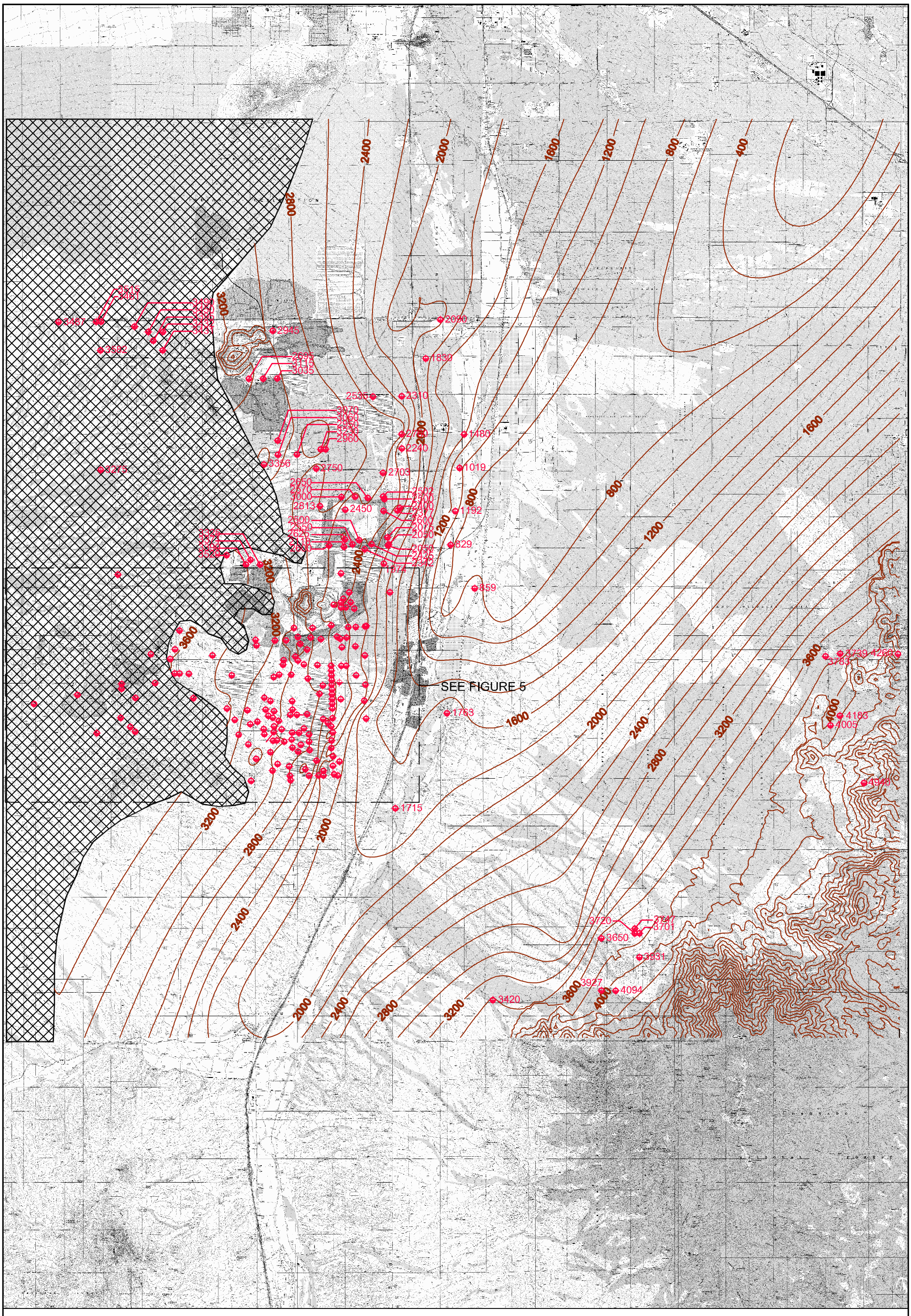
W-9 WELL NOT FULLY PENETRATING TO BEDROCK

N

HYDRO GEO CHEM, INC.

