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June 6, 2014

DRC-2014-003821

Sent VIA OVERNIGHT DELIVERY

Mr. Rusty Lundberg
Director
Division of Radiation Control
Utah Department of Environmental Quality
195 North 1950 West
P.O. Box 144850
Salt Lake City, UT 84114-4820

Re: Transmittal of Hydrogeology Report for the White Mesa Uranium Mill, Blanding Utah In Response to the Request for Information ("RFI"), dated March 26, 2014, regarding the DRC review of the August 27, 2009 Hydrogeologic Report

Dear Mr. Lundberg:

Enclosed are two copies of the White Mesa Uranium Mill Hydrogeology Report, which was revised in response to the Division of Radiation Control ("DRC") Request for Information ("RFI"), dated March 26, 2014.

The revised Hydrogeology Report incorporates the relevant information from studies conducted at the White Mesa Mill since the submission of the original Hydrogeology Report in 2009.

If you should have any questions regarding this report please contact me.

Yours very truly,

Kathy Weinel

ENERGY FUELS RESOURCES (USA) INC.
Kathy Weinel
Quality Assurance Manager

CC: David C. Frydenlund
Harold R. Roberts
David E. Turk
Dan Hillsten
Frank Filas

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HYDROGEOLOGY OF THE WHITE MESA URANIUM MILL

BLANDING, UTAH

June 6, 2014

Prepared for:

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HYDROGEOLOGY OF THE WHITE MESA URANIUM MILL

BLANDING, UTAH

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June 6, 2014

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APPENDICES

1. INTRODUCTION

In response to the Utah Department of Environmental Quality Division of Radiation Control (DRC) letter to Energy Fuels Resources (USA) Inc. (EFRI) dated March 26, 2014 (RFI letter), an updated site hydrogeological report has been prepared which discusses the hydrogeology of the White Mesa Uranium Mill, (the Mill or the site) located south of Blanding, Utah as per Part 1.F.10 of the amended Utah Department of Environmental Quality (UDEQ) Ground Water Quality Discharge Permit UGW370004 (the Permit).

Part I.F.10 of the Permit describes requirements for the report which consist of:

> a) Local hydrogeologic conditions in the shallow aquifer, including, but not limited to: local geologic conditions; time relationships and distribution of shallow aquifer head measurements from facility wells and piezometers; local groundwater flow directions; and distribution of aquifer permeability and average linear groundwater velocity across the site, and
>
> b) Well specific groundwater quality conditions measured at facility monitoring wells for all groundwater monitoring parameters required by this Permit, including, but not limited to: temporal contaminant concentrations and trends from each monitoring well; statistical tests for normality of each contaminant and well, including univariate or equivalent tests; calculation of the mean concentration and standard deviation for each well and contaminant.

As per the RFI letter the hydrogeologic report is to focus on part a). Part b) is covered by INTERA site 'background' reports (INTERA, 2007a; INTERA 2007b; INTERA, 2008), and more recent reports (including INTERA, 2008; INTERA, 2009; INTERA, 2010; INTERA, 2012a; INTERA 2012b; INTERA, 2013a; INTERA, 2013b; INTERA, 2014a; INTERA, 2014b; and INTERA, 2014c) that are updates to the background reports.

Specifically, DRC requests that a site hydrogeological report submitted in August, 2009 (HGC, 2009), be updated with relevant hydrogeological information provided in the following:

1. Southwest Investigation Report (November 7, 2012) describing work to better characterize the perched groundwater zone downgradient (southwest) of the tailings cells,
2. EFR Nitrate contamination investigation activities (through September 2011) that included installation of soil borings and upgradient perched groundwater monitoring wells,

3. Implementation of a Nitrate Corrective Action Plan (May 7, 2012) and ongoing activities to address a perched nitrate groundwater plume,
4. Continued implementation of corrective actions related to the chloroform plume that were initiated in 2003,
5. October 12, 2012 Source Assessment Report for groundwater monitoring wells in Out of Compliance (OOC) status,
6. November 9, 2012 pH Report which included proposed revised GWCL's for all MW-series wells after determination that OOC status for pH in certain wells was not due to cell leakage,
7. December 7, 2012 Pyrite Investigation Report which included analysis of core samples for pyrite content and modeling to demonstrate that pH trends were plausibly the result of aeration of the formation due to wildlife pond recharge and/or monitoring well development, overpumping, and sampling,
8. Infiltration and Contaminant Transport Modeling to assess contaminant transport times from tailings cells to local receptors,
9. Ongoing collection and analysis of groundwater samples and water level data, and
10. Discontinuance of recharge to the two upper (northern) wildlife ponds to dissipate the associated perched groundwater mound.

2. BACKGROUND AND OVERVIEW

Figure 1A is a site map showing general site features and the locations of wells, piezometers, springs, and lithologic cross-sections. Hydrogeologic investigation of the site has been ongoing since the initial investigation in 1977-1978 (Dames and Moore, 1978). Major hydrogeologic and groundwater investigations include UMETCO (1993); UMETCO (1994); TITAN (1994); International Uranium (USA) Corporation (IUSA) and Hydro Geo Chem, Inc. (HGC) [2000]; IUSA and HGC (2001); HGC (2004); HGC (2007); INTERA (2007a); INTERA (2007b); INTERA (2008); Hurst and Solomon (2008); INTERA (2009); HGC (2010e); INTERA (2012a); INTERA (2012b); HGC (2012b); HGC (2012c); and HGC (2014).

Investigations to date and more than 30 years of perched groundwater monitoring indicate that tailings cell operation has not impacted perched groundwater. The lack of tailing cell impact is detailed in Hurst and Solomon (2008) and various INTERA documents (INTERA, 2007a; INTERA 2007b; INTERA, 2008; INTERA, 2010; INTERA, 2012a; INTERA 2012b; INTERA, 2013a; INTERA, 2013b; INTERA, 2014a; INTERA, 2014b; and INTERA, 2014c).

Perched groundwater was impacted by disposal of laboratory wastes to two (now abandoned) sanitary leach fields in the early years of Mill operation (prior to about 1980) before tailings cells were operational (HGC, 2007). Disposal of laboratory wastes to the abandoned scale house and former office leach fields (HGC, 2007) is considered the source of a chloroform plume (defined by concentrations greater than 70 micrograms per liter [µg/L]) located upgradient to cross-gradient (northeast to east) of the tailings cells (Figure 1B). The eastern portion of the chloroform plume likely originated from the abandoned scale house leach field (located immediately north-northwest of TW4-18 [Figure 1B]), and the western portion from the former office leach field (located in the immediate vicinity of TW4-19 [Figure 1B]).

Perched groundwater has also been impacted by nitrate (INTERA, 2009). A nitrate plume (defined by concentrations greater than 10 milligrams per liter [mg/L]) that contains elevated chloride extends from upgradient (northeast) of the tailings cells to a portion of the area beneath the tailings cells as described in the Nitrate Corrective Action Plan (nitrate CAP)[HGC, 2012a]. The precise source(s) of the nitrate plume are not well defined. However, the footprint of a former agricultural/stock watering pond referred to as the ‘historical pond’ is located beneath the upgradient portion of the nitrate plume and extends to the north of the plume (1B). This pond was active from the early part of the 20th century until the area was regraded as part of Mill construction circa 1980 (HGC, 2012a). This pond is considered one of the likely historical sources of nitrate and chloride to the nitrate plume. Ammonium sulfate handling in the vicinity of the ammonium sulfate crystal tanks (southeast of TWN-2 [Figure 1B]) is considered the only potential current source of nitrate to the nitrate plume and is being addressed through implementation of Phase 1 of the nitrate CAP [HGC (2012a) and EFRI (2013)].

Both the chloroform and nitrate plumes are under remediation by pumping and are discussed in more detail in Section 3.

Appendix A contains copies of lithologic logs from site perched monitoring wells and piezometers. Appendix B contains copies of perched well construction schematics. Appendix C contains logs of borings installed by INTERA as part of the nitrate investigation that supported the nitrate CAP. Logs of soil borings installed as part of Phase I of the nitrate CAP implementation are provided in EFRI (2013).

2.1 Overview of Site Hydrogeology

TITAN (1994) provides a detailed description of site hydrogeology based on information available at that time. A brief summary of site hydrogeology that is based in part on TITAN (1994) and updated with information from the literature and more recent site investigations listed in Section 1 is provided below.

2.1.1 Geology/Stratigraphy

The White Mesa Uranium Mill is located within the Blanding Basin (the Basin) of the Colorado Plateau physiographic province. Bedrock units exposed in the Basin include Upper Jurassic through Cretaceous sedimentary rocks (Figure 2, from Doelling, 2004). The general succession, in ascending order, is the Upper Jurassic Brushy Basin Member of the Morrison Formation, the Lower Cretaceous Burro Canyon Formation, and the Upper Cretaceous Dakota Sandstone and Mancos Shale. Typical of large portions of the Colorado Plateau province, the rocks within the Basin are relatively undeformed.

The Mill has an average elevation of approximately 5,600 feet above mean sea level (ft amsl) and is underlain by unconsolidated alluvium and indurated sedimentary rocks. Indurated rocks include those exposed within the Basin (described above), and consist primarily of sandstone and shale. The indurated rocks are relatively flat lying with dips generally less than 3º. The alluvial materials consist primarily of aeolian silts and fine-grained aeolian sands with a thickness varying from a few feet to as much as 25 to 30 feet across the site. The alluvium is underlain by the Dakota Sandstone and Burro Canyon Formation, and where present, the Mancos Shale. The Dakota and Burro Canyon are sandstones having a total thickness ranging from approximately 55 to 140 feet. Beneath the Burro Canyon Formation lies the Morrison Formation, consisting, in descending order, of the Brushy Basin Member, the Westwater Canyon Member, the Recapture

Member, and the Salt Wash Member. The Brushy Basin and Recapture Members of the Morrison Formation, classified as shales, are very fine-grained, have a very low permeability, and are considered aquicludes. The Brushy Basin Member is primarily composed of bentonitic mudstones, siltstones, and claystones. The Westwater Canyon and Salt Wash Members also have a low average vertical permeability due to the presence of interbedded shales.

Beneath the Morrison Formation lie the Summerville Formation, an argillaceous sandstone with interbedded shales, and the Entrada Sandstone. Beneath the Entrada lies the Navajo Sandstone. The Navajo and Entrada Sandstones constitute the primary aquifer in the area of the site. The Entrada and Navajo Sandstones are separated from the Burro Canyon Formation by approximately 1,000 to 1,100 feet of materials having a low average vertical permeability. Groundwater within this system is under artesian pressure in the vicinity of the site, is of generally good quality, and is used as a secondary source of water at the site. Stratigraphic relationships beneath the site are summarized in Figure 3 (adapted from TITAN, 1994 and based on the lithology of water supply well WW-3, located just northwest of TWN-2 [Figure 1B]).

The Upper Jurassic Morrison Formation is the youngest Jurassic unit in the Basin. In many places an unconformity separates the Morrison Formation from underlying Middle Jurassic strata. The Morrison was deposited in a variety of depositional environments, ranging from eolian to fluvial and lacustrine. Much of the Morrison is composed of fluvial sandstone and mudstone that have sources to the west and southwest of the Basin (Peterson and Turner-Peterson, 1987). The upper Brushy Basin Member (typically described as a bentonitic shale), was deposited in a combination of lacustrine and marginal lacustrine environments (Turner and Fishman, 1991).

The contact between the Morrison Formation and overlying strata has been the subject of much discussion. In the southeastern part of the Basin, the Lower Cretaceous Burro Canyon Formation overlies the Morrison Formation. The contact between the Burro Canyon Formation and the Morrison Formation has been interpreted as a disconformity (Young, 1960); however, Tschudy *et al.*, (1984) indicated that the Burro Canyon Formation may be a continuation of deposition of the Morrison Formation. Recent studies by Aubrey (1992) also suggest interfingering between the Morrison Formation and overlying units.

Kirby (2008) indicates that the contact between the Morrison Formation and the Burro Canyon Formation (between the Brushy Basin Member of the Morrison and the Burro Canyon Formation) near Blanding, Utah is disconformable with “local erosional relief of several feet”. Data collected from perched borings at the site that penetrate the Brushy Basin are consistent with a disconformable, erosional contact in agreement with Kirby (2008).

2.1.2 Hydrogeologic Setting

The site and vicinity has a dry to arid continental climate, with an average annual precipitation of approximately 13.3 inches, and an average annual lake evaporation rate of approximately 47.6 inches. Recharge to major aquifers (such as the Entrada/Navajo) occurs primarily along the mountain fronts (for example, the Henry, Abajo, and La Sal Mountains), and along the flanks of folds such as Comb Ridge Monocline.

Although the water quality and productivity of the Navajo/Entrada aquifer are generally good, the depth (approximately 1,200 feet below land surface [ft bls]) makes access difficult. The Navajo/Entrada aquifer is capable of yielding significant quantities of water to wells (hundreds of gallons per minute [gpm]). Water in WW-series supply wells completed across these units at the site rises approximately 800 feet above the base of the overlying Summerville Formation (TITAN, 1994).

2.1.3 Perched Water Zone

Perched groundwater occurs within the Dakota Sandstone and Burro Canyon Formation beneath the site and is used on a limited basis to the north (upgradient) of the site because it is more easily accessible than the Navajo/Entrada aquifer. Perched groundwater originates mainly from precipitation and local recharge sources such as unlined reservoirs (Kirby, 2008) and is supported within the Burro Canyon Formation by the underlying, fine-grained Brushy Basin Member of the Morrison Formation.

Water quality of the Dakota Sandstone and Burro Canyon Formation is generally poor due to high total dissolved solids (TDS) in the range of approximately 1,100 to 7,900 milligrams per liter (mg/L), and is used primarily for stock watering and irrigation. The saturated thickness of the perched water zone generally increases to the north of the site, increasing the yield of the perched zone to wells installed north of the site. The generally low permeability of the perched zones limits well yields. Although sustainable yields of as much as 4 gallons per minute (gpm) have been achieved in site wells penetrating higher transmissivity zones near wildlife ponds, yields are typically low (<$^{1}/_{2}$ gpm) due to the generally low permeability of the perched zone. Many of the perched monitoring wells purge dry and take several hours to more than a day to recover sufficiently for groundwater samples to be collected. During redevelopment (HGC, 2011b) many of the wells went dry during surging and bailing and required several sessions on subsequent days to remove the proper volumes of water.

Although in areas having greater saturated thicknesses perched groundwater extends into the overlying Dakota Sandstone, perched groundwater at the site is hosted primarily by the Burro

Canyon Formation, which consists of a relatively hard to hard, fine- to medium-grained sandstone containing siltstone, shale and conglomeratic materials. As discussed above, the Burro Canyon Formation is separated from the underlying regional Navajo/Entrada aquifer by approximately 1,000 to 1,100 feet of Morrison Formation and Summerville Formation materials having a low average vertical permeability. As discussed above, the Brushy Basin Member of the Morrison Formation (a bentonitic shale), lying immediately beneath the Burro Canyon Formation, forms the base of the perched water zone at the site. Figure 4 is a photograph of the contact between the Burro Canyon Formation and the underlying Brushy Basin Member taken from a location along Highway 95 north of the Mill. This photograph illustrates the transition from the cliff-forming sandstone of the Burro Canyon Formation to the slope-forming Brushy Basin Member.

Figure 5 is a perched groundwater elevation contour map generated from first quarter, 2014 data. Historic water level maps based on data from 1990, 1994 and 2002 are provided in Appendix D.

As shown in Figure 5 and Appendix D, perched water flow across the site is generally from northeast to southwest. Beneath and south of the tailings cells, in the west central portion of the site, perched water flow is south-southwest to southwest. Flow on the western margin of the mesa is also south, approximately parallel to the rim (where the Burro Canyon Formation is terminated by erosion). On the eastern side of the site perched water flow is also generally southerly. Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). Perched water discharges in seeps and springs located to the west, south, east, and southeast of the site.

In general, perched groundwater elevations have not changed significantly at most of the site monitoring wells since installation, except in the vicinity of the wildlife ponds and pumping wells. For example, relatively large increases in water levels occurred between 1994 and 2002 at MW-4 and MW-19, located in the east and northeast portions of the site, as discussed in HGC (2007). These water level increases in the northeastern and eastern portions of the site are the result of seepage from wildlife ponds. Piezometers PIEZ-1 through PIEZ-5, shown in Figure 5, were installed in 2001 for the purpose of investigating these changes. The mounding associated with the wildlife ponds and the general increase in water levels in the northeastern portion of the site have resulted in a local steepening of groundwater gradients over portions of the site. Conversely, pumping of chloroform wells MW-4, TW4-4, TW4-19, TW4-20, and MW-26, and nitrate wells TW4-22, TW4-24, TW4-25, and TWN-2 has depressed the perched water table locally and reduced average hydraulic gradients to the south and southwest of these wells. Pumping is designed to remove chloroform and nitrate associated with the chloroform and nitrate plumes shown on Figure 1B.

Hydraulic testing of perched zone wells yields a hydraulic conductivity range of approximately 2 x 10^{-8} to 0.01 centimeters per second (cm/s) as discussed in HGC (2012b). Hydraulic conductivity estimates are summarized in Tables 1 through 4. Table1 provides estimates of hydraulic conductivity from slug test data analyzed using the KGS and Bouwer-Rice solutions available in AQTESOLVE (HydroSOLVE, 2000). Table 2 summarizes recovery and slug test data analyzed using the Moench solutions in WHIP (HGC, 1988) and AQTESOLVE. The estimates provided in Tables 1 and 2 are based on HGC (2002); HGC (2005); HGC (2010a); HGC (2010b); HGC (2010c); HGC (2010d); HGC (2011a); HGC (2011c); HGC (2013a); and HGC (2013b). Table 3 summarizes analyses of test data collected during long-term pumping within the chloroform plume area using the Theis solutions available in AQTESOLVE (HGC, 2004). Table 4 (from TITAN, 1994) summarizes hydraulic conductivity estimates based on testing prior to 1994.

In general, the highest permeabilities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher permeability zone associated with the chloroform plume and consisting of poorly indurated coarser-grained materials has been inferred to exist in this portion of the site (HGC, 2007).

Permeabilities downgradient (southwest) of the tailings cells are generally low. The low permeabilities and shallow hydraulic gradients downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site.

2.1.4 Seeps and Springs in Relation to Perched Zone Hydrogeology

Hydro Geo Chem (2010e) discusses the relationships between the perched water zone and seeps and springs at the margins of White Mesa. The relationships between seeps and springs and site geology/stratigraphy are provided in Figure E.1 and Figure E.2 of Appendix E. Key findings of HGC (2010e) include the following:

1. Incorporating the seep and spring elevations in perched water elevation contour maps produces little change with regard to perched water flow directions except in the area west of the tailings cells and near Entrance Spring. West of the tailings cells, incorporation of Westwater Seep creates a more westerly hydraulic gradient. Westwater Seep appears to be nearly downgradient of the western portion of the cell complex (Figure 5). Ruin Spring is downgradient of the eastern portion of the cell complex (Figure 5). Westwater Seep is the closest apparent discharge point west of the tailings cells and Ruin Spring is the closest discharge point south-southwest of the tailings cells. Including the Entrance Spring elevation on the east side of the site creates a more easterly gradient in the perched water contours, and places Entrance Spring more directly downgradient of the northern wildlife ponds. Seeps and springs on the east side of the mesa are either

cross-gradient of the tailings cells or are separated from the tailings cells by a groundwater divide

2. Ruin Spring and Westwater Seep are interpreted to occur at the contact between the Burro Canyon Formation and the Brushy Basin Member. Corral Canyon Seep, Entrance Spring, and Corral Springs are interpreted to occur at elevations within the Burro Canyon Formation at their respective locations but above the contact with the Brushy Basin Member. All seeps and springs (except Cottonwood Seep which is located near the Brushy Basin Member/Westwater Canyon Member contact) are associated with conglomeratic portions of the Burro Canyon Formation. Provided they are poorly indurated the more conglomeratic portions of the Burro Canyon Formation are likely to have higher permeabilities and the ability to transmit water more readily than finer-grained portions. This behavior is consistent with on-site drilling and hydraulic test data that associates higher permeability with the poorly indurated coarser-grained horizons detected east and northeast of the tailing cells associated with the chloroform plume)

3. Cottonwood Seep is located more than 1,500 feet west of the mesa rim in an area where the Dakota Sandstone and Burro Canyon Formation (which hosts the perched water system) are absent due to erosion. Cottonwood Seep occurs near a transition from slope-forming to bench-forming morphology (indicating a change in lithology). Cottonwood Seep (and 2nd Seep located immediately to the north) are interpreted to originate from coarser-grained materials within the lower portion of the Brushy Basin Member (or upper portion of the Westwater Canyon Member) and are therefore not (directly) connected to the perched water system at the site.

4. Only Ruin Spring appears to receive a predominant and relatively consistent proportion of its flow from perched water. Ruin Spring originates from conglomeratic Burro Canyon Formation sandstone where it contacts the underlying Brushy Basin Member, at an elevation above the alluvium in the associated drainage. Westwater Seep, which also originates at the contact between the Burro Canyon Formation and the Brushy Basin Member, likely receives a significant contribution from perched water. All seeps and springs other than Ruin Spring (and 2nd Seep just north of Cottonwood Seep) are located within alluvium occupying the basal portions of small drainages and canyons. The relative contribution of flow to these features from bedrock and from alluvium is indeterminate.

5. All seeps and springs are reported to have enhanced flow during wet periods. For seeps and springs associated with alluvium, this behavior is consistent with an alluvial contribution to flow. Enhanced flow during wet periods at Ruin Spring, which originates from bedrock above the level of the alluvium, likely results from direct recharge of Burro Canyon Formation and Dakota Sandstone outcropping near the mesa margin in the vicinity of Ruin Spring. This recharge would be expected to temporarily increase the flow at Ruin Spring (as well as other seeps and springs where associated bedrock is directly recharged) after precipitation events.

6. The assumption that the seep or spring elevation is representative of the perched water elevation is likely to be correct only in cases where the feature receives most or all of its flow from perched water and where the supply is relatively continuous (for example at Ruin Spring). The perched water elevation at the location of a seep or spring that receives

> a significant proportion of water from a source other than perched water may be different from the elevation of the seep or spring. The elevations of seeps that are dry for at least part of the year will not be representative of the perched water elevation when dry. The uncertainty that results from including seeps and springs in the contouring of perched water levels must be considered.

Although there are uncertainties associated with incorporation of seep and spring elevations into maps depicting perched water elevations or maps depicting the Burro Canyon Formation/Brushy Basin Member contact elevations, perched water elevation maps now incorporate seep and spring elevations other than Cottonwood Seep, and contact elevation maps now incorporate Westwater Seep and Ruin Spring elevations.

As discussed in item c), Cottonwood Seep was interpreted in HGC (2010e) to be associated with coarser-grained materials within the lower portion of the Brushy Basin Member. The justification for this interpretation is based primarily on 1) the rate of flow at Cottonwood Seep, which is estimated to be between 1 and 10 gpm (consistent with Dames and Moore, 1978), 2) the need for relatively permeable materials to transmit this rate of flow, and 3) the change in morphology near Cottonwood Seep indicating a change in lithology. The change in morphology from slope-former to bench-former just east of Cottonwood Seep can be seen in the topographic map included in Appendix E (Figure E1) and the annotated photograph provided in Figure 6.

The upper portion of the Brushy Basin Member, which hydraulically isolates the perched zone from underlying materials, is composed primarily of bentonitic mudstone, claystone, and shale. The rate of flow at Cottonwood Seep is inconsistent with the materials found within the upper portion of the Brushy Basin but is consistent with coarser-grained materials expected either within the lower portion of the Brushy Basin Member or within the upper portion of the underlying Westwater Canyon (sandstone) Member. The relationship between Cottonwood Seep and lithology is shown on the geologic map provided in Appendix E (Figure E.2) and Figure 6.

As shown in Figures 6 and E.1, Cottonwood Seep is located approximately 230 feet below the base of the perched zone defined by the contact between the cliff-forming Burro Canyon Formation and the underlying slope-forming Brushy Basin Member. The change in morphology from slope-former to bench-former occurs within the lower portion of the Brushy Basin Member (or the upper portion of the Westwater Canyon Member), between the termination of the perched zone at the mesa rim and Cottonwood Seep. The bench-like area hosting Cottonwood Seep begins at the change in morphology east of Cottonwood Seep and terminates west of Cottonwood Seep where a cliff-forming sandstone, interpreted to be within the Westwater Canyon Member, is exposed. The contact between the Westwater Canyon Member and the Brushy Basin Member is interpreted to be located between this sandstone outcrop and the change in morphology from slope-former to bench-former. This places Cottonwood Seep at the transition between the Brushy Basin Member and the underlying Westwater Canyon Member. This is consistent with the stratigraphy provided in Figure 3 which places the contact between the Brushy Basin Member and the Westwater Canyon Member at elevations between approximately 5,220 and 5,230 ft amsl in this portion of the site, within 5 to 15 feet of the elevation of Cottonwood Seep (5234 ft amsl).

Details of the coarse-grained nature of the lower portion of the Brushy Basin Member are consistent with Shawe (2005) as will be discussed in Section 3.1.1.

2.1.5 Tailings Cells

Details of the construction of tailings cells 2 though 4A are provided in UMETCO (1993). Mill tailings are disposed in lined cells excavated below grade into the upper Dakota Sandstone. Cells 2 and 3 are underlain by a synthetic liner placed over compacted bedding material. The bedding material serves as a drain layer. The drain layer and a sand drain on the downstream embankment are connected to a leak detection lateral. Slime drains were installed above the liner in each cell within the area having the lowest topographic elevation.

Cell 4A and cell 4B have a clayey liner overlain by geotextile and a synthetic liner. Leak detection laterals drain to the southwest and southeast corners of cells 4A and 4B, respectively.

Although the cells are equipped with leak detection systems, and monitoring activities have not detected impacts to the perched aquifer from tailings cell disposal (as discussed in Section 2), the Mill installed additional perched monitoring wells between existing wells on the downgradient margin of the cell complex and between existing cells to function as an ‘early warning system’ for any potential impacts to perched water. These additional wells, MW-23 through MW-25, and MW-27 through MW-31, were installed and tested in 2005 (HGC 2005). At this time, temporary wells TW4-15 and TW4-17, located at the eastern edge of the cell complex and installed in 2002 (HGC, 2002), were converted to permanent status and renamed MW-26 and MW-32, respectively. Subsequently, upon installation of tailings cell 4B, MW-33 through MW-37 were added to the west and south (downgradient) edges of the cell.

3. DETAILED SITE HYDROGEOLOGY

A detailed description of site hydrogeology is provided in the following Sections.

3.1 Stratigraphy and Formation Characteristics

The site stratigraphy is summarized in Figure 3. Details of formations underlying the site that are stratigraphically above the Westwater Canyon Member of the Morrison Formation are provided in the following Sections.

3.1.1 Brushy Basin Member

As discussed in Sections 2.1.1 and 2.1.3, the upper portion of the Brushy Basin Member is composed of bentonitic mudstone, claystone, and shale, which hydraulically supports the perched zone and isolates it from underlying materials.

The upper portion of the Brushy Basin Member is described by Shawe (2005) as "principally mudstone; it contains only minor amounts of sandstone, conglomeratic sandstone, and conglomerate as discontinuous lenses". Shawe (2005) describes the lower portion of the Brushy Basin as coarser-grained, having "mudstone layers which contain, near their base, lenses lithologically similar to sandstone of the Salt Wash Member, and near their top, conglomeratic sandstone lenses".

With regard to the vicinity of Cottonwood Seep (discussed in Section 2.1.4), the expectation of coarser-grained materials is consistent with its location near the transition from the lower coarser-grained portion of the Brushy Basin Member into the underlying Westwater Canyon Member. As discussed in Craig *et al.* (1955), and Flesch (1974), the Westwater Canyon Member intertongues with the Brushy Basin Member. Craig *et al.* (1955) state "The Westwater Canyon Member forms the lower portion of the upper part of the Morrison in northeastern Arizona, northwestern New Mexico, and places in southeastern Utah and southwestern Colorado near the Four Corners, and it intertongues and intergrades northward into the Brushy Basin Member".

3.1.2 Burro Canyon Formation/Dakota Sandstone

Although the Dakota Sandstone and Burro Canyon Formations are often described as a single unit due to their similarity, previous investigators at the site have distinguished between them. The Dakota Sandstone is a relatively hard to hard, generally fine-to-medium grained sandstone cemented by kaolinite clays. The Dakota Sandstone locally contains discontinuous interbeds of siltstone, shale, and conglomeratic materials. Porosity is primarily intergranular. The underlying

Burro Canyon Formation is the primary host of the perched groundwater at the site. The Burro Canyon Formation is similar to the Dakota Sandstone but is generally more poorly sorted, contains more conglomeratic materials, and becomes argillaceous near its contact with the underlying Brushy Basin Member (TITAN, 1994). The permeabilities of the Dakota Sandstone and Burro Canyon Formations at the site are generally low. Porosities and water contents measured in samples of Dakota Sandstone and Burro Canyon Formation collected from borings MW-16 and MW-17 are described in Sections 3.1.2.1 and 3.1.2.2 below. Porosity estimates from these borings agree with measurements reported by MWH (MWH, 2010) for archived samples collected from borings MW-23 and MW-30.

No significant joints or fractures within the Dakota Sandstone or Burro Canyon Formation have been documented in any wells or borings installed across the site (Knight-Piésold, 1998). Any fractures observed in cores collected from site borings are typically cemented, showing no open space.

3.1.2.1 Dakota Sandstone

The Dakota Sandstone, named by Meek and Hayden (1862) for exposures in northeastern Nebraska, is exposed in the Blanding Basin. Where the Burro Canyon Formation is present the Dakota Sandstone rests disconformably upon it. In many localities a three-fold lithologic sequence is present, consisting of a basal conglomeratic sandstone with an underlying disconformity, a middle unit of carbonaceous shale and coal, and an upper unit of evenly-bedded sandstone which intertongues with the overlying Mancos Shale. These strata have been described as deposits of transitional environments which accompanied the westward transgressing Mancos Sea (Young, 1973).

The basal conglomerate represents floodplain braided channel deposits which continue into the adjacent paludal environment. The carbonaceous shales are partly marshy but most formed in lagoon ponds, tidal flats and tidal channels of the lagoonal environment just seaward of the marsh belt. The evenly-bedded sandstone was formed at the shoreline as a mainland or barrier beach deposit of the littoral marine environment. Faunal evidence summarized by O'Sullivan *et al*., (1972) indicates that the lower part of the Dakota Sandstone is of Early Cretaceous age and the upper part is of Late Cretaceous age.

Based on samples collected during installation of wells MW-16 (abandoned) and MW-17, located beneath and immediately downgradient of the tailings cells at the site (Figure 1B), porosities of the Dakota Sandstone range from 13.4% to 26%, and average 20% (Table 5) which is nearly the same as the average porosity of 19% reported by MWH (MWH, 2010) for archived sandstone samples collected from MW-23 and MW-30.

Water saturations from MW-16 and MW-17 range from 3.7% to 27.2%, averaging 13.5%, and the average volumetric water content is approximately 3% (Table 5). The permeability of the Dakota Sandstone based on packer tests in borings installed at the site ranges from 2.71 x 10^{-6} cm/s to 9.12 x 10^{-4} cm/s, with a geometric average of 3.89 x 10^{-5} cm/s (TITAN, 1994).

3.1.2.2 Burro Canyon Formation

As defined by Stokes and Phoenix (1948), the Burro Canyon Formation at its type locality near Slick Rock, Colorado, consists of alternating conglomerate, sandstone, shale, limestone and chert ranging in thickness from 150 to 260 feet. In the Blanding Basin the Burro Canyon Formation consists of deposits of alluvial and floodplain materials up to about 100 feet thick consisting of medium to coarse grained sandstone, conglomerate, pebbly sandstone, and claystone. At several horizons in the formation are persistent, widely traceable, conglomeratic sandstones interpreted as deposits of a braided channel subenvironment. Sandwiched between these sandstones are variegated mudstone units with some sandstone and siltstone lenses, the products of interchannel and meandering channel subenvironments. Fossils collected from the Burro Canyon Formation at various localities include freshwater invertebrates, dinosaur bones and plants. None are truly diagnostic but all suggest an Early Cretaceous (Aptian) age.

The average porosity of the Burro Canyon Formation is similar to that of the Dakota Sandstone. Based on samples collected from the Burro Canyon Formation at MW-16 (abandoned, located beneath tailings cell #4B as shown in Figure 1B), porosity ranges from 2% to 29.1%, averaging 18.3%, similar to the average porosity of 19% reported by MWH (MWH, 2010) for archived sandstone samples collected from MW-23 and MW-30. Water saturations of unsaturated materials collected from MW-16 range from 0.6% to 77.2%, and average 23.4% (Table 5).

TITAN (1994), reported that the hydraulic conductivity of the Burro Canyon Formation ranges from 1.9 x 10^{-7} to 1.6 x 10^{-3} cm/s, with a geometric mean of 1.01 x 10^{-5} cm/s, based on the results of 12 pumping/recovery tests performed in monitoring wells and 30 packer tests performed in borings prior to 1994 (Table 4). As discussed in Section 2, subsequent testing of wells by HGC yields a hydraulic conductivity range of approximately 2 x 10^{-8} to 0.01 cm/s (HGC, 2012b).

In general (as discussed in Section 2.1.3), the highest permeabilities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher permeability zone (associated with poorly indurated coarser-grained materials in the general area of the chloroform plume) has been inferred to exist in this portion of the site (HGC, 2007). As discussed in HGC (2004), analysis of drawdown data collected from this zone during long-term pumping of MW-4, MW-26 (TW4-15), and TW4-19

(Figure 1B) yielded estimates of hydraulic conductivity ranging from approximately 4 x 10^{-5} to 1 x 10^{-3} cm/s (Table 3). The decrease in perched zone permeability south to southwest of this area (south of TW4-4), based on tests at TW4-6, TW4-26, TW4-27, TW4-29 through TW4-31, and TW4-33 and TW4-34 (Table 1), indicates that this higher permeability zone “pinches out”, consistent with the interpretation provided in HGC (2007).

Relatively high conductivities measured at MW-11, located on the southeastern margin of the downgradient edge of tailings cell 3, and at MW-14, located on the downgradient edge of tailings cell 4A, of 1.4 x 10^{-3} cm/s and 7.5 x 10^{-4} cm/s, respectively (UMETCO, 1993 and Table 4), may indicate that this higher permeability zone extends beneath the southeastern portion of the tailings cell complex. However, based on hydraulic tests south and southwest of these wells, this zone of higher permeability does not appear to exist within the saturated zone downgradient (south-southwest) of the tailings cells

Slug tests performed at groups of wells and piezometers located northeast (upgradient) of, in the immediate vicinity of, and southwest (downgradient) of the tailings cells indicate generally lower permeabilities compared with the area of the chloroform plume. The following results are based on analysis of automatically logged slug test data using the KGS solution available in AQTESOLVE (HydroSOLVE, 2000).

Testing of TWN-series wells installed in the northeast portion of the site as part of nitrate investigation activities (HGC, 2009) yielded a hydraulic conductivity range of approximately 3.6 x 10^{-7} to 0.01 cm/s with a geometric average of approximately 6 x 10^{-5} cm/s. The value of 0.01 cm/s estimated for TWN-16 is the highest measured at the site, and the value of 3.6 x 10^{-7} cm/s estimated for TWN-7 is one of the lowest measured at the site. Testing of MW-series wells MW-23 through MW-32 (HGC, 2005) installed between and at the margins of the tailings cells in 2005 (and using the higher estimate for MW-23) yielded a hydraulic conductivity range of approximately 2 x 10^{-7} to 1 x 10^{-4} cm/s with a geometric average of approximately 2 x 10^{-5} cm/s. Hydraulic tests conducted at DR-series piezometers installed as part of the southwest area investigation (HGC 2012b) downgradient of the tailings cells yielded hydraulic conductivities ranging from approximately 2 x 10^{-8} to 4 x 10^{-4} cm/s with a geometric average of 9.6 x 10^{-6} cm/s. The low permeabilities and shallow hydraulic gradients downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site (approximately 0.26 feet per year (ft/yr) to 0.91 ft/yr based on calculations presented in HGC, 2012b).

The extensive hydraulic testing of perched zone wells at the site indicates that perched zone permeabilities are generally low with the exception of the apparently isolated zone of higher permeability associated with the chloroform plume east to northeast (cross-gradient to upgradient) of the tailings cells. The geometric average hydraulic conductivity (less than 1 x 10^{-5} cm/s) of the DR-series piezometers which cover an area nearly half the size of the total monitored area at White Mesa (excluding MW-22), is nearly identical to the geometric average hydraulic conductivity of 1.01 x 10^{-5} cm/s reported by TITAN (1994), and is within the range of 5 to 10 feet per year (ft/yr) [approximately 5 x 10^{-6} cm/s to 1 x 10^{-5} cm/s] reported by Dames and Moore (1978) for the (saturated) perched zone during the initial site investigation.

3.1.3 Mancos Shale

Conformably overlying the Dakota Sandstone is the Upper Cretaceous Mancos Shale. The Mancos Shale was deposited in the Western Interior Cretaceous seaway (Figure 7) and is primarily composed of uniform, dark-gray mudstone, shale, and siltstone. It was deposited in nearshore and offshore neritic subenvironments of the Late Cretaceous Sea during its overall southwestern transgression and subsequent northeastward regression.

The Mancos Shale was named by Cross and Purington (1899) from exposures near Mancos, Colorado. Outcrops of the Upper Cretaceous Mancos Shale occur as hills and slopes generally near or directly beneath overlying Quaternary pediment remnants across portions of the Blanding Basin. Mancos Shale is absent in most of the Blanding Basin (due to erosion) where rocks of the Dakota Sandstone and Burro Canyon Formation are either exposed or mantled by thin unconsolidated deposits.

The Mancos Shale in the Blanding Basin consists of marine shale and interbeds of thin (less than 2 feet) sandstone and siltstone beds. Various pelecypod fossils are common in Mancos Shale outcrop areas (Huff and Lesure, 1965; Haynes *et al.*, 1972). Total thickness is estimated at 30 to 40 feet, but is generally negligible to 20 feet, a small erosional remnant of its original thickness of approximately 2,000 feet. The Mancos Shale was deposited during transgression and highstand of the Cretaceous Interior Seaway during the Late Cretaceous (Elder and Kirkland, 1994). Where present, the Mancos Shale may act as an important impermeable layer reducing the amount of potential infiltration and recharge to the underlying Dakota-Burro Canyon perched aquifer (Avery, 1986; Goodknight and Smith, 1996).

The Mancos Shale belongs to the group of thick marine organic muds (or black shales) generally thought of as deposited in geosynclinal areas. Bentonitic volcanic ash layers are abundant in the Mancos Shale (Shawe, 1968). An abundance of pyrite in the layers may indicate that iron was an important constituent of the ash, possibly being liberated by devitrification of glass and redeposited with the diagenetic development of pyrite. Hydrogen sulfide was abundant in the organic rich sediments accumulating at the bottom of the Mancos Sea, if it was a typical sapropelic marine environment, as seems likely, and may have been especially abundant in the volcanic ash (Fenner, 1933).

Trapped sea water that is buried in the mud of the Mancos Shale likely had a high content of organic material consistent with the abundance of diagenetic pyrite. Chemical reduction resulting from hydrogen sulfide generated in carbon-rich sediments is characteristic of stagnant sea bottoms.

In the Early Tertiary, the original clay and silt deposited in the Mancos Shale became compacted to about a third to a tenth of its original water saturated volume by the time it was buried to a depth of about 10,000 feet (Shawe, 1976). Pore water throughout the Colorado Plateau, driven from compacting mud, moved largely upward into younger sediments (Yoder, 1955), but much water must have moved into the lower more porous strata because of local conditions of rock structure (Hedberg, 1936), because of the relatively high water density, and because of abnormally high fluid pressures. Expulsion of water likely occurred throughout the deposition of the Mancos Shale in the Late Cretaceous and during deposition of younger sediments in the Early Tertiary. Therefore expulsion occurred during a period of many millions of years and at depths ranging from near- surface to nearly maximum depths of burial.

Faulting occurred in many places on the Colorado Plateau, including the Blanding Basin during the Late Cretaceous and Early Tertiary when the Mancos was being deeply buried by younger strata, and this provided numerous avenues to allow water movement into underlying porous strata. It seems likely therefore that the Dakota Sandstone at the base of the Mancos Shale and the dominantly sandy underlying Burro Canyon Formation contained pore water which was expelled from the Mancos and was under abnormally high fluid pressures (Shawe, 1976).

Compaction of bedding around pyrite crystals shows the early development of part of the diagenetic pyrite, and indicates that pore fluids were being squeezed out of the Mancos Shale during the period of diagenesis. As pore fluids became trapped in the Mancos Shale following deposition of sediment in the Late Cretaceous, they immediately began to react with black opaque minerals, with magnetite deposited with the abundant ash fall material and possibly with volcanic glass and other iron-bearing material to form pyrite. Faulting that occurred on the Colorado Plateau in the Late Cretaceous and Early Tertiary facilitated movement of the Mancos pore water into underlying beds, causing removal of hematite coating on sand grains, destruction of detrital black opaque minerals, and growth of iron sulfide minerals (Shawe, 1976).

3.1.4 Pyrite Occurrence in the Dakota Sandstone and Burro Canyon Formation

As discussed above, downward movement of the Mancos Shale pore water into underlying beds of the Dakota Sandstone and Burro Canyon Formations caused removal of hematite coatings on sand grains, destruction of detrital black opaque minerals, and the growth of iron sulfide minerals. Shawe (1976) classifies the Dakota Sandstone and Burro Canyon Formations as “altered-facies” rocks primarily as a result of the invasion of pore waters expelled from the overlying Mancos Shale during compaction. Shawe states that “altered facies rocks that developed by solution attack are notable for their almost complete loss of black opaque minerals and gain of significant pyrite.” Shawe further states that “altered-facies rocks contain only sparse black opaque minerals but appreciable pyrite” and that “alteration caused destruction of most detrital back opaque minerals, precipitation of substantial pyrite, and recrystallization of carbonate minerals that took up much of the iron liberated from the solution of black opaque minerals.”

According to Shawe (1976), “altered-facies sandstone is light gray or, where weathered, also light buff to light brown. It contains only a small amount of black opaque heavy minerals and may or may not contain carbonaceous material. The light buff to light brown colors are imparted by limonite formed from oxidation of pyrite in weathered rock.”

Furthermore Shawe (1976) states “In weathered rocks as observed in thin sections pyrite has been replaced by ’limonite’, but preservation of original pyrite crystal forms and lack of abundant limonite ‘wash’ or dustlike limonite suggest that the forms of most limonite are indicative of the original forms of pyrite before oxidation. Pyrite (or limonite) in sandstone occurs as isolated interstitial patches as much as 2 millimeters (mm) in diameter enclosing many detrital grains, or as cubes 1 mm across and smaller that are mainly interstitial but that also partially replace detrital grains.” Also “limonite pseudomorphs after marcasite have been recognized in vugs in altered-facies sandstone of the Burro Canyon Formation.” Shawe (1976) also notes that pyrite is more common below the water table and iron oxides (likely formed by oxidation of pyrite) are more common in the vadose zone. These observations are consistent with the occurrence of and oxidation of pyrite in the formations hosting the perched water at the site as will be discussed in Section 4.

3.2 Contact Descriptions

Lithologic contacts between the Brushy Basin Member of the Morrison Formation, and between the Dakota Sandstone and the overlying soils and/or the Mancos Shale, are described in the Sections 3.2.1 and 3.2.2. Cross-sections through soils based on soil borings installed as part of implementing Phase I of the nitrate CAP are presented and discussed in Section 3.2.3.

3.2.1 Brushy Basin Member/Burro Canyon Formation Contact Elevations

Figure 8 is a contour map of the Burro Canyon Formation/Brushy Basin Member contact generated from perched well, piezometer, DR-series boring data and the locations and elevations of Westwater Seep and Ruin Spring. Figure 8 was generated based on data indicating that only Westwater Seep and Ruin Spring are located at the contact between the Burro Canyon Formation and the Brushy Basin Member (HGC, 2012b). As discussed in HGC (2012b) examination of the area near Cottonwood Seep in July 2010 and re-examination in October 2011 revealed no evidence for a hydraulic connection with the perched zone. The absence of any visible seeps or anomalous vegetation in the Brushy Basin Member east and northeast of Cottonwood Seep is consistent with dry conditions in the upper portion of the Brushy Basin Member.

Figure 8 shows that the erosional Brushy Basin/Burro Canyon contact surface dips generally to the south-southwest and is very irregular in the northeast portion of the site. A paleoridge in the Brushy Basin erosional paleosurface extends from beneath cell 4B to the southwest near abandoned boring DR-18. To the east of this paleoridge, a paleovalley extends from south of cell 4A to the northeast, extending into the vicinity of the northern wildlife ponds. A paleovalley subparallel to the cell 4B paleoridge is also present on the west side of the paleoridge, between the paleoridge and the western mesa margin.

The approximate axes of these and other paleoridges and paleovalleys in the southwest portion of the site are indicated on Figure 8. These features are especially important in this portion of the site due to the generally small saturated thicknesses and the consequently relatively large impacts these features are expected to have on perched water flow in this area.

Other notable features include a paleoridge surrounded by paleovalleys that trend northwest – southeast (rather than northeast – southwest) in the area northeast of the millsite, a paleovalley extending from the area of cell 4B to Westwater Seep, and paleovalleys converging on Ruin Spring.

3.2.2 Mancos Shale/Dakota Contact Elevations

Figures 9 through 11 are elevation contour maps of the top of bedrock (top of the Dakota Sandstone or Mancos Shale [where present]), the top of the Dakota Sandstone, and the top of bedrock showing Mancos thickness. Based on these maps, the top of Dakota and top of bedrock surfaces dip generally to the south-southwest consistent with the general dip of the top of Brushy Basin surface. In the northeast portion of the site these surfaces are generally less irregular than the top of the Brushy Basin surface.

Notable features include a structural high in the top of Dakota and top of bedrock surfaces near tailing cell 4B, and a north-south trending structural high in the top of bedrock surface east to northeast of the tailing cell complex. The latter feature is primarily the result of a ridge-like remnant of the Mancos Shale that reaches thicknesses greater than 30 feet along the axis of the feature.

Structural highs near cell 4B are present in the top of Brushy Basin surface (Figure 8), the top of bedrock (Figure 9), and the top of Dakota (Figure 10) surface. These features are ridge-like in all three surfaces but the paleoridge in the top of Brushy Basin is not coincident with the paleoridge in the top of bedrock and top of Dakota surfaces except in the vicinity of cell 4B. The primary axis of the paleoridge in the Brushy Basin surface extends from MW-33 at the southwest corner of cell 4B through DR-10, MW-21 and DR-18. The axis of the paleoridge in the top of bedrock surface extends from MW-35 through DR-11, DR-15, and DR-21. The axis of the paleoridge in the top of Dakota surface appears to extend from the vicinity of MW-24 (at the southwest corner of cell 1) through MW-33, DR-11, and possibly DR-15 (but is less well-defined near DR-15).

3.2.3 Soils Above Dakota and /or Mancos

Figure 12 depicts the locations of soil borings installed near the ammonium sulfate crystal tanks as part of implementing Phase I of the nitrate CAP (HGC, 2012a). Borings were installed to depths of refusal using a drive-point rig as described in EFRI (2013). The depth of refusal is assumed to represent competent bedrock. Figure 13 depicts soils cross-sections developed from these borings.

Unconsolidated soils consist primarily of silts with interbedded sands and clays. Weathered Mancos Shale was encountered in many of the borings. Detailed logs of all soil borings are provided in EFRI (2013).

Soils present above the Mancos Shale in this portion of the site are dominated by the same fine-grained materials typical of other portions of the site. Soil types encountered in borings installed by INTERA (Appendix C) are generally consistent with those found in the vicinity of the ammonium sulfate crystal tanks and other portions of the site.

3.3 Perched Water Elevations, Saturated Thicknesses, and Depths to Water

As discussed in Section 2.1.3, Figure 5 is a contour map of perched water elevations generated from first quarter, 2014 water level data. Figure 5 contains perched well and piezometer water level data, and the elevations of all seeps and springs except Cottonwood Seep (for which there is no evidence to establish a connection to the perched water system and which is located near the Brushy Basin Member/Westwater Canyon Member contact, indicating that its elevation is not representative of the perched potentiometric surface). Fill-in contours between the 10-foot elevation contours are provided over portions of the site, including the area immediately west-southwest of the tailings cells to allow detail in an area having relatively flat hydraulic gradients.

Figure 5 was generated assuming that each seep or spring (except Cottonwood Seep) is a known discharge point for perched water and that the elevation of the seep or spring is representative of the elevation of perched water at that location (HGC, 2010e). As discussed in Section 2.1.4 this may not be appropriate for seeps/springs that are dry for portions of the year. Figure 14 shows the saturated thicknesses of the perched zone based on first quarter, 2014 water level data.

Figure 15 shows depths to water as of the first quarter of 2014. Depths to perched water range from approximately 29 feet below top of casing (btoc) northeast of the tailings cells (at TWN-2) to approximately 117 feet btoc at the southwestern margin of tailings cell 3. Prior to cessation of water delivery to the northern wildlife ponds the shallowest depths to water were encountered in piezometers and wells near these ponds. Saturated thicknesses range from approximately 86 feet at MW-19 near the northern wildlife ponds to less than 5 feet in the southwest portion of the site, downgradient of the tailings cells. A saturated thickness of approximately 2 feet occurs in well MW-34 along the south dike of tailings cell 4B, and the perched zone has been consistently dry at MW-33 located at the southwest corner of cell 4B, and at MW-21 located south-southwest of cell 4B. Both are located on a structural high in the top of Brushy Basin Member surface (Figure 8).

3.4 Interpretation of Cross-Sections

Lithologic and soils cross-sections prepared for various portions of the site are discussed in the following Sections. In general, the lithologies encountered in the borings used to construct the cross-sections are consistent with the literature and with past investigations at the site (prior to TITAN, 1994).

3.4.1 Central and Northeast Areas

Figures 16A, 16B and 17 are lithologic cross-sections in the central to northeast portions of the site, as shown on Figure 1A. Figure 16A is a northeast-southwest oriented cross-section (NE-SW) extending from MW-3 to TWN-12. Figure 16B is a parallel cross section (NE2-SW2) extending from TWN-18 to TWN-19. Figure 17 is a northwest-southeast cross-section (NW-SE) extending from TWN-7 to Piez-3. Figures 16A, 16B, and 17 indicate site features located near the cross-sections.

These cross-sections indicate that the top of Brushy Basin surface is irregular in the northeast portion of the site and that, as discussed in Sections 3.1.2.1 and 3.1.2.2, the Burro Canyon Formation and Dakota Sandstone contain shale/claystone and conglomerate interbeds of varying thickness and continuity. Where poorly indurated, coarser sand and conglomeratic horizons are expected to be relatively permeable, shale/claystone horizons are expected to be at least partial barriers to perched groundwater flow, and where present in the vadose zone, to represent at least partial barriers to downward percolation of recharge. That local saturated conditions have not been encountered above shale/claystone horizons during drilling within the Dakota Sandstone and Burro Canyon Formations suggests that recharge rates over most of the site are generally low, except near unlined ponds or surface depressions, or other areas having enhanced recharge due to their locations within drainages or due to relatively flat, poorly drainable topography.

The perched water table surface is relatively elevated in the vicinities of the wildlife ponds and in the vicinity of the historical pond near TWN-2 (Figure 1B). As will be discussed in Section 3.5.2, the persistently high water level at TWN-2 likely results from low permeability and possibly enhanced recharge in the vicinity of TWN-2 due to graded areas of the millsite having relatively flat topography and poor runoff.

3.4.2 Southwest Area

Figures 18 and 19 are cross-sections showing the hydrogeology of the perched zone in the area southwest of the tailings cells located as shown in Figure 1A. Figure 18 provides west-east cross-sections (W-E and W2-E2) across the area immediately west and southwest of cell 4B. Figure 19 is a south-north cross-section (S-N) from the south dike of cell 4B to Ruin Spring. Cross-sections W-E and S-N are oriented approximately parallel to perched water flow and W2-E2 is oriented roughly perpendicular to perched water flow. Except for abandoned DR-series borings, water levels in the cross sections are based on first quarter, 2014 data. Water levels for abandoned DR-series borings are from the second quarter, 2011. Water levels for DR-series piezometers have not changed significantly between the third quarter of 2011 and the first quarter of 2014 (as shown in Figure 20) suggesting that second quarter, 2011 water levels for abandoned borings are likely representative of current conditions.

As shown in cross-section W-E in Figure 18 (and in Figure 14) the saturated thickness of the perched zone in the southwest area of the site varies from negligible to more than 20 feet. The variable saturated thickness has implications regarding the flow of perched water to known discharge points Westwater Seep and Ruin Spring. Perched water moving downgradient from the area of the tailings cells westward toward abandoned boring DR-2 must pass through a region of low saturated thickness occupied by DR-6 and DR-7 (Figures 5, 14 and 18). This implies (by

Darcy's Law) that some downgradient areas having larger saturated thicknesses must receive local recharge from precipitation because the water supplied by lateral perched flow is inadequate to maintain the large saturated thicknesses in areas near sinks such as Westwater Seep and Ruin Spring.

Two areas of relatively large saturated thickness that are downgradient of areas of small saturated thickness are of particular interest: the area near DR-2 (abandoned) and DR-5 located west of the area near DR-6 and DR-7 as shown in Figure 18 (cross-section W-E), and the area near DR-25 located south of the area near MW-20 as shown in Figure 19 (cross-section S-N). Each of the above areas of larger saturated thickness is downgradient of the corresponding area of small saturated thickness, and each downgradient area of larger saturated thickness is near a perched water sink. The primary known perched groundwater sinks downgradient of DR-2 abandoned) and DR-5 are Westwater Seep to the northeast and the paleovalley leading south to Ruin Spring (Figures 8 and 14). The primary sink near abandoned boring DR-25 is Ruin Spring. Lateral flow from areas of larger saturated thickness that may exist to the east of cross-section S-N may supply the water needed to maintain the relatively large saturated thickness near DR-25. However, the reported temporary increases in flow from Ruin Spring (and Westwater Seep) after precipitation events (HGC, 2010e) are problematic unless flow is temporarily enhanced by local recharge.

As discussed in HGC (2010e), enhanced local recharge is likely near the mesa margins where weathered Dakota Sandstone and Burro Canyon Formation are exposed by erosion (Figure E.2, Appendix E). Logs at DR-2 and DR-5 show only a few feet of unconsolidated material above the Dakota Sandstone and visual inspection of the mesa near DR-2 (abandoned) and DR-5 shows that weathered Dakota is often exposed (consistent with the geology presented in Dames and Moore (1978). Due to the thin veneer of alluvium overlying the Dakota Sandstone, and thin or absent Mancos Shale, recharge near DR-2 and DR-5 (cross-section W-E, Figure 18) will be facilitated. Similarly, in the area near abandoned boring DR-25 and Ruin Spring, recharge will be facilitated by the thinness or absence of the Mancos Shale and the surface exposure of the Dakota Sandstone and Burro Canyon Formation between DR-25 and Ruin Spring (cross-section S-N, Figure 19).

3.5 Perched Water Occurrence and Flow

Description of the occurrence and flow of perched water at the site focuses on three general areas: 1) the nitrate investigation area, 2) the area of the chloroform plume, and 3) areas beneath and downgradient of the tailing cells, as per Sections 3.5.2, 3.5.3, and 3.5.4 respectively.

3.5.1 Overview

As discussed in Section 2.1.3, perched groundwater at the site occurs primarily within the Burro Canyon Formation as well as the overlying Dakota sandstone where saturated thicknesses are greater. Flow onto the site occurs as underflow from areas northeast of the millsite where perched zone saturated thicknesses are generally greater. Flow exits the Mill property in seeps and springs to the east, west, southwest and southeast. Any flow that does not discharge in seeps or springs presumably exits as underflow to the southeast. Perched water flow is generally from northeast to south-southwest across the site.

3.5.1.1 General Site Flow Pattern

First quarter 2014 perched water elevations (Figure 5) show the typical south-southwesterly flow pattern at the site. The historic water level contour maps in Appendix D demonstrate the persistence of the generally southwesterly perched flow pattern

As discussed in Section 2.1.3, beneath and downgradient of the tailings cells, on the west side of the site, perched water flow is south-southwest to southwest. On the eastern side of the site perched water flow is more southerly. Perched zone hydraulic gradients currently range from a maximum of approximately 0.075 feet per foot (ft/ft) east of tailings cell 2 (near the eastern portion of the chloroform plume) to approximately 0.0022 ft/ft in the northeast corner of the site (between TWN-19 and TWN-16. Hydraulic gradients in the southwest portion of the site are typically close to 0.01 ft/ft, but the gradient is less than 0.005 ft/ft west/southwest of tailings Cell 4B, between Cell 4B and DR-8. The overall average site hydraulic gradient, between TWN-19 in the extreme northeast to Ruin Spring in the extreme southwest, is approximately 0.011 ft/ft.

Perched groundwater discharges in springs and seeps along the mesa margins. These features are located along Westwater Creek Canyon and Cottonwood Canyon to the west-southwest of the site, and along Corral Canyon to the east of the site, where the Burro Canyon Formation is exposed. Based on the data presented in Figure 5, the discharge points located most directly downgradient of the tailings cells are Westwater Seep and Ruin Spring. Westwater Seep is located approximately 2,200 feet west of the tailings cell complex at the site; Ruin Spring is located approximately 9,400 feet south-southwest of the tailings cell complex at the site (Figure 1B).

Dry areas beneath cell 4B and southwest of cell 4B (south of MW-21) affect perched water flow and are defined in Figure 5 by areas where the kriged contact between the Burro Canyon Formation and the Brushy Basin Member is higher in elevation than the kriged perched water elevation. The dry areas shown in Figure 5 encompass abandoned dry well MW-16, dry well

MW-21, dry well MW-33, and abandoned dry boring DR-18. The areas defined by the heavy yellow dashed contour lines have saturated thicknesses less than 5 feet. As shown in Figure 5 and southwest area cross-sections (Figures 18 and 19), a large portion of the perched zone west and southwest (downgradient) of the tailings cells has a saturated thickness less than 5 feet. This zone has been persistent based on measurements since the third quarter of 2011. An apparent perched water divide exists in the vicinity of DR-2 (abandoned) and DR-5 (Figure 5). Perched water north of this apparent divide is expected to flow primarily northeast toward Westwater Seep and perched water south of this apparent divide is expected to flow primarily south toward Ruin Spring (as will be discussed in Section 3.5.4).

Figure 14 shows the axes of paleoridges and paleovalleys in the Brushy Basin Member erosional paleosurface and posted first quarter, 2014 saturated thicknesses. As indicated, paleoridges in the southwest area of the site are associated with dry areas and with areas of low saturated thicknesses; paleovalleys are associated with areas of higher saturated thicknesses. Westwater Seep and Ruin Spring are located in paleovalleys. The average saturated thickness based on measurements at MW-35, DR-7, and DR-6, which are the points closest to a line between the southeast portion of tailings Cell 3 and Westwater Seep, is approximately 5 feet. The average saturated thickness based on measurements at MW-37, DR-13, MW-3, MW-20, and DR-21, which lay close to a line between the southeast portion of tailings cell 4B and Ruin Spring, is approximately 9 feet.

Perched water mounding associated with the wildlife ponds locally changes the generally southerly perched water flow patterns. For example, northeast of the Mill site, mounding associated with the northern wildlife ponds results in locally northerly flow near PIEZ-1. Mounding also causes the hydraulic gradient to be more westerly west of the ponds and more easterly east of the ponds. The impact of the mounding associated with the northern ponds, to which water has not been delivered since March 2012, is diminishing and is expected to continue to diminish as the mound decays due to reduced recharge.

3.5.1.2 Influence of Pumping and Wildlife Pond Seepage on Flow and Dissolved Constituent Concentrations

Figures 1A and 1B show the locations of chloroform and nitrate pumping wells at the site. MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells, and TWN-2, TW4-22, TW4-24, and TW4-25 are nitrate pumping wells. Figure 21 is a map showing kriged first quarter 2014 perched water levels, the extents of the nitrate and chloroform plumes at the site, and inferred perched water flow paths. Figure 22 is a detail map showing the locations of pumping wells, first quarter, 2014 kriged water levels, and inferred capture zones associated with the pumping wells.

As described in HGC (2012a) the nitrate pumping system, which became operational in the first quarter of 2013, is designed to (eventually) establish hydraulic capture of the nitrate plume upgradient (north of) TW4-22 and TW4-24. MW-30 and MW-31, located at the downgradient edge of the plume, are not pumped to minimize the potential for downgradient chloroform migration As described in HGC (2007), the chloroform pumping system, which became operational in 2003 with the pumping of MW-4, TW4-19, and MW-26 (TW4-15), and later enhanced by the addition of TW4-20 in 2005 and TW4-4 in 2010, is designed primarily to reduce mass in upgradient portions of the plume where saturated thicknesses, concentrations, and well productivities are higher. Mass reduction is thereby maximized, the source of chloroform to downgradient areas cut off, and natural attenuation facilitated.

Local depression of the perched water table occurs near chloroform pumping wells MW-4, TW4-4, TW4-19, TW4-20, and MW-26 (Figure 22). Pumping of chloroform wells MW-4 and TW4-19 began in 2003 (HGC, 2004). Well-defined cones of depression are evident near all chloroform pumping wells except TW4-4, which began pumping in the first quarter of 2010, and was the last chloroform well to be brought on-line. Although operation of chloroform pumping well TW4-4 has depressed the water table in the vicinity of TW4-4, a well-defined cone of depression is not clearly evident. The lack of a well-defined cone of depression near TW4-4 likely results from 1) variable permeability conditions in the vicinity of TW4-4, and 2) persistent relatively low water levels at adjacent well TW4-14, as will be discussed in Section 3.5.3.

Local depression of the perched water table also occurs near nitrate pumping wells TW4-22, TW4-24, TW4-25, and TWN-2 (Figure 22), which are operated to reduce nitrate mass in the perched groundwater as per the nitrate CAP (HGC, 2012a). Cones of depression are in the process of development in the vicinities of nitrate pumping wells which were brought on-line in the first quarter of 2013. Relatively slow development of capture zones is expected due to generally low permeability within the nitrate plume.

The hydraulic effects of the chloroform and nitrate pumping systems overlap. Figure 22 shows the inferred capture of both chloroform and nitrate pumping systems as of the first quarter, 2014. Capture zones are calculated by hand based on the kriged water level contours following the rules for flow nets. From each pumping well, stream tubes that bound the capture zone are reverse-tracked, and perpendicularity is maintained between each stream tube and the intersected kriged water level contours.

Recharge from the wildlife ponds has impacted perched water elevations and flow directions at the site by creating perched groundwater mounds as discussed in Section 3.5.1. Furthermore, the March 2012 cessation of water delivery to the northern ponds, which are generally upgradient of the nitrate and chloroform plumes at the site, has resulted in changing conditions that are expected to impact constituent concentrations and migration rates within the plumes. Specifically, past recharge from the ponds has helped limit many constituent concentrations within the plumes by dilution while the associated groundwater mounding has increased hydraulic gradients and contributed to plume migration. Since use of the northern wildlife ponds ceased in March 2012, the reduction in recharge and decay of the associated groundwater mound are expected to increase many constituent concentrations within the plumes while reducing hydraulic gradients and rates of plume migration.

The impacts associated with cessation of water delivery to the northern ponds are expected to propagate downgradient (south and southwest) over time. Wells close to the ponds are generally expected to be impacted sooner than wells farther downgradient of the ponds. Therefore, constituent concentrations are generally expected to increase in downgradient wells close to the ponds before increases are detected in wells farther downgradient of the ponds. Although such increases are anticipated to result from reduced dilution, the magnitude and timing of the increases are difficult to predict due to the complex permeability distribution at the site and factors such as pumping and the rate of decay of the perched groundwater mound. The potential exists for some wells completed in higher permeability materials to be impacted sooner than some wells completed in lower permeability materials even though the latter may be closer to the ponds.

Localized increases in concentrations of constituents such as chloroform and nitrate within and near the chloroform plume, and of nitrate and chloride within and near the nitrate plume, may occur even when these plumes are under control. Ongoing mechanisms that can be expected to increase constituent concentrations locally as a result of reduced wildlife pond recharge include but are not limited to:

1. Reduced dilution - the mixing of low constituent concentration pond recharge into existing perched groundwater will be reduced over time.
2. Reduced saturated thicknesses – dewatering of any higher permeability layers receiving primarily low constituent concentration pond water will result in wells intercepting these layers receiving a smaller proportion of the low constituent concentration water.

The combined impact of the above two mechanisms may be especially evident at chloroform pumping wells MW-4, MW-26, TW4-4, TW4-19, and TW4-20; nitrate pumping wells TW4-22, TW4-24, TW4-25, and TWN-2; and non-pumped wells adjacent to the pumped wells. The overall impact is expected to be generally higher constituent concentrations in these wells over time until mass reduction resulting from pumping and natural attenuation eventually reduces concentrations. Short-term changes in concentrations at pumping wells and wells adjacent to pumping wells are also expected to result from changes in pumping conditions.

3.5.2 Nitrate Investigation Area

The extent of the nitrate plume addressed by the nitrate CAP (HGC, 2012a) and referred to as the 'nitrate plume' is shown in Figure 21. Figure 21 also displays kriged first quarter, 2014 perched water level contours and inferred flow paths and shows the extent of the chloroform plume which overlaps the nitrate plume in the vicinity of TW4-22. Nitrate exceeding 10 mg/L also occurs to the southeast of the plume in relatively isolated pockets (near TW4-10, TW4-12, TW4-18, and TW4-27). As discussed in HGC (2014), this southeastern nitrate is attributed to sanitary leach field discharge associated with the chloroform plume and/or with former cattle ranching operations at the site. Nitrate exceeding 10 mg/L at far down gradient location MW-20 is also likely associated with former cattle ranching operations. The potential for cattle to contribute nitrate to soil is discussed in McFarland *et al* (2006). Elevated nitrate in soil can then act as a source to groundwater.

Perched groundwater flow within the area of the nitrate plume varies from southwest to west-southwest. The generally southwesterly gradient typical of the majority of the site is influenced by past recharge from the northern wildlife ponds, and elevated water levels in the vicinities of wells TWN-2 and TWN-3. TWN-2 is within the footprint of the historical pond and TWN-3 is immediately east of the footprint of the pond, as shown in Figure 1B. Recharge from the northern wildlife ponds, located immediately northeast of the nitrate plume, caused a shift in gradient in the northern portion of the plume from southwesterly to west-southwesterly (compare Appendix D 1990 and 1994 water level maps with Figure 21). The persistently high water level at TWN-2, which has functioned as a nitrate pumping well since the first quarter of 2013, likely results from low permeability and possibly enhanced recharge in the vicinity of TWN-2 due to graded areas of the millsite having relatively flat topography and poor runoff.

Cones of depression associated with nitrate pumping wells TW4-22, TW4-24, TW4-25, and TWN-2, have been developing since initiation of pumping during the first quarter of 2013. Hydraulic capture associated with these wells is developing slowly due to low permeability conditions. That sufficient capture will eventually develop is indicated by calculations presented in EFRI (2014a) showing that nitrate pumping exceeds pre-pumping flow through the nitrate plume by a factor between approximately 1.2 and 2.5.

Water level patterns near nitrate pumping wells are expected to be influenced by the presence of, and the decay of, the groundwater mound associated with the northern wildlife ponds, and by the persistently low water level elevation at TWN-7. Chloroform and nitrate pumping wells interact. The long term interaction between nitrate and chloroform pumping systems will require more data to be collected as part of routine monitoring.

Criteria regarding control and potential migration of the nitrate plume are detailed in the nitrate CAP (HGC, 2012a). As stated in the CAP, MW-5, MW-11, MW-30, and MW-31 are located downgradient of TW4-22 and TW4-24. MW-30 and MW-31 are within the nitrate plume near its downgradient edge and MW-5 and MW-11 are outside and downgradient of the plume. Per the CAP, hydraulic control based on concentration data is considered successful if the concentrations of nitrate in MW-30 and MW-31 remain stable or decline, and concentrations of nitrate in downgradient wells MW-5 and MW-11 do not exceed the 10 mg/L standard. Based on these criteria, the nitrate plume is under control.

The plume has not migrated downgradient to MW-5 or MW-11 because nitrate has not been detected at MW-11 and has been detected at concentrations less than 1 mg/L at MW-5. Nitrate concentrations in both MW-30 and MW-31 at the downgradient edge of the plume have been relatively stable, demonstrating that plume migration is minimal or absent (EFRI, 2014a).

Chloride has been relatively stable at MW-30 but appears to be increasing at MW-31 (EFRI 2014a). The apparent increase in chloride and stable nitrate at MW-31 suggests a natural attenuation process that is affecting nitrate but not chloride. A likely process that would degrade nitrate but leave chloride unaffected is reduction of nitrate by pyrite. The likelihood of this process in the perched zone is discussed in HGC (2012c).

Understanding of perched water level behavior in the area northeast of the millsite was enhanced by the installation of TWN-series wells northeast of the nitrate plume in 2009. Prior to the installation of these wells, upgradient information was limited to that provided by MW-1, MW-18, MW-19, PIEZ-1, and PIEZ-2. As shown in Figure 1B, nitrate wells TWN-5, TWN-8, TWN-9, TWN-10, TWN-11, TWN-12, TWN-13, TWN-15, and TWN-17 have been abandoned as per the nitrate CAP.

In general, water level data provided by these wells and existing wells and piezometers in the northeast portion of the Mill property indicated that perched water flow is to the southwest. Data from many of these wells helped to better define the extent of the perched groundwater mound resulting from former recharge at the northern wildlife ponds. Figure 23 is a water level contour map from the fourth quarter, 2011 constructed prior to both TWN well abandonment and cessation of water delivery to the northern wildlife ponds.

3.5.3 Area of Chloroform Plume

As noted in Section 3.5.1.2, the area of the chloroform plume is shown in Figure 21. Water level and concentration data presented in this Section are from EFRI (2014b) unless otherwise indicated.

Perched groundwater flow within the area of the chloroform plume has been generally southerly to southwesterly. As discussed in HGC (2007) the chloroform plume resulted from disposal of laboratory wastes to the abandoned scale house and former office sanitary leach fields. Disposal took place in the early years of Mill operation before the tailings cells were functional. Laboratory wastes have been disposed to tailings cells since cells became operational circa 1980.

As discussed in HGC (2007), the abandoned scale house leach field accepted laboratory wastes prior to the former office leach field. The abandoned scale house leach field was located immediately north-northwest of well TW4-18 (Figure 1B). Historic perched water flow in this area was to the south or south-southeast (Appendix D). Chloroform disposed in the abandoned scale house leach field migrated primarily southerly to the vicinity of well MW-4 where it was detected in 1999. Hydraulic gradients in this area were enhanced by recharge from the northern wildlife ponds located north of MW-4.

The former office leach field is located in the immediate vicinity of well TW4-19 (a chloroform pumping well) and immediately northeast of tailings cell 2 (and chloroform pumping well TW4-20) [Figure 1B]. Perched water flow in this area was historically southwest (Appendix D), and hydraulic gradients have been enhanced by recharge from the northern wildlife ponds (located to the northeast).

Once chloroform pumping began in 2003 and nitrate pumping began in 2013, changes to the flow regime formerly dominated by wildlife pond recharge in the vicinity of the chloroform plume began to change locally under the influence of the pumping. Well defined cones of depression are evident in the vicinity of all chloroform pumping wells except TW4-4, which began pumping in the first quarter of 2010. Although operation of chloroform pumping well TW4-4 has depressed the water table in the vicinity of TW4-4, a well-defined cone of depression is not clearly evident.

As discussed in Section 3.5.1.2 variable permeability conditions likely contribute to the lack of a well-defined cone of depression near chloroform pumping well TW4-4. Changes in water levels at wells immediately south of TW4-4 resulting from TW4-4 pumping are expected to be muted because TW4-4 is located at a transition from relatively high to relatively low permeability conditions south (downgradient) of TW4-4. The permeability of the perched zone at TW4-6 and

TW4-26 (and recently installed well TW4-29) is approximately two orders of magnitude lower than at TW4-4 (Table 1). Any drawdown of water levels at wells immediately south of TW4-4 resulting from TW4-4 pumping is also difficult to determine because of the general, long-term increase in water levels in this area due to recharge from the wildlife ponds.

Water levels at TW4-4 and TW4-6 increased by nearly 2.7 and 2.9 feet, respectively, between the fourth quarter of 2007 and the fourth quarter of 2009 (just prior to the start of TW4-4 pumping) at rates of approximately 1.2 feet/year and 1.3 feet/year, respectively. However, the increase in water level at TW4-6 has been reduced since the start of pumping at TW4-4 (first quarter of 2010) to approximately 0.5 feet/year suggesting that TW4-6 is within the hydraulic influence of TW4-4 (Figure 24). Water level elevations at these wells are eventually expected to be influenced by cessation of water delivery to the northern wildlife ponds as discussed above. Recharge from the southern wildlife pond is expected to continue to have an effect on water levels near TW4-4, but the effects related to recharge from the northern ponds are expected to diminish over time as water is no longer delivered to the northern ponds.

The lack of a well-defined cone of depression at TW4-4 is also influenced by the persistent, relatively low water level at non-pumping well TW4-14, located east of TW4-4 and TW4-6. For the first quarter of 2014, the water level at TW4-14 (approximately 5528.8 feet ft amsl) is approximately 11 feet lower than the water level at TW4-6 (approximately 5539.7 ft amsl) and 15 feet lower than at TW4-4 (approximately 5544.1 ft amsl) even though TW4-4 is pumping.

Well TW4-27 (installed south of TW4-14 in the fourth quarter of 2011) has a static water level of approximately 5527.6 ft amsl, similar to TW4-14 (approximately 5528.8 ft amsl). TW4-27 was positioned at a location considered likely to detect any chloroform present and/or to bound the chloroform plume to the southeast and east (respectively) of TW4-4 and TW4-6. Groundwater data collected since installation indicates that TW4-27 does indeed bound the chloroform plume to the southeast and east of TW4-4 and TW4-6 (respectively), however chloroform exceeding 70 µg/L has been detected at recently installed temporary perched well TW4-29 (located south of TW4-27) since the second quarter of 2013.

Prior to the installation of TW4-27, the persistently low water level at TW4-14 was considered anomalous because it appeared to be downgradient of all three wells TW4-4, TW4-6, and TW4-26, yet chloroform was not detected at TW4-14. Chloroform had apparently migrated from TW4-4 to TW4-6 and from TW4-6 to TW4-26, which suggested that TW4-26 was actually downgradient of TW4-6, and TW4-6 was actually downgradient of TW4-4, regardless of the flow direction implied by the low water level at TW4-14. The water level at TW4-26 (5538.5

feet amsl) is, however, lower than water levels at adjacent wells TW4-6 (5539.7 feet amsl), and TW4-23 (5542.4 feet amsl).

Hydraulic tests indicate that the permeability at TW4-27 is an order of magnitude lower than at TW4-6 and three orders of magnitude lower than at TW4-4 (Table 1). The similar water levels at TW4-14 and TW4-27, and the low permeability estimate at TW4-27 suggest that both wells are completed in materials having lower permeability than nearby wells. The low permeability condition likely reduces the rate of long-term water level increase at TW4-14 and TW4-27 compared to nearby wells, yielding water levels that appear anomalously low as will be discussed in Section 3.8. This behavior is consistent with hydraulic test data collected from recently installed wells TW4-29, TW4-30, TW4-31, and new wells TW4-33 and TW4-34, which indicate that the permeability of these wells is one to two orders of magnitude higher than the permeability of TW4-27 (HGC, 2014). The low permeability at TW4-14 and TW4-27 is expected to retard the transport of chloroform to these wells (compared to nearby wells). First quarter, 2014 chloroform concentrations at TW4-26 and TW4-27 are 1.4 ug/L and non-detect, respectively and both wells are outside the chloroform plume.

Although chloroform exceeding 70 µg/L was detected at recently installed well TW4-29 (located south of TW4-27) and at new well TW4-33 (located between TW4-4 and TW4-29), chloroform was not detected at recently installed well TW4-30, located east and downgradient of TW4-29, nor at recently installed well TW4-31, located east of TW4-27, nor at new well TW4-34, located south and cross-gradient of TW4-29. The detections at TW4-29 and TW4-33 suggest that chloroform migrated southeast from the vicinity of TW4-4 to TW4-33 then TW4-29 in a direction nearly cross-gradient with respect to the direction of groundwater flow implied by the groundwater elevations. Such migration is possible because the water level at TW4-29 is lower than the water level at TW4-4 (and TW4-6). The hydraulic conductivities of TW4-29, TW4-30, and TW4-31 are one to two orders of magnitude lower than the conductivity of TW4-4, and one to two orders of magnitude higher than the conductivity of TW4-27 (Table 1). The permeability and water level distributions are generally consistent with the apparent nearly cross-gradient migration of chloroform around the low permeability zone defined by TW4-14 and TW4-27.

Data from existing, recently installed and new wells indicate that:

1. Chloroform exceeding 70 µg/L at TW4-29 is bounded by concentrations below 70 µg/L at wells TW4-26, TW4-27, TW4-30 and TW4-34. TW4-30 is downgradient of TW4-29; TW4-26 is upgradient of TW4-29; and TW4-27 and TW4-34 are cross-gradient of TW4-29.
2. Chloroform concentrations at TW4-33 that are lower than concentrations at TW4-29, and the likelihood that a pathway exists from TW4-4 to TW4-33 to TW4-29, suggests that

concentrations in the vicinity of TW4-33 were likely higher prior to initiation of TW4-4 pumping, and that lower concentrations currently detected at TW4-33 are due to its closer proximity to TW4-4.

Furthermore, TW4-4 pumping is likely to reduce chloroform at both TW4-33 and TW4-29 by cutting off the source. The decrease at TW4-33 is expected to be faster than at TW4-29 because TW4-33 is in closer proximity to TW4-4 pumping. Such behavior is expected by analogy with the decreases in chloroform concentrations that occurred at TW4-6 and TW4-26 once TW4-4 pumping began (HGC, 2014).

Chloroform exceeding 70 ug/L was detected at TW4-8 during the first quarter, 2014 sampling event. A new well (shown in Figure 1B) is therefore planned immediately to the east of TW4-8. To ensure that chloroform in the vicinity of TW4-29 is completely bounded, a new well is also planned to the south of TW4-30 (Figure 1B).

3.5.4 Beneath and Downgradient of Tailings Cells

More than 30 years of groundwater monitoring beneath and downgradient of the tailings cells indicates that the tailings cells have not impacted groundwater as discussed in Section 2. In the event that seepage from tailings cells should impact groundwater at a future date, the likely pathways to known discharge points Westwater Seep and Ruin Spring are calculated in Section 3.5.4.1. Perched zone water balances within the areas near DR-2 (abandoned) and DR-5, and flow within the vicinities of Westwater Seep and Ruin Spring are calculated in Sections 3.5.4.2 and 3.5.4.3.

3.5.4.1 Overview

Figure 25 is a water level contour map showing inferered pathlines from various locations on the west or south (downgradient) dikes of the tailings cells toward known discharge points Westwater Seep and Ruin Spring. These pathlines show the primary expected directions of perched water flow. As indicated, perched water passing beneath the west dike of cell 4B has the potential to travel to either of known discharge points Westwater Seep or to Ruin Spring because of an apparent groundwater divide in the vicinity of DR-2 (abandoned) and DR-5. Perched water north of this apparent divide is expected to flow primarily northeast to Westwater Seep and perched water south of this apparent divide is expected to flow primarily south toward Ruin Spring. The presence of this apparent divide is consistent with enhanced local recharge.

The path to Ruin Spring from the area south of the apparent divide is sub-parallel to the western rim of the mesa. The path is generally along a paleovalley between the mesa rim and the dry portion of the Brushy Basin Member paleoridge defined by MW-21 and abandoned boring DR-

18. Perched water passing beneath the south dike of Cell 4B is expected to travel south-southwest to Ruin Spring, to the east of the dry paleoridge defined by MW-21 and abandoned boring DR-18.

As discussed previously, the data suggest that flow in the southwest portion of the site is influenced by paleotopography to a greater extent than in other areas of the site due to the prevalence of small saturated thicknesses.

As discussed in Section 2.1.4, there is no evidence to hydraulically connect Cottonwood Seep to the perched water system; therefore no inferred flow pathway depicted in Figure 25 leads to Cottonwood Seep. Section 3.6.3 posits a potential pathway that may hypothetically exist between the perched zone near DR-8 and Cottonwood Seep for purposes of travel time calculations, and to allow for the possibility that an as yet unidentified pathway may exist.

3.5.4.2 Water Balance Near DR-2 and DR-5

Enhanced recharge south/southwest of Westwater Seep near DR-2 (abandoned) and DR-5 is likely needed to maintain the relatively large saturated thicknesses there, considering the slow rate of perched water flow into that area via the zone of small saturated thickness and the presence of known sinks to the northeast (Westwater Seep) and to the south (paleovalley leading to Ruin Spring).

Because the water columns in most piezometers penetrating the area of low saturated thicknesses were inadequate for hydraulic testing, only one estimate of hydraulic conductivity was obtained, at DR-10. As shown in Table 1, the KGS method hydraulic conductivity estimates at DR-10 (located within the area of low saturated thickness) were one to two orders of magnitude lower than at DR-5 and DR-9, located west of the area of low saturated thickness. Assuming the estimate at DR-10 is representative of the area of low saturated thickness, the transmissivity (the product of hydraulic conductivity and saturated thickness) of the area of low saturated thickness is two to three orders of magnitude lower than for the area of larger saturated thickness to the west (near DR-2, DR-5, and DR-9). Figures 5 and 25 show that the hydraulic gradient in this area is relatively flat, and the gradient does not change significantly across the area of low saturated thickness.

Water flows westward from the area of the tailings cells through the area of low saturated thickness between DR-6 and DR-10 (Figure 25). Using Darcy's Law, and assuming a hydraulic conductivity of 3 x 10^{-6} cm/s (0.0084 feet per day [ft/day], based on the KGS estimate provided for DR-10 in Table 1), an average hydraulic gradient of 0.0057 ft/ft, an average saturated thickness of 2.4 ft, and a width of approximately 1,600 feet (the approximate distance between

DR-6 and DR-10), the rate of perched water flow westward through the area of low saturated thickness is approximately 0.18 cubic feet per day (ft^3/day) or 0.001 gpm.

Water flows out of the area of larger saturated thickness (near DR-2 [abandoned] and DR-5) to the northeast toward known discharge point Westwater Seep and to the south through the paleovalley leading towards known discharge point Ruin Spring. The rate of flow out of this area northeast to Westwater Seep is expected to be smaller than the discharge rate at Westwater Seep which also receives water from the east and northeast. The discharge rate at Westwater Seep is too small for a reliable estimate. However, the rate of flow south through the paleovalley leading towards Ruin Spring can be calculated using the geometric average hydraulic conductivity of 0.0089 ft/day (based on KGS estimates for DR-8, DR-9, and DR-10 in Table 1), an approximate hydraulic gradient of 0.0088 ft/ft, an average saturated thickness of 12 ft, and a width of approximately 2,250 ft (between DR-8 and DR-10), as 2.1 ft^3/day, or 0.011 gpm, an order of magnitude larger than the calculated flow into the area. The difference between calculated inflow and outflow is approximately 0.01 gpm.

These calculations indicate that an additional water source is needed to maintain the relatively large saturated thicknesses west of the area of low saturated thickness between DR-6 and DR-10; otherwise Westwater Seep and the paleovalley to the south would drain the area of larger saturated thickness more quickly than water was supplied. The most likely source of additional water is infiltration of precipitation enhanced by the direct exposure of weathered Dakota Sandstone and Burro Canyon Formation, and the thinness or absence of any overlying low permeability materials such as the Mancos Shale. Assuming uniform recharge over an area of approximately 175 acres (the portion of the mesa west of Westwater Seep and north of DR-8 and DR-9), the calculated difference of 0.01 gpm implies a conservatively low recharge rate of 0.0011 inches per year (in/yr). Most of the recharge likely occurs near the mesa rim where the Dakota and Burro Canyon are exposed (Figure E.1 and Figure E.2, Appendix E). Such recharge is expected to be enhanced within drainages where they cross weathered Dakota Sandstone and Burro Canyon Formation.

Furthermore, these calculations indicate that perched water flow in the portion of the site south of Westwater Seep is inadequate as a primary supply to Cottonwood Seep. Perched water flow from the area of the tailings cells through the area of low saturated thickness towards Cottonwood Seep would have to be more than three orders of magnitude higher than calculated above to provide a supply of between 1 and 10 gpm. The required flow would have to be even larger considering that some of the incoming flow is diverted to known discharge point Westwater Seep and to the paleovalley that leads south to known discharge point Ruin Spring. Even if this calculation were performed using the geometric average of the KGS hydraulic conductivity estimates for all tested DR-series piezometers (approximately 1 x 10^{-5} cm/s or 0.028 ft/day) rather than the estimate for DR-10 (3 x 10^{-6} cm/s or 0.0084 ft/day), the calculated rate of flow through the area of low saturated thickness would be approximately 0.0032 gpm, which is still approximately three orders of magnitude lower than the estimated discharge rate of Cottonwood Seep. The inadequacy of the perched zone as the primary supply to Cottonwood Seep indicates that the primary source or sources of Cottonwood Seep lie elsewhere.

3.5.4.3 Water Balance Near Ruin Spring and Westwater Seep

Figure 26 is a map showing inferred perched water pathlines in the immediate vicinities of Ruin Spring and Westwater Seep. These pathlines were used to estimate expected flow rates to these features based on Darcy's Law using local hydraulic gradients, saturated thicknesses, and hydraulic conductivity estimates. Saturated thicknesses posted on Figure 26 were calculated as the difference between kriged first quarter, 2014 water level and top of Brushy Basin Member surfaces.

The area of the perched zone providing flow to Ruin Spring was estimated by assuming the flow is divided between Ruin Spring to the west and Corral Spring to the east. This division coincides approximately with a groundwater divide that extends southwest from the southern wildlife pond toward Ruin Spring, approximately parallel to the southeasternmost flow path depicted on Figure 21. Using the geometric average hydraulic conductivity based on estimates at DR-21, DR-23, and DR-24 (2.2 x 10^{-5} cm/s or 0.06 ft/day based on KGS analysis of automatically logged slug test data [Table 6]), which are closest to Ruin Spring, an average hydraulic gradient of 0.01 ft/ft, and an average saturated thickness of approximately 18 feet over a width of approximately 7,700 feet (along the 5420 foot elevation contour), yields a rate of perched flow of approximately 83 ft^3/day or 0.43 gpm.

The calculated value of 0.43 gpm is slightly less than the estimated average flow for Ruin Spring of 0.5 gpm. Assuming that the difference between the calculated perched water flow and the estimated flow at Ruin Spring (0.07 gpm or 13 ft^3/day) is due to local recharge over the area of Figure 26 covered by the inferred flow paths (approximately 420 acres or 18.3 x 10^6 ft^2), then the local recharge rate needed to make up the difference is approximately 7.1x 10^{-7} ft/day or 0.0031 in/yr.

Flow to Westwater Seep was estimated in a similar fashion. Hydraulic conductivities used in the calculations are summarized in Table 6. Hydraulic conductivity estimates at DR-5, DR-8, DR-9, DR-10, and DR-11 are based on automatically logged slug test data analyzed using the KGS solution method; estimates at MW-12, MW-14, and MW-15 are based on pumping test analyses reported in TITAN (1994) [Table 4]. Estimates from DR-2, DR-16, and DR-17 are not available as hydraulic tests could not be performed because these borings were abandoned after surveying and water level collection based on the criteria presented in HGC (2012b). Tests also could not be performed at DR-6 nor DR-7 due to an insufficient water column.

Using a geometric average hydraulic conductivity of 9.8 x 10^{-6} cm/s (0.027 ft/day), an average hydraulic gradient of 0.013 ft/ft, and an average saturated thickness of 4.5 feet over a width of approximately 3,300 feet, yields a rate of perched flow of approximately 5.2 ft^3/day or 0.027 gpm. If the geometric average of the hydraulic conductivities estimated at the four closest wells (MW-23, MW-24, MW-35, and DR-5) is substituted (1.8 x 10^{-5} cm/s [0.05 ft/day]), the calculated rate of perched flow is 9.6 ft^3/day or 0.05 gpm. In calculating the latter average, the highest estimate from the MW-24 test was used. Because the flow to Westwater Seep is too small to be reliably measured (as discussed in Section 3.7), either result is considered reasonable.

3.6 Perched Water Migration Rates and Travel Times

Perched water pore velocities and travel times along selected pathlines shown in Figure 27 were calculated using Darcy's Law. The calculated pore velocities and travel times are representative of the movement of a conservative solute assuming no hydrodynamic dispersion. Hydraulic conductivity estimates used for pathlines 1, 2A, and 2B are summarized in Table 7, and for pathlines 3 through 6 in Table 8. Pore velocity estimates are summarized in Table 9.

3.6.1 Nitrate Investigation Area

Perched water pore velocities and travel times were calculated along Path 1 (Figure 27) located within the nitrate plume. Path 1 is approximately 1,250 feet long. Under current conditions, a particle migrating along Path1 would be captured by nitrate pumping well TW4-24.

The average hydraulic conductivity along Path 1 is assumed to be the geometric average of the conductivities of wells located within and immediately upgradient and downgradient of the nitrate plume (wells TWN-2, TWN-3, TWN-18, TW4-21, TW4-22, TW4-24, MW-11, MW-30, and MW-31) as estimated by analyzing automatically logged slug test data using the KGS solution (Table 7). Using a geometric average conductivity of 1.31 x 10^{-4} cm/s (0.37 ft/day), a hydraulic gradient of 0.028 ft/ft, and a porosity of 0.18, the estimated average pore velocity along Path 1 is approximately 21 ft/yr. This implies that approximately 60 years would be required to traverse Path 1.

Historic hydraulic gradients within the area of the nitrate plume were likely much larger than 0.028 ft/ft during the time prior to Mill construction when the historical pond was active (Figure 1B). The depth to water at TWN-2, located within the former footprint of the historical pond

(Figure 1B), was approximately 16 feet bls prior to its conversion to a nitrate pumping well. The relatively small depth to water is interpreted to result from the relatively low perched zone permeability at TWN-2 (approximately 1.5 x 10^{-5} cm/s) and slightly elevated recharge by precipitation resulting from the relatively flat topography in that portion of the site. When the historical pond was active and ponded water was present in the vicinity of TWN-2, depths to water were likely negligible as the associated groundwater mound likely reached an elevation just beneath the pond bottom.

Historic water level maps (Appendix D) show that water levels in the vicinities of MW-30 and MW-31, located along the downgradient margin of tailings cell 2, and at the downgradient margin of the nitrate plume, were approximately 5,520 feet amsl. Assuming that the perched water level beneath the historical pond was close to the pond bottom (approximately 5,625 feet amsl), the perched water level at the downgradient edge of cell 2 was approximately 5,520 feet amsl, and the distance between the southern edge of the historical pond and the downgradient edge of cell 2 was approximately 2,200 feet, the historic hydraulic gradient is calculated as approximately 0.048 ft/ft. This estimate is more than four times the overall average site hydraulic gradient of approximately 0.011 ft/ft (calculated between TWN-19 and Ruin Spring).

Using the geometric average hydraulic conductivity of 0.36 ft/day (as discussed above), an historic hydraulic gradient of 0.048 ft/ft, and a porosity of 0.18, the estimated historic pore velocity downgradient of the historical pond is approximately 35 ft/yr, implying that nitrate originating from the historical pond could have migrated to the downgradient edge of cell 2 within 63 years. Assuming the historical pond was active circa 1920, that nitrate was conservative, and ignoring hydrodynamic dispersion, nitrate originating from the historical pond could have reached the vicinities of MW-30 and MW-31 by 1983.

3.6.2 Area of Chloroform Plume

Perched water pore velocities and travel times along Paths 2A and 2B (Figure 27), located within the chloroform plume area, were calculated. Path 2A is approximately 1,200 feet long and path 2B is approximately 1,450 feet long. Under current conditions, a particle migrating along Path 2A would be captured by chloroform pumping well MW-26, and. a particle migrating along Path 2B would be captured by chloroform pumping well MW-4. In evaluating average hydraulic conductivities along these paths, estimates assuming both confined and unconfined conditions were used. This methodology is considered appropriate for this area of the site because of the potential for semi-confined conditions to exist at least locally (HGC, 2004).

The average hydraulic conductivity along Path 2A is assumed to be the geometric average of the conductivities of nearby wells MW-26, TW4-5, TW4-9, TW4-10, and TW4-18 (Table 7). Using a geometric average conductivity of 4.88 x 10^{-4} cm/s (1.4 ft/day), a hydraulic gradient of 0.0275 ft/ft, and a porosity of 0.18, the estimated average pore velocity along Path 2A is approximately 76 ft/yr. This pore velocity implies that approximately 16 years would be required to traverse Path 2A.

The average hydraulic conductivity along Path 2B is assumed to be the geometric average of the conductivities of nearby wells MW-4A, TW4-2, TW4-5, TW4-9, and TW4-32 (Table 7) (no data are available for nearby wells TW4-3 or TW4-11.) Estimates based on the early time data for MW-4A (formerly located 10 feet south of MW-4) were used in calculating the averages because these data are considered more representative of conditions in the immediate vicinity of MW-4. Using a geometric average conductivity of 2.53 x 10^{-4} cm/s (0.71 ft/day), a hydraulic gradient of 0.026 ft/ft, and a porosity of 0.18, the estimated average pore velocity along Path 2B is approximately 38 ft/yr. This pore velocity implies that approximately 38 years would be required to traverse Path 2B.

Historic hydraulic gradients within the northern (upgradient) areas of the eastern portion of the chloroform plume (prior to about 1990) were likely larger and contributed to relatively rapid movement of chloroform from the abandoned scale house leach field (located immediately north of TW4-18) to MW-4 where chloroform was detected in 1999. The assumptions are made that water levels near the abandoned scale house leach field were affected relatively early by wildlife pond seepage (owing to the close proximity of the northern wildlife ponds) and that the water level at TW4-18, which has been relatively stable since installation in 2002, is representative of the water level at the leach field circa 1980. Based on these assumptions and the historic water level maps provided in Appendix D, the hydraulic gradient between the abandoned scale house leach field and MW-4 was approximately 0.048 ft/ft in 1990 and approximately 0.029 ft/ft in 1999, averaging 0.038 ft/ft. This is more than three times the overall average site hydraulic gradient of approximately 0.011 ft/ft (calculated between TWN-19 and Ruin Spring) and is approximately the same as the current hydraulic gradients at the leading edge of the southeastern portion of the chloroform plume.