# LOCATION MAP OF BASIN FILL WELLS NOT DRILLED TO BEDROCK PDSTI REGION

| Approved | Date | | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 4/30/07 | JEK | 3/7/07 | 7830086A | A.3 |




LEGEND

1715 BOREHOLE FULLY PENETRATING TO BEDROCK WITH BEDROCK ELEVATION

KRIGED BEDROCK ELEVATION (FT AMSL[1])

BEDROCK SURFACE NOT DEFINED

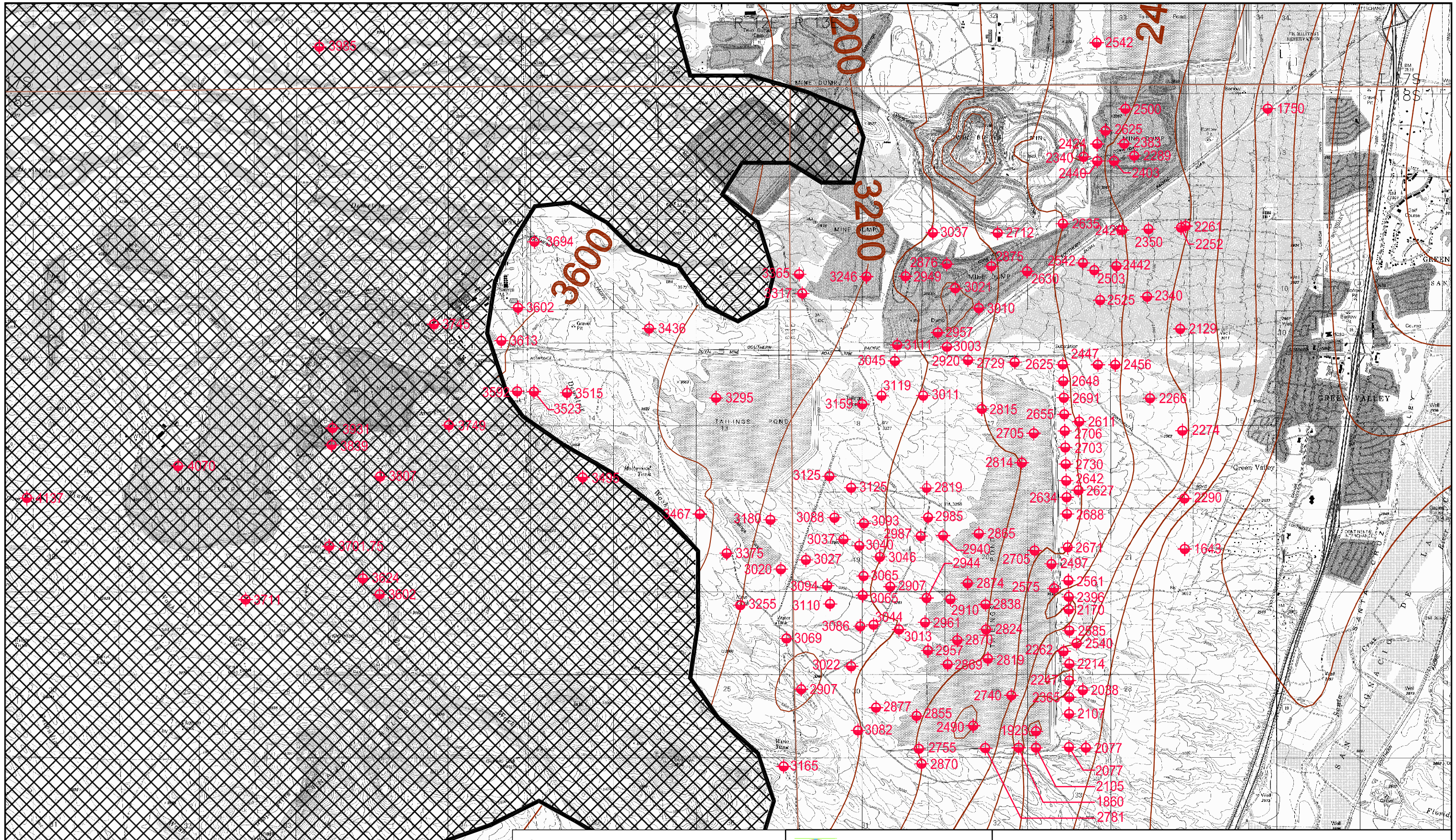
[1]FEET ABOVE MEAN SEA LEVEL

N

HYDRO GEO CHEM, INC.

# BEDROCK ELEVATION MAP
# PDSTI REGION

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 05/22/07 | RAM | 11/08/07 | 7830121A | A.4 |