Using a geometric average hydraulic conductivity of 1.1 ft/day (Table 3) based on estimates from wells MW-4A, TW4-5, TW4-9, TW4-10, and TW4-18 (located near a line connecting MW-4 with the abandoned scale house leach field), a hydraulic gradient of 0.038 ft/ft, and a porosity of 0.18, and ignoring hydrodynamic dispersion, the calculated average pore velocity prior to 1999 was approximately 84 ft/yr. This is sufficient for chloroform to have migrated from the abandoned scale house leach field to MW-4 between 1978 and 1999. This calculation implies that chloroform could have migrated nearly to TW4-4 by 1999.

3.6.3 Beneath and Downgradient of Tailings Cells

Estimated times for a hypothetical conservative solute originating from the tailings cells and migrating downgradient to known discharge points Westwater Seep and Ruin Spring are calculated in the following Sections. Because the hypothetical conservative solute is assumed to originate from the tailings cells, the time for the solute to migrate downward from the base of a tailings cell to the perched water must be taken into account. Vadose zone travel times are estimated in Section 3.6.3.1. Total travel times are estimated in Section 3.6.3.2.

3.6.3.1 Vadose Zone

Depths to perched water near tailings cell 2 vary from approximately 60 feet btoc near the northeast (upgradient) corner of the cell to approximately 114 feet btoc at the northwest corner of the cell. Depths to water near tailings cell 3 vary from approximately 67 feet btoc near the northeast (upgradient) corner of the cell to approximately 117 feet btoc at the southwest (downgradient) corner of the cell. Depths to water near tailings cells 4A and 4B vary from approximately 73 feet btoc near the northeast (upgradient) corner of cell 4A to approximately 114 feet btoc at the southern (downgradient) margin of cell 4B. The average depth to water near cell 2 is approximately 73 feet btoc; near cell 3 approximately 90 feet btoc; and near cells 4A and 4B approximately 94 feet btoc. Because the cells are installed a maximum of approximately 25 feet below grade, the average depth to perched water from the base of cell 2 is approximately 48 feet; beneath cell 3 approximately 65 feet; and beneath cells 4A and 4B approximately 69 feet.

Any seepage from the cell liners would have to travel downward through approximately 48 feet of vadose materials to impact perched water beneath cell 2; through approximately 65 feet to impact perched water beneath cell 3; and through approximately 69 feet to impact perched water beneath cells 4A and 4B.

Knight-Piésold (1998) estimated a maximum volumetric seepage rate for tailings cell 3 based on cell construction and liner characteristics, of approximately 80 cubic feet per day (ft/day) or 0.42 gpm over the entire cell. Most of this seepage was estimated to be via diffusion through the liner. This rate was estimated to decrease over time as the cell desaturates once the final cover is emplaced. Assuming a cell footprint of 3.38×10^{6} ft ^{2}, this maximum rate is equivalent to 2.37×10^{-5} ft/day or 0.0086 ft/yr.

The average saturation expected in vadose bedrock beneath the tailings cells is approximately 20% based on saturations measured in bedrock samples presented in Table 5 (from TITAN, 1994).

Assuming that the Knight-Piesold estimates from cell 3 are also representative of cell 2 and cells 4A and 4B, and assuming that this rate of seepage would not significantly raise the average saturation of the underlying vadose zone materials, the average rate of downward movement of a conservative solute dissolved in the seepage, assuming 1) no hydrodynamic dispersion, 2) an average water saturation of 0.20, and 3) an average porosity of 0.18, can be approximated as:

$$\frac{0.0086 ft / yr}{(.20)(.18)} = 0.24 ft / yr$$

The average times to travel from cell liners to the perched water zone would then be approximately 200 years beneath cell 2;. 270 years beneath cell 3; and 288 years beneath cells 4A and 4B. These are conservative estimates because the maximum estimated seepage rate is used, and the average vadose zone water saturations would be likely to increase, thereby reducing the downward rates of travel, and increasing the travel times.

Numerical modeling of potential tailings cell seepage and rates of downward migration of solutes are provided in MWH (2010). Based on Figure A-3 from MWH (2010), the simulated seepage rates beneath tailings cells 2 and 3 would reach a maximum of approximately 7.7 millimeters per year (mm/yr) [0.025 ft/yr] by year 25, then drop to approximately 0.7 mm/yr (0.0023 ft/yr) by year 70. The average seepage rate over the 240 year simulation period is approximately 0.0043 ft/yr, half the estimate used in the above calculations. Using this rate with the above assumptions would double the travel times estimated for seepage to reach perched water beneath cells 2, 3, and 4A and 4B. However, the MWH analyses used smaller initial water saturations for the vadose zone which correspondingly reduced travel time estimates. Based on personal communication with MWH personnel, a 200+ year vadose zone travel time estimate for cells 2 and 3 is considered reasonable.

The estimates calculated above for cell 2 (200 years), cell 3 (270 years) and cells 4A and 4B (288 years) will be used in subsequent calculations. Because cells 2 and 3 are at least 30 years old, the travel times starting from the present time will be 170 years for cell 2, and 240 years for cell 3. Cell 4B was installed in 2010 and cell 4A refurbished and put into use shortly thereafter so the effective travel time will be assumed to be 255 years for these cells. Furthermore, the estimates for cells 4A and 4B are considered even more conservative because of improvements in tailings cell design and liner quality that were incorporated in these cells but were not available during construction of cells 2 and 3.

3.6.3.2 Perched Water Zone Downgradient of Tailings Cells

Perched water pore velocities and travel times along selected paths between the tailings cells and perched water discharge points were calculated for pathlines 3 through 6 shown in Figure 27.

The Figure 27 pathlines were selected as the shortest Figure 25 paths from the tailings cells to a) Westwater Seep (Path 3), b) Ruin Spring via the west side of the Brushy Basin paleoridge (Path 5), and c) Ruin Spring via the east side of the Brushy Basin paleoridge (Path 6). A pathline from the tailings cells to the vicinity of DR-8 (Path 4) is also shown in Figure 27. From the vicinity of DR-8 perched water is expected to flow primarily south (within a paleovalley) toward Ruin Spring. However, a potential pathline from the vicinity of DR-8 is also shown in Figure 27 that posits a hypothetical connection between the perched zone and Cottonwood Seep. Path 4 provides the shortest pathline between the tailings cells and the western edge of the perched zone near DR-8, and the potential path provides the shortest hypothetical connection between the western edge of Path 4 and Cottonwood Seep.

Hydraulic conductivities used in the calculations are summarized in Table 8. Hydraulic conductivity estimates are based on automatically logged slug test data analyzed using the KGS solution method, except for MW-12, MW-14, and MW-15. Hydraulic conductivity estimates at MW-12, MW-14, and MW-15 are based on pumping test analyses reported in Table 4 (from TITAN, 1994). Hydraulic tests could not be performed at DR-2, DR-16, DR-18, nor DR-25. These borings were abandoned after surveying and water level collection based on the criteria presented in HGC (2012b). Tests also could not be performed at DR-6 nor DR-7 due to insufficient water column height. Pore velocity calculations for pathlines 3 through 6 are summarized in Table 9.

Path 3 is approximately 2,200 feet long with an average hydraulic gradient of 0.0123 feet per foot (ft/ft) based on the first quarter, 2014 water level at MW-23 (5,495 ft amsl) and the elevation of Westwater Seep (5,468 ft amsl). The geometric average hydraulic conductivity of the perched zone in the vicinity of Path 3 (based on data from DR-5, DR-8, DR-9, DR-10, DR-11, MW-12, MW-23, MW-24, and MW-36) is 9.8 x 10^{-6} cm/s (0.027 ft/day). Assuming an effective porosity of 0.18, the average perched water pore velocity along Path 3 is 0.68 feet per year (ft/yr), yielding a travel time of approximately 3,230 years. Including a vadose zone travel time of approximately 240 years for cell 3, the total travel time is approximately 3,470 years.

Path 4 is approximately 4,125 feet long with an average hydraulic gradient of 0.0046 ft/ft based on the first quarter, 2014 water level at MW-36 (5,493 ft amsl) and the water level at DR-8 (5,474 ft amsl). The geometric average hydraulic conductivity of the perched zone in the vicinity of Path 4 (based on data from DR-5, DR-8, DR-9, DR-10, DR-11, MW-12, MW-23, MW-24, and MW-36) is 9.8 x 10^{-6} cm/s (0.027 ft/day). Assuming an effective porosity of 0.18, the average perched water pore velocity along Path 4 is 0.26 feet per year (ft/yr), yielding a travel time of approximately 15,850 years. Including a vadose zone travel time of approximately 250 years for cell 4A, the total travel time is approximately 16,100 years. The additional time to travel along the hypothetical pathway to Cottonwood Seep is not calculated because of the hypothetical nature of the pathway and because the hypothetical pathway is through the Brushy Basin Member which is considered an aquiclude. If such a pathway exists, the combined travel time along Path 4 and the hypothetical pathway (which adds approximately 2,150 horizontal feet to the total path length), would be significantly greater than 16,100 years.

Path 5 is approximately 11,800 feet long with an average hydraulic gradient of 0.0096 ft/ft based on the first quarter, 2014 water level at MW-36 (5,493 ft amsl) and the elevation of Ruin Spring (5,380 ft amsl). The geometric average hydraulic conductivity of the perched zone in the vicinity of Path 5 (based on test data from DR-5, DR-8, DR-9, DR-10, DR-11, DR-14, DR-17, DR-19, DR-20, DR-21, DR-23, DR-24, MW-23, MW-24, and MW-36) is 1.1 x 10^{-5} cm/s (0.031 ft/day). Assuming an effective porosity of 0.18, the average perched water pore velocity along Path 5 is 0.60 ft/yr, yielding a travel time of approximately 19,650 years. Including a vadose zone travel time of approximately 250 years for cell 4A, the total travel time is approximately 19,900 years.

Path 6 is approximately 9,685 feet long with an average hydraulic gradient of 0.0116 ft/ft based on the first quarter, 2014 water level at MW-34 of 5,492 ft amsl and the elevation of Ruin Spring (5,380 ft amsl). The geometric average hydraulic conductivity of the perched zone in the vicinity of Path 6 (based on test data from DR-11, DR-13, DR-21, DR-23, DR-24, MW-3, MW-14, MW-15, MW-20 and MW-37) is 1.38 x 10^{-5} cm/s (0.039 ft/day). Assuming an effective porosity of 0.18, the average perched water pore velocity along Path 6 is 0.91 ft/yr, yielding a travel time of approximately 10,650 years. Including a vadose zone travel time of approximately 250 years for cell 4B, the total travel time is approximately 10,900 years.

3.7 Implications For Seeps and Springs

The lithologic and hydraulic data collected from the southwest area investigation (HGC 2012b) allow a more comprehensive assessment of the hydrogeology of the site and have implications with regard to seeps and springs southwest of the site. The data indicate that dilution of perched water by local recharge is expected to occur in the vicinities of Westwater Seep and Ruin Spring, and that perched zone permeabilities and flow rates in the southwestern portion of the site are too low (by several orders of magnitude) for the perched zone to serve as the primary source of water for Cottonwood Seep

3.7.1 Westwater Seep and Ruin Spring

As discussed in HGC (2010e) the water source for both Westwater Seep and Ruin Spring is lateral flow from upgradient portions of the perched zone enhanced by local recharge near the edge of the mesa. Most of this recharge likely occurs near the mesa rim where weathered Dakota Sandstone and Burro Canyon Formation are exposed. Such recharge is likely to be enhanced within drainages where they cross weathered Dakota Sandstone and Burro Canyon Formation. The results of the southwest area investigation (HGC, 2012b) indicate that the permeability of the perched zone in the southwest area of the site is on average lower than previously estimated (as in HGC, 2009) and that the contribution to flow at Westwater Seep and Ruin Spring by local recharge may be more significant than previously thought.

3.7.2 Cottonwood Seep

The low perched zone permeabilities and small saturated thicknesses in the southwest area of the site are consistent with low rates of perched water flow, as shown by the calculated flow through the area of small saturated thickness southwest of the tailings cells (between DR-6 and DR-10) provided in Section 3.5.4.2. This low rate of perched water flow (approximately 0.001 gpm) is inadequate (by more than three orders of magnitude) to function as the primary supply to Cottonwood Seep which has flows estimated to be between 1 and 10 gpm. As discussed in Section 3.5.4.2, the estimated flow of between 1 and 10 gpm at Cottonwood Seep is consistent with Dames and Moore (1978).

In summary, the perched zone cannot be the primary source of water to Cottonwood Seep for the following reasons:

1. Cottonwood Seep occurs in the lower third of Brushy Basin Member, approximately 230 feet below the contact between the Burro Canyon Formation and the Brushy Basin Member, more than 1,500 ft west of the termination of the perched zone, and just west of a change in morphology from slope-former to bench-former. The change in morphology is indicative of a change in lithology. As discussed in HGC (2010e) Cottonwood Seep likely originates from coarser-grained materials within the lower portion of the Brushy Basin Member. Alternatively, Cottonwood Seep may originate from coarser-grained materials of the Westwater Canyon (sandstone) Member intertongueing with the overlying Brushy Basin Member at the transition between the two Members. The presence of coarser-grained materials similar to the Salt Wash (sandstone) Member within the lower portion of the Brushy Basin member is discussed in Shawe (2005). The intertongueing of the Westwater Canyon and Brushy Basin Members is discussed in Craig *et al.* (1955) and Flesch (1974). Based on lithologic cross sections provided in TITAN (1994), the elevation of Cottonwood Seep (5,234 ft amsl) is within 5 to 15 feet of the elevation of the contact between the Brushy Basin Member and the underlying Westwater Canyon Member (5,220 to 5,230 ft amsl). This is also shown in Figure 3.

2. The flow at Cottonwood Seep exceeds the flow in the perched zone in the area southwest of the tailings cells by several orders of magnitude. Flows at Cottonwood Seep are also relatively large compared to seeps and springs known to originate from the perched zone, consistent with a primary source other than perched water.
3. There is no evidence to establish a direct hydraulic connection between the perched zone and Cottonwood Seep, located more than 1,500 ft west of the termination of the Burro Canyon Formation which hosts the perched water zone. Examination of the area between Cottonwood Seep and mesa rim (the edge of the perched zone) reveals that the upper portion of the Brushy Basin Member appears dry and no previously undiscovered seeps originating from the Burro Canyon Formation near Cottonwood Seep were identified.

Because the results of the southwest area investigation do not provide evidence that Cottonwood Seep is hydraulically connected to the perched water system at the site, and because the perched zone near Cottonwood Seep is inadequate as a primary supply, the primary source (or sources) of water to Cottonwood Seep must lie elsewhere. The primary source(s) must be significant to supply consistent flows at rates between 1 and 10 gpm. By contrast, flows at Ruin Spring (estimated at approximately $^1/_2$ gpm, consistent with Dames and Moore, 1978) are lower than at Cottonwood Seep (between 1 and 10 gpm), and flows at Westwater Seep are too small to measure reliably. Westwater Seep generally consists of damp soil that can be sampled only by excavating and waiting for enough water to seep in for sample collection (see Figures 28 and 29 taken from HGC, 2010e).

Although no evidence of a direct hydraulic connection between the perched zone and Cottonwood Seep was provided by the southwest area investigation, the possibility of a hypothetical, as yet unknown, connection was postulated for the purpose of calculating a travel time from the tailings cells to the western edge of the perched zone (near DR-8), and thence along a potential pathway to Cottonwood Seep. The total travel time from the tailings cells to DR-8 was calculated as approximately 16,100 years. Should a potential pathline such as that shown in Figure 27 exist, the total time needed to travel from the tailings cells to Cottonwood Seep would be significantly larger than 16,100 years.

3.7.3 Potential Dilution of Perched Water Resulting From Local Recharge of the Dakota and Burro Canyon Near Seeps and Springs

As discussed in Section 3.5.4.2, the rate of flow in the perched water zone in the southwest area of the site is small and a contribution from local recharge is needed to explain many areas of relatively high saturated thickness near sinks such as Westwater Seep and Ruin Spring that are downgradient of areas of relatively low saturated thickness. The presence of local recharge is expected to affect the water quality of seeps and springs and has the potential to dilute any dissolved constituents that may migrate from upgradient areas.

3.8 Implications For Transport of Chloroform and Nitrate

Chloroform and nitrate plumes are under remediation by pumping. Pumping systems are designed to remove chloroform and nitrate mass from the perched zone as quickly as is practical to allow natural attenuation in the far downgradient portions of the plumes to be more effective. Furthermore, nitrate pumping is designed to capture approximately the northern $^2/_3$ of the nitrate plume. Pumping at the downgradient margin of the chloroform plume is impractical primarily due to low permeability and low productivity conditions. Pumping at the downgradient margin of the nitrate plume is also impractical primarily because of the potential to draw chloroform downgradient.

In the absence of remedial pumping, the western portion of the nitrate plume would eventually migrate towards Westwater Seep and the eastern portion toward Ruin Spring (Figure 30). In the absence of remedial pumping, the western portion of the chloroform plume would eventually migrate towards Ruin Spring and the eastern portion toward the perched groundwater low centered on TW4-31 (near the southeastern tip of the plume [Figure 30]). Should the low at TW4-31 eventually disappear, chloroform within the eastern portion of the plume would be expected to migrate towards Corral Springs. As indicated by calculations in Section 3.6, thousands of years would be required for either constituent to reach a discharge point. That is sufficient time for either constituent to degrade naturally prior to reaching a discharge point as will be discussed in Section 4.4.

The groundwater low at TW4-31 (located immediately east of TW4-27) is interpreted to result from partial hydraulic isolation from upgradient and cross-gradient areas that were more strongly affected by wildlife pond seepage. Wildlife pond seepage resulted in increases in water levels at wells in the vicinity of TW4-27 as shown in Figure 31. Water levels in wells TW4-6, TW4-26, and TW4-13 rose relatively rapidly compared with water levels at TW4-14. The permeabilities of TW4-6 and TW4-26 are similar (Table 1) and both exhibit similar water level behavior. The permeability at TW4-27 is low (Table 1) and the similarity in water level behavior at TW4-14 and TW4-27 indicates that TW4-14 is also installed in low permeability materials. These low permeability materials are the likely cause of the partial hydraulic isolation of TW4-31. Because the groundwater low at TW4-31 is interpreted to result from variable permeability and from transient hydraulic conditions brought on by wildlife pond seepage, water levels in this area are expected to ‘catch up’ eventually with water levels in less hydraulically isolated areas. One result of these conditions is the development of relatively steep hydraulic gradients at the leading edge of the chloroform plume in this area.

Water balance calculations near Westwater Seep and Ruin Spring (Section 3.5.4.3) indicate that local recharge is needed to maintain areas having relatively large saturated thicknesses that supply water to known discharge points Westwater Seep and Ruin Spring but that are isolated from other portions of the perched zone by areas of relatively low saturated thickness. The presence of local recharge near these discharge points at least in part explains increased flow at these features after precipitation events (HGC, 2010e). In the unlikely event that nitrate or chloroform not removed by pumping did not degrade within the thousands of years needed to reach a discharge point, local recharge would act to reduce concentrations prior to discharge.

4. COMPOSITION OF DAKOTA SANDSTONE AND BURRO CANYON FORMATION

As discussed in HGC (2012c), samples of selected archived drill core and drill cuttings were analyzed visually and quantitatively by an analytical laboratory. Table 10 summarizes the mineralogy of samples submitted to the contract laboratory for quantitative analysis. Table 11 summarizes the occurrence of pyrite, iron oxides, and carbonaceous material in site drilling logs having sufficient detail. Table 12 summarizes the results of laboratory visual (microscopic) analyses for sulfides. Table 13 and Figure 32 summarize the occurrence of pyrite in site borings based on both lithologic logs and laboratory analyses.

4.1 Mineralogy

As discussed in Section 3.1.2, the Dakota Sandstone is a relatively hard to hard, generally fine-to-medium grained sandstone cemented by kaolinite clays. The underlying Burro Canyon Formation is similar to the Dakota Sandstone but is generally more poorly sorted, contains more conglomeratic materials, and becomes argillaceous near its contact with the underlying Brushy Basin Member of the Morrison Formation.

Based on quantitative analysis of samples for major and minor mineralogy (Table 10), the primary mineral occurring in the Burro Canyon Formation is quartz (greater than or equal to 80% in all analyzed samples except SS-26 which consisted of ‘play sand’). Other detected minerals (not necessarily present in all the samples) include potassium feldspar, plagioclase, mica, kaolinite, calcite, dolomite, anhydrite, gypsum, pyrite, hematite, and magnetite. Because of their relatively high reactivity, pyrite, calcite and dolomite are expected to have the most potential to impact perched water chemistry. The presence of carbonaceous matter (Table 11) is also expected to impact perched water chemistry.

4.2 Pyrite Occurrence

As discussed in Section 3.1.4 pyrite occurs within the Dakota Sandstone and Burro Canyon Formations which host the perched water at the site. Table 11 summarizes the occurrence of pyrite, iron oxides, and carbonaceous material in site boring logs. Pyrite has been noted in approximately $^{2}/_{3}$ of site borings having detailed lithologic logs. These borings are located upgradient, cross-gradient and downgradient of the millsite and tailings cells. In addition, carbonaceous material has been noted at many locations which is consistent with at least locally reducing conditions and the existence of pyrite (Table 11).

As discussed in HGC (2012c), samples of selected archived drill core and drill cuttings were analyzed visually and quantitatively by a contract analytical laboratory. Table 13 and Figure 32 summarize the occurrence of pyrite in site borings based on lithologic logs and laboratory analyses.

The results of the visual and quantitative analysis verify the site-wide, apparently ubiquitous existence of pyrite in the perched zone at the site. The existence of pyrite is confirmed at locations upgradient, cross-gradient, and downgradient of the millsite and tailings cells. The results are consistent with Shawe's (1976) description of the Dakota Sandstone and Burro Canyon Formations as "altered-facies" rocks within which pyrite formed as a result of invasion by pore waters originating from compaction of the overlying Mancos Shale.

Pyrite and/or marcasite were detected in all samples submitted for visual (microscopic) analysis (Table 12) having pyrite noted in their respective lithologic logs. Pyrite occurs primarily as individual grains and as a cementing material, and more rarely as inclusions in quartz grains. Pyrite and/or marcasite were detected at volume percents ranging from approximately 0.05 to 25. Grain sizes ranged from approximately one micrometer to nearly 2,000 micrometers. Small grain sizes suggest that much of the pyrite present in the formation may not be detectable during lithologic logging of boreholes and that the actual abundance of pyrite is larger than indicated by the lithologic logs. The detection of marcasite (orthorhombic crystalline FeS_2), which is more reactive than pyrite (cubic crystalline FeS_2), is an important result of the investigation because its reaction rate with either oxygen or nitrate will likely be higher. The laboratory visual (microscopic) analysis confirms the visual observations made during initial well logging.

Pyrite was detected by quantitative x-ray diffraction (XRD) analysis in samples from MW-3A, MW-24, MW-26, MW-27, MW-28, and MW-32 at concentrations ranging from 0.1% to 0.8% by weight (Table 10). Based on the iron content via XRD analysis and the total sulfur analysis, pyrite may also be present in samples from MW-23, MW-25, and MW-29 at concentrations ranging from 0.1% to 0.3%. The presence of pyrite is not indicated in MW-30 or MW-31 by either method of analysis, although it was noted in the lithologic logs. This suggests that the samples submitted for analysis from these borings may not have been representative, or that pyrite degraded over time during storage. Except for MW-30 and MW-31, the quantitative analysis confirms the visual observations made during initial well logging.

Although pyrite was not directly detected by XRD in samples from MW-23, MW-25, or MW-29, the detected iron and sulfur in these samples is consistent with the presence of pyrite. While at least a portion of the detected sulfur may result from the gypsum or anhydrite detected in some of these samples (Table 10), iron not in the form of pyrite would be expected to exist primarily in the form of iron oxides or perhaps iron carbonates. The absence of detected iron oxides or carbonates in samples from these borings suggests iron in the form of pyrite.

Furthermore, pyrite was either directly detected or possibly detected based on the presence of iron and sulfur in samples from MW-3A, MW-23, MW-24, MW-28, and MW-29, which did not have pyrite noted in the associated lithologic logs. These results are consistent with the small grain sizes noted via the laboratory visual (microscopic) analysis indicating the absence of pyrite in a lithologic log does not necessarily mean pyrite is not present in the associated boring, and that pyrite occurrence at the site has likely been underestimated based on the lithologic logs.

4.3 Expected Influence of Transient Conditions, Oxygen Introduction, and the Mancos and Brushy Basin Shales on Dakota/Burro Canyon Chemistry

Current conditions within the perched groundwater system hosted by the Burro Canyon Formation and Dakota Sandstone do not approach steady state over much of the monitored area. A large part of the site perched water system is transient and affected by long-term changes in water levels due to past and current activities unrelated to the disposal of materials to the site tailings cells. Changes in water levels have historically been related to seepage from the wildlife ponds; however past impacts related to the historical pond, and to a lesser extent the sanitary leach fields, are also expected. Water levels have decreased at some locations due to chloroform and nitrate pumping and cessation of water delivery to the northern wildlife ponds.

The transient nature of a large portion of the perched water system, manifested in long-term changes in saturated thicknesses and rates of groundwater flow, is expected to result in trends in pH and concentrations of many dissolved constituents that are unrelated to site operations. Changes in saturated thicknesses and rates of groundwater flow can result in changes in concentrations of dissolved constituents (or pH) for many reasons. For example, as discussed in HGC (2012c), groundwater rising into a vadose zone having a different chemistry than the saturated zone can result in changes in pH and groundwater constituent concentrations. If the rise in groundwater represents a long-term trend, long-term changes in groundwater constituent concentrations (or pH) may result.

Under conditions where vadose zone chemistry is not markedly different from saturated zone chemistry, changing groundwater flow rates may result in changing constituent concentrations due to changes in dilution. For example, relatively constant flux of a particular solute into the groundwater zone that results in a relatively constant groundwater concentration under conditions of steady groundwater flow, will likely result in changing concentrations should groundwater flow become unsteady. If the change in flow rate is in one direction over a long period of time, a long-term trend in the solute concentration is expected to result. Examples include oxygen dissolved in recharge or a constituent present in vadose zone materials overlying perched groundwater that dissolves in recharge and leaches into perched water at a steady rate. An increase in perched flow may cause an increase in dilution and a reduction in constituent concentration and vice-versa. For example, a decrease in dilution related to cessation of water delivery to the northern wildlife ponds is expected to result in increases in dissolved constituent concentrations within chloroform and nitrate plumes as discussed in Section 3.4.1.2.

Furthermore, the mere presence of the tailings cells as barriers to natural recharge and exchange of gas with the atmosphere may result in changes in perched water chemistry. Any such changes are likely to be relatively slow and in one direction, potentially yielding long term trends in parameter values.

The perched groundwater chemistry at the Mill is also expected to be impacted by the following factors:

1. The relatively low permeability of the perched zone. This condition increases groundwater residence times and the time available for groundwater to react with the formation.
2. The location of the perched system between two shales, the underlying Brushy Basin Member of the Morrison Formation and the overlying Mancos Shale. Both are potential sources of numerous dissolved constituents. Potential interaction between the Brushy Basin Member and perched water are discussed in TITAN (1994).
3. The rate of interaction between the shales and the perched water. Interaction with the Mancos Shale at any particular location will depend on the presence, thickness, and composition of the Mancos, the rate of recharge through the Mancos into the perched zone, and the saturated thickness and rate of groundwater flow in the perched zone. Interaction with the Brushy Basin Member at any particular location will depend on the composition of the Brushy Basin, and the saturated thickness and rate of flow in the perched zone. Oxygen introduced into site monitoring wells may also react with the Brushy Basin and affect overlying perched water chemistry.
4. The rate of oxygen introduction into the perched zone via recharge or via site groundwater monitoring wells. Introduced oxygen is available to oxidize constituents such as pyrite, which impacts the local groundwater chemistry near each recharge source and near each well by releasing acid and sulfate. The resulting increased acidity can also destabilize various mineral phases in the aquifer matrix. The degree of impact on groundwater chemistry will depend on the amount of pyrite, the rate of oxygen transfer, the neutralization capacity and saturated thickness of the perched zone, and the rate of groundwater flow.
5. Elements other than iron and sulfur as contaminants in pyrite. Pyrite reacting with oxygen introduced into the formation will release these elements, potentially altering both the

> vadose zone and the groundwater chemistry. The potential for pyrite to have significant contaminants (such as selenium) is enhanced by its origin from fluids expelled from the Mancos Shale.

Changes in perched zone constituent concentrations and pH are therefore expected to result from the introduction of oxygen into the subsurface, the oxidation of pyrite and other constituents, changes in recharge rates, and past and current recharge passing through the Mancos Shale.

For example, the Mancos Shale is a significant source of selenium (Baker, 2007; Colorado Department of Health and Environment, 2011; Tuttle, 2005). Because the Mancos overlies the perched zone over much of the site (Figure 11) it could represent a past and ongoing source of selenium. Selenium originating from the Mancos Shale could potentially increase concentrations in the perched zone by three mechanisms: 1) Ongoing leaching from the Mancos Shale via recharge; 2) oxidation of Mancos-derived selenium in the Burro Canyon Formation and Dakota Sandstone by dissolved nitrate in the perched water and/or oxygen introduced into the perched zone via perched well casings; and 3) oxidation of pyrite containing Mancos-derived selenium by dissolved perched zone nitrate and /or oxygen introduced into the perched zone via perched well casings. Selenium already present in the Dakota Sandstone and Burro Canyon Formation (including as a constituent in pyrite) could have originated from the Mancos in the past, and could affect the entire formation rather than just the areas beneath the current erosional remnants of the Mancos.

Precipitation percolating downward from the land surface is expected to leach selenium from the Mancos Shale and carry it downward into the perched zone. Beneath the tailings cells, any such leaching is expected to have occurred for the most part prior to the installation of the cells which represent a barrier to infiltration of precipitation. Vadose pore waters in the Dakota Sandstone and Burro Canyon Formation beneath the cells may thus be expected to contain selenium leached from the Mancos in the past. Perched water rising into vadose pore waters containing selenium may enhance mass transfer and result in increased selenium concentrations in the perched water.

Potentially increasing selenium concentrations may also result from the oxidation of selenium already present in the Dakota Sandstone and Burro Canyon Formation. Oxidation of selenium by nitrate present in perched water and/or by oxygen introduced into the formation via the well casings may result in increasing dissolved selenium concentrations. The possibility of nitrate oxidation of selenium is presented in Potoroff (2005).

A third potential source for increasing dissolved selenium concentrations in perched water is oxidation of pyrite by nitrate and/or oxygen introduced into the formation via well casings. Pyrite typically contains trace elements including selenium. Selenium has been measured at concentrations as high as 0.2% by weight in pyrite (Deditius, 2011). As discussed in HGC

(2012c), pyrite oxidation is expected to result in other changes that include an increase in dissolved sulfate (unless a sink for sulfate is present). Oxidation of pyrite by dissolved oxygen is expected to result in a decrease in pH as acid is released in the reaction:

$$FeS_2 + 3^3/_4O_2 + 3^1/_2H_2O = Fe(OH)_3 + 2SO_4^{2-} + 4H^+$$

Oxidation of pyrite by nitrate may also occur as discussed in HGC (2012c). This process may result in either an increase or decrease in pH depending on the reaction pathway:

$$5\ FeS_2 + 14NO_3^- + 4H^+ = 7N_2 + 10SO_4^{2-} + 5Fe^{2+} + 2H_2O;\ \text{or}$$

$$2\ FeS_2 + 6NO_3^- + 2H_2O = 3N_2 + 4SO_4^{2-} + 2FeOOH + 2H^+$$

The interaction between nitrate and pyrite will be discussed in more detail in the following Section.

4.4 Implications For Perched Water Chemistry and Natural Attenuation of Nitrate and Chloroform

As discussed above, past, current, and future interaction of the perched water zone with the overlying Mancos Shale and underlying Brushy Basin Member can be expected to affect perched water chemistry at the site. Changes in perched water chemistry related to oxidation of pyrite by oxygen introduced into the subsurface dissolved in recharge and via well casings is also expected to occur.

Concentrations of chloroform and nitrate already present in the perched zone will be affected over time by various processes, including direct mass removal by pumping. Natural attenuation of both constituents is expected to result from physical processes that include dilution by recharge and hydrodynamic dispersion. Volatilization into the vadose zone is another physical process that is expected to lower chloroform concentrations in perched water. Mass reduction processes expected to lower both nitrate and chloroform concentrations include chemical and biologically-mediated processes. The impacts of pyrite degradation by oxygen, degradation of nitrate by pyrite, and reductive dechlorination of chloroform are discussed in Sections 4.4.1 through 4.4.3.

4.4.1 Pyrite Degradation by Oxygen

As discussed in HGC (2012c), the pH values measured in many site groundwater monitoring wells located upgradient, within the vicinity of, and downgradient of the millsite and tailings cells displayed decreasing trends. pH decreases in many of these wells were accompanied by increases in sulfate concentrations. Ten of the MW-series groundwater monitoring wells were out of compliance (OOC) with respect to pH due to a decreasing trend.

As discussed in INTERA (2012a and 2102b) and Section 5 below, changes in pH were determined to result from natural causes unrelated to the operation of the tailings cells. Based on work described in HGC (2012c), the decreases in pH and increases in sulfate in OOC wells were explainable by oxidation of pyrite, which releases acid and sulfate as described above. Screening-level calculations and geochemical modeling using PHREEQC (Parkhurst and Appelo, 1999) indicated that pyrite measured in samples from the perched zone existed in more than sufficient quantity to have resulted in the measured changes in pH and sulfate at three representative wells located immediately upgradient (MW-27), immediately downgradient (MW-24), and far downgradient (MW-3A) of the tailings cells. The calculations also indicated that pyrite existed in sufficient quantity to maintain these trends provided sufficient oxygen was available. Continued release of any contaminants within site pyrite is expected as is release of pH sensitive constituents present in the Burro Canyon Formation and Dakota Sandstone.

4.4.2 Nitrate Degradation by Pyrite

As discussed in HGC (2012c), nitrate will degrade in the presence of pyrite. Nitrate will also degrade, and more readily, in the presence of organic matter. Both pyrite and organic material in the form of carbonaceous matter have been logged in drill cuttings from the perched zone.

As discussed in (Korom, 1992), the thermodynamically favored electron donor for reduction of nitrate in groundwater is typically organic matter. This process under neutral conditions is represented via the following generalized reaction (e.g. van Beek, 1999; Rivett *et al.*, 2008; Tesoriero and Puckett, 2011; Zhang, 2012):

$$5CH_2O + 4NO_3^- = 2N_2 + 4HCO_3^- + H_2CO_3 + 2H_2O \text{ (Reaction 1);}$$

In acidic (pH<6.4) aquifer conditions, reduction of nitrate by organic matter can be generalized by the following pathway:

$$5CH_2O + 4NO_3^- + 4H^+ = 2N_2 + 5H_2CO_3 + 2H_2O \text{ (Reaction 2).}$$

In both cases, five moles of organic matter are required to reduce four moles of nitrate. Under acidic conditions the alkalinity generated by denitrification by organic matter consumes acid.

In the absence of dissolved oxygen, pyrite can also be oxidized by nitrate. Denitrification by pyrite may occur via two primary reaction pathways. The pathway most commonly applied in geochemical studies (Kolle *et al.*, 1983, 1985; Postma *et al.*, 1991; Korom, 1992; Robertson *et al.*, 1996; Pauwels *et al.*, 1998; Hartog *et al.*, 2001, 2004; Spiteri *et al.*, 2008) is a bacteria-mediated reaction that yields ferrous iron, sulfate, water, and nitrogen gas as follows:

$$5FeS_2 + 14NO_3^- + 4H^+ = 7N_2 + 10SO_4^{2-} + 5Fe^{2+} + 2H_2O \text{ (Reaction 3).}$$

By Reaction 3, five moles of pyrite reduce 14 moles of nitrate, consuming four moles of acid. Reaction 3 is considered applicable when pyrite concentrations exceed nitrate concentrations (van Beek,1999). Where nitrate concentrations exceed pyrite concentrations, Reaction 4 is a more likely mechanism (Kolle *et al.*, 1987; van Beek, 1999; Schlippers and Jorgensen, 2002):

$$2FeS_2 + 6NO_3^- + 4H_2O = 3N_2 + 4SO_4^{2-} + 2Fe(OH)_3 + 2H^+ \text{(Reaction 4).}$$

By Reaction 4, two moles of pyrite reduce six moles of nitrate, yielding iron hydroxide, sulfate, acid, and nitrogen gas. Therefore, when nitrate concentrations exceed pyrite concentrations (Reaction 4), denitrification by pyrite is more efficient than when pyrite is in excess (Reaction 3). Additionally, Reaction 4 produces acid, while Reaction 3 consumes acid, indicating that the impact of denitrification by pyrite on aquifer geochemistry is controlled by the relative abundance of pyrite and nitrate.

Reaction 4 is an overall reaction that combines Reaction 3 and a second step whereby ferrous iron is oxidized by nitrate. This second step is more likely to occur when excess nitrate is present and available to oxidize ferrous iron (Kolle *et al.*, 1987; Rivett *et al.*, 2008; Zhang 2012).

Stoichiometric calculations were used to determine the weight percent of perched zone pyrite that would be required to reduce 43,700 lbs of nitrate via reaction mechanisms 3 and 4 (assuming each was the only denitrification reaction occurring). 43,700 lbs of nitrate is the baseline nitrate mass calculated as specified in the nitrate CAP (HGC, 2012a). 43,700 lbs of nitrate corresponds to 19,822 kg and 319,684 moles. Although noted in lithologic logs the organic matter content of the perched zone has not been quantified so calculations regarding nitrate degradation by reactions 1 and 2 are not presented, even though significant nitrate reduction via these mechanisms is likely to occur.

Nitrate can either migrate towards Ruin Spring to the south-southwest or to Westwater Seep to the west. Assuming the entire nitrate plume migrated south towards Ruin Spring, the volume of the perched zone through which the nitrate plume would migrate was assumed to be on average 20 feet thick, 1,200 feet wide, and 10,000 feet long, representing a total saturated formation volume of 2.4 x 10^8 ft^3 or 6.8 x 10^9 liters. Assuming the entire nitrate plume migrated west toward Westwater Seep, the volume of the perched zone through which the nitrate plume would migrate was assumed to be on average 18 feet thick, 2,800 feet wide, and 4,950 feet long, representing a total saturated formation volume of 2.5 x 10^8 ft^3 or 7 x 10^9 liters. To be conservative, the following calculations are based on the smaller volume of 6.8 x 10^9 liters.

Using these estimates, reaction 3 would require 114,173 moles of pyrite to consume 43,700 lbs of nitrate, and would consume 91,338 moles of acid (1.34 x 10^{-5} moles H^+ per liter of formation). Reaction 4 would require 106,561 moles of pyrite to degrade the nitrate, producing 106,561 moles of acid or 1.57 x 10^{-5} moles H^+ per liter of formation.

Assuming a conservatively large porosity of 0.2 for the perched zone (HGC, 2012c), the total volume of water is 1.36 x 10^9 liters; and assuming a solids density of 2.6 kg L^{-1}, yields a total solid mass of 1.4 x 10^{10} kg.

Using this solid mass, both Reactions 3 and 4 would require pyrite formation weight percents of 0.000098% (9.8 x 10^{-5} %) and 0.000091% (9.1 x 10^{-5} %), respectively, to degrade 43,700 lbs of nitrate.

These calculated pyrite weight percents are orders of magnitude less than conservative estimates of pyrite content based on samples analyzed during the pyrite investigation (HGC, 2012c), which ranged from 0.0056% to 0.08% (5.6 x 10^{-3} % to 8 x 10^{-2} %). These results suggest that the available pyrite content in the path of the nitrate plume is two to three orders of magnitude greater than needed to degrade the total mass (43,700 lbs) of nitrate. These calculations are conservative in that they assume the degradation of the entire mass of nitrate and not just the mass needed to reduce concentrations below 10 mg/L. Whether or not pyrite oxidation by nitrate at the site is generating or consuming acid depends largely on whether oxidation of ferrous iron by nitrate is occurring (i.e. whether pyrite denitrification is occurring by Reaction 3 or Reaction 4; whether nitrate exists in excess).

The preferred mechanism for denitrification by pyrite is likely to vary spatially. If pyrite is assumed to be relatively evenly distributed throughout the formation, while nitrate occurs in a discrete plume, Reaction 3 may dominate on the plume edges while Reaction 4 may dominate the core of the plume.

4.4.3 Chloroform Reduction

As discussed in HGC (2007), the presence of chloroform daughter products indicates that chloroform is degrading naturally via reductive dechlorination. Calculations presented in HGC (2007) based on daughter product concentrations indicated that the entire chloroform plume would be reduced to concentrations below 70 ug/L within approximately 190 years. Reductive dechlorination takes place under anaerobic conditions which were inferred to exist only locally within the perched zone. The low rates of degradation and the persistence of nitrate associated with the chloroform plume are consistent with primarily aerobic conditions.

However, the presence of widespread pyrite in the perched zone is consistent with at least locally anaerobic conditions, and with the low calculated rates of chloroform degradation presented in HGC (2007). Continued reductive dechlorination is expected within locally anaerobic portions of the perched zone.

5. SUMMARY OF INTERA WORK AND FINDINGS

Background groundwater quality evaluations have been performed for each MW-series groundwater monitoring well. Groundwater compliance limits (GWCLs) have been established for each permit constituent on an intra-well basis.

A Revised Background Groundwater Quality Report (INTERA, 2007a) evaluated groundwater analytical data collected since the initiation of groundwater sampling. The revisions included a Flow Sheet that was approved by the DRC and contained steps for analyzing data and setting GWCLs. INTERA (2007a) identified naturally occurring elevated, increasing, and decreasing concentrations of various constituents in monitoring wells located far upgradient, far downgradient, and in the vicinity of the Mill Site. This report also presented a thorough discussion and identification of the most appropriate indicator parameters (chloride, fluoride, sulfate, and uranium) based on constituents in tailings solutions and their behavior in groundwater. Analysis of the indicator parameters in monitoring wells, including monitoring wells that contained increasing trends in other constituents, provided no evidence of tailings cell seepage. Since INTERA (2007a), three additional Background Reports (INTERA 2007b, 2008, and 2014c) evaluate available data and determine GWCLs for each permit constituent in each well based on the DRC-approved Flow Sheet.

Upon approval of the GWDP in 2010, constituents with two consecutive GWCL exceedances are subject to a Source Assessment Report (SAR) as defined in the GWDP. The initial SAR was submitted in October of 2012 (INTERA 2012a) and covered all of the constituents in wells with consecutive exceedances since the approval of the GWDP in 2010. The October 2012 SAR (INTERA 2012a) presented a geochemical analysis of parameters that exhibited exceedances as well as an analysis of the indicator parameters in each of those wells to determine if the exceedance could be related to potential tailings seepage or Mill-related activities. Since then, four additional SARs, (INTERA 2013a, 2013b, 2014a, qne 2014b) cover additional consecutive exceedances. In all cases the exceedances for which the SARs were performed were determined to result from naturally occurring conditions in the groundwater at the site or from other factors that are affecting groundwater but are unrelated to tailings cell operation. These other factors include the chloride and nitrate plume that is addressed by the nitrate CAP and a sitewide decline in pH that was identified at the time of the Background Report.

At the time of the Background Report, an overall decline in pH across the site was observed. Background analysis and determination of GWCLs for pH were performed using laboratory pH measurements rather than using measurements that are collected in the field at the time of sampling by using a pH probe. Since the latter of these two methods of measuring pH is more reliable, an additional pH analysis was performed in 2012 using only field data. GWCLs for pH were recalculated at this time using the field measurements. As discussed in Section 4.4.1, HGC (2012c) determined that pH decreases resulted from pyrite oxidation enhanced by oxygen delivery to the perched zone. Oxygen delivery mechanisms included advective transport to the perched zone dissolved in wildlife pond seepage, and diffusive transport to perched water in the vicinities of perched wells via perched well casings. pH decreases were therefore determined to be unrelated to tailings cell operation.

6. SUMMARY AND CONCLUSIONS

The Mill is is situated on White Mesa and is located within the Blanding Basin physiographic province. The Mill has an average elevation of approximately 5,600 feet above mean sea level (ft amsl) and is underlain by unconsolidated alluvium and indurated sedimentary rocks.

Indurated rocks include those exposed within the Blanding Basin, and consist primarily of sandstone and shale. The indurated rocks are relatively flat lying with dips generally less than 3º. The alluvial materials overlying the indurated rocks consist primarily of aeolian silts and fine-grained aeolian sands with a thickness varying from a few feet to as much as 25 to 30 feet across the site. The alluvium is underlain by the Dakota Sandstone and Burro Canyon Formation, and where present, the Mancos Shale. The Dakota Sandstone and Burro Canyon Formation are sandstones having a total thickness ranging from approximately 55 to 140 feet. Beneath the Burro Canyon Formation lies the Morrison Formation, consisting, in descending order, of the Brushy Basin Member, the Westwater Canyon Member, the Recapture Member, and the Salt Wash Member. The Brushy Basin and Recapture Members of the Morrison Formation, classified as shales, are very fine-grained and have a very low permeability. The Brushy Basin Member is primarily composed of bentonitic mudstones, siltstones, and claystones. The Westwater Canyon and Salt Wash Members also have a low average vertical permeability due to the presence of interbedded shales.

Beneath the Morrison Formation lie the Summerville Formation, an argillaceous sandstone with interbedded shales, and the Entrada Sandstone. Beneath the Entrada lies the Navajo Sandstone. The Navajo and Entrada Sandstones constitute the primary aquifer in the area of the site. The Entrada and Navajo Sandstones are separated from the Burro Canyon Formation (and the perched water system monitored at the site) by approximately 1,000 to 1,100 feet of materials having a low average vertical permeability. Groundwater within this system is under artesian pressure in the vicinity of the site, is of generally good quality, and is used as a secondary source of water at the site. Stratigraphic relationships beneath the site are summarized in Figure 3.

The site and vicinity has a dry to arid continental climate, with an average annual precipitation of approximately 13.3 inches, and an average annual lake evaporation rate of approximately 47.6 inches. Recharge to major aquifers (such as the Entrada/Navajo) occurs primarily along the mountain fronts (for example, the Henry, Abajo, and La Sal Mountains), and along the flanks of folds such as Comb Ridge Monocline.

Perched groundwater occurs in the Dakota Sandstone and Burro Canyon Formation beneath the site and is used on a limited basis to the north (upgradient) of the site because it is more easily accessible than the Navajo/Entrada aquifer. Perched groundwater originates mainly from precipitation and local recharge sources such as unlined reservoirs (Kirby, 2008) and is supported within the Burro Canyon Formation by the underlying, fine-grained Brushy Basin Member, considered an aquiclude.

Water quality of the Dakota Sandstone and Burro Canyon Formation is generally poor due to high total dissolved solids (TDS) in the range of approximately 1,100 to 7,900 milligrams per liter (mg/L) and is used primarily for stock watering and irrigation. Nitrate and chloroform plumes occur in site perched water as shown in Figure 1B. The nitrate plume extends from upgradient (north-northeast) of the tailings cells to beneath the cells. The chloroform plume is located primarily upgradient to cross-gradient of the cells. Sources of the nitrate plume are not well-defined but a historical pond shown on Figure 1B is considered a source of nitrate and chloride to the plume. The only potentially active source of nitrate to the plume is related to ammonium sulfate crystal handling near the ammonium sulfate crystal tanks located southeast of TWN-2 (Figure 1B) and is being addresses through implementation of Phase I of the nitrate CAP. Past sources of the chloroform plume are two abandoned sanitary leach fields (located near TW4-18 and TW4-19) that received laboratory wastes prior to tailings cells becoming operational circa 1980. Both plumes are under remediation by pumping.

The saturated thickness of the perched water zone generally increases to the north of the site, increasing the yield of the perched zone to wells installed north of the site. The generally low permeability of the perched zones limits well yields. Although sustainable yields of as much as 4 gallons per minute (gpm) have been achieved in site wells penetrating higher transmissivity zones near wildlife ponds, yields are typically low ($<^1/_2$ gpm) due to the generally low permeability of the perched zone. Many of the perched monitoring wells purge dry and take several hours to more than a day to recover sufficiently for groundwater samples to be collected. During redevelopment (HGC, 2011b) many of the wells went dry during surging and bailing and required several sessions on subsequent days to remove the proper volumes of water.

As shown in Figure 5 and Appendix D, perched water flow across the site is generally (and historically) from northeast to southwest. Beneath and south of the tailings cells, in the west central portion of the site, perched water flow is south-southwest to southwest. Flow on the western margin of White Mesa is also south, approximately parallel to the rim (where the Burro Canyon Formation is terminated by erosion). On the eastern side of the site perched water flow is also generally southerly. Hydraulic gradients at the site currently range from approximately 0.002 ft/ft in the northeastern corner of the site to approximately 0.075 ft/ft east of tailings cell 2 (in the vicinity of the chloroform plume).

Because of mounding near wildlife ponds, flow direction ranges locally from westerly (west of the ponds) to easterly (east of the ponds). The March 2012 cessation of water delivery to the northern ponds, which are generally upgradient of the nitrate and chloroform plumes at the site, has resulted in changing conditions that are expected to impact constituent concentrations and migration rates within these plumes. Specifically, past recharge from the ponds has helped limit many constituent concentrations within these plumes by dilution while the associated groundwater mounding has increased hydraulic gradients and contributed to plume migration. Since use of the northern wildlife ponds ceased in March 2012, the reduction in recharge and decay of the associated groundwater mound are expected to increase many constituent concentrations within the plumes while reducing hydraulic gradients and acting to reduce rates of plume migration. The impacts associated with cessation of water delivery to the northern ponds are expected to propagate downgradient (south and southwest) over time.

Perched water discharges in seeps and springs located to the west, south, east, and southeast of the site (Figure 1B). Flow onto the site occurs as underflow from areas northeast of the millsite where perched zone saturated thicknesses are generally greater. Flow exits the Mill property in seeps and springs to the east, west, southwest and southeast. Any flow that does not discharge in seeps or springs presumably exits as underflow to the southeast. Darcy's Law calculations of perched water flow to Ruin Spring and Westwater Seep yield reasonable results and suggest that local recharge contributes to seep/spring flow.

Hydraulic testing of perched zone wells yields a hydraulic conductivity range of approximately 2 x 10^{-8} to 0.01 cm/s (Tables 1- 4). In general, the highest permeabilities and well yields are in the area of the site immediately northeast and east (upgradient to cross gradient) of the tailings cells. A relatively continuous, higher permeability zone associated with the chloroform plume and consisting of poorly indurated coarser-grained materials has been inferred to exist in this portion of the site (HGC, 2007).

Permeabilities downgradient (southwest) of the tailings cells are generally low. The low permeabilities and shallow hydraulic gradients downgradient of the tailings cells result in average perched groundwater pore velocity estimates that are among the lowest on site. Furthermore, more than 30 years of groundwater monitoring indicate no impacts to perched water from tailings cell operation (based on various work by INTERA and Hurst and Solomon [2008]).

As discussed above, perched groundwater discharges in seeps and springs located along the mesa margins. The relationships between seeps and springs and site geology/stratigraphy are provided in Figure E.1 and Figure E.2_. Seep and spring investigation (HGC, 2010e) and investigation of the southwest portion of the site (HGC, 2012b) indicate the following:

1. Incorporating the seep and spring elevations in perched water elevation contour maps produces little change with regard to perched water flow directions except in the area west of the tailings cells and near Entrance Spring. West of the tailings cells, incorporation of Westwater Seep creates a more westerly hydraulic gradient. Westwater Seep appears to be nearly downgradient of the western portion of the cell complex (Figure 25). Ruin Spring is downgradient of the eastern portion of the cell complex (Figure 25). Westwater Seep is the closest apparent discharge point west of the tailings cells and Ruin Spring is the closest discharge point south-southwest of the tailings cells. Including the Entrance Spring elevation on the east side of the site creates a more easterly gradient in the perched water contours, and places Entrance Spring more directly downgradient of the northern wildlife ponds. Seeps and springs on the east side of the mesa are either cross-gradient of the tailings cells or are separated from the tailings cells by a groundwater divide

2. Ruin Spring and Westwater Seep are interpreted to occur at the contact between the Burro Canyon Formation and the Brushy Basin Member. Corral Canyon Seep, Entrance Spring, and Corral Springs are interpreted to occur at elevations within the Burro Canyon Formation at their respective locations but above the contact with the Brushy Basin Member. All seeps and springs (except Cottonwood Seep which is located near the Brushy Basin Member/Westwater Canyon Member contact) are associated with conglomeratic portions of the Burro Canyon Formation. Provided they are poorly indurated the more conglomeratic portions of the Burro Canyon Formation are likely to have higher permeabilities and the ability to transmit water more readily than finer-grained portions. This behavior is consistent with on-site drilling and hydraulic test data that associates higher permeability with the poorly indurated coarser-grained horizons detected east and northeast of the tailing cells associated with the chloroform plume.

3. Cottonwood Seep is located more than 1,500 feet west of the mesa rim in an area where the Dakota Sandstone and Burro Canyon Formation (which hosts the perched water system) are absent due to erosion (Figures E.1 and E.2). Cottonwood Seep occurs near a transition from slope-forming to bench-forming morphology (indicating a change in lithology). Cottonwood Seep (and 2nd Seep located immediately to the north [Figure 8]) is interpreted to originate from coarser-grained materials within the lower portion of the Brushy Basin Member (or upper portion of the Westwater Canyon Member). Alternatively, Cottonwood Seep may originate from coarser-grained materials of the Westwater Canyon (sandstone) Member intertongueing with the overlying Brushy Basin Member at the transition between the two Members. The presence of coarser-grained materials similar to the Salt Wash (sandstone) Member within the lower portion of the Brushy Basin member is discussed in Shawe (2005). The intertongueing of the Westwater Canyon and Brushy Basin Members is discussed in Craig *et al.* (1955) and Flesch (1974). Based on lithologic cross sections provided in TITAN (1994), the elevation of Cottonwood Seep (5234 ft amsl) is within 5 to 15 feet of the elevation of the contact between the Brushy Basin Member and the underlying Westwater Canyon

Member (5220 to 5230 ft amsl). This is also shown in Figure 3. Cottonwood Seep is therefore not (directly) connected to the perched water system at the site.

4. Only Ruin Spring appears to receive a predominant and relatively consistent proportion of its flow from perched water. Ruin Spring originates from conglomeratic Burro Canyon Formation sandstone where it contacts the underlying Brushy Basin Member, at an elevation above the alluvium in the associated drainage. Westwater Seep, which also originates at the contact between the Burro Canyon Formation and the Brushy Basin Member, likely receives a significant contribution from perched water. All seeps and springs other than Ruin Spring (and 2nd Seep just north of Cottonwood Seep) are located within alluvium occupying the basal portions of small drainages and canyons. The relative contribution of flow to these features from bedrock and from alluvium is indeterminate.
5. All seeps and springs are reported to have enhanced flow during wet periods. For seeps and springs associated with alluvium, this behavior is consistent with an alluvial contribution to flow. Enhanced flow during wet periods at Ruin Spring, which originates from bedrock above the level of the alluvium, likely results from direct recharge of Burro Canyon Formation and Dakota Sandstone exposed near the mesa margin in the vicinity of Ruin Spring. This recharge would be expected to temporarily increase the flow at Ruin Spring (as well as other seeps and springs where associated bedrock is directly recharged) after precipitation events. As discussed previously, local recharge is consistent with Darcy's law calculations of perched water flow to Ruin Spring and Westwater Seep.

The assumption that the seep or spring elevation is representative of the perched water elevation is likely to be correct only where the feature receives most or all of its flow from perched water and where the supply is relatively continuous (for example at Ruin Spring). The perched water elevation at the location of a seep or spring that receives a significant proportion of water from a source other than perched water may be different from the elevation of the seep or spring. The elevations of seeps that are dry for at least part of the year will not be representative of the perched water elevation when dry. The uncertainty that results from including seeps and springs in the contouring of perched water levels must be considered.

The rate of flow in the perched water zone in the southwest area of the site (downgradient of the tailings cells) is small and contributions from local recharge are needed to explain many areas of higher saturated thickness near sinks such as Westwater Seep and Ruin Spring that are downgradient of areas of low saturated thickness (HGC, 2012b). The presence of local recharge is expected to affect the water quality of seeps and springs and has the potential to dilute any dissolved constituents that may migrate from upgradient areas.

As discussed in HGC (2012c), samples of selected archived drill core and drill cuttings were analyzed visually and quantitatively by a contract analytical laboratory. Table 13 and Figure 32 summarize the occurrence of pyrite in site borings based on lithologic logs and laboratory analyses. The results verify the site-wide, apparently ubiquitous existence of pyrite in the perched zone at the site. The existence of pyrite is confirmed at locations upgradient, cross-gradient, and downgradient of the millsite and tailings cells. The results are consistent with Shawe's (1976) description of the Dakota Sandstone and Burro Canyon Formations as "altered-facies" rocks within which pyrite formed as a result of invasion by pore waters originating from compaction of the overlying Mancos Shale.

A large portion of the perched water system at the site is in a transient state, manifested in long-term changes in saturated thicknesses and rates of groundwater flow. This condition is expected to result in trends in pH and concentrations of many dissolved constituents that are unrelated to site operations. Changes in saturated thicknesses and rates of groundwater flow can result in changes in concentrations of dissolved constituents (or pH) for many reasons. For example, as discussed in HGC (2012c), groundwater rising into a vadose zone having a different chemistry than the saturated zone can result in changes in pH and groundwater constituent concentrations. If the rise in groundwater represents a long-term trend, long-term changes in groundwater constituent concentrations (or pH) may result.

Under conditions where vadose zone chemistry is not markedly different from saturated zone chemistry, changing groundwater flow rates may result in changing constituent concentrations due to changes in dilution. For example, relatively constant flux of a particular solute into the groundwater zone that results in a relatively constant groundwater concentration under conditions of steady groundwater flow, will likely result in changing concentrations should groundwater flow become unsteady. If the change in flow rate is in one direction over a long period of time, a long-term trend in the solute concentration is expected to result. Examples include oxygen dissolved in recharge or a constituent present in vadose zone materials overlying perched groundwater that dissolves in recharge and leaches into perched water at a steady rate. An increase in perched flow may cause an increase in dilution and a reduction in constituent concentration and vice-versa. For example, a decrease in dilution related to cessation of water delivery to the northern wildlife ponds is expected to result in increases in dissolved constituent concentrations within chloroform and nitrate plumes.

Furthermore, the mere presence of the lined tailings cells as barriers to natural recharge and exchange of gas with the atmosphere may result in changes in perched water chemistry. Any such changes are likely to be relatively slow and in one direction, potentially yielding long term trends in parameter values.

The perched groundwater chemistry at the Mill is also expected to be impacted by the following factors:

1. The relatively low permeability of the perched zone. This condition increases groundwater residence times and the time available for groundwater to react with the formation.
2. The location of the perched system between two shales, the underlying Brushy Basin Member of the Morrison Formation and the overlying Mancos Shale. Both are potential sources of numerous dissolved constituents.
3. The rate of interaction between the shales and the perched water. Interaction with the Mancos Shale at any particular location will depend on the presence, thickness, and composition of the Mancos, the rate of recharge through the Mancos into the perched zone, and the saturated thickness and rate of groundwater flow in the perched zone. Interaction with the Brushy Basin Member at any particular location will depend on the composition of the Brushy Basin, and the saturated thickness and rate of flow in the perched zone. Oxygen introduced into site monitoring wells may also react with the Brushy Basin and affect overlying perched water chemistry.
4. The rate of oxygen introduction into the perched zone via recharge or via site groundwater monitoring wells. Introduced oxygen is available to oxidize constituents such as pyrite, which impacts the local groundwater chemistry near each recharge source and near each well by releasing acid and sulfate. The resulting increased acidity can also destabilize various mineral phases in the aquifer matrix. The degree of impact on groundwater chemistry will depend on the amount of pyrite, the rate of oxygen transfer, the neutralization capacity and saturated thickness of the perched zone, and the rate of groundwater flow.
5. Elements other than iron and sulfur as contaminants in pyrite. Pyrite reacting with oxygen introduced into the formation will release these elements, potentially altering both the vadose zone and the groundwater chemistry. The potential for pyrite to have significant contaminants (such as selenium) is enhanced by it’s origin from fluids expelled from the Mancos.

Changes in perched zone constituent concentrations and pH are therefore expected to result from the introduction of oxygen into the subsurface, the oxidation of pyrite and other constituents, changes in recharge rates, and past and current recharge passing through the Mancos Shale.

Decreasing trends in pH accompanied by increasing sulfate concentrations in MW-series wells that were OOC for pH were determined to result from oxidation of pyrite based on screening-level calculations and geochemical modeling presented in HGC (2012c). The calculations also indicated that pyrite existed in sufficient quantity to maintain these trends provided sufficient oxygen was available.

6.1 Perched Water Pore Velocities in the Nitrate Plume Area

Perched water pore velocities and travel times calculated within the nitrate plume along Path 1 (Figure 27) yield an estimated average pore velocity of approximately 21 ft/yr and a travel time of approximately 60 years, based on a first quarter, 2014 hydraulic gradient of 0.028 ft/ft.

Historic hydraulic gradients within the area of the nitrate plume were likely much larger than 0.028 ft/ft during the time prior to Mill construction when the historical pond was active (Figure 1B). Based on historic water levels in the vicinities of MW-30 and MW-31, located along the downgradient margin of tailings cell 2 (Appendix D), and at the downgradient margin of the nitrate plume, an historic hydraulic gradient is estimated as approximately 0.048 ft/ft. This is more than four times the overall average site hydraulic gradient of approximately 0.011 ft/ft (calculated between TWN-19 and Ruin Spring).

Using the historic hydraulic gradient of 0.048 ft/ft, the estimated historic pore velocity downgradient of the historical pond is approximately 35 ft/yr, implying that nitrate originating from the historical pond could have migrated to the downgradient edge of cell 2 within 63 years. Assuming the historical pond was active by 1920, that nitrate was conservative, and ignoring hydrodynamic dispersion, nitrate originating from the historical pond could have reached the vicinities of MW-30 and MW-31 by 1983.

6.2 Perched Water Pore Velocities in the Chloroform Plume Area

Perched water pore velocities and travel times within the chloroform plume area along Paths 2A and 2B (Figure 27) were calculated based on first quarter, 2014 hydraulic gradients of 0.0275 ft/ft and 0.0262 ft/ft, respectively. The estimated average pore velocity along Path 2A is approximately 76 ft/yr, implying that approximately 16 years would be required to traverse Path 2A. The estimated average pore velocity along Path 2B is approximately 38 ft/yr, implying that approximately 38 years would be required to traverse Path 2B.

Historic hydraulic gradients within the northern (upgradient) areas of the eastern portion of the chloroform plume (prior to about 1990) were likely larger and contributed to relatively rapid movement of chloroform from the abandoned scale house leach field (located immediately north of TW4-18) to MW-4 where chloroform was detected in 1999. Based on historic water levels (Appendix D) the hydraulic gradient between the abandoned scale house leach field and MW-4 is estimated as approximately 0.048 ft/ft in 1990 and approximately 0.029 ft/ft in 1999, averaging 0.038 ft/ft. This is more than three times the overall average site hydraulic gradient of approximately 0.011 ft/ft (calculated between TWN-19 and Ruin Spring) and is approximately the same as current hydraulic gradients at the leading edge of the southeastern portion of the chloroform plume.

The historic hydraulic gradient implies an average pore velocity prior to 1999 of approximately 84 ft/yr, sufficient for chloroform to have migrated from the abandoned scale house leach field to MW-4 between 1978 and 1999. This calculation implies that chloroform could have migrated nearly to TW4-4 by 1999.

6.3 Hydrogeology and Perched Water Pore Velocities in the Southwest Area

Investigation of the southwest area of the site, including seeps and springs (HGC, 2012b), indicates that permeabilities in the southwest portion of the site are on average lower than previously estimated (as for example in HGC, 2009), and that perched water discharges to Westwater Seep and Ruin Spring, but there is no evidence for a direct hydraulic connection between the perched water zone and Cottonwood Seep. The hydraulic test and water level data also demonstrate that the perched zone southwest of cell 4B is inadequate as a primary supply to Cottonwood Seep by several orders of magnitude and that that the primary source of Cottonwood Seep lies elsewhere. However, a hypothetical connection between the perched zone near piezometer DR-8 and Cottonwood Seep is postulated for the purposes of calculating perched water travel times and to allow for the possibility that an as yet unidentified connection may exist

Important results of the southwest area investigation are:

1. The Brushy Basin Member erosional paleosurface in the southwest area of the Mill site is dominated by a paleoridge extending from beneath Cell 4B to abandoned boring DR-18 (Figure 8). The paleoridge is flanked to the west by a north-south trending paleovalley oriented roughly parallel to the western mesa rim (Figure 8).
2. The southwest area of the Mill site is characterized by generally low saturated thicknesses, low permeabilities, and relatively shallow hydraulic gradients. This is illustrated in Table 1 and Figure 14. Hydraulic gradients in the southwest portion of the site are typically close to 0.1 ft/ft, but are less than approximately 0.005 ft/ft west/southwest of tailings Cell 4B, between Cell 4B and DR-8.
3. The paleotopography of the Brushy Basin Member erosional surface has a greater influence on perched water flow in the southwest portion of the site than other areas because of the low saturated thicknesses and dry areas associated with the paleoridge extending south-southwest from the tailings cells (Figures 8, 14, 18, and 19).
4. The low transmissivities implied by the low permeabilities and low saturated thicknesses combined with the shallow hydraulic gradients imply low rates of perched water flow in the southwest portion of the site. Calculated average pore velocities along Pathlines 3, 5,

and 6 (Figure 27) from tailings cells to known discharge points Westwater Seep and Ruin Spring range from 0.60 ft/yr to 0.91 ft/yr, and travel times from 3,230 to 19,650 years based on first quarter, 2014 water level data. If vadose zone travel times from the base of the tailings cells to the perched water are included, the range of calculated travel times is 3,470 to 19,900 years.

5. The estimated travel time from the tailings cells to the vicinity of DR-8 (Path 4) is approximately 15,850 years based on first quarter, 2014 water level data and a calculated pore velocity of 0.26 ft/yr. Including the vadose travel time of approximately 250 years yields a total travel time of 16,100 years. Assuming a hypothetical pathway to Cottonwood Seep, the time to travel along Path 4 and thence along the potential pathway from the edge of Path 4 to Cottonwood Seep (which adds approximately 2,150 horizontal feet) is expected to be significantly greater than 16,100 years.
6. Brushy Basin Member paleotopography influences the locations of Westwater Seep and Ruin Spring; both are located in paleovalleys within the Brushy Basin Member paleosurface (Figure 8).
7. Local recharge is needed to explain areas of relatively large saturated thickness that supply Westwater Seep and Ruin Spring, because lateral flow into these areas from upgradient low saturated thickness portions of the perched zone is inadequate. The calculated perched zone recharge rate in the approximate 175 acre area southwest of Westwater Seep (near DR-2 [abandoned] and DR-5) is approximately 0.0011 in/yr.
8. The perched water system in the southwestern portion of the site is inadequate as the primary supply to Cottonwood Seep by several orders of magnitude. Therefore the primary source(s) of Cottonwood Seep must lie elsewhere.

6.4 Fate of Chloroform and Nitrate

Natural attenuation of nitrate and chloroform in the perched water is expected to result from physical processes that include dilution by recharge and hydrodynamic dispersion. Volatilization is another physical process that is expected to lower chloroform concentrations in perched water. Mass reduction processes expected to lower both nitrate and chloroform concentrations include chemical and biologically-mediated processes. These processes include reduction of nitrate by pyrite, and anaerobic reductive dechlorination of chloroform.

Both nitrate and chloroform plumes are under remediation by pumping. Pumping acts to reduce nitrate and chloroform mass as rapidly as is practical, allowing natural attenuation to be more effective.

The nearest potential discharge points for nitrate originating from the nitrate plume are Westwater Seep and Ruin Spring, both located downgradient of the tailings cell complex at the site. The nearest potential discharge points for chloroform are Ruin Spring and ultimately Corral Springs for the southeastern portion of the plume. Corral Springs is located downgradient of the eastern portion of the chloroform plume and cross-gradient of the tailings cell complex. Calculations of perched water flow rates indicate that thousands of years will be required for perched water at the downgradient margins of the tailings cells to reach a discharge point. Because both chloroform and nitrate plumes are more distant from discharge points than the tailings cell complex, even more time would be required for chloroform or nitrate to reach a discharge point. This is more than sufficient time for any residual chloroform or nitrate within the respective plumes to be attenuated through physical, chemical, and/or biological processes.

7. REFERENCES

Aubrey, W. M. 1992. Stratigraphy and Sedimentology of Latest Jurassic to Mid-Cretaceous Rocks, Four Corners Area, in Semken, S. C., ed., Field Guide to a Geologic Excursion in the Northeastern Navajo Nation: Shiprock, New Mexico, Navajo Community College, p. 33-40.

Avery, C. 1986. Bedrock Aquifers of Eastern San Juan County, Utah: Utah Department of Natural Resources Technical Publication no. 86, 114 p.

Baker. 2007. Passive Treatment of Selenium-Contaminated Groundwater. Colorado NPS Connection, Summer, 2007.

Colorado Department of Public Health and Environment, Water Quality Control Division. January 2011. Total Maximum Daily Load Assessment, Gunnison River and Tributaries, Uncompahgre River and Tributaries, Delta/Mesa/Montrose Counties, Colorado.

Craig et al. 1955. Stratigraphy of the Morrison and Related Formations, Colorado Plateau Region. A Preliminary Report. U. S. Geological Survey Bulletin 1009-E.

Cross, C. W., and Purington, C. W. 1899. Description of the Telluride Quadrangle (Colorado): U.S. Geological Survey Geological Atlas, Folio 57, 19 p.

Deditius, Artur P., Satoshi Utsunomiya, Martin Reich, Stephen E. Kesler, Rodney C. Ewing, Robert Hough, and John Walsh. 2011. Trace Metal Nonoparticles in Pyrite. Ore Geology reviews 42 (2011) p. 32-46.

Doelling, H. H. 2004. Geologic Map of the La Sal 30′ x 60' Quadrangle, San Juan, Wayne, and Garfield Counties, Utah, and Montrose and San Miguel Counties, Colorado: Utah Geological Survey Map 205, scale 1:100,000.

Dames and Moore. 1978. White Mesa Uranium Project, San Juan County, Utah. For Energy Fuels Nuclear, Inc. January 30, 1978.

Energy Fuels Resources, Inc. (EFRI). 2013. Proposal for Remediation of Nitrate Contaminated Soils. Phase I of Final Nitrate Corrective Action Plan, May 7, 2012 and Stipulation and Consent Order of December 12, 2012 Docket UGW-12-04. Submitted to R. Lundberg, Utah Division of Radiation Control, December 12, 2013.

EFRI. 2014a. White Mesa Uranium Mill. Nitrate Monitoring Report, State of Utah Stipulated Consent Agreement, January 2009, Docket No. UGW09-03, 1st Quarter (January through March) 2014.

EFRI. 2014b. White Mesa Uranium Mill. Chloroform Monitoring Report, State of Utah Notice of Violation and Groundwater Corrective Action Order UDEQ Docket No. UGW-20-01 1st Quarter (January through March) 2014.

Elder, W. P., and Kirkland, J. I. 1994. Cretaceous Paleogeography of the Southern Western Interior Region, in Caputo, M.V., Peterson, J. A., and Franczyk, K. J. editors, Mesozoic Systems of the Rocky Mountain Region, USA: Denver, Colorado, Rocky Mountain Section, SEPM (Society for Sedimentary Geology), p. 415- 440.

Fenner, C. N. 1933. Pneumatolytic Processes in the Formation of Minerals and Ores, in Ore Deposits of the Western States (Lindgren Volume): American Institute Mining & Metallurgical Engineers, p. 58-106

Flesch. 1974. Stratigraphy and Sedimentology of the Morrison Formation (Jurassic), Ojito Spring Quadrangle, Sandoval County, New Mexico: A Preliminary Discussion. New Mexico Geological Society Guidebook, 25th Field Conference, Ghost Ranch (Central-Northern New Mexico), 1974.

Goodknight, C. S., and Smith, G. M. 1996. Influences of Geologic and Hydrogeologic Conditions on the Uranium Mill Tailings Repository Design, Monticello, Utah, in Huffman, A. C., Jr., Lund, W.R., and Godwin, L.H., editors, Geology and Resources of the Paradox Basin: Utah Geological Association Guidebook 25, p. 377-388

Hartog, N., Griffionen, J., Van Bergen, P., and Van Der Weidjen, C. 2001. Determining The Reactivity of Reduced Components in Dutch Aquifer Sediments. Proceedings of a Symposium Held During the Sixth IAHS Scientific Assembly at Maastricht, the Netherlands, July 2001).

Hartog, N., P.F. Van Bergen, J.W. De Leeuw, and J. Griffioen. 2004. Reactivity of organic matter in aquifer sediments: Geological and geochemical controls. Geochimica Cosmochimica Acta 2004, 68 (6), 1281-1292.

Haynes, D. D., Vogel, J. D., and Wyant, D. G. 1972. Geology, Structure, and Uranium Deposits of the Cortez [1° x 2°] Quadrangle, Colorado and Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-629, 2 sheets, scale 1:250,000.

Hedberg, H. D. 1936. Gravitational Compaction of Clays and Shales: American Association of Petroleum Geologists Bulletin v. 10, no. 11, p. 241-287.

Huff, L.C., and Lesure, F. G. 1965. Geology and Uranium Deposits of Montezuma Canyon area, San Juan County, Utah: U.S. Geological Survey Bulletin 1190, 102 p.

Hurst and Solomon. 2008. Utah Division of Radiation Control. Summary of Work Completed, Data Results, Interpretations and Recommendations for the July 2007 Sampling Event at the Denison Mines, USA, White Mesa Uranium Mill Near Blanding, Utah. Prepared by T. Grant Hurst and D. Kip Solomon, Department of Geology and Geophysics, University of Utah. Submitted May 2008.

Hydro Geo Chem, Inc (HGC). 1988. WHIP. Well Hydraulics Interpretation Program, Version 3.22, User's Manual. July, 1988

HGC. 2002. Hydraulic Testing at the White Mesa Uranium Mill Near Blanding, Utah During July, 2002. August 22, 2002.

HGC. 2004. Final Report. Long Term Pumping at MW-4, TW4-10, and TW4-15. White Mesa Uranium Mill Near Blanding, Utah. May 26, 2004.

HGC. 2005. Perched Monitoring Well Installation and Testing at the White Mesa Uranium Mill, April through June 2005. August 3, 2005.

HGC. 2007. Preliminary Contamination Investigation Report. White Mesa Uranium Mill Site Near Blanding, Utah. November 20, 2007.

HGC. 2009. Site Hydrogeology and Estimation of Groundwater Travel Times in the Perched Zone. White Mesa Uranium Mill Near Blanding, Utah. August 27, 2009.

HGC. 2010a. Perched Monitoring Well Installation and Hydraulic Testing. White Mesa Uranium Mill, October 2009. March 10, 2010.

HGC. 2010b. Letter Report to David Frydenlund, Esq. March 10, 2010.

HGC. 2010c. Hydraulic Testing of TW4-4, TW4-6, and TW4-26. White Mesa Uranium Mill. July 2010. September 20, 2010.

HGC. 2010d. Installation and Hydraulic Testing of Perched Monitoring Wells MW-33, MW-34, and MW-35 at the White Mesa Uranium Mill Near Blanding Utah. October 11, 2010.

HGC. 2010e. Hydrogeology of the Perched Groundwater Zone and Associated Seeps and Springs Near the White Mesa Uranium Mill Site, Blanding, Utah. November 12, 2010.

HGC. 2011a. Installation and Hydraulic Testing of Perched Monitoring Wells MW-36 and MW-37 at the White Mesa Uranium Mill Near Blanding Utah. June 28, 2011.

HGC. 2011b. Redevelopment of Existing Perched Monitoring Wells. White Mesa Uranium Mill Near Blanding, Utah. September 30, 2011

HGC. 2011c. Installation, Hydraulic Testing, and Perched Zone Hydrogeology of Perched Monitoring Well TW4-27. White Mesa Uranium Mill Near Blanding Utah. November 28, 2011.

HGC. 2012a. Corrective Action Plan for Nitrate. White Mesa Uranium Mill Near Blanding, Utah. May 7, 2012

HGC. 2012b. Revised Report on the Hydrogeology of the Perched Groundwater Zone in the Area Southwest of the Tailings Cells. White Mesa Uranium Mill Site. Blanding, Utah. August 3, 2012.

HGC. 2012c, Investigation of Pyrite in the Perched Zone. White Mesa Uranium Mill Site. Blanding, Utah. December 7, 2012.

HGC. 2013a. Installation and Hydraulic Testing of Perched Monitoring Wells TW4-28 through TW4-31. White Mesa Uranium Mill Near Blanding Utah. April 30, 2013.

HGC. 2013b. Installation and Hydraulic Testing of Perched Monitoring Wells TW4-32 through TW4-34. White Mesa Uranium Mill Near Blanding Utah.As Built Report. October 30, 2013.

HGC. 2014. Contamination Investigation Report. TW4-12 and TW4-27 Areas. White Mesa Uranium Mill Near Blanding, Utah. January 23, 2014.

HydroSOLVE, Inc. 2000. AQTESOLVE for Windows. User's Guide.

INTERA. 2007a. Revised Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah. October 2007.

INTERA. 2007b. Revised Addendum: Evaluation of Available Pre-Operational and Regional Background Data, Background Groundwater Quality Report: Existing Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah.November 16, 2007.

INTERA. 2008. Revised Addendum: Background Groundwater Quality Report: New Wells for Denison Mines (USA) Corp.'s Mill Site, San Juan County, Utah. April 30, 2008.

INTERA. 2009. Nitrate Contamination Investigation Report White Mesa Uranium Mill Site, Blanding, Utah.

INTERA. 2010. Background Groundwater Quality Report for Wells MW-20 and MW-22 for Denison Mines (USA) Corp.'s White Mesa Mill Site, San Juan County, Utah. June1, 2010.

INTERA. 2012a. Source Assessment Report, White Mesa Uranium Mill. Blanding, Utah October 10, 2012.

INTERA. 2012b. PH Report White Mesa Uranium Mill, Blanding, Utah. November 9, 2012,.

INTERA. 2013a. Source Assessment Report for TDS in MW-29 White Mesa Uranium Mill, Blanding Utah May 7 2013.

INTERA. 2013b. Source Assessment Report for Selenium in MW-31, White Mesa Uranium Mill. August 30, 2013.

INTERA. 2014a. Source Assessment Report for Gross Alpha in MW-32, White Mesa Uranium Mill. January 13, 2014.

INTERA. 2014b. Source Assessment Report for Sulfate in MW-01 and TDS in MW-03A, White Mesa Uranium Mill. March 18, 2014.

INTERA. 2014c. Background groundwater quality Report for Monitoring Wells MW-35, MW-36, and MW-37. White Mesa Uranium Mill, Blanding, Utah. May 1, 2014.

International Uranium (USA) Corporation and Hydro Geo Chem. 2000. Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah.

International Uranium (USA) Corporation and Hydro Geo Chem. 2001. Update to report "Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah"

Kirby. 2008. Geologic and Hydrologic Characterization of the Dakota-Burro Canyon Aquifer Near Blanding, San Juan County, Utah. Utah Geological Survey Special Study 123.

Knight-Piésold. 1998. Evaluation of Potential for Tailings Cell Discharge – White Mesa Mill. Attachment 5, Groundwater Information Report, White Mesa Uranium Mill, Blanding, Utah. Submitted to UDEQ.

Kolle, W., P. Werner, O. Strebel, and J. Bottcher. 1983. Denitrification in a reducing aquifer. Vom Wasser 1983, 61, 125-147.

Kolle, W., O. Strebel, and J. Bottcher. 1985. Formation of sulphate by microbial denitrification in a reducing aquifer. Water Supply 1985, 3, 35-40.

Kolle, W., O. Strebel, and J. Bottcher. 1987. Reduced sulphur compounds in sandy aquifers and their interactions with groundwater. Proceedings of the Dresden Symposium of *Groundwater Monitoring and Management*, March, 1987.

Korom, S.F. 1992. Natural denitrification in the saturated zone: A review. Water Resources Research, 1992, 28, 1657-1668.

McFarland, Michael J. (Utah State University), M. Schmitz (Utah Division of Water Quality), R. B. Brobst (EPA), D. Desai (Utah State University), and H. R. Hall (Utah State University). 2006. Use of Disturbed Western Rangelands as Dedicated Biosolids Beneficial Use Sites. Proceedings of the Water Environment Federation, WEFTEC 2006: Session 21 through Session 30, pp. 2044-2059 (16). October, 2006.

Meek, F. B., and Hayden, F. V. 1862. Descriptions of New Cretaceous Fossils from Nebraska Territory: Acad. National Science, Philadelphia Proc., p. 21-28.

MWH Americas. 2010.Revised Infiltration and Contaminant Transport Modeling Report, White Mesa Mill Site, Blanding Utah, Denison Mines (USA) Corp. March, 2010.

O'Sullivan, R. B., Repenning, C. A., Beaumont, E. C., and Page, Fl. G. 1972. Stratigraphy of the Cretaceous Rocks and the Tertiary Ojo Alamo Sandstone, Navajo and Hopi Indian Reservations, Arizona, New Mexico and Utah: U.S. Geological Society Professional Paper 521-E, 61 p.

Parkhurst, D. L., and C. A. J. Appelo. 1999. User's Guide to PHREEQC (Version 2) - A Computer Program for Speciation, Batch Reaction, One-Dimensional Transport, and Inverse Geochemical Calculations. US Department of the Interior, USGS, Water-Resources Investigations Report 99-4259, 1999.

Pauwels, H., W. Kloppmann, J.C. Foucher, A. Martelat, and V. Fritsche. 1998. Field tracer test for denitrification in a pyrite-bearing schist aquifer. Applied Geochemistry, 1998, 13 (6), 767-778.

Peterson, Fred, and Turner-Peterson, C. E. 1987. The Morrison Formation of the Colorado Plateau-Recent Advances in Sedimentology, Stratigraphy, and Paleotectonics: North American Paleontological Conference, 4th, Proceedings, Hunteria, v. 2, no. 1, p. 1–18.

Postma, D., C. Boesen, H. Kristiansen, and F. Larsen. 1991. Nitrate reduction in an unconfined sandy aquifer - water chemistry, reduction processes, and geochemical modeling. Water Resource Research, 1991, 27 (8), 2027-2045.

Potoroff, Edward J., Matthew P. Wickham, Jacob S. Waples, and Bruce Bertram. 2005. Case Study of Selenium Mobilization From Mancos Shale: Relationship to Nitrate Contamination. Geological Society of America Abstracts with Programs, Vol 37, No. 6, p 45.

Rivett, M.O., S.R. Buss, P. Morgan, J.W.N. Smith, and C.D. Bemment. 2008. Nitrate attenuation in groundwater: A review of biogeochemical controlling processes. Water Research, 2008, 42, 4215-4232.

Robertson, W.D., B.M. Russel, and J.A. Cherry. 1996. Attenuation of nitrate in aquitard sediments of southern Ontario. Journal of Hydrology, 1996, 180 (1), 267-281

Schippers, A., and B.B. Jorgensen. 2002. Biogeochemistry of pyrite and iron sulfide oxidation in marine sediments. Geochimica et Cosmochimica Acta, 2002, 66 (1), 85-92.

Shawe, D. R. 1968. Petrography of Sedimentary Rocks in the Slick Rock District, San Miguel and Dolores Counties, Colorado. U.S. Geological Survey Professional Paper 576-B., 34 p.

Shawe, D. R. 1976. Sedimentary Rock Alteration in the Slick Rock District, San Miguel and Dolores Counties, Colorado. U.S. Geological Survey Professional Paper 576-D., 51 p.

Shawe. 2005. U S Geological Survey Professional Paper 576-F. Geologic Investigations in the Slick Rock District, San Miguel and Dolores Counties, Colorado.

Spiteri, C., C.P. Slomp, K. Tuncay, and C. Meile. 2008. Modeling biogeochemical processes in subterranean estuaries: Effect of flow dynamics and redox conditions on submarine groundwater discharge of nutrients. Water Resources Research, 2008, 44, W02430.

Stokes, W. L. and Phoenix, D. A. 1948. Geology of the Egnar-Gypsum Valley Area, San Miguel and Montrose Counties, Colorado: U.S. Geological Survey Oil and Gas Preliminary Map 93.

Tesoriero, A.J. and L.J. Puckett. 2011. O2 reduction and denitrification rates in shallow aquifers. Water Resources Research, 2011, 37, W12522.

TITAN. 1994. Hydrogeological Evaluation of White Mesa Uranium Mill. Submitted to Energy Fuels Nuclear.

Tschudy, R.H., Tschudy, B.D., and Craig, L.C. 1984. Palynological Evaluation of Cedar Mountain and Burro Canyon Formation, Colorado Plateau: U.S. Geological Survey Professional Paper 1281, 24 p.

Turner, C. E., and Fishman, N. S. 1991. Jurassic Lake T'oo'dichi' - A Large Alkaline, Saline Lake, Morrison Formation, Eastern Colorado Plateau: Geological Society of America Bulletin, v. 103, p. 538–558.

Tuttle, M. L. W., 2005. Salt and Selenium in Mancos Shale, Terrane on the Gunnison Gorge National Conservation Area, Western Colorado, USA. Geological Society of America Abstracts with Programs, Vol 37, No. 6, p 45.

UMETCO. 1993. Groundwater Study, White Mesa Facility, Blanding Utah. Prepared by UMETCO Minerals Corporation and Peel Environmental Services. January, 1993.

UMETCO. 1994. Groundwater Study 1994 Update, White Mesa Facility, Blanding Utah. Prepared by UMETCO Minerals Corporation. June, 1994.

van Beek, C.G.E.M. 1999. Redox Processes Active in Denitrification. Chapter in: Redox Fundamentals, Processes, and Applications, J. Schuring, H.D. Schulz, W.R. Fischer, J. Bottcher, and W.H.M. Duijnisveld, eds. Springer-Verlag New York, 1999.

Yoder, H. S., Jr. 1955. Role of Water in Metamorphism, in Poldevaart, Arie, Crust of the Earth: Geological Society of America Special Paper 62, p. 505-523.

Young, R. G. 1960. Dakota Group of Colorado Plateau: American Association of Petroleum Geologists Bulletin, v. 44, no. 2, p. 156-194.

Young, R. G. 1973. Depositional Environments of Basal Cretaceous Rocks of Colorado Plateau. Geological Society Memorandum.

Zhang, Y. 2012. Coupled biogeochemical dynamics of nitrogen and sulfur in a sandy aquifer and implications for groundwater quality. Thesis presented at Utrecht University, Netherlands, November 19, 2012.

8. 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 1
Results of Slug test Analyses Using KGS and Bouwer-Rice Solutions

		Automatically Logged Data			Hand Collected Data		
		KGS		Bouwer-Rice	KGS		Bouwer-Rice
Test	Saturated Thickness	K (cm/s)	Ss (1/ft)	K (cm/s)	K (cm/s)	Ss (1/ft)	K (cm/s)
TWN-1	54	1.70E-04	2.22E-03	NI	1.97E-04	1.25E-03	1.36E-04
TWN-2	74	1.49E-05	3.20E-04	2.25E-05	2.04E-05	1.16E-04	2.73E-05
TWN-3	60	8.56E-06	8.73E-06	8.97E-06	7.75E-06	1.53E-05	8.89E-06
TWN-4	85	1.76E-03	3.43E-04	2.79E-05	1.25E-03	1.84E-06	NI
TWN-5	77	4.88E-04	3.88E-07	4.06E-04	4.88E-04	3.88E-07	3.70E-04
TWN-6	79	1.74E-04	2.22E-03	NI	3.50E-04	2.22E-12	3.36E-04
TWN-7	11	3.57E-07	2.22E-03	4.59E-07	3.57E-07	2.21E-03	NI
TWN-8	80	1.51E-04	3.66E-04	7.55E-05	4.73E-04	1.41E-06	2.48E-04
TWN-9	29	2.99E-05	6.92E-03	2.86E-05	6.02E-05	5.59E-03	7.93E-05
TWN-10	20	3.83E-05	0.1	2.31E-05	8.71E-05	8.12E-03	1.10E-04
TWN-11	68	1.18E-04	1.08E-05	9.83E-05	9.34E-05	7.18E-05	9.78E-05
TWN-12	67	8.05E-05	4.65E-05	7.69E-05	1.28E-04	1.27E-07	7.39E-05
TWN-13	68	2.62E-06	0.1	4.77E-06	2.09E-06	0.1	6.93E-06
TWN-14	57	3.61E-06	6.39E-03	2.74E-06	3.98E-06	3.17E-03	7.93E-06
TWN-15	58	4.75E-05	1.04E-03	2.61E-05	5.86E-05	3.49E-04	6.42E-05
TWN-16	41	0.0142	8.02E-04	6.47E-03	NI	NI	NI
TWN-17	69	3.73E-06	0.033	6.18E-06	1.41E-06	0.061	1.96E-06
TWN-18	83	2.27E-03	2.44E-06	1.14E-03	2.67E-03	2.22E-12	NI
TWN-19	50	2.69E-05	2.49E-03	1.81E-05	3.83E-05	3.34E-03	NI
MW-03 (mlt; pssc)	5.2	4.00E-07	1.92E-02	1.50E-05	--	--	--
MW-05 (lt; pssc)	10	3.50E-06	4.40E-03	3.90E-06	3.20E-06	--	4.30E-06
MW-05 (et; pssc)				2.40E-05			1.80E-05
MW-17	18	2.60E-05	1.71E-04	2.70E-05	2.20E-05	--	3.00E-05
MW-18	58	2.90E-04	4.60E-07	2.40E-04	3.20E-04	--	2.50E-04
MW-19	80	1.70E-05	1.44E-06	1.30E-05	1.20E-05	--	1.50E-05
MW-19, confined	47	1.60E-05	3.24E-06	1.20E-05	--	--	--
MW-20 (mlt; pssc)	12	--	--	9.30E-06	--	--	--
MW-20 (mlt)				5.90E-06			2.50E-06
MW-22 (pscc)	51	1.00E-06	2.00E-03	7.90E-06	9.00E-07	--	--
MW-22				4.40E-06			3.40E-06
MW-23	12	3.20E-08	0.1	1.60E-06	NI	NI	NI
MW-23b	12	2.30E-07	2.30E-03	2.50E-07	NI	NI	2.00E-07
MW-24	3.4	4.16E-05	5.20E-03	3.15E-05	3.03E-05	0.0152	3.03E-05
MW-25	33	1.10E-04	3.00E-04	7.40E-05	1.70E-04	2.00E-04	1.00E-04
MW-27	36	8.20E-05	5.30E-04	3.60E-05	1.40E-04	8.70E-05	3.10E-05
MW-28	23	1.70E-06	0.02	1.70E-06	1.70E-06	0.02	2.00E-06
MW-29	18	1.10E-04	1.90E-04	9.30E-05	1.30E-04	2.10E-04	1.00E-04
MW-30	24	1.00E-04	2.90E-04	6.40E-05	1.10E-04	1.40E-04	5.10E-05
MW-31	53	7.10E-05	2.50E-05	6.90E-05	7.40E-05	7.20E-06	6.90E-05
MW-32	46	3.00E-05	8.80E-05	2.60E-05	2.80E-05	2.50E-04	3.00E-05
MW-35	12	3.48E-04	1.95E-05	2.18E-04	2.59E-04	1.78E-05	1.65E-04
MW-36	6.2	4.51E-04	4.29E-04	NA	7.73E-04	2.66E-04	6.52E-04
MW-36 (lt)	6.2	NA	NA	1.84E-04	NA	NA	NA
MW-36 (et)	6.2	NA	NA	5.07E-04	NA	NA	NA
MW-37	2.9	1.28E-05	2.22E-12	1.21E-05	NA	NA	NA
TW4-4 (et)	22	NA	NA	1.26E-03	NA	NA	NA
TW4-4 (lt)	22	1.66E-03	6.21E-05	2.89E-04	1.63E-03	3.01E-04	7.91E-04
TW4-6	24	1.15E-05	3.67E-05	1.00E-05	1.19E-05	1.49E-04	1.32E-05
TW4-20	43	5.90E-05	1.60E-05	4.20E-05	7.00E-05	1.20E-05	5.30E-05
TW4-21	63	1.90E-04	1.10E-04	3.20E-05	1.90E-04	3.20E-05	9.40E-06
TW4-22	55	1.30E-04	6.80E-06	1.10E-04	1.30E-04	4.50E-06	1.10E-04
TW4-23	43	3.80E-05	7.40E-03	2.90E-05	3.40E-01	6.40E-04	7.90E-05
TW4-24	53	1.60E-04	1.10E-03	1.00E-04	1.20E-04	1.70E-03	5.20E-05
TW4-25	89	5.80E-05	0.001	3.70E-05	7.40E-05	1.10E-03	5.00E-05
TW4-26	18	2.40E-05	3.23E-04	2.16E-05	2.28E-05	3.13E-04	2.55E-05
TW4-27 (uncorrected)	9	NA	NA	NA	2.13E-06	1.51E-03	1.59E-06
TW4-27 (100% correction)		7.01E-07	2.22E-03	1.99E-06	NA	NA	NA
TW4-27(60% correction)		1.35E-06	1.27E-03	1.15E-06	NA	NA	NA
TW4-28	67.9	3.52E-04	1.22E-06	3.92E-04	3.29E-04	7.49E-06	4.07E-04
TW4-29	17.7	4.24E-05	1.19E-03	5.24E-05	4.52E-05	9.62E-04	5.66E-05
TW4-29 (lt)	17.7	NA	NA	2.00E-05	NA	NA	3.80E-05
TW4-30	9.6	1.44E-04	1.00E-02	6.22E-05	1.34E-04	1.00E-02	1.38E-04
TW4-30 (et)	9.6	NA	NA	1.63E-04	NA	NA	2.91E-04
TW4-30 (lt)	9.6	NA	NA	1.12E-05	NA	NA	1.41E-05
TW4-31	18.1	4.18E-05	2.54E-05	3.87E-05	3.24E-05	9.65E-05	4.01E-05
TW4-32	64.8	9.53E-05	1.15E-04	NA	5.34E-05	7.97E-04	5.86E-05
TW4-32(et)	64.8	NA	NA	1.09E-04	NA	NA	1.34E-04
TW4-32(lt)	64.8	NA	NA	2.51E-05	NA	NA	1.17E-05
TW4-33	13.1	5.51E-05	3.73E-04	5.78E-05	5.25E-05	5.32E-04	5.76E-05
TW4-34	25.2	9.98E-05	1.13E-03	1.54E-04	9.39E-05	1.54E-03	1.25E-04
TW4-34 (lt)	25.2	NA	NA	1.17E-04	NA	NA	NA
DR-5	12.3	2.95E-05	4.21E-05	3.80E-05	2.86E-05	2.65E-03	3.76E-05
DR-8, Oct 2012	7.8	2.46E-08	1.00E-02	3.56E-07	4.46E-08	1.00E-02	4.45E-07
DR-8, Oct 2011	7.7	3.40E-08	0.01	NA	1.07E-07	0.0011	NA
DR-9	24.5	4.49E-04	4.30E-06	3.41E-04	4.73E-04	1.21E-05	4.73E-04
DR-10	3	2.92E-06	6.54E-03	5.56E-06	9.71E-06	8.41E-04	9.71E-06
DR-11	8.9	8.88E-06	8.88E-04	1.54E-05	5.83E-06	2.22E-03	1.11E-05
DR-13	11.2	5.90E-06	7.33E-05	5.38E-06	4.93E-06	1.57E-04	1.49E-06
DR-13(et)	11.2	NA	NA	NA	NA	NA	6.81E-06
DR-14	18.8	1.26E-05	7.34E-05	1.66E-05	7.78E-06	4.84E-04	6.18E-06
DR-14(et)	18.8	NA	NA	NA	NA	NA	1.23E-05
DR-17	6.5	1.24E-05	1.53E-04	1.43E-05	3.17E-06	5.00E-03	2.19E-06
DR-17(et)	6.5	NA	NA	NA	NA	NA	8.35E-06
DR-19	3.5	3.29E-05	2.54E-03	3.78E-05	3.39E-05	1.86E-03	4.08E-05
DR-20	17.9	2.14E-06	1.91E-05	2.69E-06	1.43E-06	1.90E-05	1.89E-06
DR-21	13.5	3.29E-05	7.17E-06	3.60E-05	2.21E-05	1.87E-04	3.49E-05
DR-23	7.5	1.96E-05	3.85E-04	2.35E-05	7.49E-06	5.00E-03	4.51E-06
DR-23(et)	7.5	NA	NA	NA	NA	NA	2.16E-05
DR-24	17.4	1.64E-05	7.49E-05	1.43E-05	1.64E-05	7.49E-05	8.23E-06
DR-24(et)	17.4	NA	NA	NA	NA	NA	1.97E-05