LEGEND

2642 BOREHOLE FULLY PENETRATING TO BEDROCK WTIH BEDROCK ELEVATION KRIGED BEDROCK ELEVATION (FT AMSL)

BEDROCK SURFACE NOT DEFINED

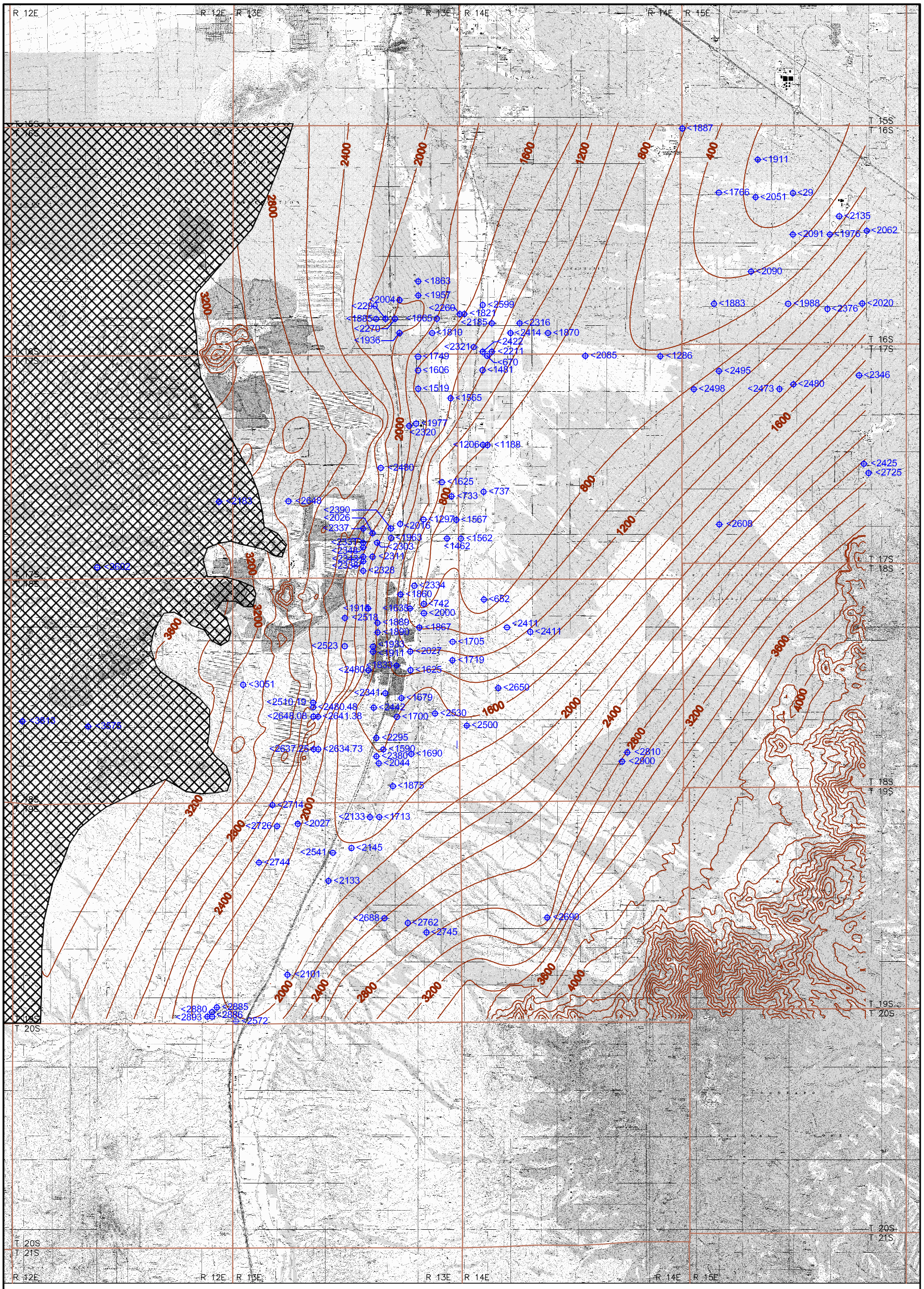
† FEET ABOVE MEAN SEA LEVEL

N

HYDRO GEO CHEM, INC.

# BEDROCK ELEVATION MAP DETAIL OF PDSTI AREA

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 05/22/07 | RAM | 11/08/07 | 7830119A | A.5 |




LEGEND

<3602 WELL NOT FULLY PENETRATING TO BEDROCK SHOWING ELEVATION BELOW WHICH BEDROCK MUST LIE, BASED ON TOTAL DEPTH OF WELL

KRIGED BEDROCK ELEVATION (FT AMSL[1])