Notes:

Bouwer-Rice = Unconfined Bouwer-Rice solution method in Aqtesolv™ unless otherwise noted
cm/s = centimeters per second
ft = feet
K = hydraulic conductivity
KGS = Unconfined KGS solution method in Aqtesolv™ unless otherwise noted
Ss= specific storage
NI= Not Interpretable .
et= early time data
mlt=middle to late time data
lt=late time data
pssc=partially submerged screen correction used for Bouwer-Rice solution
NA=not applicable

TABLE 2
Results of Recovery and Slug Test Analyses Using Moench Solution

			Automatically-Logged Data				Hand Data
Well ID	**Interpretation Method**	**Type**	**Hydraulic Conductivity (cm/sec)**	**Storativity**	**Saturated Thickness (feet)**	**Skin**	**Hydraulic Conductivity (cm/sec)**
MW-01	WHIP	pump/recovery	7.70E-07	0.0082	20	none	7.70E-07
	AQTESOLV (Moench, Leaky)	pump/recovery	7.70E-07	0.0082	20	none	7.70E-07
	AQTESOLV (Moench, Unconfined)	pump/recovery	8.90E-07	0.01	40	none	--
MW-03	WHIP	slug	4.30E-05	0.01	5.2	none	--
MW-05	WHIP	slug	1.10E-05	0.1	10	none	--
MW-17	WHIP	slug	2.90E-05	0.01	18	none	--
MW-18	WHIP	slug	4.40E-04	2.20E-05	45	none	--
	WHIP	slug	5.30E-04	0.02	45	6.54	--
MW-19	WHIP	slug	7.10E-06	0.032	47	none	--
	WHIP	slug	1.70E-05	0.027	47	2.24	--
	AQTESOLV (Moench, Leaky)	slug	1.70E-05	0.027	47	2.24	--
MW-20	WHIP	slug	8.20E-06	0.02	12	none	--
MW-22	WHIP	slug	4.20E-06	0.014	51	none	--

Notes:

cm/sec = Centimeters per second

WHIP analyses via modfied Moench Leaky Solution

TABLE 3
Estimated Perched Zone Hydraulic Properties Based on Analysis of Observation Wells Near MW-4 and TW4-19 During Long Term Pumping of MW-4 and TW4-19

Observation Well	Theis Solution (Confined or Unconfined)	Transmissivity (ft^2/day)	Storage Coefficient	Water Bearing Zone Thickness (feet)	Average Hydraulic Conductivity (ft/day)	Average Hydraulic Conductivity (cm/sec)
TW4-1	Unconfined	8.9	0.023	39	0.23	8.20E-05
	Confined	8.4	0.023	24	0.35	1.30E-04
TW4-2	Unconfined	4.6	0.0065	39	0.12	4.30E-05
	Confined	3.8	0.0063	24	0.16	5.70E-05
TW4-7	Unconfined	4.7	0.011	39	0.12	4.30E-05
	Confined	3.3	0.011	24	0.14	5.00E-05
TW4-8	Unconfined	4.5	0.010	39	0.12	4.30E-05
	Confined	3.9	0.010	24	0.16	5.70E-05
MW-4A	Unconfined	5.8	0.019	39	0.15	5.40E-05
	Confined	3.5	0.019	24	0.15	5.40E-05
MW-4A (early time)	Unconfined	12.4	0.0029	39	0.32	1.10E-04
	Confined	9.1	0.0031	24	0.38	1.40E-04
TW4-5	Unconfined	89	0.0043	67	1.3	4.60E-04
	Confined	87	0.0043	31	2.8	1.00E-03
TW4-9	Unconfined	72	0.0043	67	1.1	3.90E-04
	Confined	71	0.0043	31	2.3	8.20E-04
TW4-10	Unconfined	48	0.0077	67	0.72	2.60E-04
	Confined	46	0.0076	31	1.5	5.40E-04
TW4-15	Unconfined	15	0.0037	67	0.22	7.90E-05
	Confined	12	0.0037	31	0.39	1.40E-04
TW4-16	Unconfined	19	0.0036	67	0.28	1.00E-04
	Confined	18	0.0035	31	0.58	2.10E-04

TABLE 3
Estimated Perched Zone Hydraulic Properties Based on Analysis of Observation Wells Near MW-4 and TW4-19 During Long Term Pumping of MW-4 and TW4-19

Observation Well	Theis Solution (Confined or Unconfined)	Transmissivity (ft^2/day)	Storage Coefficient	Water Bearing Zone Thickness (feet)	Average Hydraulic Conductivity (ft/day)	Average Hydraulic Conductivity (cm/sec)
TW4-18	Unconfined	76	0.0046	67	1.1	3.90E-04
	Confined	74	0.0046	31	2.4	8.60E-04
TW4-19	Unconfined	44	0.12	67	0.66	2.40E-04
	Confined	39	0.12	31	1.3	4.60E-04

Notes:

cm/sec = Centimeters per second
ft/day = Feet per day
ft^2 /day = Feet squared per day

TABLE 4
Summary of Hydraulic Properties
White Mesa Uranium Mill
from TITAN (1994)

Boring/ Well Location	Test Type	Interval (ft-ft)	Document Referenced	Hydraulic Conductivity (ft/yr)	Hydraulic Conductivity (cm/sec)
Soils					
6	Laboratory Test	9	D&M	1.20E+01	1.20E-05
7	Laboratory Test	4.5	D&M	1.00E+01	1.00E-05
10	Laboratory Test	4	D&M	1.20E+01	1.20E-05
12	Laboratory Test	9	D&M	1.40E+02	1.40E-04
16	Laboratory Test	4.5	D&M	2.20E+01	2.10E-05
17	Laboratory Test	4.5	D&M	9.30E+01	9.00E-05
19	Laboratory Test	4	D&M	7.00E+01	6.80E-05
22	Laboratory Test	4	D&M	3.90E+00	3.80E-06
			Geometric Mean	2.45E+01	2.37E-05
Dakota Sandstone					
No. 3	Injection Test	28-33	D&M (1)	5.68E+02	5.49E-04
No. 3	Injection Test	33-42.5	D&M	2.80E+00	2.71E-06
No. 12	Injection Test	16-22.5	D&M	5.10E+00	4.93E-06
No. 12	Injection Test	22.5-37.5	D&M	7.92E+01	7.66E-05
No. 19	Injection Test	26-37.5	D&M	7.00E+00	6.77E-06
No. 19	Injection Test	37.5-52.5	D&M	9.44E+02	9.12E-04
			Geometric Mean	4.03E+01	3.89E-05
Burro Canyon Formation					
No. 3	Injection Test	42.5-52.5	D&M	5.80E+00	5.61E-06
No. 3	Injection Test	52.5-63	D&M	1.62E+01	1.57E-05
No. 3	Injection Test	63-72.5	D&M	5.30E+00	5.13E-06
No. 3	Injection Test	72.5-92.5	D&M	3.20E+00	3.09E-06
No. 3	Injection Test	92.5-107.5	D&M	4.90E+00	4.74E-06
No. 3	Injection Test	122.5-142	D&M	6.00E-01	5.80E-07
No. 9	Injection Test	27.5-42.5	D&M	2.70E+00	2.61E-06
No. 9	Injection Test	42.5-59	D&M	2.00E+00	1.93E-06
No. 9	Injection Test	59-82.5	D&M	7.00E-01	6.77E-07
No. 9	Injection Test	82.5-107.5	D&M	1.10E+00	1.06E-06
No. 9	Injection Test	107.5-132	D&M	3.00E-01	2.90E-07
No. 12	Injection Test	37.5-57.5	D&M	9.01E-01	8.70E-07
No. 12	Injection Test	57.5-82.5	D&M	1.40E+00	1.35E-06
No. 12	Injection Test	82.5-102.5	D&M	1.07E+01	1.03E-05
No. 28	Injection Test	76-87.5	D&M	4.30E+00	4.16E-06
No. 28	Injection Test	87.5-107.5	D&M	3.00E-01	2.90E-06
No. 28	Injection Test	107.5-132.5	D&M	2.00E-01	1.93E-07
WMMW1	(7) Recovery	92-112	Peel (2)	3.00E+00	2.90E-06
WMMW3	(7) Recovery	67-87	Peel	2.97E+00	2.87E-06
WMMW5	(7) Recovery	95.5-133.5	H-E	1.31E+01	1.27E-05
WMMW5	(7) Recovery	95.5-133.5	Peel	2.10E+01	2.03E-05
WMMW11	(7) Recovery	90.7-130.4	H-E (3)	1.23E+03	1.19E-03
WMMW11	(7) Single Well Drawdown	90.7-130.4	Peel	1.63E+03	1.58E-03
WMMW12	(7) Recovery	84-124	H-E	6.84E+01	6.61E-05
WMMW12	(7) Recovery	84-124	Peel	6.84E+01	6.61E-05
WMMW14	Single Well Drawdown	90-120	(5) H-E	1.21E+03	1.16E-03
WMMW14	Single Well Drawdown	90-120	(6) H-E	4.02E+02	3.88E-04
WMMW15	Single Well Drawdown	99-129	H-E	3.65E+01	3.53E-05
WMMW15	(7) Recovery	99-129	Peel	2.58E+01	2.49E-05
WMMW16	Injection Test	28.5-31.5	Peel	9.42E+02	9.10E-04
WMMW16	Injection Test	45.5-51.5	Peel	5.28E+01	5.10E-05
WMMW16	Injection Test	65.5-71.5	Peel	8.07E+01	7.80E-05
WMMW16	Injection Test	85.5-91.5	Peel	3.00E+01	2.90E-05
WMMW17	Injection Test	45-50	Peel	3.10E+00	3.00E-06
WMMW17	Injection Test	90-95	Peel	3.62E+00	3.50E-06
WMMW17	Injection Test	100-105	Peel	5.69E+00	5.50E-06
WMMW18	Injection Test	27-32	Peel	1.14E+02	1.10E-04
WMMW18	Injection Test	85-90	Peel	2.59E+01	2.50E-05
WMMW18	Injection Test	85-90	Peel	2.69E+01	2.60E-05
WMMW18	Injection Test	120-125	Peel	4.66E+00	4.50E-06
WMMW19	Injection Test	55-60	Peel	8.69E+00	8.40E-06
WMMW19	Injection Test	95-100	Peel	1.45E+00	1.40E-06
			Geometric Mean	1.05E+01	1.01E-05
Entrada/Navajo Sandstones					
WW-1	Recovery		D'Appolonia (4)	3.80E+02	3.67E-04
WW-1	Multi-well drawdown		D'Appolonia	4.66E+02	4.50E-04
WW-1,2,3	Multi-well drawdown		D'Appolonia	4.24E+02	4.10E-04
			Geometric Mean	4.22E+02	4.08E-04

Notes

(1) D&M = Dames & Moore, Environmental Report, White Mesa Uranium Project, January 1978.

(2) Peel = Peel Environmental Services, UMETCO Minerals Corp., Ground Water Study, White Mesa Facility, June 1994.

(3) H-E = Hydro-Engineering, Ground-Water Hydrology at the White Mesa Tailings Facility, July 1991.

(4) D'Appolonia, Assessment of the Water Supply System, White Mesa Project, Feb. 1981.

(5) Early test data.

(6) Late test data.

(7) Test data reanalyzed by TEC.

TABLE 5
Properties of the Dakota/Burro Canyon Formation
White Mesa Uranium Mill
from TITAN (1994)

Formation	Well No. and Sample Interval		% Moisture Content	Moisture Content, Volumetric	Dry Unit Weight (lbs/cu ft)	% Porosity	Particle Specific Gravity	% Saturation	% Retained Moisture	% Liquid Limit	% Plastic Limit	% Plasticity Index	Rock Type
Dakota	WMMW-16	26.4' - 38.4'	1.50	3.30	135.20	17.90	2.64	18.20	5.10	--	--	--	Sandstone
	WMMW-16	37.8' - 38.4'	0.40	0.80	127.40	22.40	2.63	3.70	6.30	--	--	--	Sandstone
	WMMW-17	27.0' - 27.5'	0.30	0.60	138.80	13.40	2.57	4.80	5.10	--	--	--	Sandstone
	WMMW-17	49.0' - 49.5'	3.60	7.10	121.90	26.00	2.64	27.20	9.60	--	--	--	Sandstone
	Formation Average:		**1.45**	**2.95**	**130.83**	**19.93**	**2.62**	**13.48**	**6.53**				
Burro Canyon	WMMW-16	45.0' - 45.5'	5.60	12.60	140.90	16.40	2.70	77.20	--	29.60	15.40	14.20	Sandy Mudstone
	WMMW-16	47.5' - 48.0'	2.60	5.90	142.80	12.00	2.60	48.90	4.40	--	--	--	Sandstone
	WMMW-16	53.5' - 54.1'	0.70	1.40	129.00	19.90	2.58	7.10	6.40	--	--	--	Sandstone
	WMMW-16	60.5' - 61.0'	0.10	0.20	117.90	27.30	2.61	0.80	9.90	--	--	--	Sandstone
	WMMW-16	65.5' - 66.0'	2.60	5.50	131.50	19.30	2.62	28.20	7.10	--	--	--	Sandstone
	WMMW-16	73.0' - 73.5'	0.10	0.30	130.30	20.60	2.63	1.30	5.50	--	--	--	Sandstone
	WMMW-16	82.0' - 82.4'	0.10	0.10	134.30	18.50	2.64	0.60	4.80	--	--	--	Sandstone
	WMMW-16	90.0' - 90.7'	0.10	0.30	161.50	2.00	2.64	12.80	0.90	--	--	--	Sandstone
	WMMW-16	91.1' - 91.4'	5.20	9.80	118.10	29.10	2.67	33.80	--	33.70	16.20	17.50	Claystone
	WMMW-17	104.0' - 104.5	0.20	0.40	161.40	1.70	2.67	26.60	0.80	--	--	--	Sandstone*
	Formation Average:		**1.90**	**4.01**	**134.03**	**18.34**	**2.63**	**23.41**	**5.57**				

Note:

**Data from this interval is actually from the Brushy Basin and is not included in the averages.*

TABLE 6
Hydraulic Conductivity Estimates For Spring Flow Calculations

Ruin Spring		Westwater Seep		Westwater Seep (2)	
location	**k (cm/s)**	**location**	**k (cm/s)**	**location**	**k (cm/s)**
DR-21	3.29E-05	DR-5	2.95E-05	DR-5	2.95E-05
DR-23	1.96E-05	DR-8	2.46E-08	MW-23	2.30E-07
DR-24	1.64E-05	DR-9	4.49E-04	MW-24	4.16E-05
		DR-10	2.92E-06	MW-35	3.48E-04
		DR-11	8.88E-06		
		MW-12	2.20E-05		
		MW-23	2.30E-07		
		MW-24	4.16E-05		
		MW-36	4.51E-04		
geomean:	2.19E-05	**geomean:**	9.76E-06	**geomean:**	1.77E-05

Notes:

k = hydraulic conductivity

cm/s = centimeters per second

TABLE 7
Hydraulic Conductivity Estimates For Travel Time Calculations
Paths 1, 2A, and 2B

PATH 1		**PATH 2A**		**PATH 2B**	
location	**k (cm/s)**	**location**	**k (cm/s)**	**location**	**k (cm/s)**
TWN-2	1.49E-05	TW4-5 u	4.60E-04	TW4-2 u	4.30E-05
TWN-3	8.56E-06	TW4-5 c	1.00E-03	TW4-2 c	5.70E-05
TWN-18	2.27E-03	TW4-9 u	3.90E-04	MW-4A u	1.10E-04
TW4-21	1.90E-04	TW4-9 c	8.20E-04	MW-4A c	1.40E-04
TW4-22	1.30E-04	TW4-10 u	2.60E-04	TW4-5 u	4.60E-04
TW4-24	1.60E-04	TW4-10 c	5.40E-04	TW4-5 c	1.00E-03
MW-11	1.40E-03	TW4-18 u	3.90E-04	TW4-9 u	3.90E-04
MW-30	1.00E-04	TW4-18 c	8.60E-04	TW4-9 c	8.20E-04
MW-31	7.10E-05	TW4-19 u	2.40E-04	TW4-10 u	2.60E-04
		TW4-19 c	4.60E-04	TW4-10 c	5.40E-04
				TW4-28	3.52E-04
geomean:	1.31E-04	**geomean:**	4.88E-04	**geomean:**	2.53E-04

Notes:

k = hydraulic conductivity
cm/s = centimeters per second
c = confined solution
u = unconfined solution

TABLE 8
Hydraulic Conductivity Estimates for Travel Time Calculations
Paths 3-6

PATHS 3 and 4		PATH 5		PATH 6	
location	**k (cm/s)**	**location**	**k (cm/s)**	**location**	**k (cm/s)**
DR-5	2.95E-05	DR-5	2.95E-05	DR-11	8.88E-06
DR-8	2.46E-08	DR-8	2.46E-08	DR-13	5.89E-06
DR-9	4.49E-04	DR-9	4.49E-04	DR-21	3.29E-05
DR-10	2.92E-06	DR-10	2.92E-06	DR-23	1.54E-05
DR-11	8.88E-06	DR-11	8.88E-06	MW-3	4.00E-07
MW-12	2.20E-05	DR-14	1.26E-05	MW-14	7.50E-04
MW-23	2.30E-07	DR-17	1.24E-05	MW-15	1.90E-05
MW-24	4.16E-05	DR-19	3.29E-05	MW-20	9.30E-06
MW-36	4.51E-04	DR-20	2.14E-06	MW-37	1.28E-05
		DR-21	3.29E-05		
		DR-23	1.96E-05		
		DR-24	1.64E-05		
		MW-23	2.30E-07		
		MW-24	4.16E-05		
		MW-36	4.51E-04		
geomean:	9.76E-06	**geomean:**	1.10E-05	**geomean:**	1.38E-05

Notes:

k = hydraulic conductivity

cm/s = centimeters per second

TABLE 9
Estimated Perched Zone Pore Velocities Along Path Lines

Path	Hydraulic Conductivity[a]		Path Length	Head Change	Hydraulic Gradient	Pore Velocity
	(cm/s)	(ft/yr)	(ft)	(ft)	ft/ft	ft/yr
1	1.31E-04	134	1,250	35	0.0280	21
2A	4.88E-04	499	1,200	33	0.0275	76
2B	2.53E-04	259	1,450	38	0.0262	38
3	9.76E-06	10.0	2,200	27	0.0123	0.68
4	9.76E-06	10.0	4,125	19	0.0046	0.26
5	1.10E-05	11.3	11,800	113	0.0096	0.60
6	1.38E-05	14.1	9,685	112	0.0116	0.91

Notes:

[a] Geometric average (from Tables 7 and 8)
Assumes effective porosity of 0.18
cm/s = centimeters per second
ft/ft = feet per foot
ft/yr = feet per year

TABLE 10
Results of XRD and Sulfur Analysis
in Weight Percent

Mineral	Formula	MW-3A	MW-23	MW-24	MW-25	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-32 (TW4-17)	SS-26*
		Depth (feet)											
		89.5	**108**	**118.5**	**65 - 67.5**	**90 - 92.5**	**80 - 82.5**	**88.5**	**102**	**65 - 67.5**	**95 - 97.5**	**105-107.5**	**NA**
quartz	SiO_2	79.7	96.2	88.4	90	86.9	95.4	90.1	95.8	87	91.7	94.1	39.2
K-feldspar	$KAlSi_3O_8$	ND	0.2	0.6	2.4	2.4	0.7	1.5	0.5	1.4	2	0.8	21.6
plagioclase	$(Na,Ca)(Si,Al)_4O_8$	ND	ND	ND	1.4	1.6	1.5	1.8	1.5	1.5	0.5	0.2	29
mica	$KAl_2(Si_3Al)O_{10}(OH)_2$	0.3	1.2	4.5	2.2	2	0.2	3	0.2	5.9	3.1	1.2	5.2
kaolinite	$Al_2Si_2O_5(OH)_4$	1.1	1	4.3	3.2	2.5	1.4	2.9	1.7	3.6	2.4	1.6	0.8
calcite	$CaCO_3$	14	ND	ND	ND	3.9	ND	ND	ND	ND	ND	1.2	0.6
dolomite	$CaMg(CO_3)_2$	4.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
anhydrite	$CaSO_4$	0.4	0.8	0.4	0.4	ND	ND	ND	ND	ND	ND	ND	ND
gypsum	$CaSO_4 \cdot 2H_2O$	ND	0.2	0.8	ND	ND	ND	0.3	ND	0.3	ND	ND	ND
iron	Fe	0.3	0.4	0.2	0.4	0.4	0.4	0.2	0.3	0.3	0.3	0.4	0.2
pyrite	FeS_2	0.1	ND	0.8	ND	0.3	0.4	0.2	ND	ND	ND	0.5	ND
hematite	Fe_2O_3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4
magnetite	Fe_3O_4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Sulfur Determination													
Total S	S	0.14	0.14	0.63	0.05	0.13	0.15	0.04	0.03	0.02	0.02	0.26	0.02
equivalent FeS_2	FeS_2	0.3	0.3	1.2	0.1	0.2	0.3	0.1	0.1	<0.1	<0.1	0.5	<0.1

Notes:

NA = Not applicable: quality control sample

ND = Not Detected

** = 'play sand'*

TABLE 11
Tabulation of Presence of
Pyrite, Iron Oxide, and Carbonaceous Fragments in Drill Logs

Well	Pyrite	C Fragments	Iron Oxide
MW-3A			X
[a]MW-16			X
[a]MW-17			X
[a]MW-18			X
[a]MW-19			X
[a]MW-20			X
[a]MW-21	X		X
[a]MW-22			X
MW-23			X
MW-24			X
MW-25	X		X
MW-26	X		X
MW-27	X		X
MW-28			X
MW-29			X
MW-30	X		X
MW-31	X		X
MW-32	X		X
MW-33			X
MW-34	X	X	X
MW-35	X	X	X
MW-36	X		X
MW-37	X		X
Piez-2			X
Piez-4	X		X
Piez-5	X		X
DR-2	X		X
DR-5	X		X
DR-6	X		X
DR-7			X
DR-8			X
DR-9	X		X
DR-10			X
DR-11	X		X
DR-12	X		X
DR-13			X
DR-14	X		X
DR-15	X		X
DR-16	X		X
DR-17			
DR-18	X		X
DR-19			X
DR-20	X		X
DR-21			X
DR-22			
DR-23	X		X
DR-24	X		X
DR-25	X		X
TW4-1			X
TW4-2	X		X
TW4-3	X	X	X
TW4-4			
TW4-5	X	X	
TW4-6	X	X	X

TABLE 11
Tabulation of Presence of
Pyrite, Iron Oxide, and Carbonaceous Fragments in Drill Logs

Well	Pyrite	C Fragments	Iron Oxide
TW4-7	X	X	X
TW4-8			X
TW4-9	X	X	X
TW4-10	X	X	
TW4-11		X	
TW4-12	X	X	X
TW4-13	X	X	X
TW4-14			X
TW4-15	X		X
TW4-16	X		X
TW4-17	X		X
TW4-18		X	X
TW4-19			X
TW4-20			X
TW4-21	X		X
TW4-22	X		
TW4-23	X	X	X
TW4-24			X
TW4-25	X		X
TW4-26			X
TW4-27	X		X
TW4-28	X	X	
TW4-29	X	X	X
TW4-30	X	X	X
TW4-31	X	X	X
TW4-32	X	X	X
TW4-33	X		X
TW4-34		X	X
TWN-1			X
TWN-2	X		X
TWN-3	X		X
TWN-4			X
TWN-5	X		X
TWN-6	X		X
TWN-7			X
TWN-8	X		X
TWN-9			X
TWN-10			X
TWN-11	X		X
TWN-12	X		X
TWN-13	X		X
TWN-14	X		X
TWN-15	X		X
TWN-16	X		X
TWN-17			X
TWN-18	X		X
TWN-19	X		X

Notes:

C Fragments = particles of carbonaceous material (plant remains, etc)

[a] = only moderately detailed log available

TABLE 12
Sulfide Analysis by Optical Microscopy

				Grain size (micrometers)		
Sample	**Depth (feet)**	**Mineral**	**Volume%**	**Minimum**	**Maximum**	**Mean**
MW-26 (TW4-15)[1]	92.5' - 97.5'	pyrite	4.30	5.6	44.4	128.9
MW-34	67.5' - 70'	pyrite	0.30	1.1	177.8	71.1
MW-36	87.5' - 90'	pyrite	5.20	5.6	88.9	52.2
MW-36	87.5' - 90'	marcasite	0.50	22.2	488.8	121.2
MW-36	112.5' - 115'	pyrite	2.20	16.7	577.7	188.9
MW-36	112.5' - 115'	marcasite	0.20	22.2	333.3	177.8
MW-37	110' - 112.5'	pyrite	9.80	11.1	1666.5	131.1
TW4-16[2]	92.5' - 95'	pyrite	0.10	11.1	105.5	47.8
TW4-22	90' - 92.5'	pyrite	0.30	5.6	66.7	26.7
TWN-5	110' - 112.5'	pyrite	15.80	5.6	1377.6	208.9
TWN-5	112.5' - 115'	pyrite	0.50	5.6	266.6	70
TWN-5	112.5' - 115'	marcasite	0.50	22.2	55.6	36.7
TWN-5	112.5' - 115'	chalcopyrite	0.02	ND	ND	6
TWN-8	117.5' - 120'	pyrite	12.00	5.6	455.1	137.8
TWN-8	117.5' - 120'	marcasite	0.60	66.6	288.9	155.5
AWN-X2[3]	87.5' - 90'	pyrite	2.40	5.6	33.3	17.8
AWN-X2[3]	87.5' - 90'	marcasite	0.60	66.6	288.9	155.5
TWN-16[4]	82.5' - 85'	pyrite	0.10	1.1	11.1	6.1
TWN-16[4]	87.5' - 90'	pyrite	0.16	7	168	35.5
TWN-16[4]	87.5' - 90'	marcasite	0.05	ND	129.5	ND
TWN-19[5]	82.5 ' - 85'	pyrite	1.18	3.5	434	42.1
TWN-19[5]	82.5 ' - 85'	marcasite	0.06	21	42	36.4
DR-9	105' - 107.5'	pyrite	17.00	2.2	677.7	136.7
DR-12	87.5' - 90'	pyrite	0.30	11.1	111.1	52.2
DR-12	87.5' - 90'	marcasite	0.10	22.2	111.1	72.2
DR-16	97.5' - 100'	pyrite	2.40	5.6	33.3	17.8
DR-16	97.5' - 100'	marcasite	0.60	66.6	288.9	155.5
DR-25	75' - 77.5'	pyrite	25.00	1.1	1955	22
DR-25	75' - 77.5'	marcasite	2.50	55.6	621.6	265.5
SS-31*	NA	chalcopyrite	0.01	ND	ND	10
SS-37*	NA	pyrite	0.02	7	14	11.7

Notes:

[1] *Samples from 92.5' - 95' and 95' - 97.5' combined due to small sample volume*

[2] *Sample from 92.5' - 95' submitted instead of sample from 95' - 97.5' because no sample material available*

[3] *Originally TWN-16*

[4] *Originally TWN-19*

[5] *Originally TWN-22*

NA = Not applicable: quality control sample

ND = Not determined

** = 'play sand'*

TABLE 13
Summary of
Pyrite in Drill Cuttings and Core

Well	Pyrite Noted in Drill Logs	Pyrite Detected by Laboratory
MW-3A		**X** (Q)
[a]MW-16		NA
[a]MW-17		NA
[a]MW-18		NA
[a]MW-19		NA
[a]MW-20		NA
[a]MW-21	**X**	NA
[a]MW-22		NA
MW-23		possible[b] (Q)
MW-24		**X** (Q)
MW-25	**X**	possible[b] (Q)
MW-26	**X**	**X** (Q)
MW-27	**X**	**X** (Q)
MW-28		**X** (Q)
MW-29		possible[b] (Q)
MW-30	**X**	ND (Q)
MW-31	**X**	ND (Q)
MW-32	**X**	**X** (Q)
MW-33		NA
MW-34	**X**	**X** (V)
MW-35	**X**	NA
MW-36	**X**	**X** (V)
MW-37	**X**	**X** (V)
Piez-2		NA
Piez-4	**X**	NA
Piez-5	**X**	NA
DR-2	**X**	NA
DR-5	**X**	NA
DR-6	**X**	NA
DR-7		NA
DR-8		NA
DR-9	**X**	**X** (V)
DR-10		NA
DR-11	**X**	NA
DR-12	**X**	**X** (V)
DR-13		NA
DR-14	**X**	NA
DR-15	**X**	NA
DR-16	**X**	**X** (V)
DR-17		NA
DR-18	**X**	NA
DR-19		NA
DR-20	**X**	NA
DR-21		NA
DR-22		NA
DR-23	**X**	NA
DR-24	**X**	NA
DR-25	**X**	**X** (V)
TW4-1		NA
TW4-2	**X**	NA
TW4-3	**X**	NA
TW4-4		NA
TW4-5	**X**	NA
TW4-6	**X**	NA
TW4-7	**X**	NA
TW4-8		NA
TW4-9	**X**	NA
TW4-10	**X**	NA
TW4-11		NA

TABLE 13
Summary of
Pyrite in Drill Cuttings and Core

Well	Pyrite Noted in Drill Logs	Pyrite Detected by Laboratory
TW4-12	**X**	NA
TW4-13	**X**	NA
TW4-14		NA
TW4-15	**X**	NA
TW4-16	**X**	**X** (V)
TW4-17	**X**	NA
TW4-18		NA
TW4-19		NA
TW4-20		NA
TW4-21	**X**	NA
TW4-22	**X**	**X** (V)
TW4-23	**X**	NA
TW4-24		NA
TW4-25	**X**	NA
TW4-26		NA
TW4-27		NA
TW4-28	**X**	NA
TW4-29	**X**	NA
TW4-30	**X**	NA
TW4-31	**X**	NA
TW4-32	**X**	NA
TW4-33	**X**	NA
TW4-34		NA
TWN-1		NA
TWN-2	**X**	NA
TWN-3	**X**	NA
TWN-4		NA
TWN-5	**X**	**X** (V)
TWN-6	**X**	NA
TWN-7		NA
TWN-8	**X**	**X** (V)
TWN-9		NA
TWN-10		NA
TWN-11	**X**	NA
TWN-12	**X**	NA
TWN-13	**X**	NA
TWN-14	**X**	NA
TWN-15	**X**	NA
TWN-16	**X**	**X** (V)
TWN-17		NA
TWN-18	**X**	NA
TWN-19	**X**	**X** (V)
AWN-X1		NA
AWN-X2	**X**	**X** (V)
AWN-X3		NA

Notes:

[a] = only moderately detailed log available

[b] = detected iron and sulfur may indicate the presence of pyrite

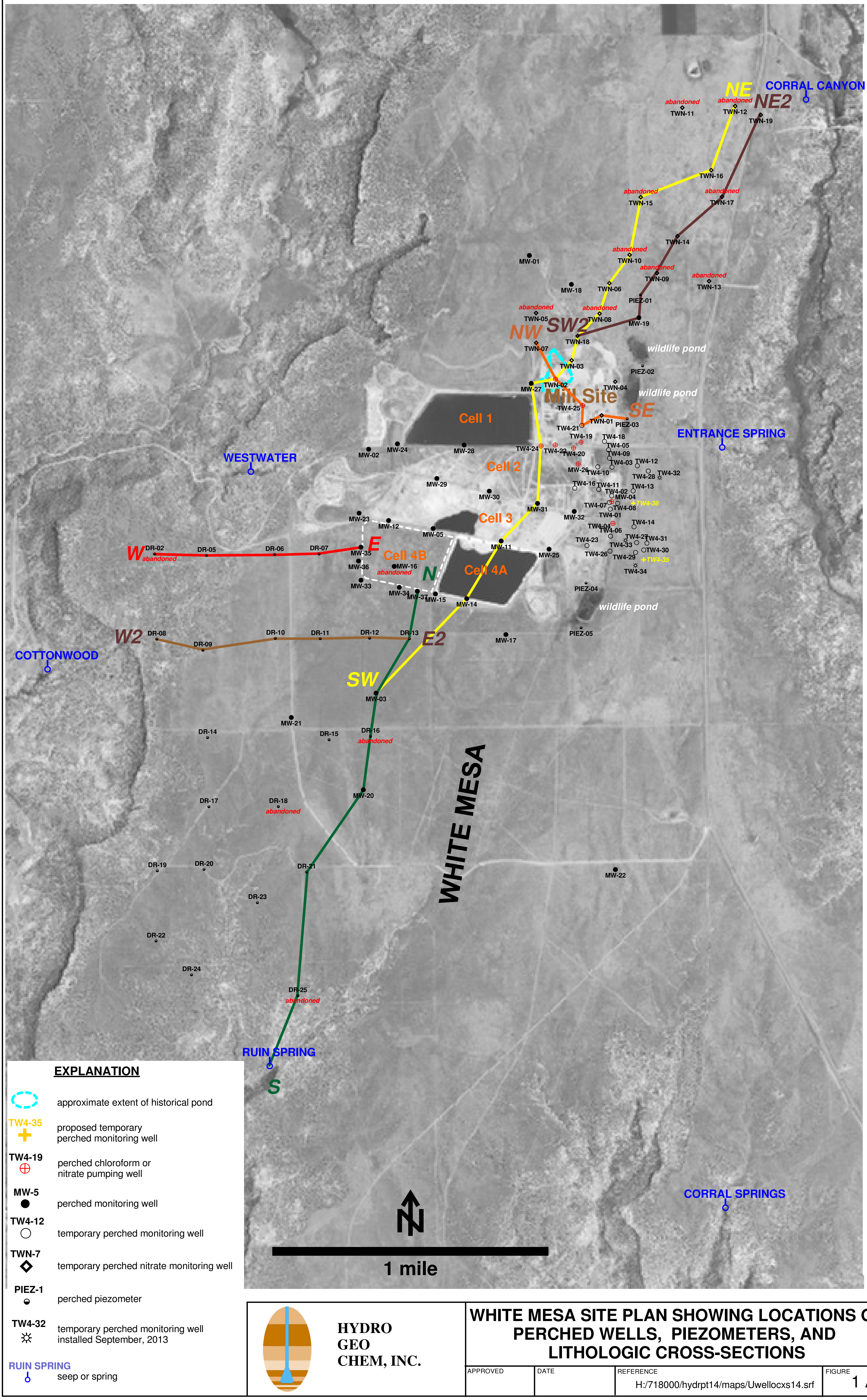
Q = quantiative analysis by XRD

V = visual (microscopic) analysis

ND = not detected by laboratory

NA = not analyzed by laboratory

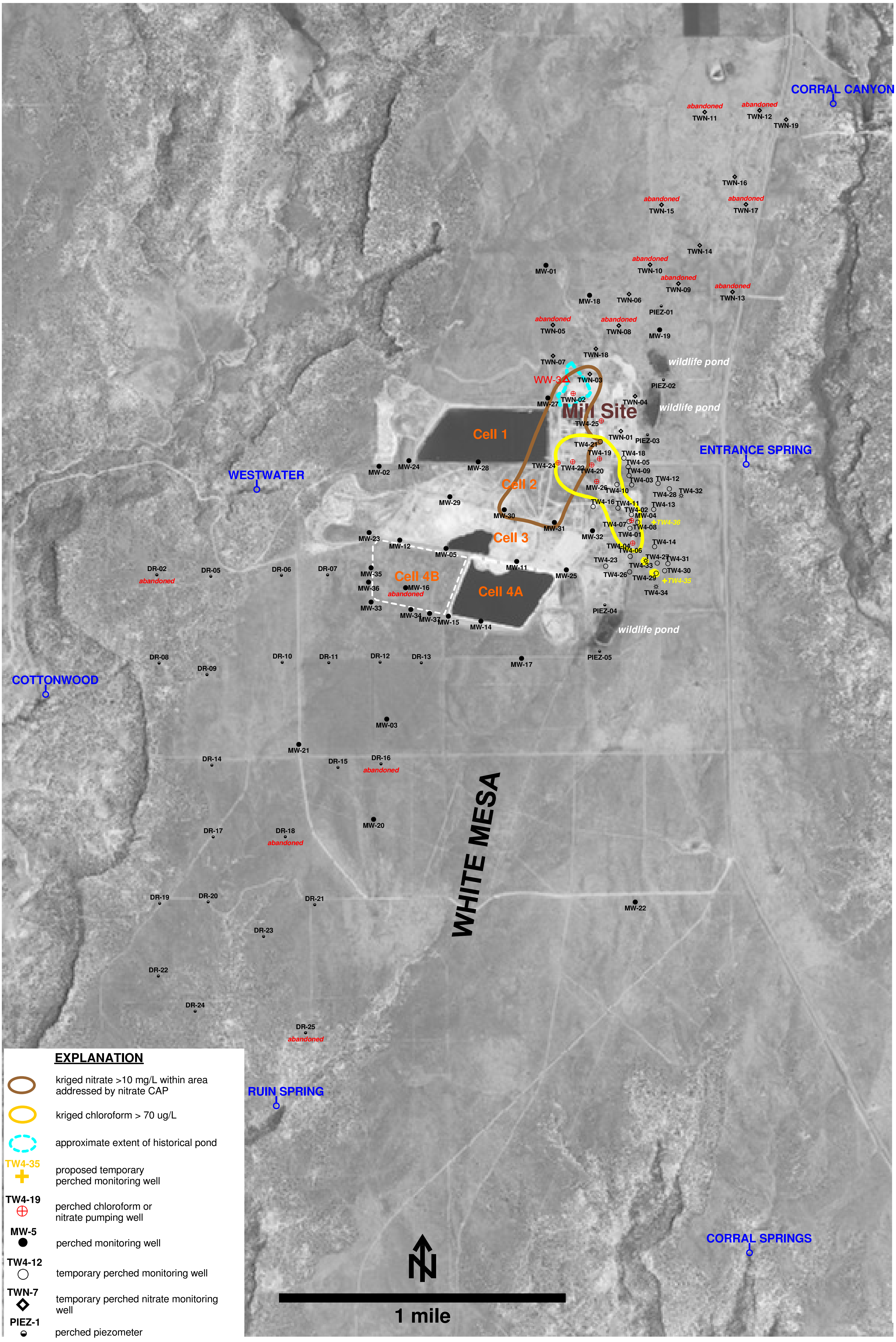
FIGURES



HYDRO
GEO
CHEM, INC.

WHITE MESA SITE PLAN SHOWING LOCATIONS OF PERCHED WELLS, PIEZOMETERS, AND LITHOLOGIC CROSS-SECTIONS

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/maps/Uwellocxs14.srf	1 A



EXPLANATION

⬭	kriged nitrate >10 mg/L within area addressed by nitrate CAP
⬭	kriged chloroform > 70 ug/L
⬭	approximate extent of historical pond
TW4-35 +	proposed temporary perched monitoring well
TW4-19 ⊕	perched chloroform or nitrate pumping well
MW-5 ●	perched monitoring well
TW4-12 ○	temporary perched monitoring well
TWN-7 ◆	temporary perched nitrate monitoring well
PIEZ-1 ◒	perched piezometer
TW4-32 ☼	temporary perched monitoring well installed September, 2013
WW-3 △	water supply well WW-3 (completed in Navajo Sandstone)
RUIN SPRING ⚲	seep or spring

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WHITE MESA SITE PLAN SHOWING LOCATIONS OF PERCHED WELLS, PIEZOMETERS, AND KRIGED NITRATE AND CHLOROFORM PLUME BOUNDARIES

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/maps/UwellocNchl.srf	1 B

SYSTEM	SERIES	FORMATION AND MEMBERS		SYMBOL	THICKNESS Meters (Feet)
QUAT.		Surficial deposits		Q	<12 (<40)
CRET.	Upper	Mancos Shale		Km	0-9 (0-30)
		Dakota Sandstone		Kd	5-15 (15-50)
	L.	Burro Canyon Formation		Kbc	24-36 (80-120)
JURASSIC	Upper	Morrison Fm.	Brushy Basin Member	Jmbb	>60 (>200)

LITHOLOGY

Modified from Doelling (2004).

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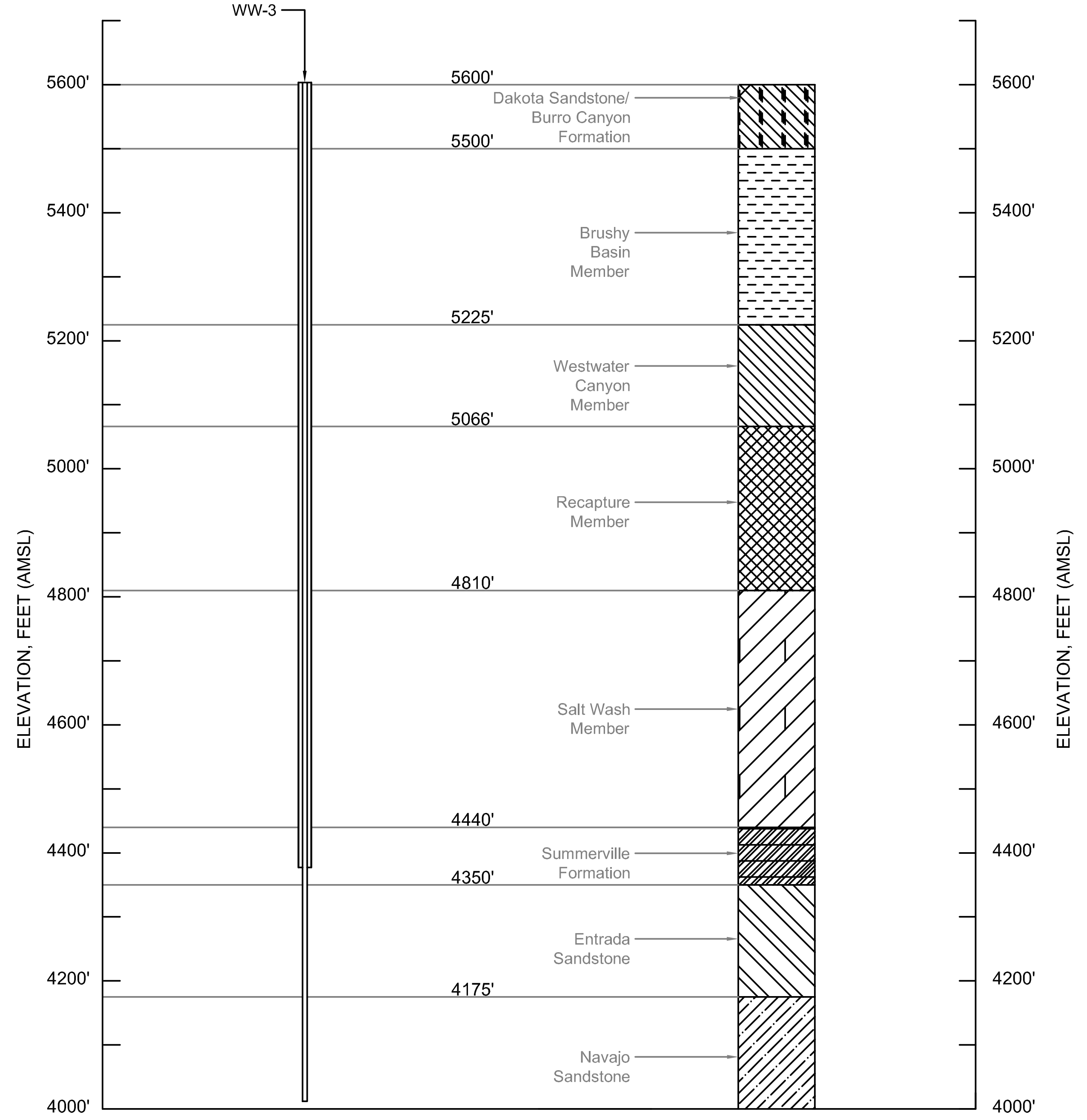
LITHOLOGIC COLUMN

Approved	Date	Author	Date	File Name	Figure
SJS	11/9/12	SJS	11/9/12	F2 litho clmn	2



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WHITE MESA STRATIGRAPHIC SECTION BASED ON LITHOLOGY OF WW-3 FROM TITAN (1994)

Approved	Date	File Name	Figure
SJS	05/02/14	718000110A	3

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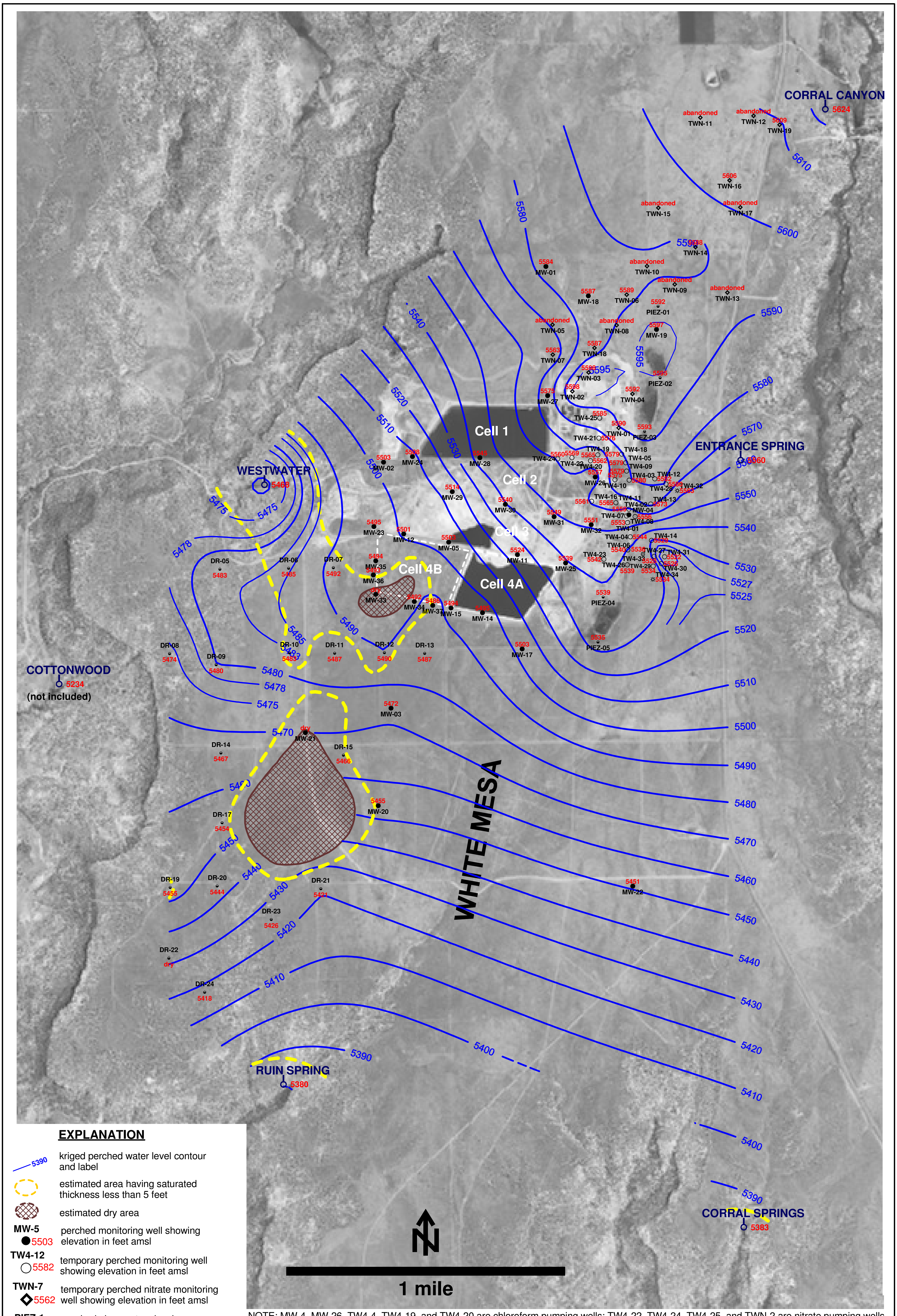
PHOTOGRAPH OF THE CONTACT BETWEEN THE BURRO CANYON FORMATION AND THE BRUSHY BASIN MEMBER

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/ hydrpt14/maps/contact2.srf	4



NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

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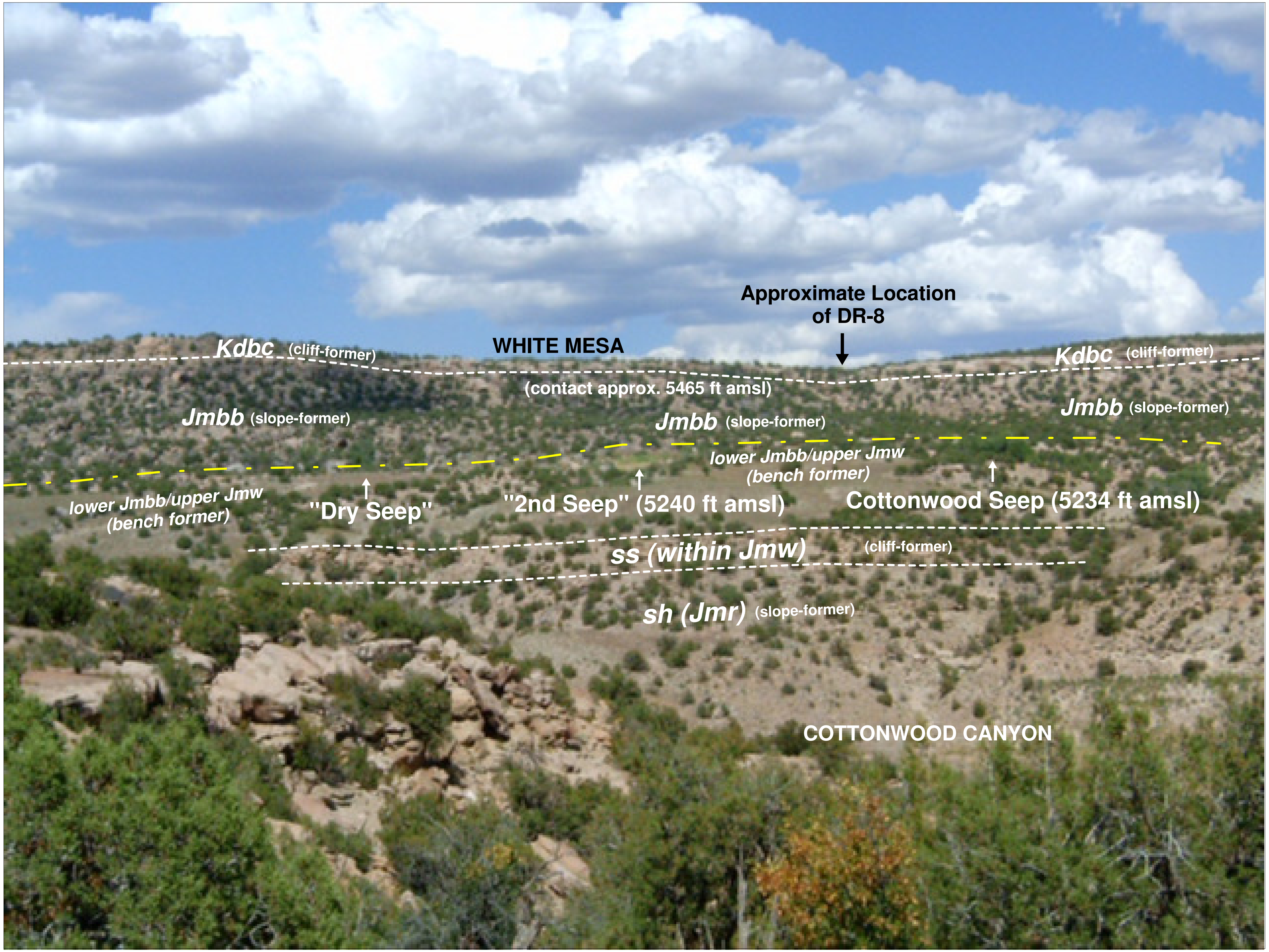
KRIGED 1st QUARTER, 2014 WATER LEVELS
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/maps/Uwl0314det.srf	5



EXPLANATION

🟩	Approximate Location of Geologic Contact
🟩	Approximate Change From Slope-Former to Bench-Former
Kdbc	Dakota Sandstone/ Burro Canyon Formation
Jmbb	Brushy Basin (Shale) Member
ss (within Jmw)	sandstone (within Westwater Canyon Member)
sh (Jmr)	shale (Recapture Member)

NOTES: adapted from HGC (2010); "2nd Seep" and "Dry Seep" are described in HGC (2010)

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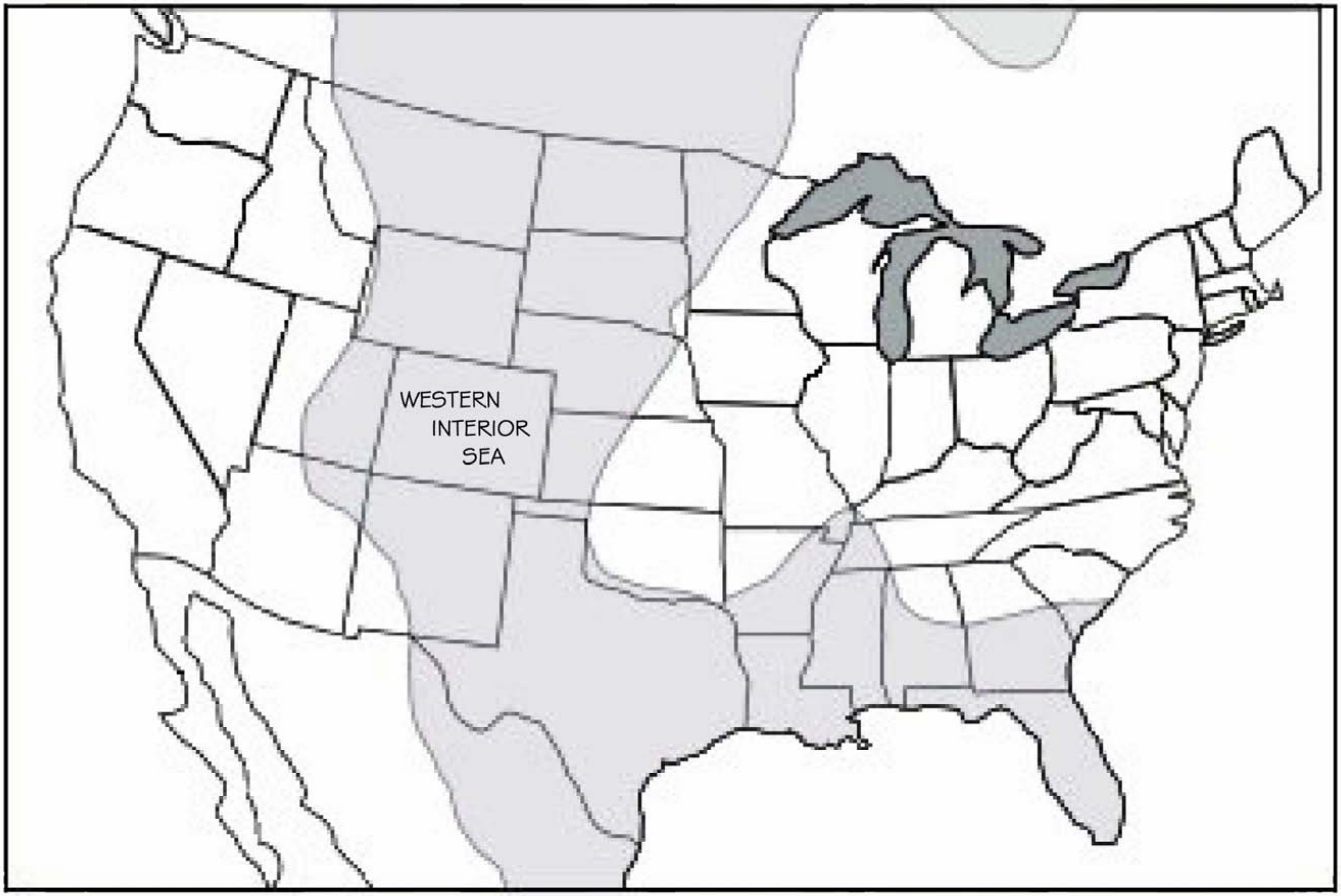
**ANNOTATED PHOTOGRAPH SHOWING
EAST SIDE OF COTTONWOOD CANYON
(looking east toward White Mesa
from west side of Cottonwood Canyon)**

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/hydrpt14/maps/cottonwood2.srf	6



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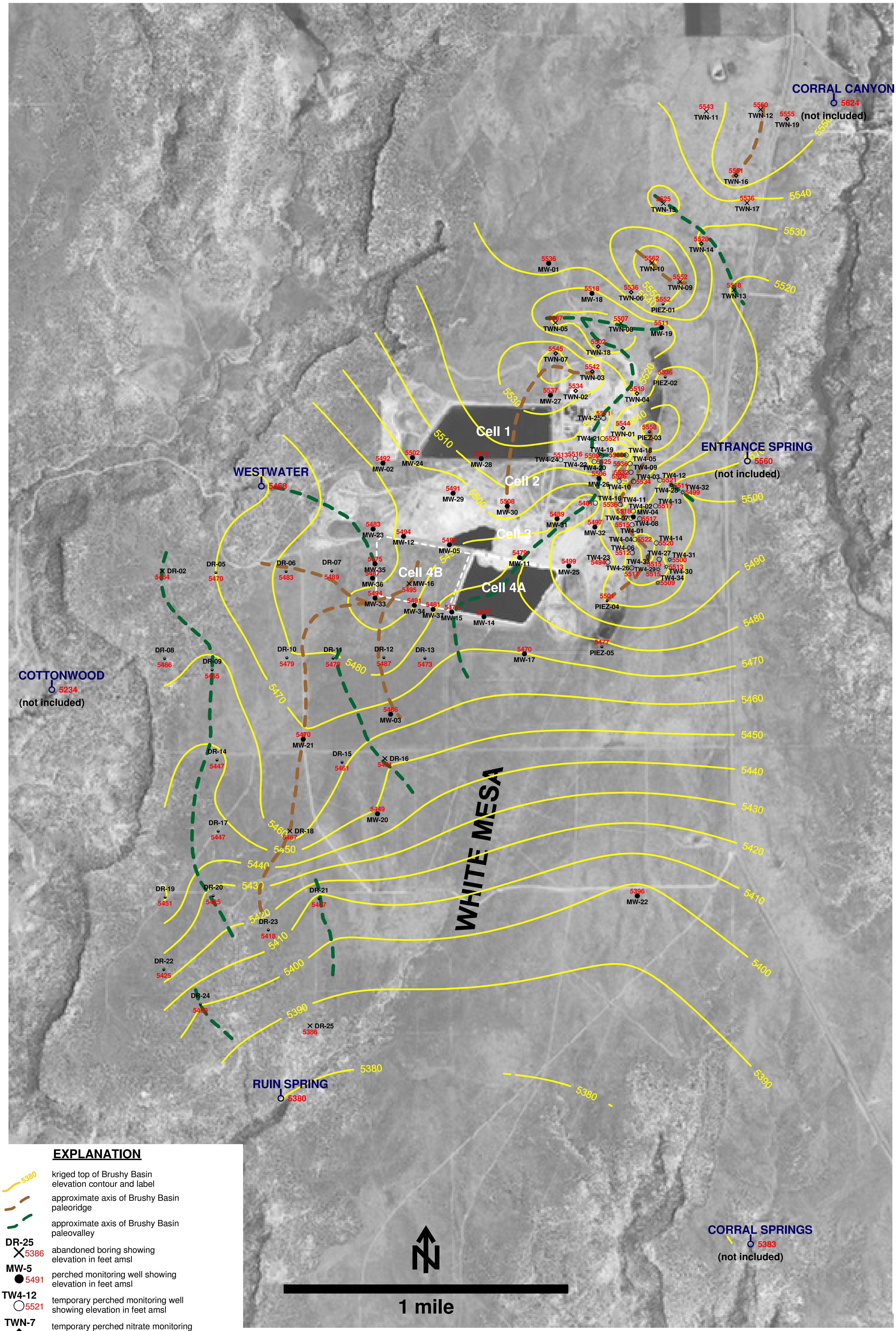
EXTENT OF THE WESTERN INTERIOR SEA (CRETACEOUS)

Approved	Date	Author	Date	File Name	Figure
SJS	11/9/12	SJS	11/9/12	F7 west int sea	7

H:\718000\hydrpt14\report\Figures.xls: F7 west int sea



EXPLANATION

5380	kriged top of Brushy Basin elevation contour and label
	approximate axis of Brushy Basin paleoridge
	approximate axis of Brushy Basin paleovalley
DR-25 ✕ 5386	abandoned boring showing elevation in feet amsl
MW-5 ● 5491	perched monitoring well showing elevation in feet amsl
TW4-12 ○ 5521	temporary perched monitoring well showing elevation in feet amsl
TWN-7 ◆ 5545	temporary perched nitrate monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5551	perched piezometer showing elevation in feet amsl
TW4-32 ☼ 5499	temporary perched monitoring well installed September, 2013 showing elevation in feet amsl
RUIN SPRING ♁ 5380	seep or spring showing elevation in feet amsl

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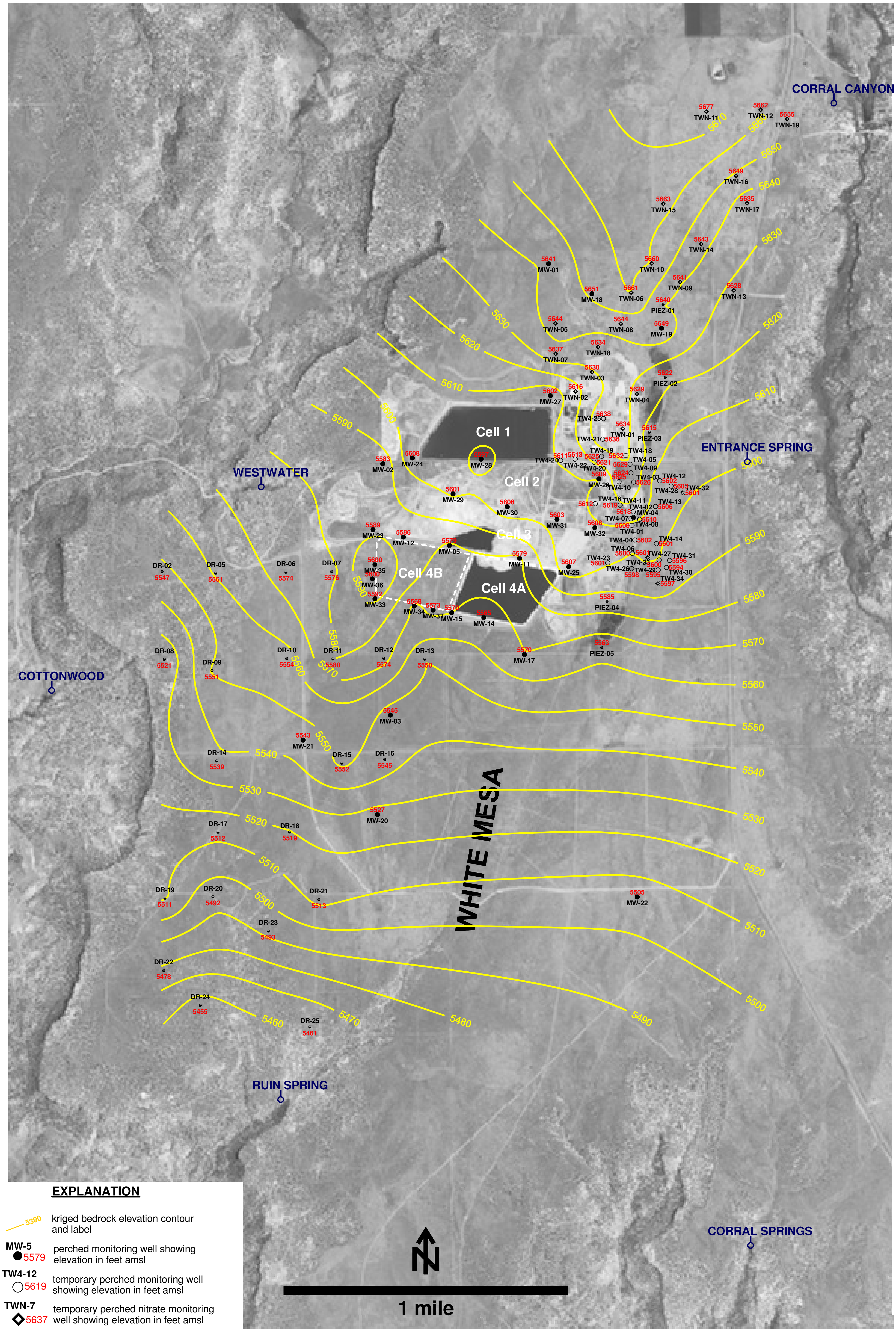
KRIGED TOP OF BRUSHY BASIN
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/fhydrpt14/Ubbel14rv.srf	8



EXPLANATION

5390	kriged bedrock elevation contour and label
MW-5 ● 5579	perched monitoring well showing elevation in feet amsl
TW4-12 ○ 5619	temporary perched monitoring well showing elevation in feet amsl
TWN-7 ◆ 5637	temporary perched nitrate monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5640	perched piezometer showing elevation in feet amsl
TW4-32 ☼ 5601	temporary perched monitoring well installed September, 2013 showing elevation in feet amsl
RUIN SPRING	seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

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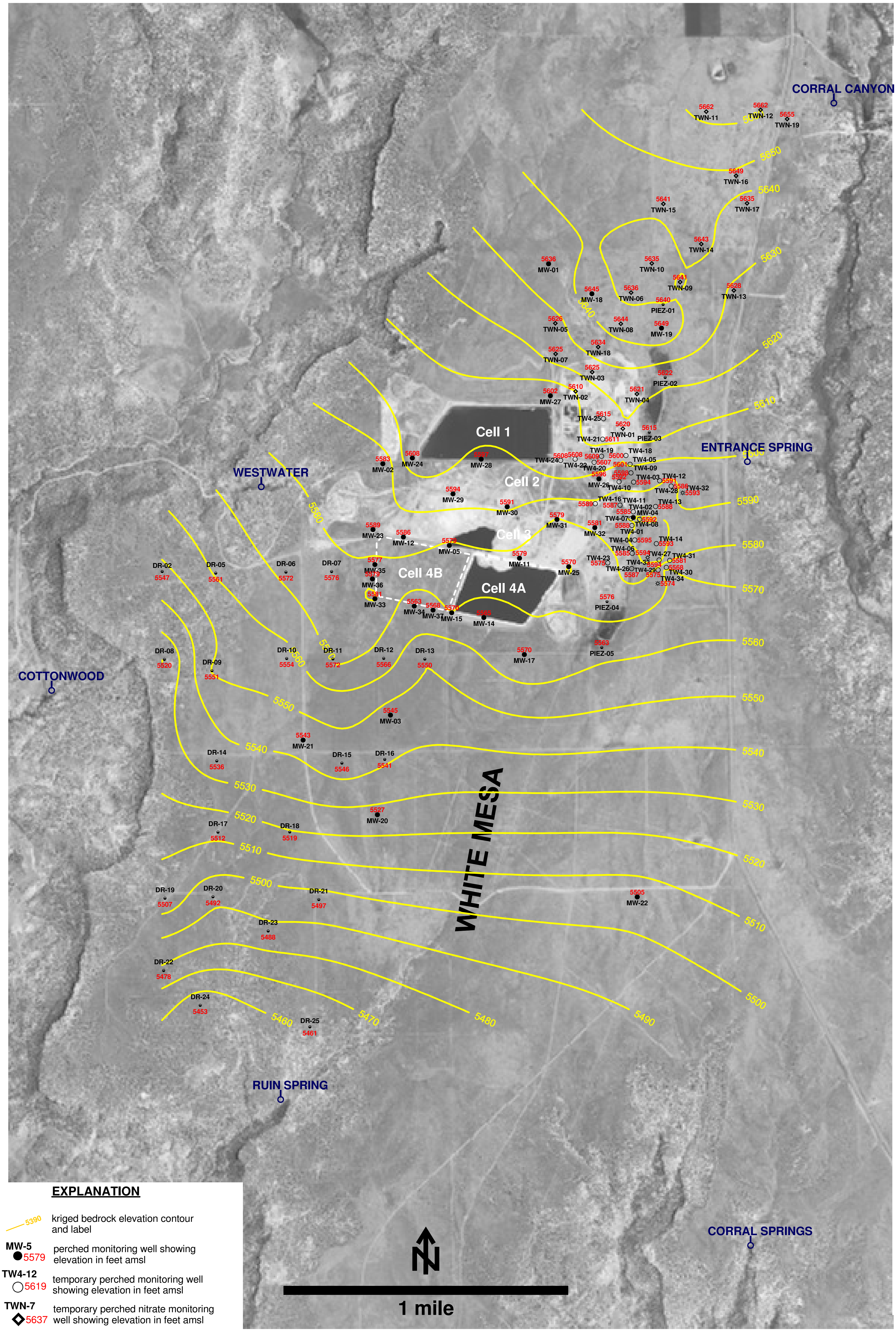
KRIGED TOP OF BEDROCK
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/bedrock/Ubdrkel14.srf	9



EXPLANATION

5390	kriged bedrock elevation contour and label
MW-5 ● 5579	perched monitoring well showing elevation in feet amsl
TW4-12 ○ 5619	temporary perched monitoring well showing elevation in feet amsl
TWN-7 ◆ 5637	temporary perched nitrate monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5640	perched piezometer showing elevation in feet amsl
TW4-32 ☼ 5601	temporary perched monitoring well installed September, 2013 showing elevation in feet amsl
RUIN SPRING ♁	seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO
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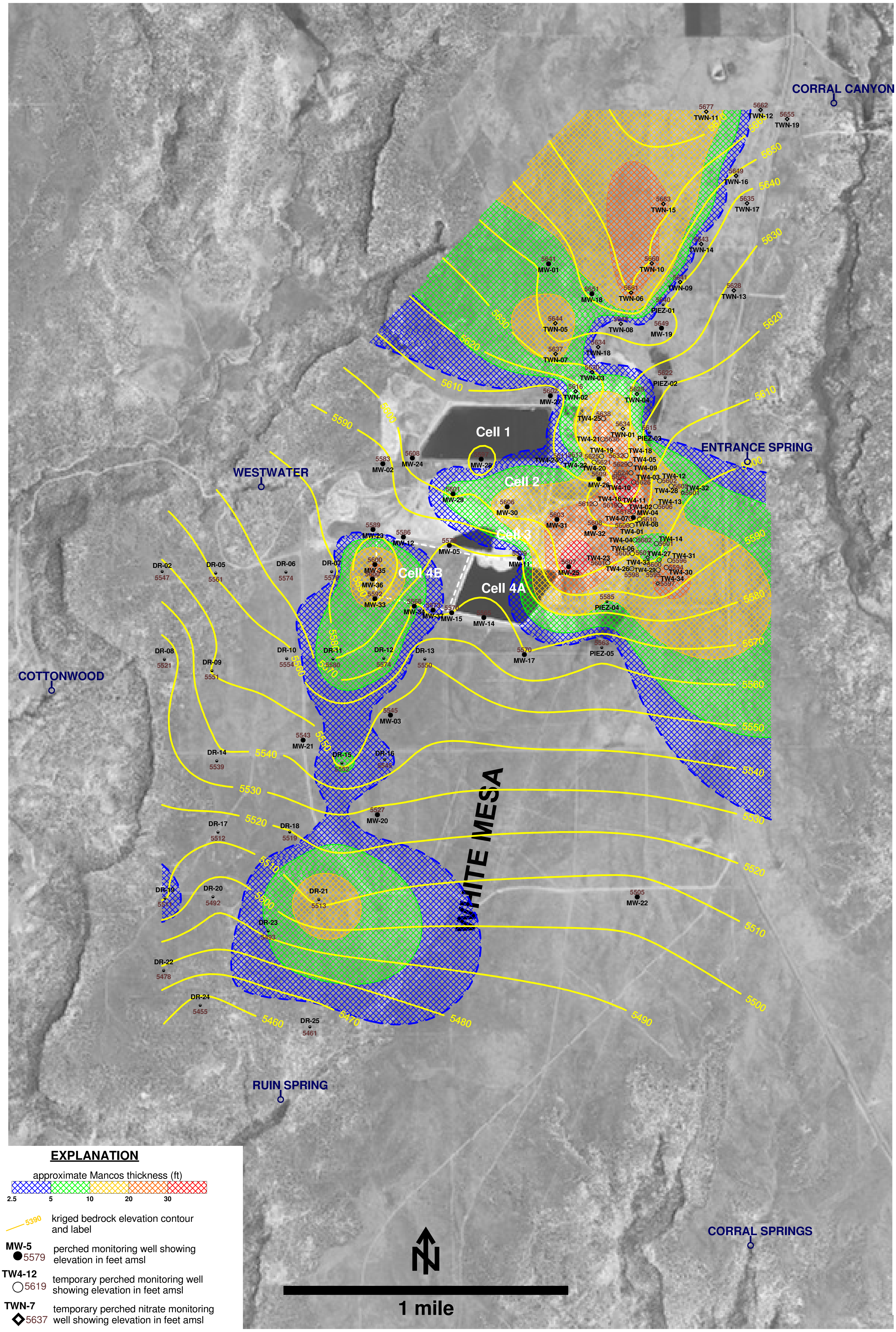
KRIGED TOP OF DAKOTA SANDSTONE
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/bedrock/Udakotael14.srf	10



EXPLANATION

approximate Mancos thickness (ft)

🟦	🟩	🟨	🟧	🟥

2.5 5 10 20 30

5390 kriged bedrock elevation contour and label

MW-5 ● 5579 perched monitoring well showing elevation in feet amsl

TW4-12 ○ 5619 temporary perched monitoring well showing elevation in feet amsl

TWN-7 ◇ 5637 temporary perched nitrate monitoring well showing elevation in feet amsl

PIEZ-1 ◓ 5640 perched piezometer showing elevation in feet amsl

TW4-32 ☼ 5601 temporary perched monitoring well installed September, 2013 showing elevation in feet amsl

RUIN SPRING seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO
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KRIGED TOP OF BEDROCK AND MANCOS SHALE THICKNESS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/bedrock/Ubdrkmanc.srf	11

EXPLANATION

● approximate 1st sampling event geoprobe boring location

● approximate 2nd sampling event geoprobe boring location

● approximate 3rd sampling event geoprobe boring location

⊕ ammonium sulfate crystal tank

north-south (N-S) cross-section

northeast - southwest (NE-SW) cross-section

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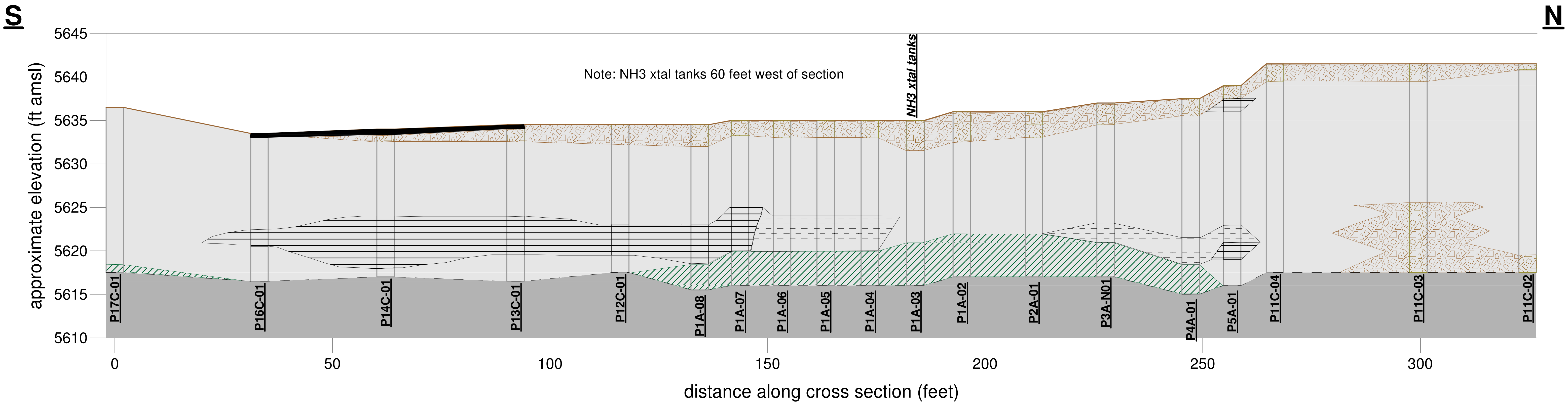
APPROXIMATE GEOPROBE BORING AND CROSS-SECTION LOCATIONS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ xsection/soilxs/soilxsloc_rev.srf	12



EXPLANATION

■ asphalt

▨ primarily sand

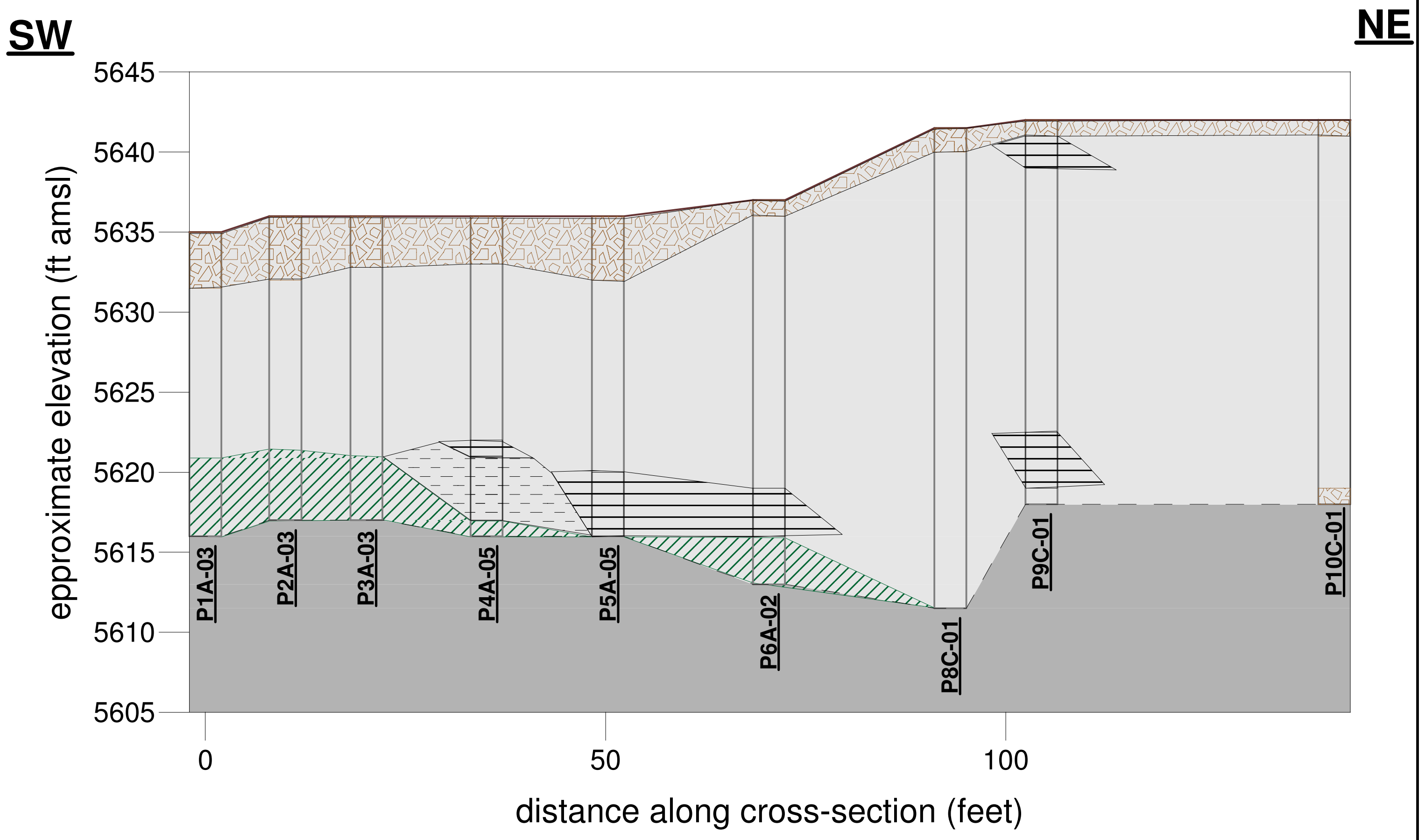
▨ primarily silt

▨ competent bedrock

▨ silt/clay

☰ primarily clay

▨ weathered mancos shale



vertical exaggeration = 2:1

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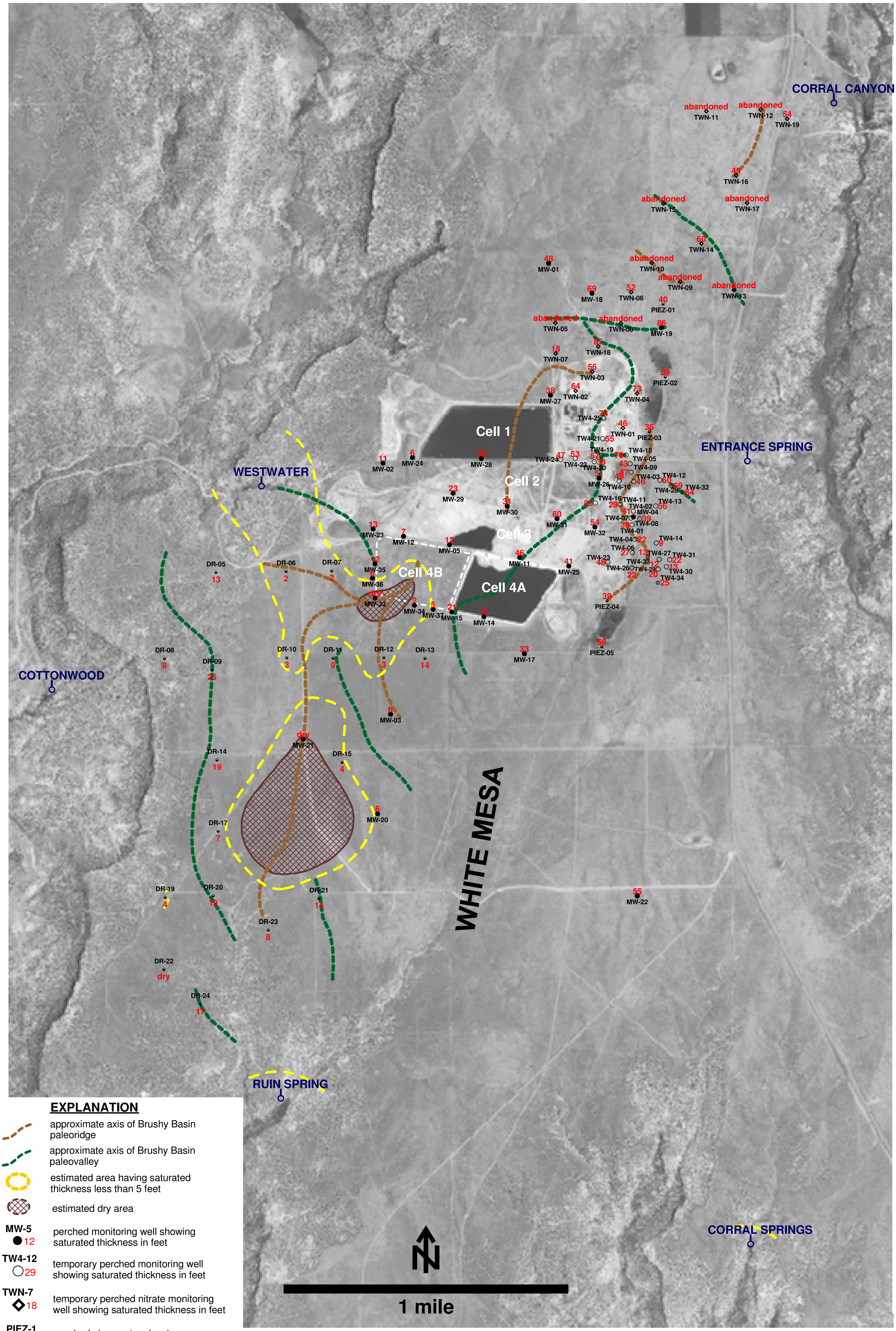
SOIL CROSS SECTIONS
EAST OF AMMONIUM SULFATE CRYSTAL TANKS
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ xsection/soilxs/soilxs.srf	13



EXPLANATION

	approximate axis of Brushy Basin paleoridge
	approximate axis of Brushy Basin paleovalley
	estimated area having saturated thickness less than 5 feet
▨	estimated dry area
MW-5 ● 12	perched monitoring well showing saturated thickness in feet
TW4-12 ○ 29	temporary perched monitoring well showing saturated thickness in feet
TWN-7 ◆ 18	temporary perched nitrate monitoring well showing saturated thickness in feet
PIEZ-1 ◒ 40	perched piezometer showing saturated thickness in feet
TW4-32 ☼ 64	temporary perched monitoring well installed September, 2013 showing saturated thickness in feet
RUIN SPRING	seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

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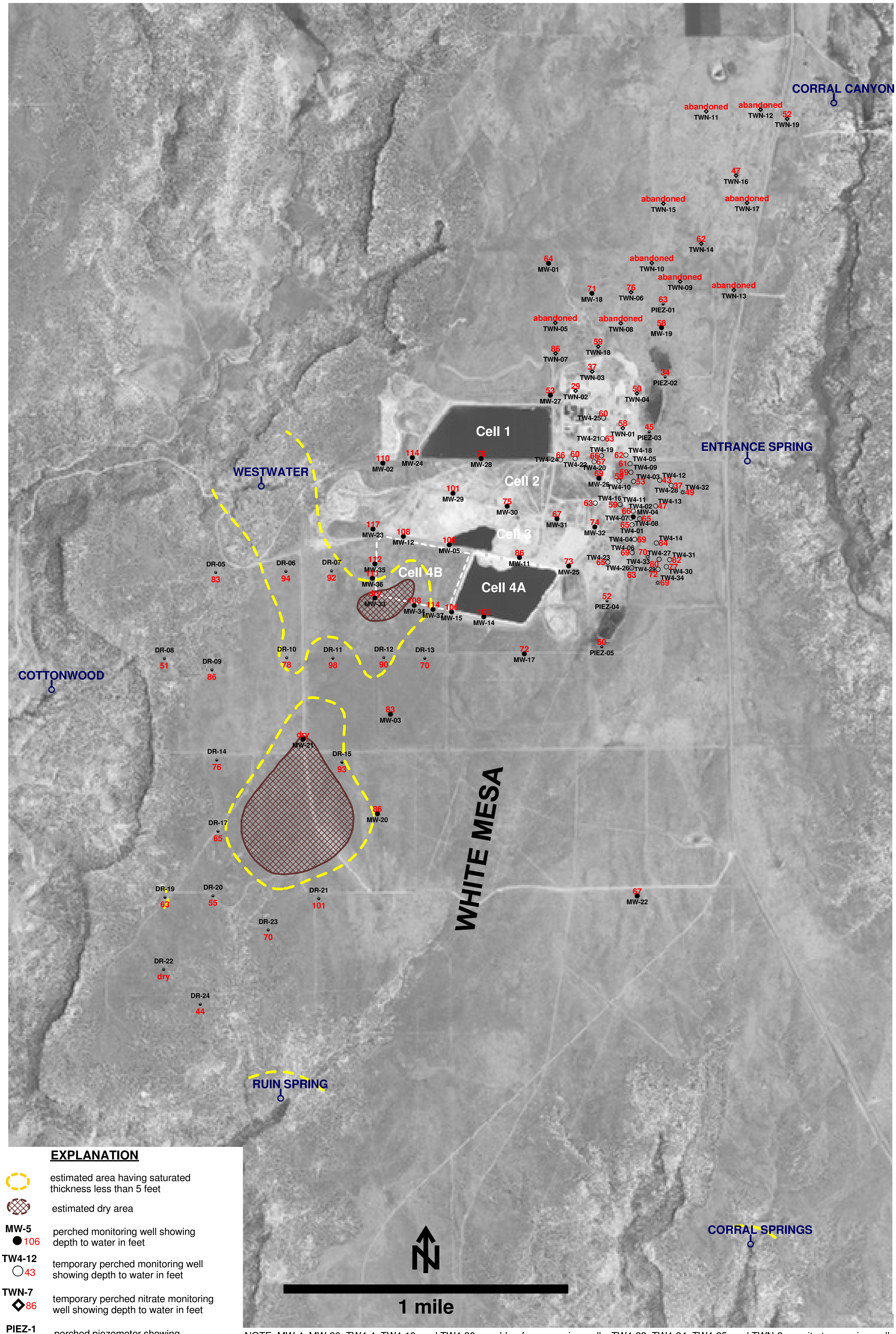
1st QUARTER, 2014 PERCHED ZONE SATURATED THICKNESSES AND BRUSHY BASIN PALEORIDGES AND PALEOVALLEYS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/maps/Usat0314rv.srf	14



EXPLANATION

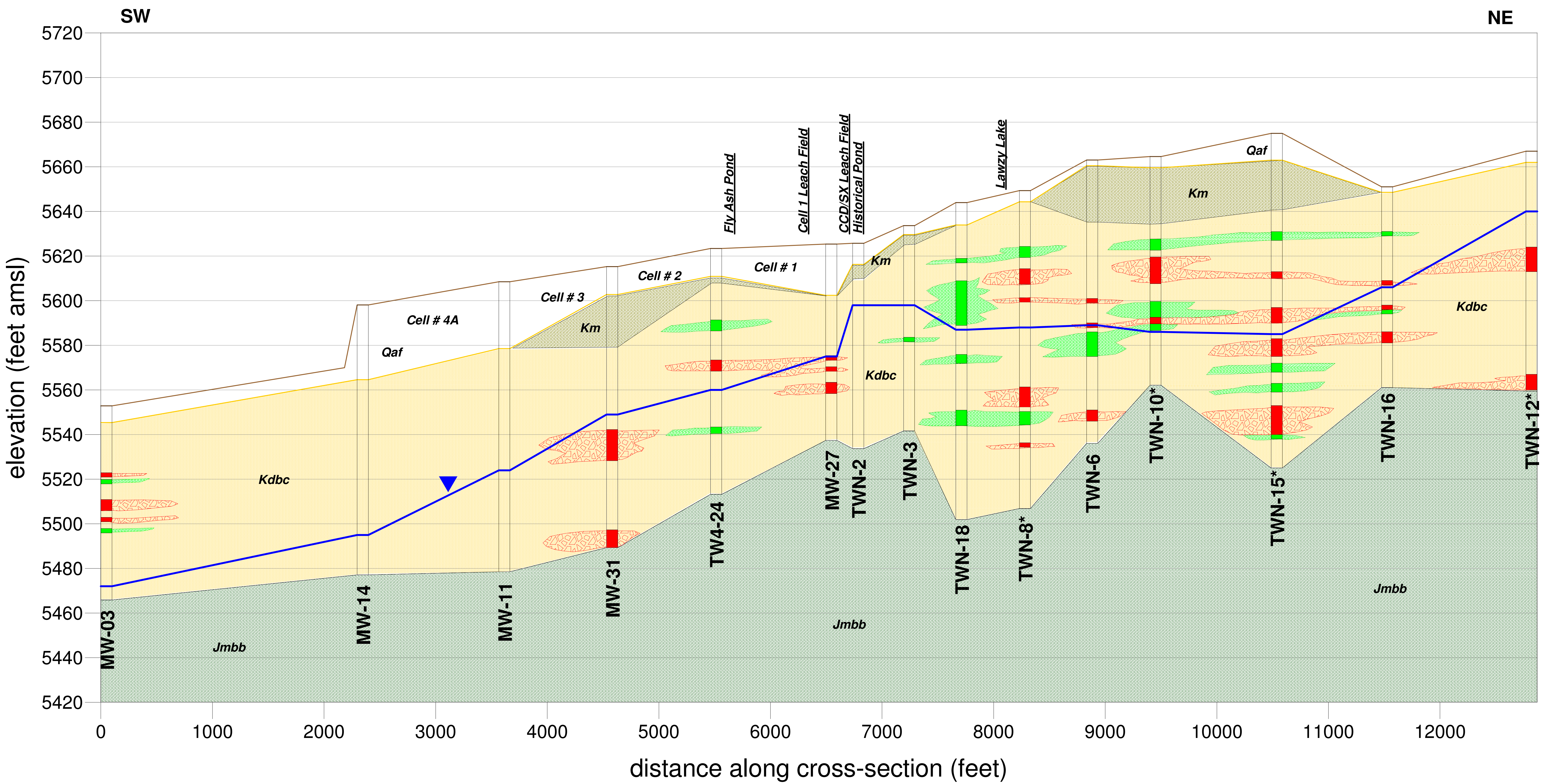
⬭	estimated area having saturated thickness less than 5 feet
▨	estimated dry area
MW-5 ● 106	perched monitoring well showing depth to water in feet
TW4-12 ○ 43	temporary perched monitoring well showing depth to water in feet
TWN-7 ◆ 86	temporary perched nitrate monitoring well showing depth to water in feet
PIEZ-1 ◒ 63	perched piezometer showing depth to water in feet
TW4-32 ☼ 49	temporary perched monitoring well installed September, 2013 showing depth to water in feet
RUIN SPRING ♁	seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO GEO CHEM, INC.