BEDROCK SURFACE NOT DEFINED

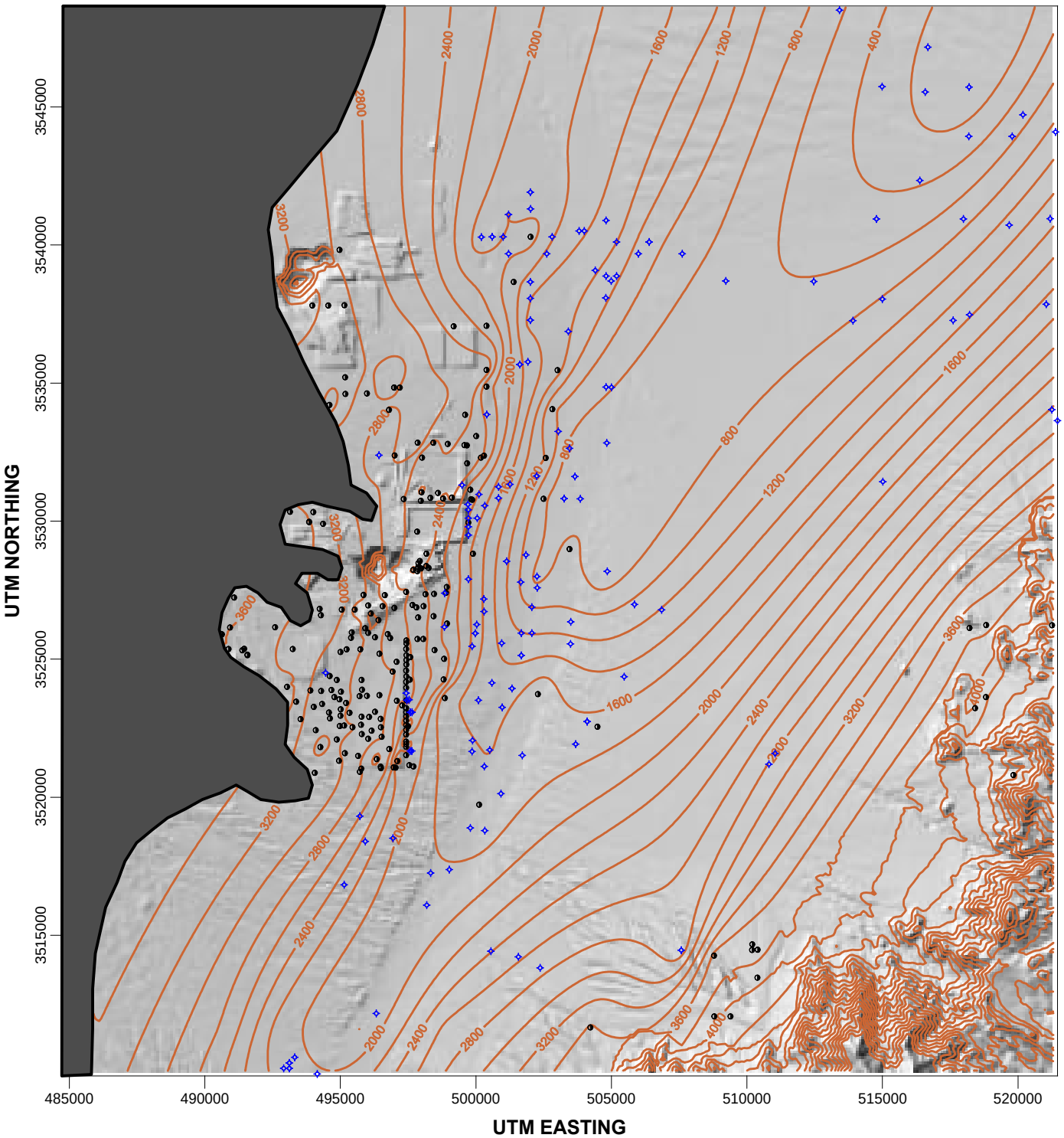
[1] FEET ABOVE MEAN SEA LEVEL

N

HYDRO GEO CHEM, INC.

# BASIN FILL WELLS NOT DRILLED TO BEDROCK SHOWING ELEVATIONS BELOW WHICH BEDROCK MUST LIE, OVERLAIN ON BEDROCK CONTOURS

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 05/22/07 | RAM | 11/08/07 | 7830120A | A.6 |




**EXPLANATION**

- well fully penetrating to bedrock
- non-fully penetrating well
- 2000 kriged bedrock elevation (feet amsl)
- bedrock surface not defined

HYDRO GEO CHEM, INC.