1st QUARTER, 2014 DEPTHS TO PERCHED WATER WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/maps/Udtw0314.srf	15



EXPLANATION

- Qaf Alluvium/Fill
- Km Mancos Shale
- Kdbc Dakota Sandstone/ Burro Canyon Formation
- Jmbb Brushy Basin Member of Morrison Formation
- 🟩 Shale/claystone in Dakota / Burro Canyon Formation
- ▨ Conglomerate in Dakota / Burro Canyon Formation
- ▼ Piezometric Surface

Note: waterl levels from TWN-8, TWN-10, TWN-12, and TWN-15 are from Q2, 2013

vertical exaggeration = 20 : 1

* denotes abandoned boring

HYDRO
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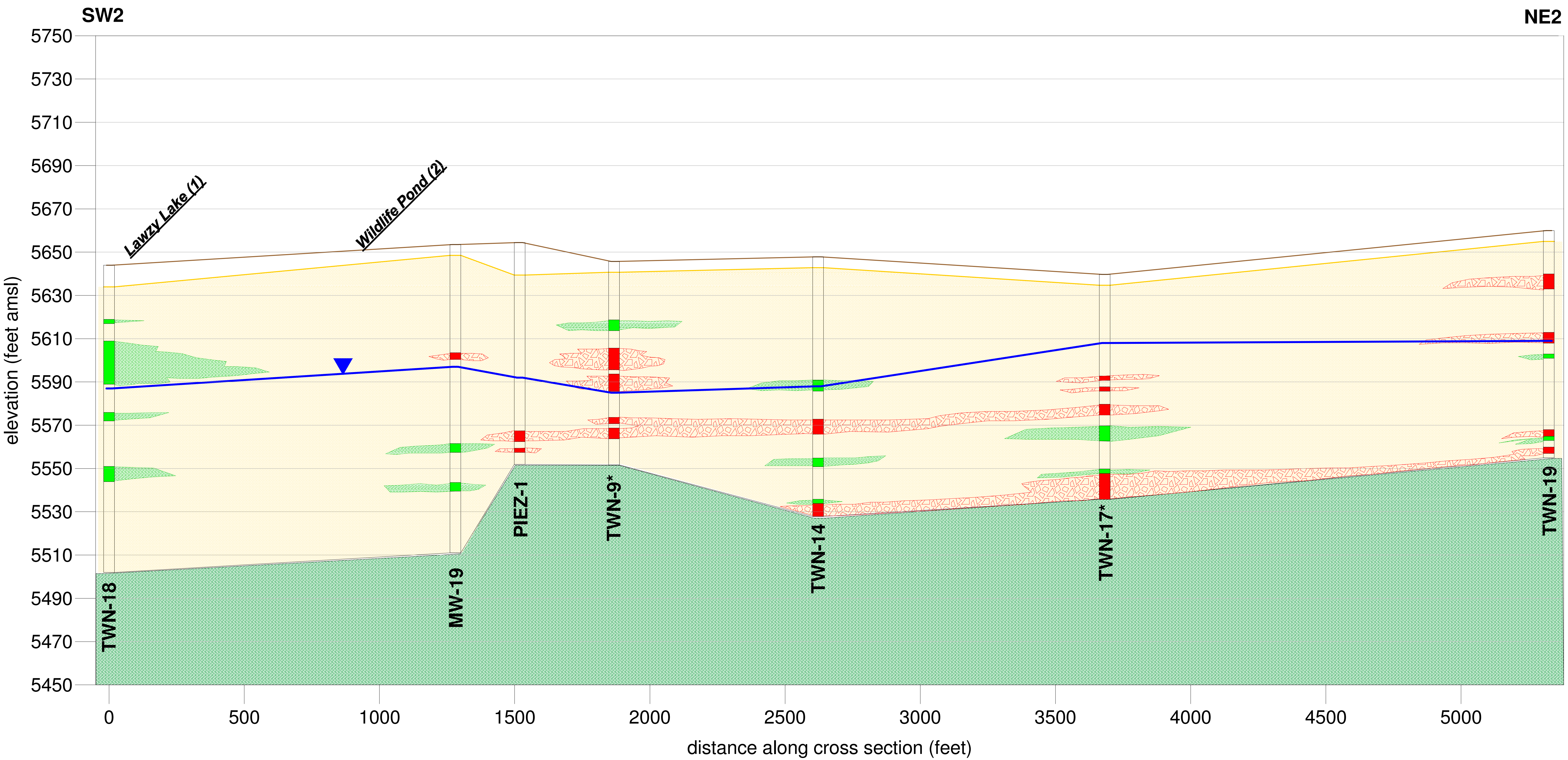
INTERPRETIVE NORTHEAST-SOUTHWEST CROSS SECTION (NE-SW) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/hydrpt14/xsection/nsxsne/nsxsneb.srf	16 A



Notes: (1) approximately 200 feet north of cross section
(2) approximately 200 feet south of cross section

EXPLANATION

Qaf Alluvium/Fill

Kdbc Dakota Sandstone/ Burro Canyon Formation

Jmbb Brushy Basin Member of Morrison Formation

🟩 Shale/claystone in Dakota / Burro Canyon Formation

▨ Conglomerate or Conglomeratic Sandstone in Dakota / Burro Canyon Formation

▼ Piezometric Surface

Note: water levels from TWN-9 and TWN-17 are from Q2, 2013

vertical exaggeration = 8 : 1

* denotes abandoned boring

HYDRO
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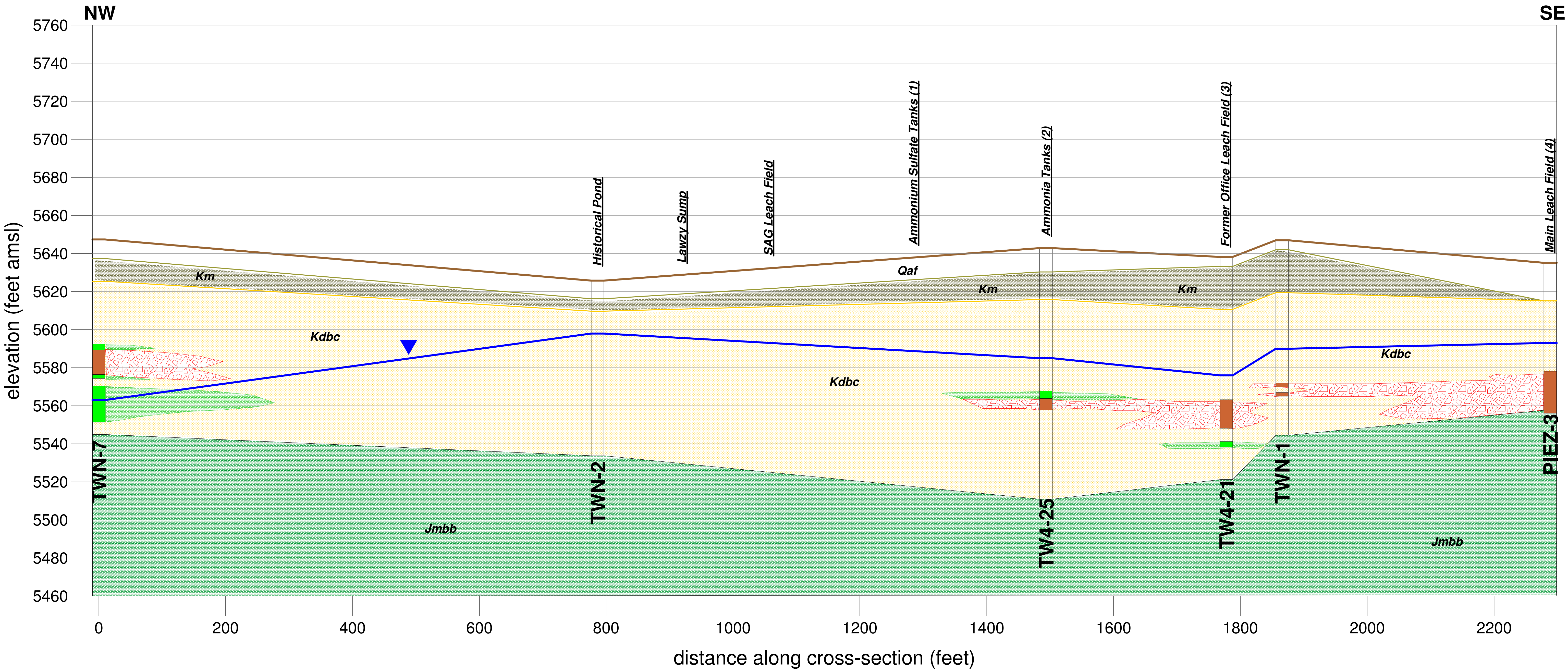
INTERPRETIVE NORTHEAST-SOUTHWEST CROSS SECTION (NE2-SW2) WHITE MESA SITE

APPROVED SJS	DATE	REFERENCE H:/718000/hydrpt14/ xsection/nsxs2ne/nsxs2neb.srf	FIGURE 16 B



Notes: (1) approximately 115 feet southwest of cross-section
(2) approximately 150 feet southwest of cross-section
(3) approximately 300 feet south of cross-section
(4) immediately south of cross-section

EXPLANATION

Qaf	Alluvium/Fill
Km	Mancos Shale
Kdbc	Dakota Sandstone/ Burro Canyon Formation
Jmbb	Brushy Basin Member of Morrison Formation
🟩	Shale/claystone in Dakota / Burro Canyon Formation
▨	Conglomerate or Conglomeratic Sandstone in Dakota / Burro Canyon Formation
▼	Piezometric Surface

vertical exaggeration = 3 : 1

HYDRO
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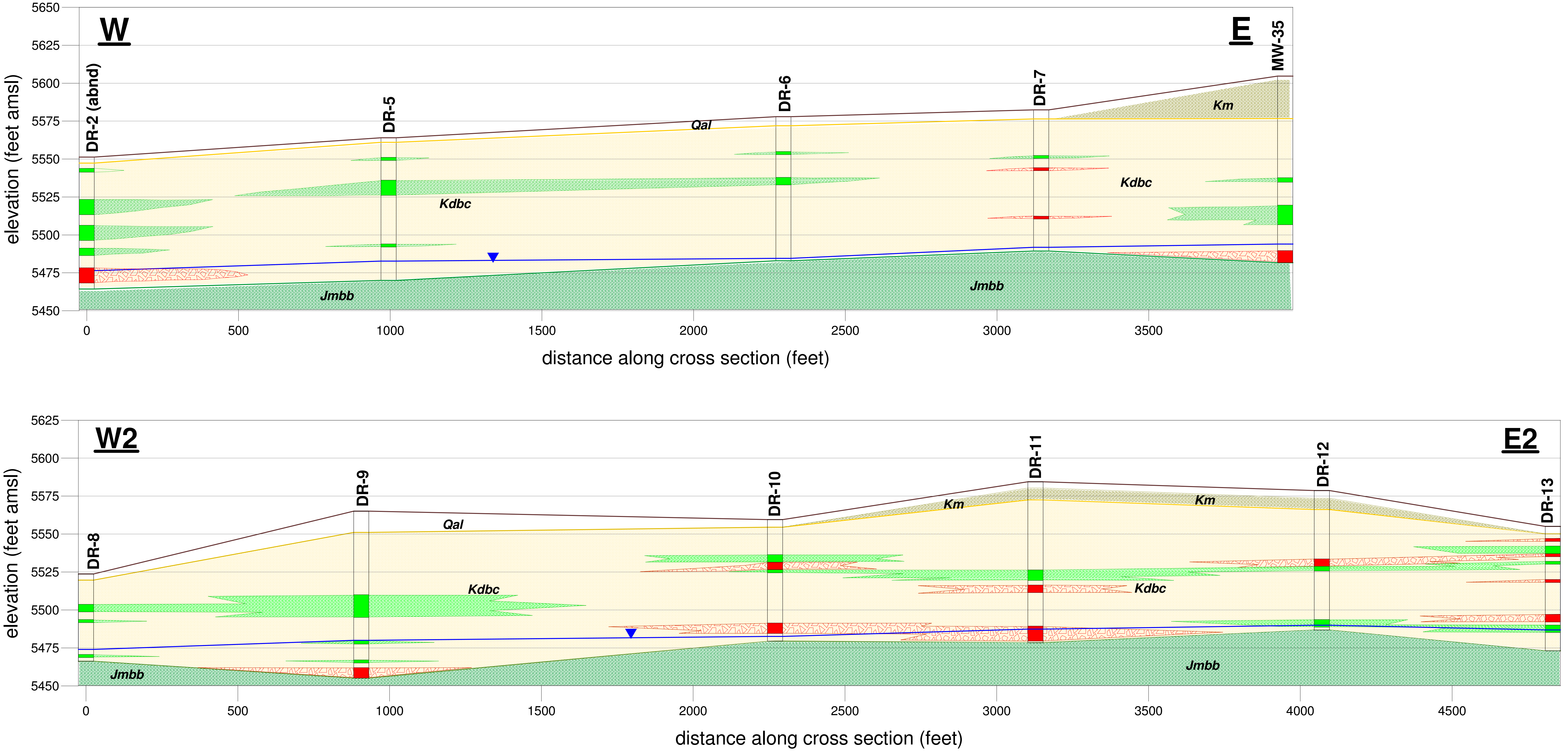
CHEM, INC.

INTERPRETIVE NORTHWEST-SOUTHEAST CROSS SECTION (NW-SE) WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/hydrpt14/ xsection/ewxsne/ewxsneb.srf	17



vertical exaggeration = 5:1

EXPLANATION

Qal	Alluvium/Fill	🟩	Shale/claystone within Dakota/Burro Canyon
Km	Mancos Shale	▨	Conglomerate within Dakota/Burro Canyon
Kdbc	Dakota Sandstone/ Burro Canyon Formation	Jmbb	Brushy Basin Member of Morrison Formation

▼ Piezometric surface

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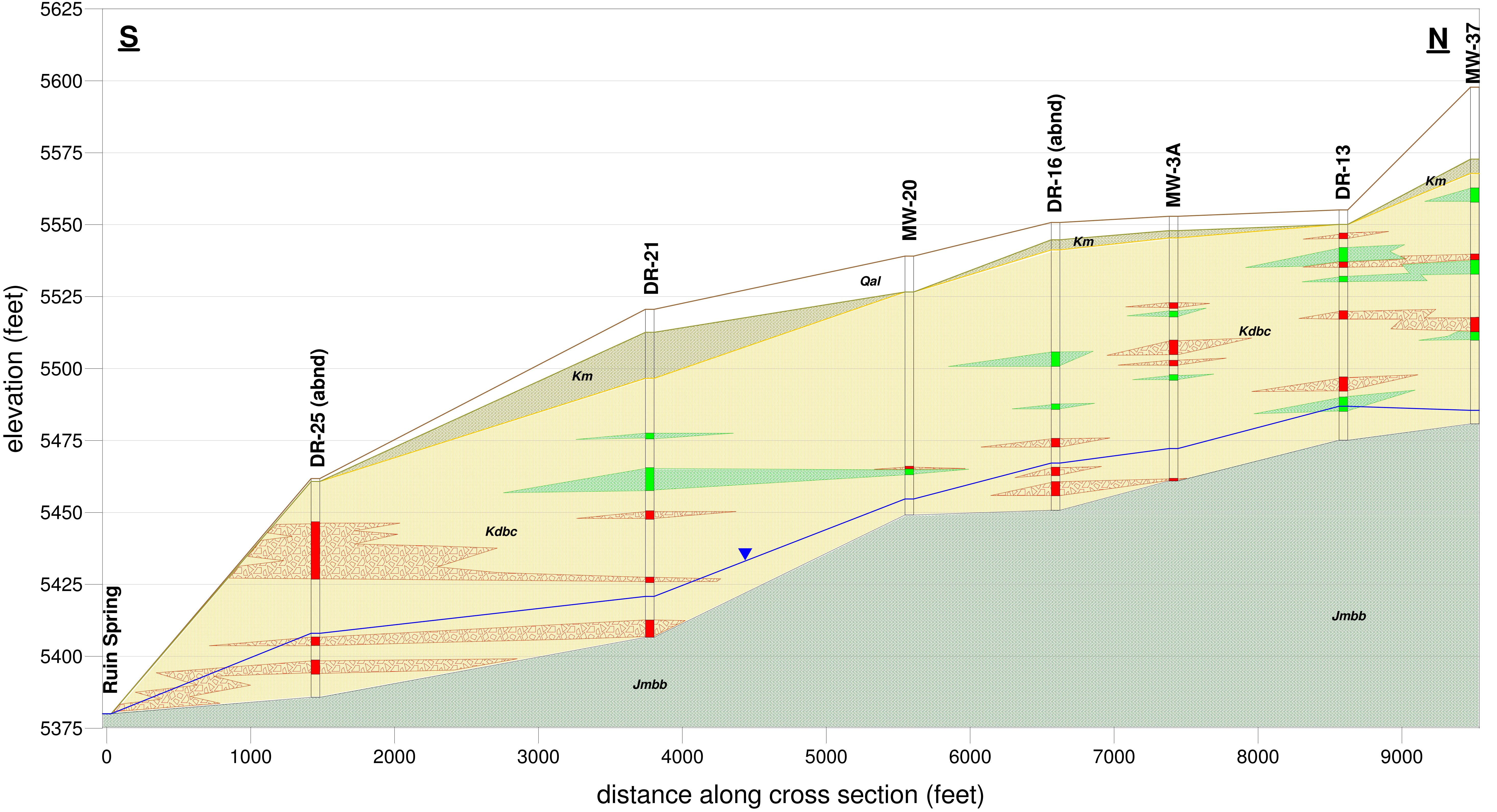
INTERPRETIVE EAST-WEST CROSS SECTIONS (W-E and W2-E2) SOUTHWEST INVESTIGATION AREA

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ xsection/ewxssw/ewxsswb.srf	18



vertical exaggeration = 20:1

EXPLANATION

Qal	Alluvium/Fill	🟩	Shale/claystone within Dakota/Burro Canyon
Km	Mancos Shale	▨	Conglomerate within Dakota/Burro Canyon
Kdbc	Dakota Sandstone/ Burro Canyon Formation	Jmbb	Brushy Basin Member of Morrison Formation

▼ Piezometric surface

HYDRO
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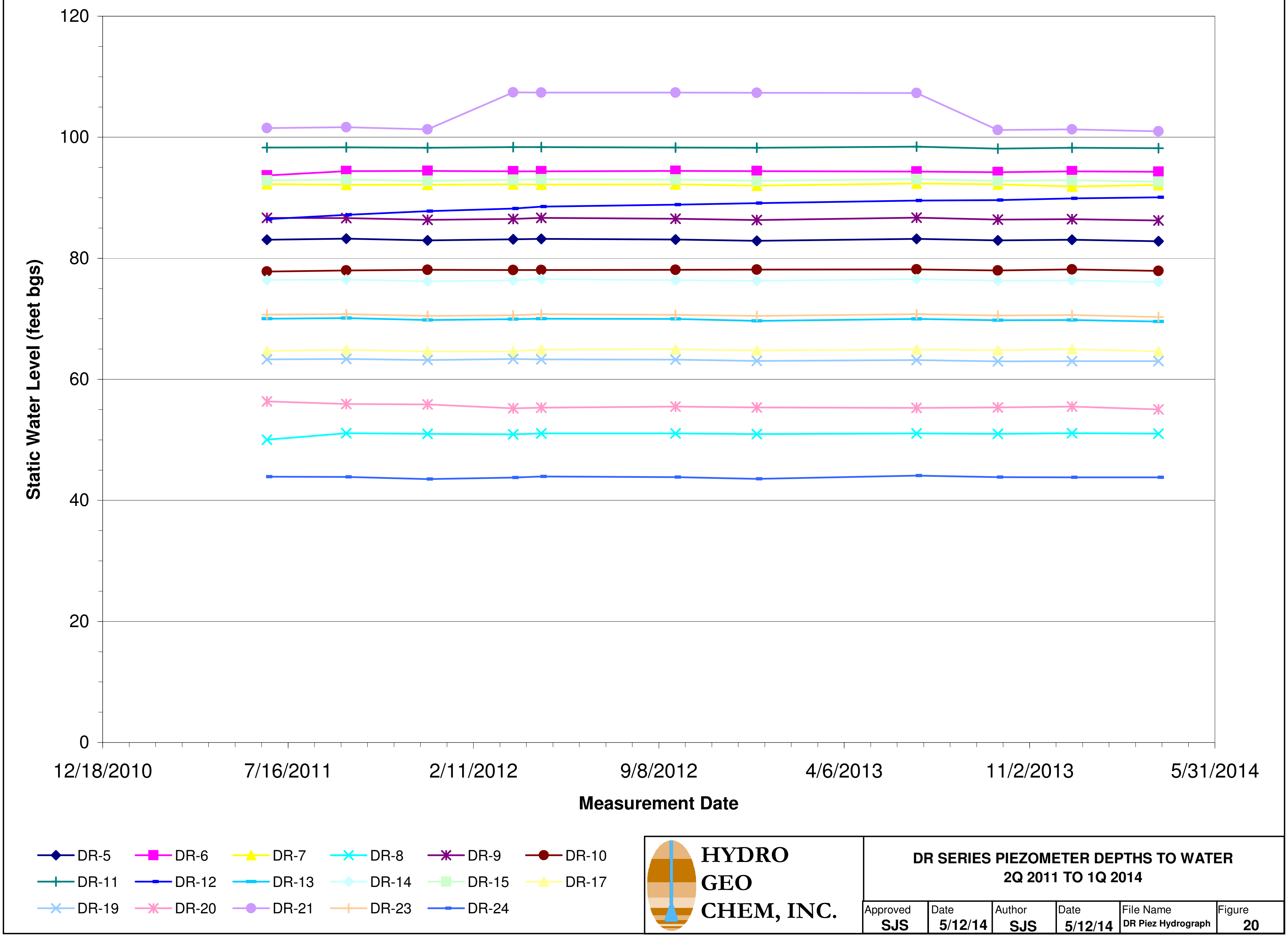
INTERPRETIVE NORTH-SOUTH CROSS SECTION (S-N) SOUTHWEST INVESTIGATION AREA

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/xsection/nsxssw/nsxsswb.srf	19

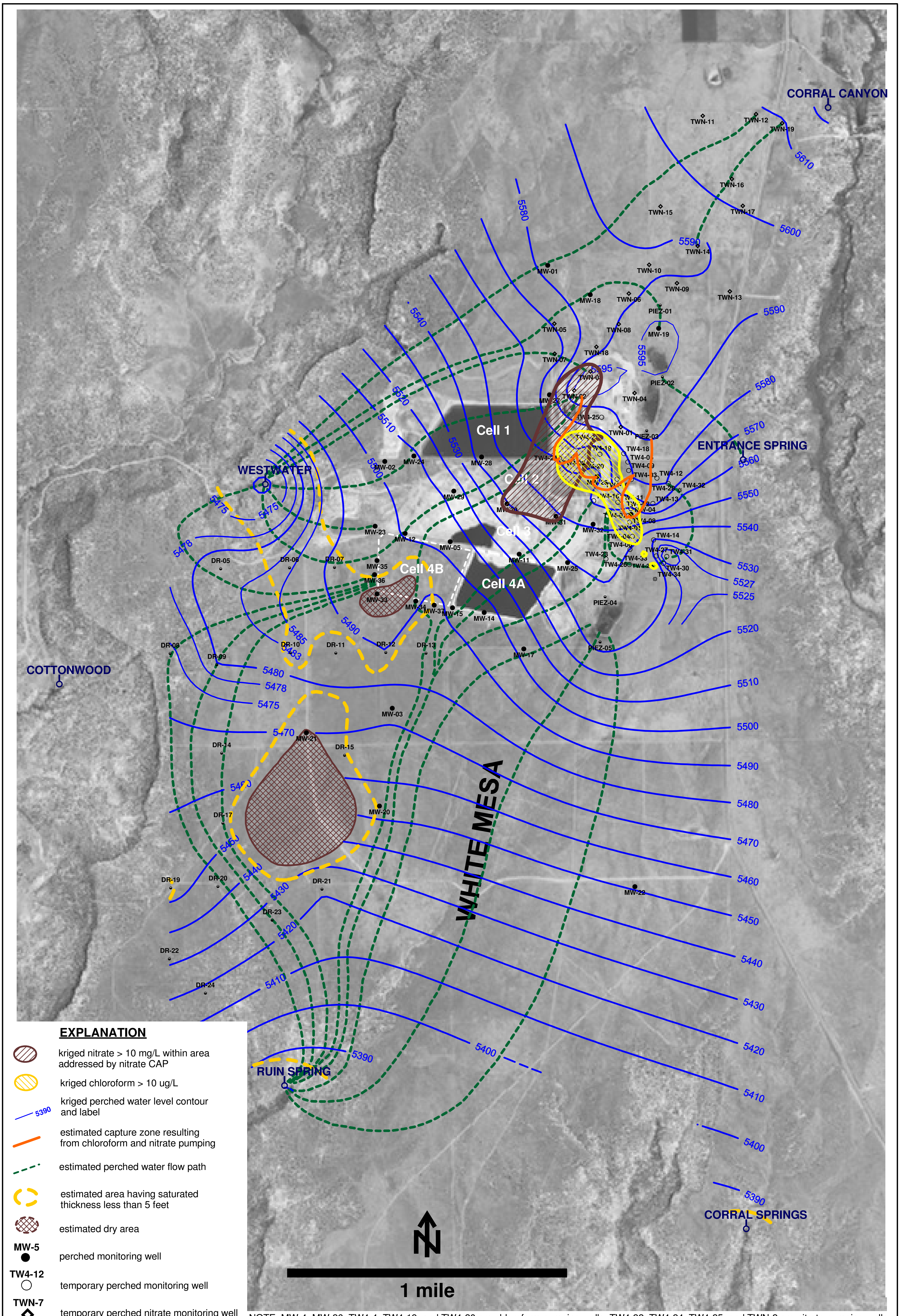


HYDRO GEO CHEM, INC.

DR SERIES PIEZOMETER DEPTHS TO WATER
2Q 2011 TO 1Q 2014

Approved	Date	Author	Date	File Name	Figure
SJS	5/12/14	SJS	5/12/14	DR Piez Hydrograph	20

H:\718000\hydrpt14\DR_ Hydrographs.xls: DR Piez Hydrographs



NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

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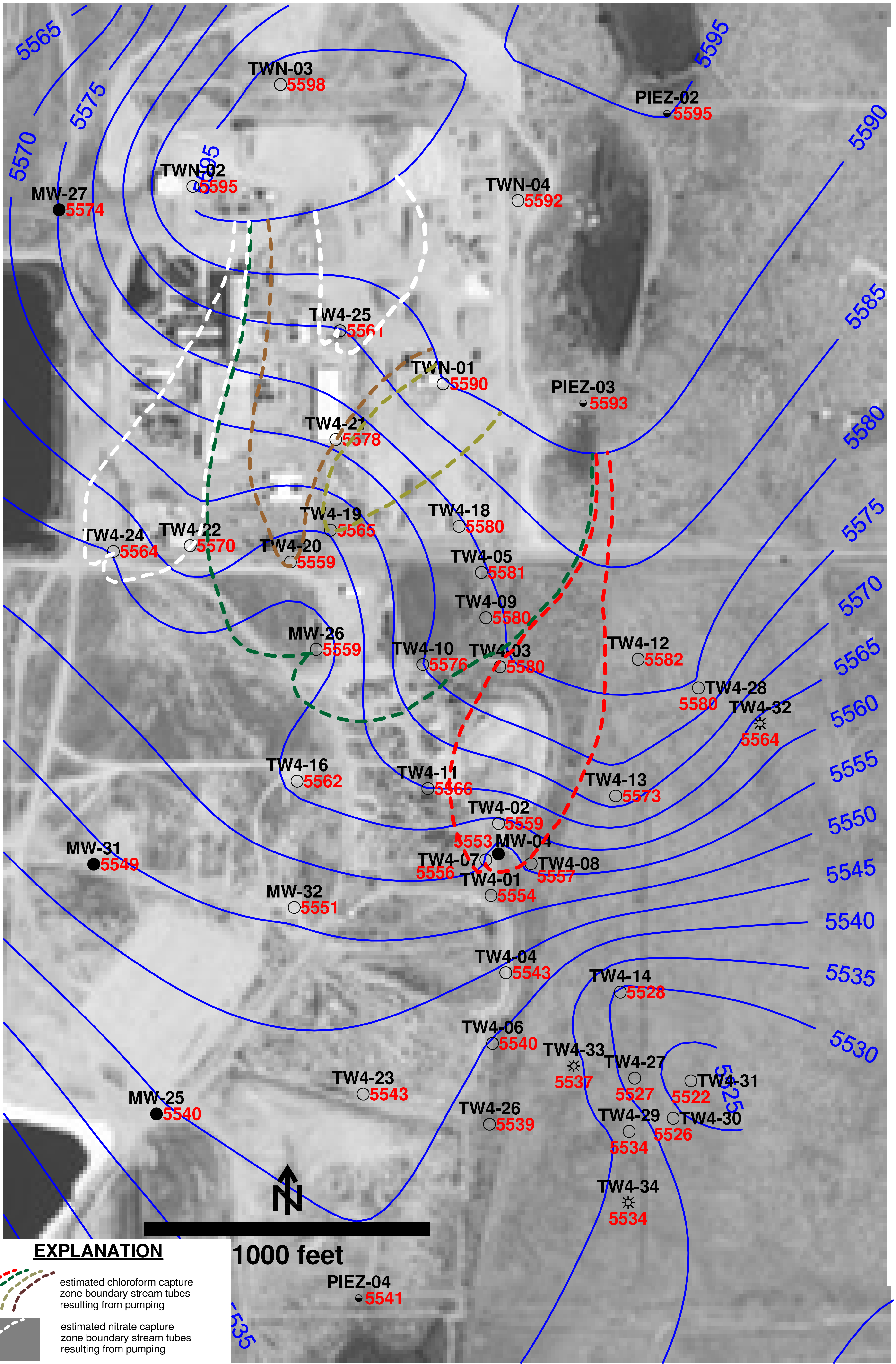
KRIGED 1st QUARTER, 2014 WATER LEVELS SHOWING INFERRED PERCHED WATER PATHLINES AND KRIGED NITRATE AND CHLOROFORM PLUMES

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/maps/UflowNchl.srf	21



EXPLANATION

estimated chloroform capture zone boundary stream tubes resulting from pumping

estimated nitrate capture zone boundary stream tubes resulting from pumping

MW-4 ● 5551 perched monitoring well showing elevation in feet amsl

TW4-1 ○ 5553 temporary perched monitoring well showing elevation in feet amsl

PIEZ-2 ◒ 5595 perched piezometer showing elevation in feet amsl

TW4-32 ☼ 5563 temporary perched monitoring well installed September, 2013 showing elevation in feet amsl

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells;
TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO
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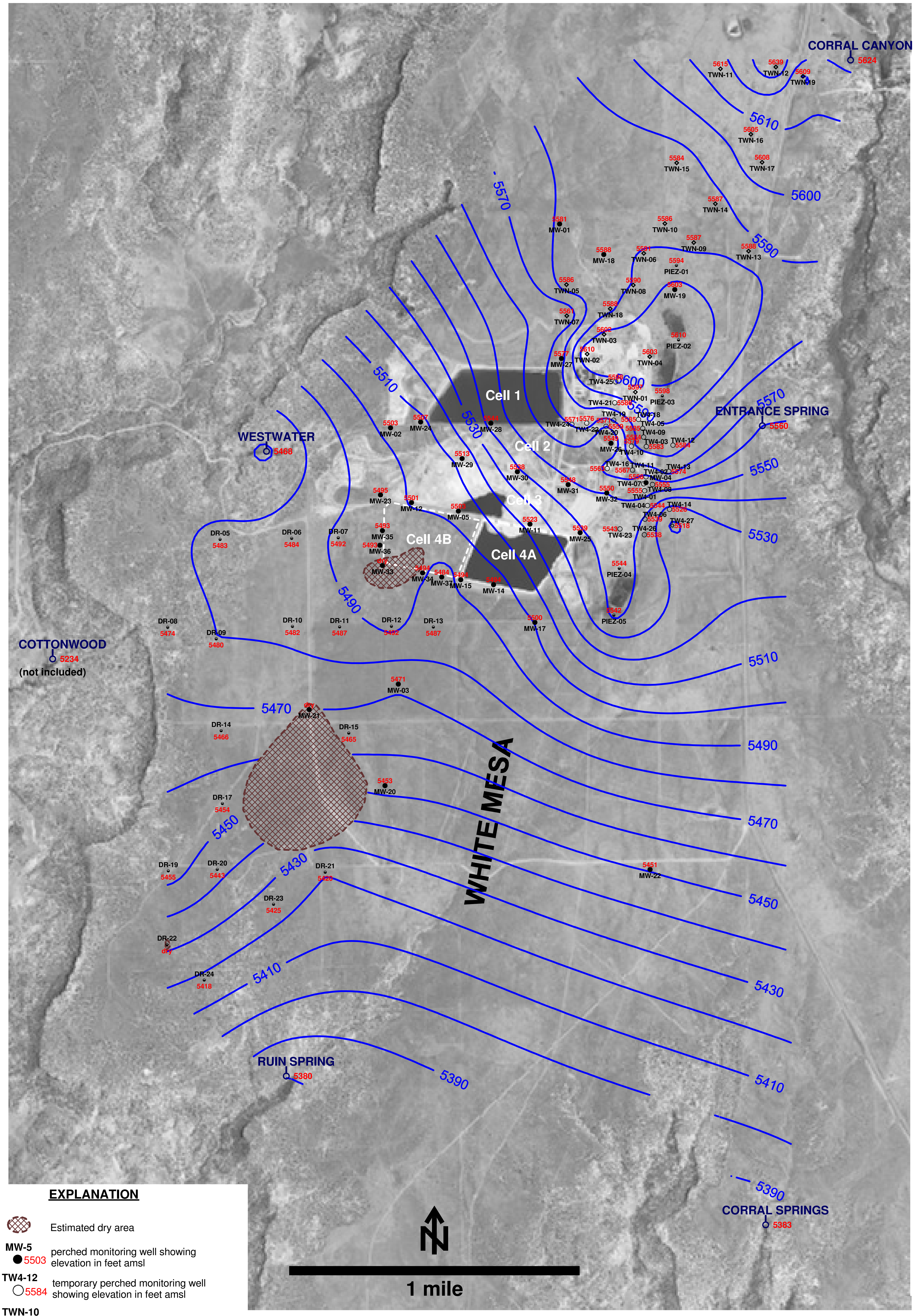
CHEM, INC.

KRIGED 1st QUARTER, 2014 WATER LEVELS AND ESTIMATED CAPTURE ZONES WHITE MESA SITE (detail map)

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ maps/Ucap0314.srf	22



EXPLANATION

▨ Estimated dry area

MW-5
● 5503 perched monitoring well showing elevation in feet amsl

TW4-12
○ 5584 temporary perched monitoring well showing elevation in feet amsl

TWN-10
◆ 5586 temporary perched nitrate monitoring well showing elevation in feet amsl

PIEZ-1
◒ 5594 perched piezometer showing elevation in feet amsl

TW4-27
☼ 5518 temporary perched monitoring well installed October, 2011 showing elevation in feet amsl

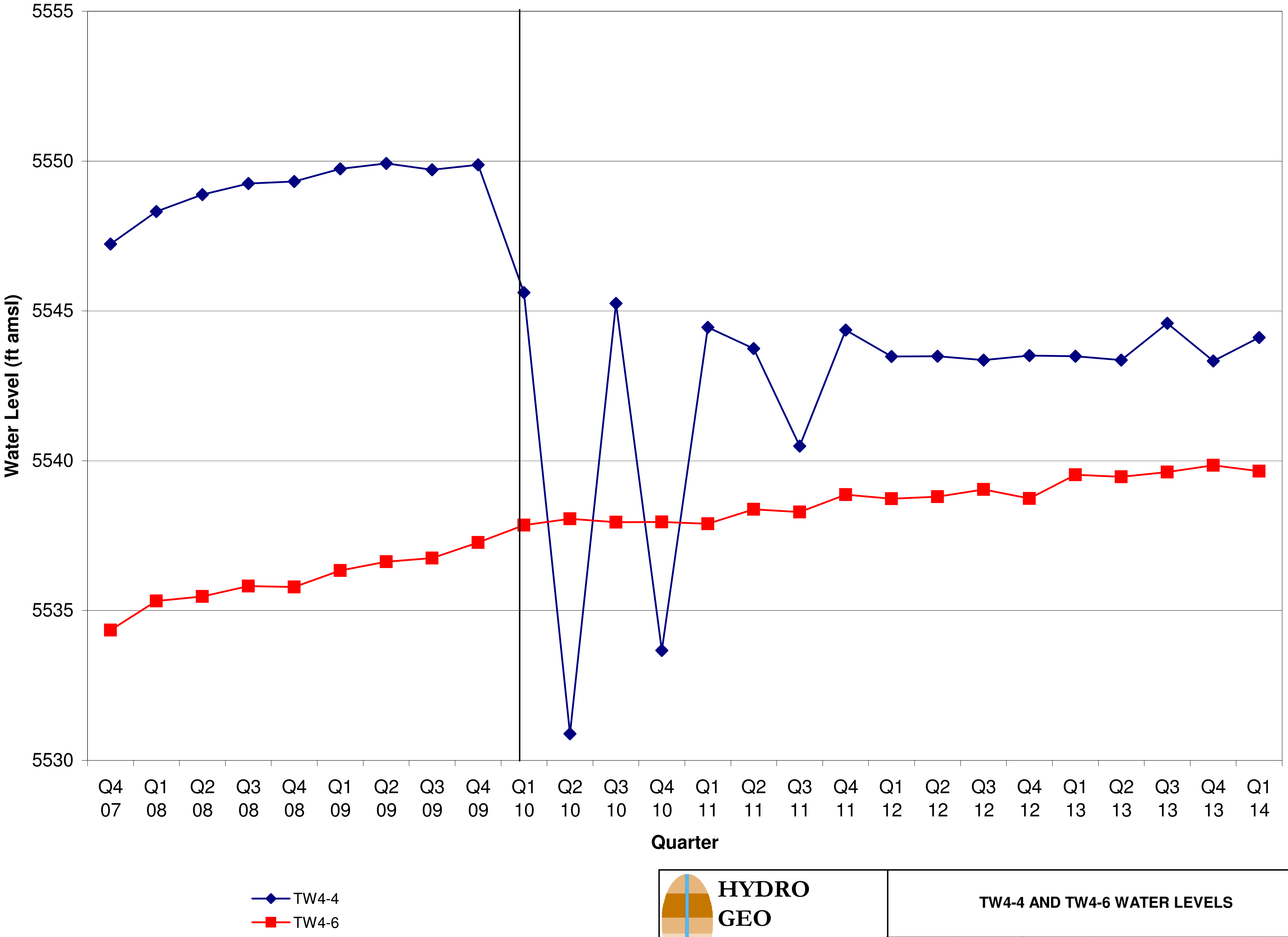
RUIN SPRING
♁ 5380 seep or spring showing elevation in feet amsl

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are pumping wells

HYDRO
GEO
CHEM, INC.

KRIGED 4th QUARTER, 2011 WATER LEVELS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/maps/Uwl1211b.srf	23

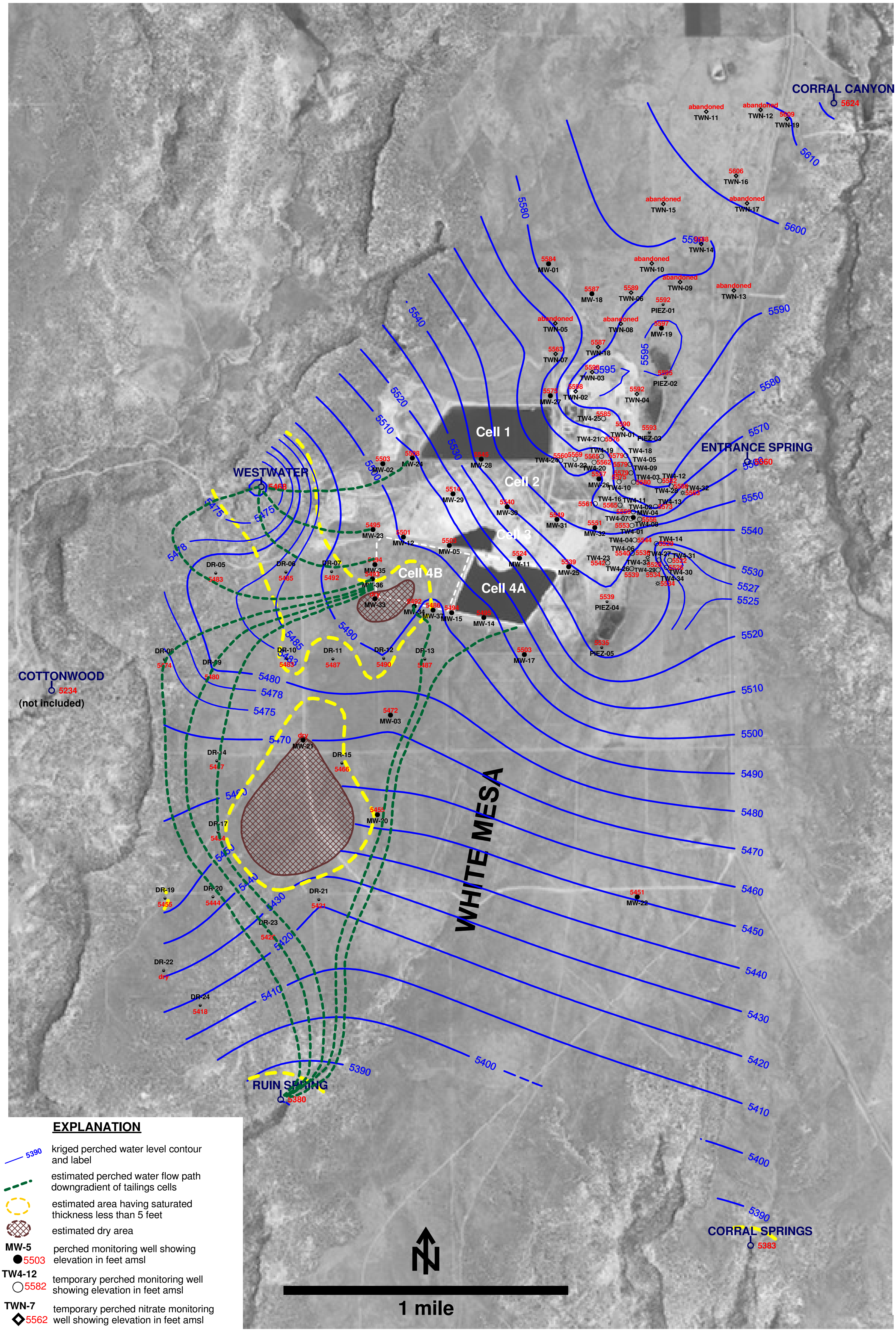


HYDRO GEO CHEM, INC.