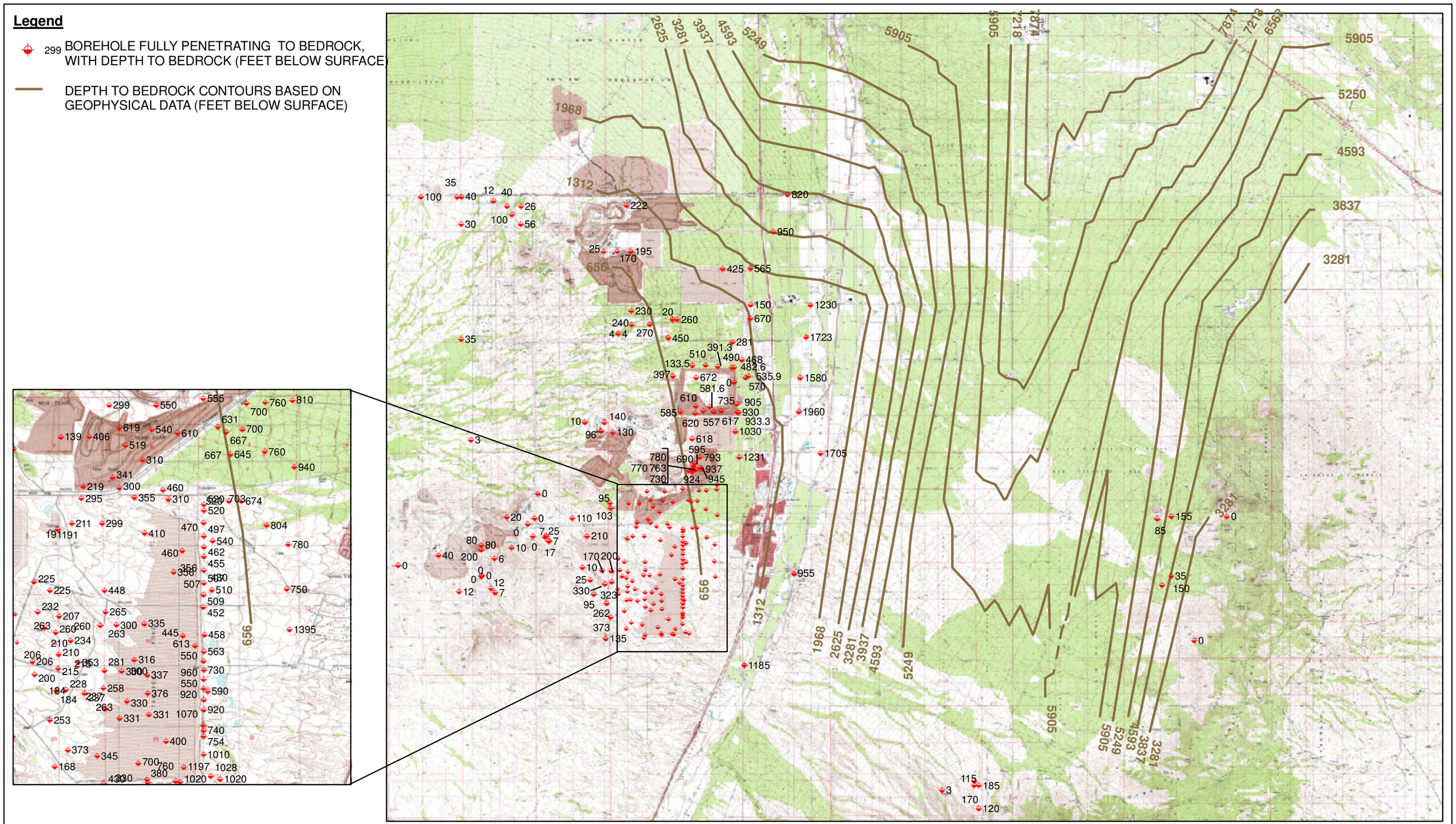
# KRIGED BEDROCK ELEVATIONS (FEET AMSL) BASED ON BOREHOLE DATA ON TOPOGRAPHIC SHADED RELIEF

| APPROVED | DATE | REFERENCE | FIGURE |
|---|---|---|---|
| SJS | 11/7/07 | H:/78300/78306/ PDSTI Data Review/bedrontopo.srf | A.7 |

**Legend**

299 BOREHOLE FULLY PENETRATING TO BEDROCK, WITH DEPTH TO BEDROCK (FEET BELOW SURFACE)

DEPTH TO BEDROCK CONTOURS BASED ON GEOPHYSICAL DATA (FEET BELOW SURFACE)




0 10,000 20,000 30,000 40,000 Feet

PROJECTION: UTM ZONE 12N NAD83 METERS

[1]Geophysical data from Rystrom, 2003

N

HYDRO GEO CHEM, INC.

**COMPARISON OF DEPTH TO BEDROCK BASED ON BOREHOLE DATA WITH ESTIMATED DEPTH TO BEDROCK BASED ON GEOPHYSICAL DATA** [1]

| Approved | Date | Author | Date | File Name | Figure |
|---|---|---|---|---|---|
| KSW | 05/14/07 | RAM | 05/14/07 | 7830030G | A.8 |