TW4-4 AND TW4-6 WATER LEVELS

Approved	Date	Author	Date	File Name	Figure
SJS		SJS		wltrend plot	24

H:\718000\may14\wltrend_q114.xls: wltrend plot



EXPLANATION

5390	kriged perched water level contour and label
	estimated perched water flow path downgradient of tailings cells
	estimated area having saturated thickness less than 5 feet
▨	estimated dry area
MW-5 ● 5503	perched monitoring well showing elevation in feet amsl
TW4-12 ○ 5582	temporary perched monitoring well showing elevation in feet amsl
TWN-7 ◆ 5562	temporary perched nitrate monitoring well showing elevation in feet amsl
PIEZ-1 ◒ 5592	perched piezometer showing elevation in feet amsl
TW4-32 ☼ 5564	temporary perched monitoring well installed September, 2013 showing elevation in feet amsl
RUIN SPRING ♁ 5380	seep or spring showing elevation in feet amsl

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO
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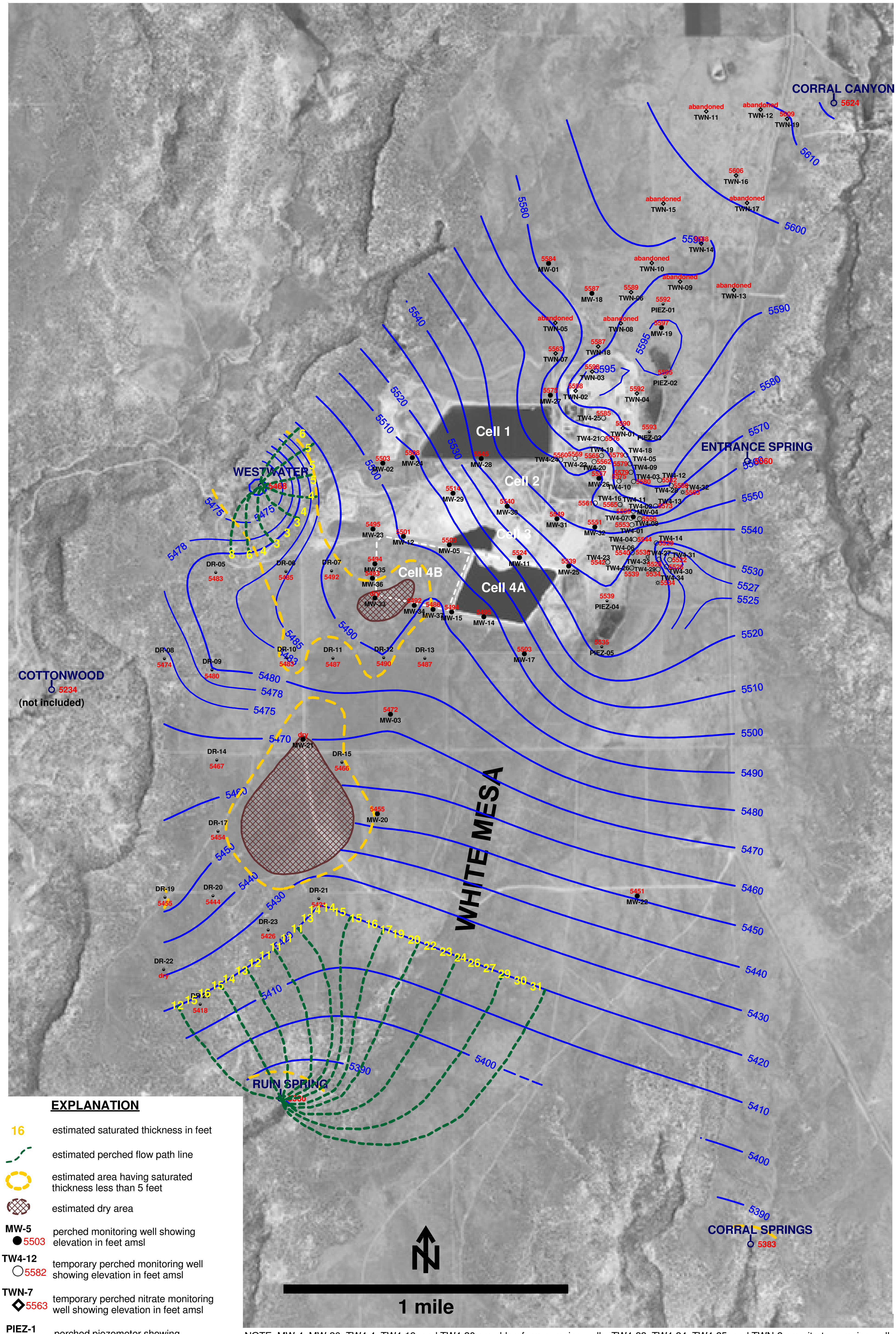
KRIGED 1st QUARTER, 2014 WATER LEVELS SHOWING INFERRED PERCHED WATER PATHLINES DOWNGRADIENT OF THE TAILINGS CELLS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/maps/Uflowsw14.srf	25



NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

EXPLANATION

16 estimated saturated thickness in feet

estimated perched flow path line

estimated area having saturated thickness less than 5 feet

▨ estimated dry area

MW-5
● 5503 perched monitoring well showing elevation in feet amsl

TW4-12
○ 5582 temporary perched monitoring well showing elevation in feet amsl

TWN-7
◆ 5563 temporary perched nitrate monitoring well showing elevation in feet amsl

PIEZ-1
● 5592 perched piezometer showing elevation in feet amsl

TW4-32
☼ 5563 temporary perched monitoring well installed September, 2013 showing elevation in feet amsl

RUIN SPRING
♁ 5380 seep or spring showing elevation in feet amsl

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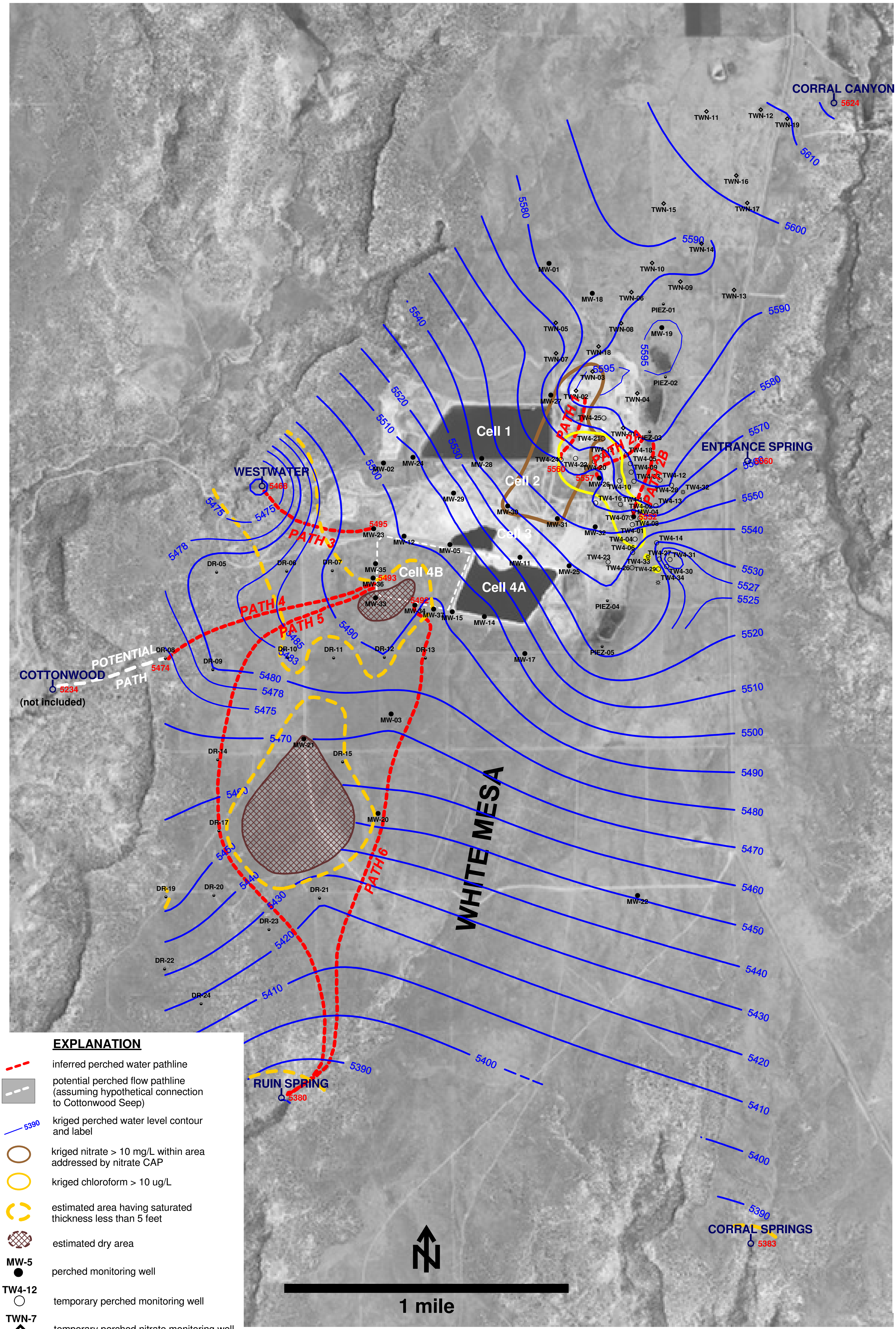
KRIGED 1st QUARTER, 2014 WATER LEVELS SHOWING INFERRED PERCHED WATER FLOW PATHLINES NEAR RUIN SPRING AND WESTWATER SEEP

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/ hydrpt4/springs/Uspgfl14.srf	26



EXPLANATION

▬ ▬	inferred perched water pathline
▬ ▬	potential perched flow pathline (assuming hypothetical connection to Cottonwood Seep)
5390	kriged perched water level contour and label
○	kriged nitrate > 10 mg/L within area addressed by nitrate CAP
○	kriged chloroform > 10 ug/L
◌	estimated area having saturated thickness less than 5 feet
▨	estimated dry area
MW-5 ●	perched monitoring well
TW4-12 ○	temporary perched monitoring well
TWN-7 ◆	temporary perched nitrate monitoring well
PIEZ-1 ◒	perched piezometer
TW4-32 ☼	temporary perched monitoring well installed September, 2013
RUIN SPRING ♁	seep or spring

NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

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CHEM, INC.

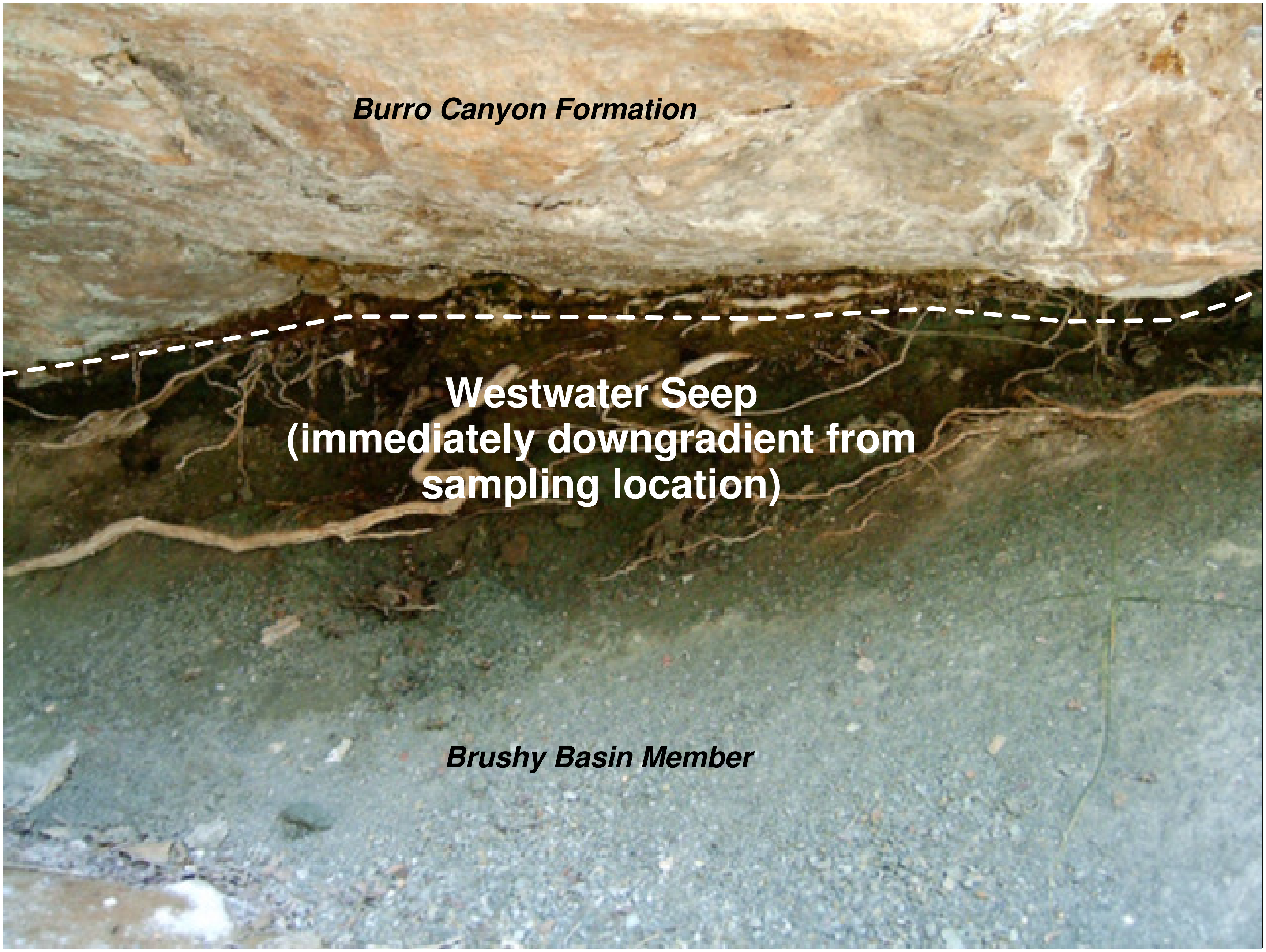
KRIGED 1st QUARTER, 2014 WATER LEVELS SHOWING INFERRED PERCHED WATER FLOW PATHS USED FOR TRAVEL TIME ESTIMATES AND KRIGED NITRATE AND CHLOROFORM PLUMES

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/maps/UpathNchl.srf	27

HYDRO GEO CHEM, INC.

PHOTOGRAPH OF THE WESTWATER SEEP SAMPLING LOCATION
JULY, 2010

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/ hydrpt14/maps/westsmpl2.srf	28



HYDRO
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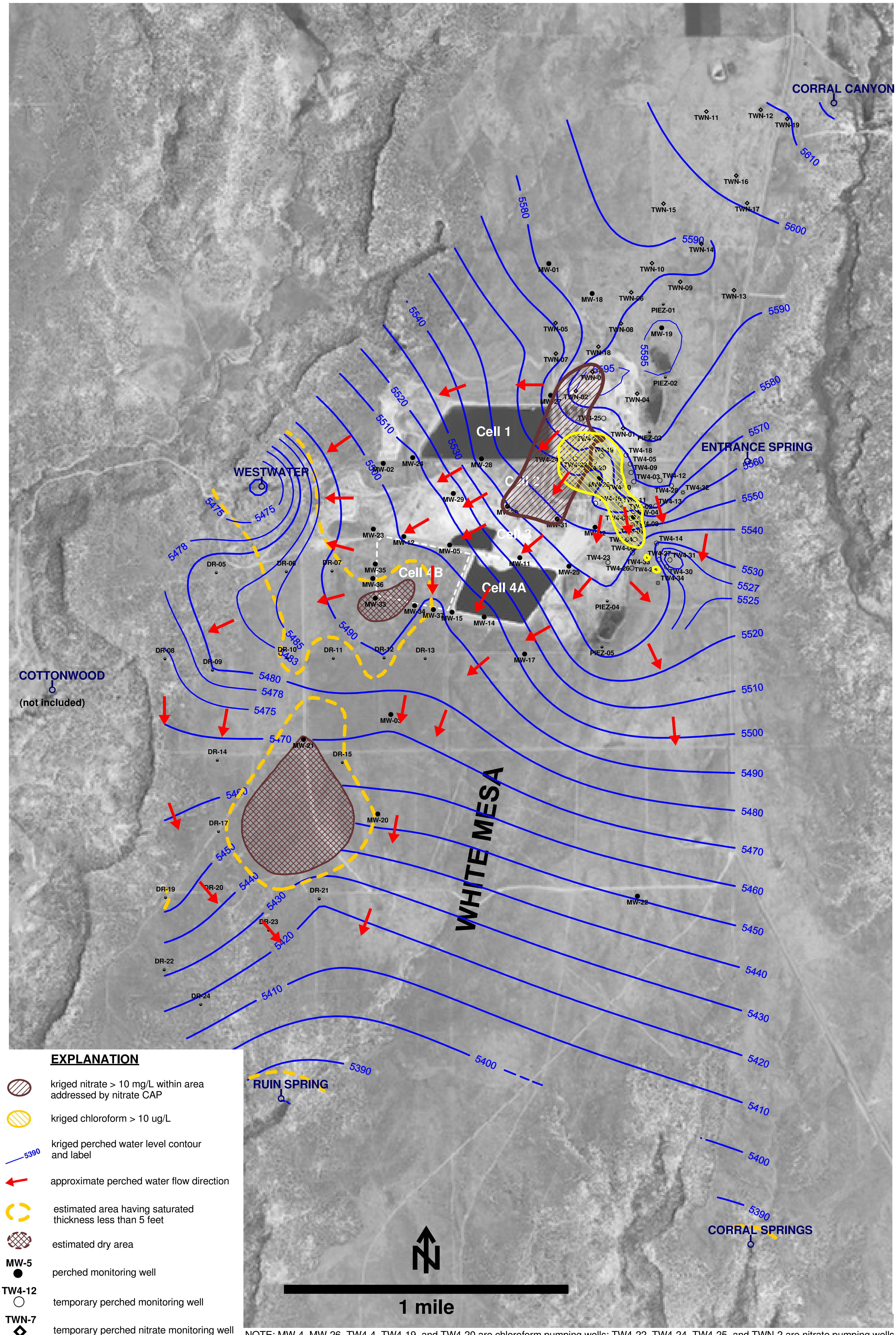
CHEM, INC.

PHOTOGRAPH OF THE CONTACT BETWEEN THE BURRO CANYON FORMATION AND THE BRUSHY BASIN MEMBER AT WESTWATER SEEP

APPROVED	DATE	REFERENCE	FIGURE
SJS		H:/718000/ hydrpt14/maps/westcontact2.srf	29



NOTE: MW-4, MW-26, TW4-4, TW4-19, and TW4-20 are chloroform pumping wells; TW4-22, TW4-24, TW4-25, and TWN-2 are nitrate pumping wells

HYDRO
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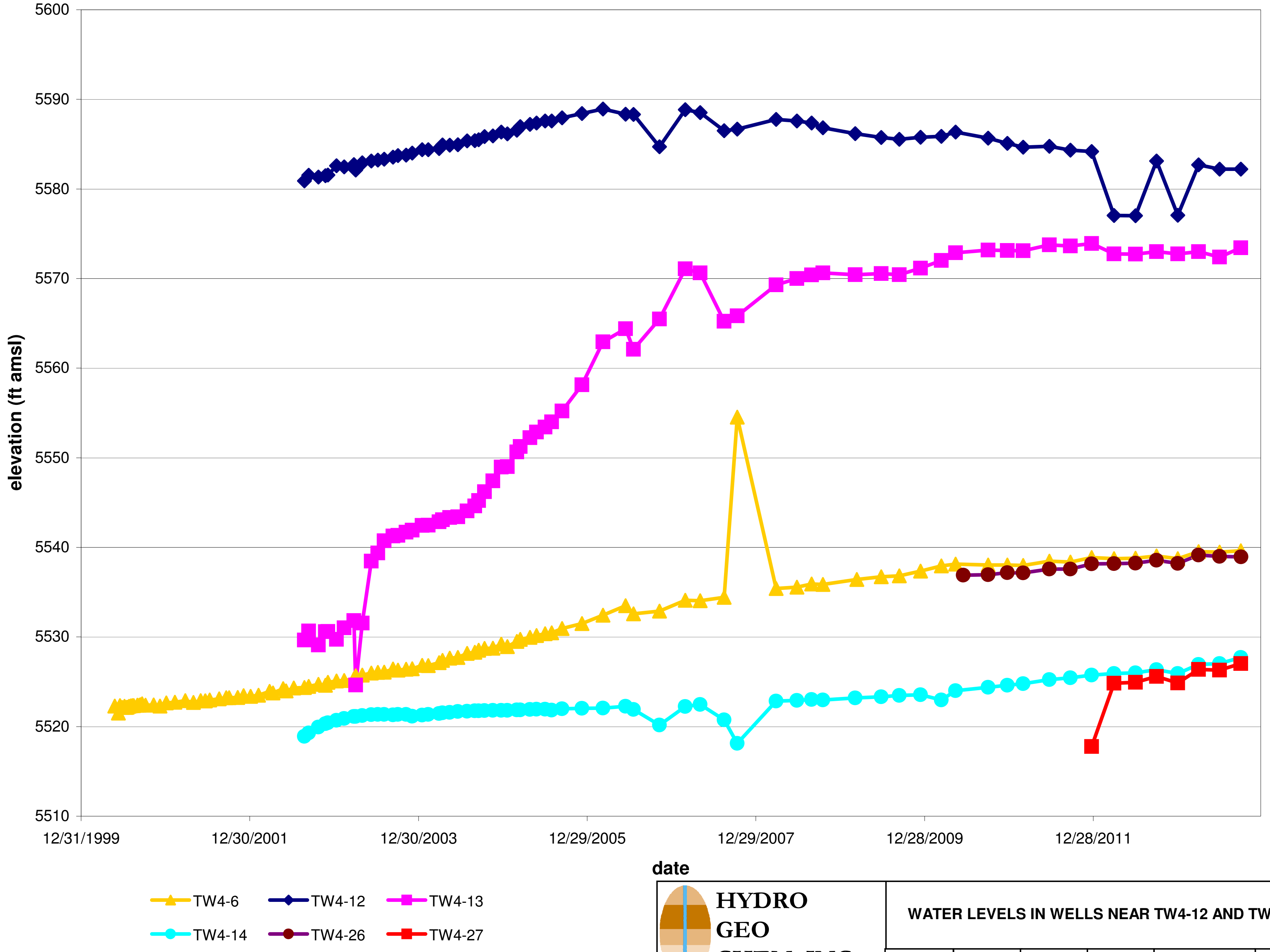
CHEM, INC.

KRIGED 1st QUARTER, 2014 WATER LEVELS SHOWING KRIGED NITRATE AND CHLOROFORM PLUMES AND GENERAL FLOW DIRECTIONS WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt4/maps/UflowNchlnp.srf	30

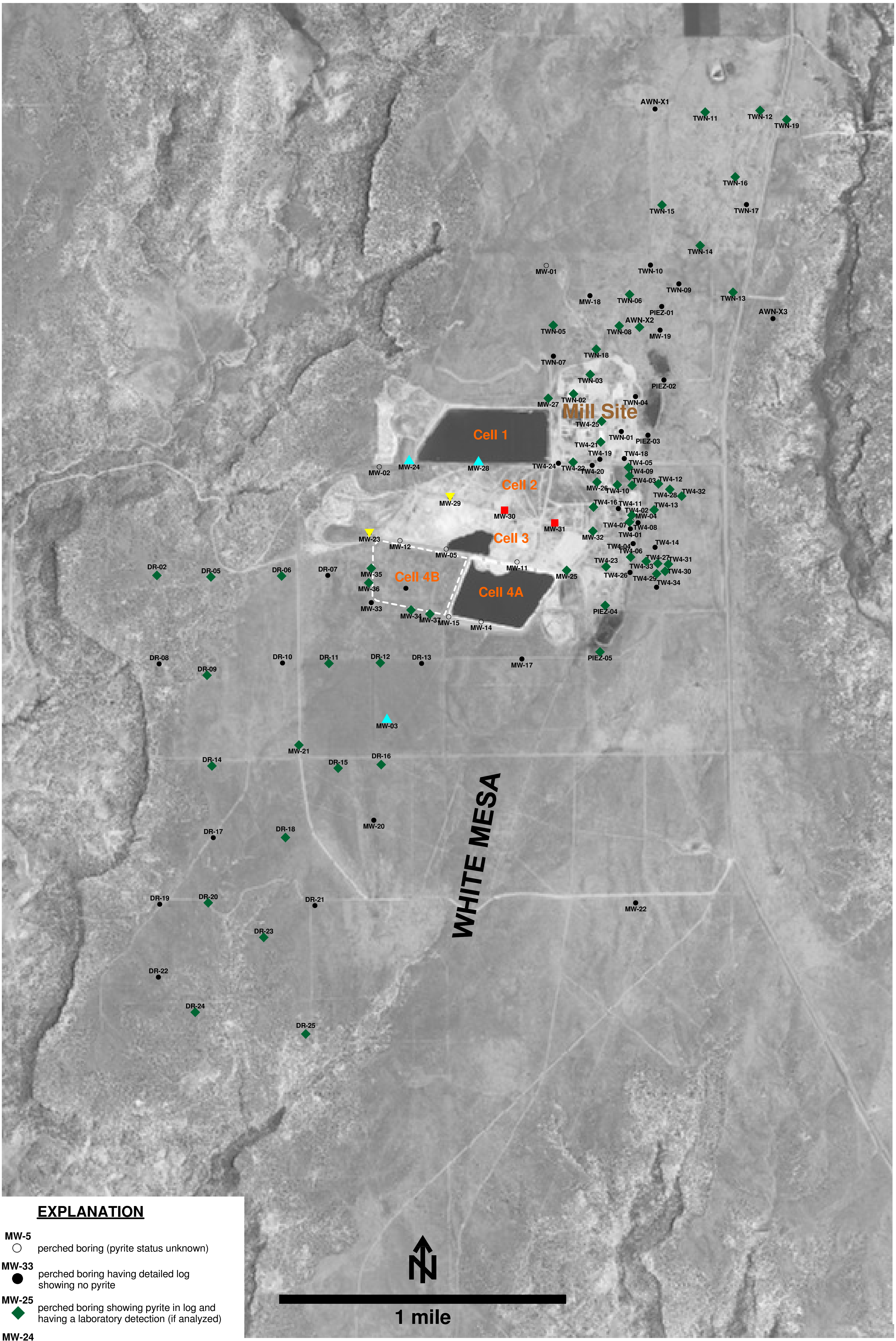


HYDRO GEO CHEM, INC.

WATER LEVELS IN WELLS NEAR TW4-12 AND TW4-27

Approved	Date	Author	Date	File Name	Figure
SJS		SJS		plot F30	31

H:\718000\hydrpt14\TW27area_wl2.xls: plot F30



EXPLANATION

MW-5 ○ perched boring (pyrite status unknown)

MW-33 ● perched boring having detailed log showing no pyrite

MW-25 ◆ perched boring showing pyrite in log and having a laboratory detection (if analyzed)

MW-24 ▲ perched boring having pyrite detected via laboratory analysis only (not shown in log)

MW-29 ▼ perched boring having a possible pyrite detection via laboratory analysis (but not in log)

MW-30 🟥 perched boring showing pyrite in log and having no laboratory detection

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WHITE MESA SITE PLAN SHOWING PYRITE OCCURRENCE IN PERCHED BORINGS

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ maps/pyrite_occurrence_rev2.srf	32

APPENDIX A

LITHOLOGIC LOGS

APPENDIX A.1

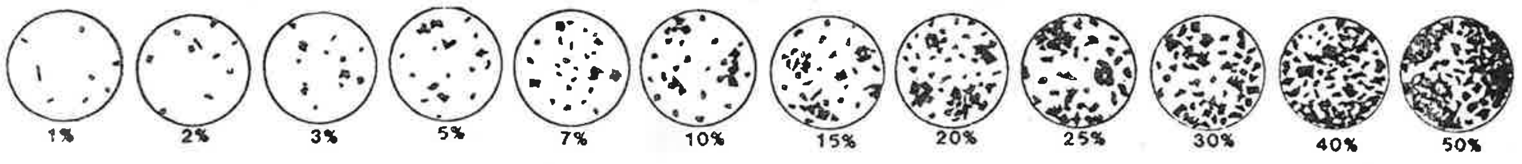
DR - SERIES

Date 5 May 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR2
Property White Mesa mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≃5576

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 95.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sndy mdst	rdbn-lt pk tn	f-c	p	a								S			Surface Soil to 2.0' Mancos Shale (unconsolidated)
5.0						sh-qtz ss	lt pk tn-	m-c	f	a								VS			Upper Dakota Ct. @ 4.0' (unconsol. to 4.0')
7.5						qtz ss	lt br	m-c	f	a		H						N			wh chert grains
10.0						sh	yw gy											S			
12.5						sh-qtz ss	dk gy	m-c	f	a								M			
15.0						qtz ss	yw tn	m	w	R								N			
17.5						qtz ss	yw tn	m	w	R		L						N			sparce limonite grain coating
20.0						qtz ss	lt gy tn	m	w	R								N			gy qtz grains
22.5						qtz ss	yw tn	m-peb	p	a								N			Moist cuttings this morning, dk chert grains + peb.
25.0						qtz ss	yw tn	m-peb	p	a								N			lt-dk chert grains
27.5						qtz ss	lt tn	f-m	w	R								N			
30.0						sh	yw gy bl											N			
32.5						sh	yw gy bl											N			
35.0						sh	yw gy bl											N			
37.5						sh	yw gy bl											N			
40.0						qtz ss sltst	lt yw tn	slt-vf	m	r								N			
42.5						qtz ss sltst	lt tn	slt-vf	m	r								N			
45.0						qtz ss sltst	lt tn	slt-vf	m	r								N			
47.5						sltst-sh	lt yw gn											N			
50.0						sh	lt gn-lt ppr d											N			
52.5						sltst-qtz ss	lt bl gy	slt-m	p	a								N			
55.0						sltst-qtz ss	lt tn	slt-vf	m	r								N			
57.5						qtz ss	lt tn	f	w	r								M			
60.0						qtz ss	lt tn	f	w	r								N			
62.5						sltst-sh	yw gy tn											N			
65.0						sh	lt gn-pp bn											N			
67.5						qtz ss	lt gy tn	vf-m	m	r			tr	a				N			
70.0						qtz ss	lt tn	m	w	R								N			
72.5						qtz ss	lt tn	m	w	R								N			
75.0						qtz/chert ss	gy tn	m-peb	p	a								N			abund dk-lt chert grains & pebbles.
77.5						qtz ss cgl	or gy	vc-peb	p	A								N			abund multi colored chert grains
80.0						qtz ss, cgl	or gy	vc-peb	p	A								N			Well began producing approx 3gpm @ 78.0'
82.5						cgl, qtz ss	wh-lt gy	m-peb	p	A	si							N			
85.0						qtz ss	wh-lt gy	m-peb	f	A	si							N			
87.5						qtz ss, sh	wh-gn	m-vc	p	a	si	L						N			Brushy Basin Ct. @ 87.0' good ct. poss. oil as cement?
90.0						sh	gn-pp bn											N			flow increased to 20 gpm @ 87.0'
92.5						sh	gn-pp bn											N			
95.0						sh	gn-pp bn											N			T.D. some tell tale rd chert grains · 1-2 mm
97.5																					
100.0																					(notesble dk bn material (dead oil?) in
102.5																					interstacese of sand grains @ 87.5)
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					Note: this well completed on 6 May 2011

PERCENTAGE COMPOSITION IMAGE

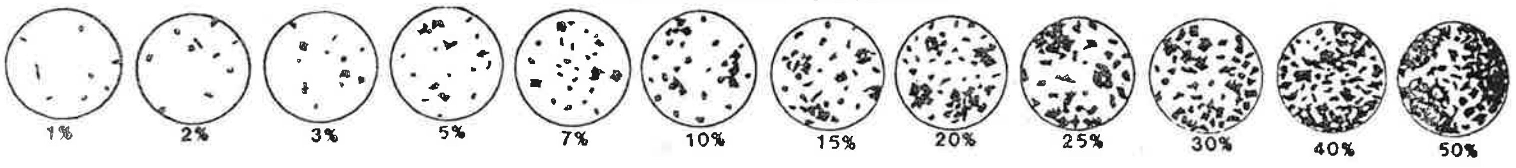


Date 5 May 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR5
Property White Mesa Mill Project cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5560

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 100.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											S			Surface Soil - unconsolidated CL
5.0						qtz ss, mdst	ywrdbn	m-c	m	a								N			Upper Dakota Ct. @ 3.0'
7.5						qtz ss	ltorbn	m-c	m	a		L						N			
10.0						qtz ss	tn	m	w	r								N			
12.5						qtz ss	tn	m	w	r								N			
15.0						qtz ss, sh	ltbn - ltgy	f	w	a		L						N			
17.5						qtz ss	vltbn	f	w	a		L						N			
20.0						qtz ss	ywgy	vf-c	p	r								N			some chert grains
22.5						qtz ss	ltgy	m-c	m	R								N			" " "
25.0						qtz ss	tn	m	w	R								N			
27.5						qtz ss	ltgy	m-c	m	r								N			
30.6						sndy sh	vltywgy	f-m	m	r								N			CH
32.5						sh	ltywgy											N			CH
35.0						sh	ywgy											N			
37.5						qtz ss, sh	tn - orgy	f-m	m	r		L						N			
40.0						qtz ss	tn	m	w	r								N			
42.5						qtz ss	ltbn	m-c	m	r		L						N			Some chert frags. and grains
45.0						qtz ss	tn	m	w	r								N			
47.5						qtz ss	vltbn	m	w	r								N			
50.0						qtz ss	ltbn	m	w	r								N			
52.5						qtz ss	lttn	m	w	r								N			
55.0						qtz ss	ltgytn	m	w	r								N			
57.5						qtz ss	ltgytn	m	w	a								N			
60.0						qtz ss	ltgytn	f-m	m	a								N			
62.5						qtz ss	wh-vdkbn	f-peb	p	a								W			moisture 1st noticed chert pebble frags.
65.0						qtz ss, sh	wh-vltgn	vf-c	p	a								N			
67.5						qtz ss	vltgytn	m-peb	p	r								N			abund. chert grains
70.0						qtz ss	vltgytn	m-c	m	r								N			
72.5						qtz ss, sh	vltgytn	m-peb	f	r								N			some chert frags & grains
75.0						qtz ss	vltgytn	m	w	r		L						N			
77.5						qtz ss	vltgytn	m	w	r								N			
80.0						qtz ss	ltortn	m	w	r		L						N			very hard drilling
82.5						qtz ss	lttn	m	w	r		L						N			"
85.0						qtz ss	lttn	m	w	R								N			"
87.5						qtz ss	vlttn	m-c	m	a								N			"
90.0						qtz ss	vlttn	f-m	f	r								N			"
92.5						qtz ss	vlttn	f-m	f	r								N			"
95.0						qtz ss, sh	wh-gn	f-m	f	r			Tr	A				M			Brushy Basin Ct @ 94.0' good contact
97.5						sh	gn											N			
100.0						sh	gn											N			T.D. telltale small red chert grains
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

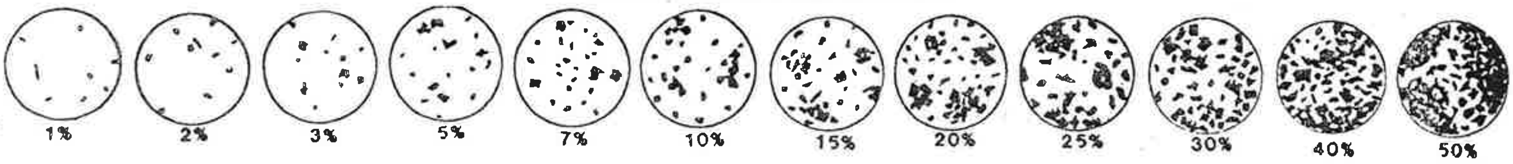


Date 5 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. DR6
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5579

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 100.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface Soil - unconsolidated - CH
5.0						mdst, sh	rdbn, ltpk											VS			Mancos Shale " CH
7.5						qtz ss, sh	ltpktn	f- m	m	r		L						VS			Upper Dakota Fm Ct. @ 6.0'
10.0						qtz ss	tn	m	w	r								N			
12.5						qtz ss	tn	m- c	m	a		L						N			
15.0						qtz ss	tn	m	w	a								N			
17.5						qtz ss	tn	m	w	a								N			
20.0						qtz ss	tn	m	w	a								N			
22.5						qtz ss	tn	m-c	m	a		L						N			
25.0						qtz ss, sh	orbn	m	w	r		L						N			
27.5						qtz ss	tn	m	w	r								N			
30.0						qtz ss	tn	m	w	a								N			
32.5						qtz ss	tn	m	w	a								N			
35.0						qtz ss	tn	m	w	R								N			
37.5						qtz ss	tn	m	w	r								N			
40.0						qtz ss.	tn	m	w	r								N			sparse chert grains
42.5						qtz ss, sh	tn-vltgn	m-vc	p	a								N			
45.0						sh, qtz ss	ltywgy	m	w	r								N			CL
47.5						qtz ss	vlt tn	m	w	r								N			
50.0						qtz ss	vlttn	f	w	r								N			
52.5						qtz ss	vlttn	m-c	m	r								N			
55.0						qtz ss	lttn	m-vc	f	r		L						N			
57.5						qtz ss	lttn	m	w	r								N			
60.0						qtz ss	lttn	f- c	f	r								N			
62.5						qtz ss	ltpktn	m	w	R								N			
65.0						qtz ss	vltgy	f- m	f	r								N			
67.5						qtz ss	vltgy	m	w	R								N			
70.0						qtz ss	vltgy	m	w	r								N			
72.5						qtz ss	vltgy	f	w	r								N			
75.0						qtz ss	vltgy	f	w	r								N			
77.5						qtz ss	tn	m- vc	m	r								N			chert frag. + grains
80.0						qtz ss	ltgytn	m	w	R								N			
82.5						qtz ss	ltgytn	m-c	m	r								N			mositure ist noticed @ 80.0'
85.0						qtz ss	ltgytn	m-c	m	r								N			
87.5						qtz ss	ltgytn	m-peb	p	a								N			chert pebbles + frags.
90.0						qtz ss	tn	m-peb	p	a								N			" " "
92.5						qtz ss	tn	c-peb	p	a								N			" " "
95.0						qtz ss	ltgytn	c-peb	p	a			tr	C				VS			
97.5						sh	ppbn-gn											N			Brushy Basin Ct @ 95.0' good contact
100.0						sh	ppbn-gn											N			T.D.
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

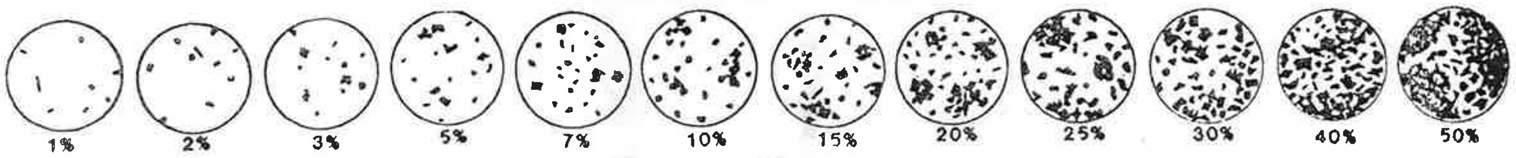


Date 27 APR 2011 Geologist L. CASEROLT Drilling Co. BAYLES EXPLORATION CO. Hole No. DR7
Property WHITE MESA MILL Project CELL 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County SAN JUAN State UTAH Location ____ Elev. 5594

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 100.6
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											N			Surface soil-unconsolidated CH
5.0						mdst	rdbn											W			surface soil - unconsolidated CH
7.5						qtz ss	orbn	m-c	m	a		L						K			Upper Dakota Ct @ 6.0'
10.0						qtz ss	ortn	m-c	m	A								N			
12.5						qtz ss	ltbn	m	w	a								N			
15.0						qtz ss	ltbn	m	w	a								N			
17.5						qtz ss	ortn	m-c	m	a								N			
20.0						qtz ss	tn	m	w	a								N			
22.5						qtz ss	tn	m	w	r								N			
25.0						qtz ss	ltbn	m-c	m	r								N			Some chert frags.
27.5						qtz ss	tn	m	w	r								N			
30.0						qtz ss	ltgytn	f-m	m	r								N			
32.5						qtz ss, sh	ltgytn	m	w	r								N			
35.0						qtz ss	ltgybn	m-c	m	r								N			
37.5						qtz ss	vltgytn	f	w	R								N			
40.0						qtz ss, cgl	ltgytn	m-peb	f	r								N			
42.5						sh, qtz ss	ltywgy	vf-f	m	r		L						N			CH
45.0						qtz ss	lttn	f-m	m	r		L						N			
47.5						qtz ss	ltpktn	m-c	f	R								N			
50.0						qtz ss	ltpktn	m-c	f	R								N			
52.5						qtz ss	ltpktn	m-peb	f	a								N			some multi colored chert grains
55.0						qtz ss	vltpktn	m	w	R								N			
57.5						qtz ss	vltpktn	f-m	m	r								N			
60.0						qtz ss	ltpktn	m-peb	f	a								N			
62.5						qtz ss	ltgytn	m	w	a								N			
65.0						qtz ss	ltgytn	m-c	m	a								N			
67.5						qtz ss	bn	c-vc	m	a								N			abund. chert frags
70.0						qtz ss	ltgybn	m-vc	m	a								N			
72.5						qtz ss, cgl	bn	c-peb	m	a								N			
75.0						qtz ss	gytn	m-c	m	r								N			
77.5						qtz ss	ltgytn	m	w	r								N			moisture first noted, some chert grains
80.0						qtz ss	ortn	m-c	m	r								N			
82.5						qtz ss	orpktn	m	w	R								N			
85.0						qtz ss	tn	m	w	R								N			
87.5						qtz ss	lttn	m	w	R								N			
90.0						qtz ss	gytn	m	w	R								N			
92.5						qtz ss	gytn	m-c	m	r								VW			
95.0						qtz ss, sh, cgl	wh, ltblgn	m-peb	m	r								W			Brushy Basin Fm Ct @ 93.0' chert pebbles.
97.5						sh	pprdbn-gn											N			mottled frags.
100.0						sh, qtz ss	gn-vltgy	vf-c	p	r			Tr	A				N			T.D.
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



Date 5 May 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR8

Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____

County San Juan State Utah Location ____ Elev. ≈5537

PAGE 1 OF 1

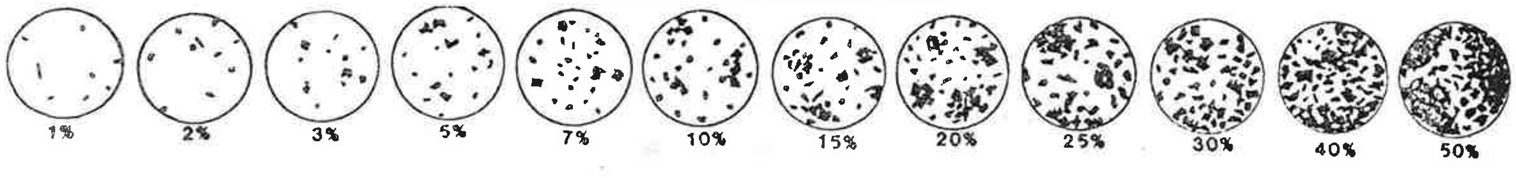
T.D. PROBE ____

T.D. DRILL 70.0

FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sh, qtz ss	ltywgy	vf	w	r								VS			Mancos Shale - soil was removed during site prep CL
5.0						sh - qtz ss	ltywgy	vf	w	r								S			upper Dakota Fm Ct @ 4.0' ML
7.5						qtz ss	tn	f-m	m	a		L						N			
10.0						qtzss	tn	f-m	m	a								N			
12.5						qtz ss	tn	m	w	a								N			
15.0						qtz ss	tn	m c	m	a								N			
17.5						qtz ss	pktn	m-c	f	r								N			
20.0						qtz ss	tn	f-m	f	r								N			
22.5						sh, qtz ss	ltywgy	f-m	f	r								N			CL
25.0						qtz ss, sh	ltywgy	f-m	f	r								N			ML
27.5						qtz ss, sltst	lttn	vf-m	f	r		L						N			
30.0						qtz ss, sh	lttn	vf-m	f	r		L						N			
32.5						qtz ss, sh	lttn- ltywgn	m	w	r								N			very hard drilling
35.0						qtz ss	ltgytn	m-c	m	R		L						N			some dkgy chert grains
37.5						qtz ss, qtzite	ltgytn	m-vc	f	a								N			abund " " "
40.0						qtz ss, qtzite	wh	m-vc	f	a								N			very hard drilling
42.5						qtz ss, qtzite	wh	m-vc	f	a								N			extremely hard drilling
45.0						qtz ss, qtzite	wh	m-vc	f	a								N			" " "
47.5						qtz ss, qtzite	wh	m-peb	p	a								N			" " "
50.0						qtz ss, qtzite	wh-vlttn	m-vc	p	a								N			" " "
52.5						qtz ss, qtzite	wh-or-dkgy	m peb	p	A								N			" " "
55.0						sh	ltgybl											N			
57.5						qtz ss, qtzite	ltgytn	f-m	m	r								W			
60.0						sh	gygn-pprdbn											N			Brushy Basin Ct @ 57.5' cutting are mottled.
62.5						sh	gn-pprdbn											N			tale tell rd chert grains
65.0						sh	gn											N			
67.5						sh	gn						Tr	A				N			
70.0						sh	gn											N			TD.
72.5																					
75.0																					
77.5																					
80.0																					
82.5																					
85.0																					
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



Date 4 may 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR 9
Property White Mesa mill Project Cell 4B . Unit No. ______ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ______ Elev. ≈ 5562

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 115.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn-ltpk											W			Surface soil to 2.0', Mancos Shale to 2.5 CL
5.0						qtz ss, sh	rdbn	f-m	m	r								S			unconsolidated ML
7.5						qtz ss, sh	rdbn	f	w	r								N			" ML
10.0						qtz ss, sh	rdbn	vf f	m	r								W			
12.5						qtz ss	rdbn	m	w	r								VS			
15.0						sh, qtz ss	dk gy bn	f m	m	a		L						VS			Upper Dakota Fm Ct @ 14.0'
17.5						qtz ss	tn	m	w	a		L						N			
20.0						qtz ss	tn	m	w	a								N			
22.5						qtz ss	tn	f m	m	a								N			
25.0						qtz ss	tn	m	w	a								N			
27.5						qtz ss	tn	f	w	r								N			
30.0						qtz ss	tn	m	w	r								N			
32.5						qtz ss	tn	m	w	a								N			
35.0						qtz ss	tn	m	w	a								N			
37.5						qtz ss	tn	m	w	a								N			
40.0						qtz ss	tn	m-C	m	a								N			
42.5						qtz ss	tn	m	w	r								N			
45.0						qtz ss	tn	f	w	r								W			
47.5						qtz ss	orgy	C-VC	p	a								N			abund chert frags
50.0						qtz ss	orgy	C-VC	p	a		L						W			" " "
52.5						qtz ss	tn	m-c	m	a								N			
55.0						qtz ss	tn	m-c	m	a								N			
57.5						sh	ywgy											N			
60.0						qtz ss, sh	ywgy	f	w	r								N			
62.5						qtz ss, sh	gy	f m	m	r								N			
65.0						qtz ss, sh	gy	f	w	r								N			
67.5						qtz ss, sh	gy	f	w	r								N			
70.0						qtz ss, sh	gy	vf f	m	r			tr	A				N			
72.5						qtz ss	gy	vf-f	m	r			tr	A				N			
75.0						qtz ss	wh	vf f	m	r								N			
77.5						qtz ss	lt tn	m	w	r								N			
80.0						qtz ss	lt tn	m	w	a								N			
82.5						qtz ss	lt tn	m	w	a								N			
85.0						qtz ss	ltgytn	m	w	R								N			moisture first noted @ 85.0'
87.5						qtz ss, sh	ltgytn	m	w	R								N			
90.0						qtz ss	lt tn	m-c	m	r								N			
92.5						qtz ss	lt tn	m	w	r								S			
95.0						qtz ss	lt tn	m	w	r								N			
97.5						qtz ss	lt tn	m	w	R								N			
100.0						qtz ss, sh	ltywgy	m	w	R								N			
102.5						qtz ss	wh	m	w	r								N			
105.0						qtz ss, cgl	wh-dkgy	C-peb	p	a			1%	C				N			
107.5						qtz ss, cgl	wh-dkgy	C-peb	p	a			1%	C				VW			
110.0						qtz ss, cgl	dkgy-gn	C-peb	p	a								N			
112.5						sh	gn											N			Brushy Basin Ct @ 110.0
115.0						sh	gn											N			T.D.
117.5																					
120.0																					
122.5																					
125.0																					

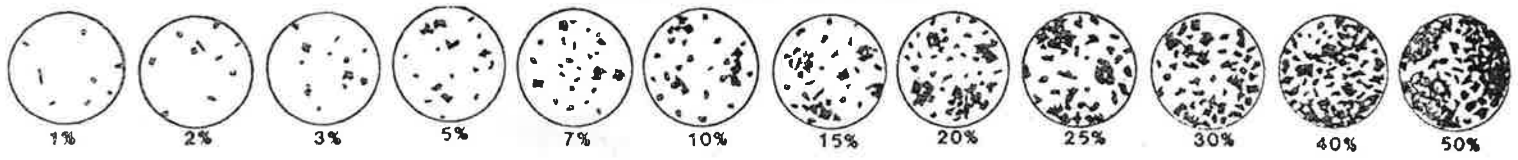
PERCENTAGE COMPOSITION IMAGE

Date 4 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. DR 10
Property White Mesa Mill Project cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈5559

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 90.0
FLUID LEVEL ______

													PYRITE						CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						mdst	rdbn											W			Surface Soil . Unconsolidated CH
5.0						mdst	rdbn											W			Surface Soil " CH
7.5						qtz ss	tn	m	w	a		L						N			Upper Dakota Fm Ct @ 5.0'
10.0						qtz ss	tn	m	w	a		L						N			
12.5						qtz ss	tn	f	w	a								N			
15.0						qtz ss	tn	m	w	a								N			
17.5						qtz ss	tn	m-c	m	a								N			some chert frags and grains
20.0						qtz ss	tn	f-m	m	r								N			
22.5						qtz ss	tn	f-m	m	r								N			
25.0						qtz ss, sh	ltywgy	f-m	m	r								N			sandy lean clay CL
27.5						qtz ss, sh	ltgy	f-m	m	r		L						N			" " , CL some chert pebbles.
30.0						qtz ss, cgl sh	dkywgy	f-peb	m	r								N			sandy lean clay CL " " "
32.5						qtz ss, cgl	ywgy	vf-peb	m	r								N			
35.0						qtz ss, sh	ywgy	vf-c	m	r								N			Lean clay CL, some chert grains
37.5						qtz ss	ywtn	f	w	r								N			
40.0						qtz ss	ywtn	f	w	r								N			
42.5						qtz ss	pktn	f	w	r								N			
45.0						qtz ss	ywgy-tn	f-m	m	r		L						N			
47.5						qtz ss	tn	f	w	r		L						N			
50.0						qtz ss	tn	m	w	r								N			
52.5						qtz ss	tn	M	w	r								N			
55.0						qtz ss	lt bn	m-peb	m	r		H						N			abund chert grains
57.5						qtz ss	tn	m	w	R								N			
60.0						qtz ss	tn	M	W	R								N			
62.5						qtz ss	tn	m-c	m	a								N			
65.0						qtz ss	ltortn	m-c	m	a		L						N			
67.5						qtz ss	vltgy	m-c	m	r								N			very hard drilling!
70.0						qtz ss, cgl	ltgybn	m-peb	p	a								N			very abund chert frags + grains
72.5						qtzite, cgl	gytn	m-peb	P	a								N			" " "
75.0						qtzite, cgl	gytn	m-VC	P	a								N			
77.5						qtzite	gytn-wh	m-vc	p	a								N			very abund chert frags & grains
80.0						qtzite	gytn-wh	m-vc	p	a								N			
82.5						sltst, sh	gn											N			Brushy Basin Ct @ 80.0'
85.0						sltst, sh	gn											N			
87.5						sh	gn											N			
90.0						sh	gn											N			T.D.
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

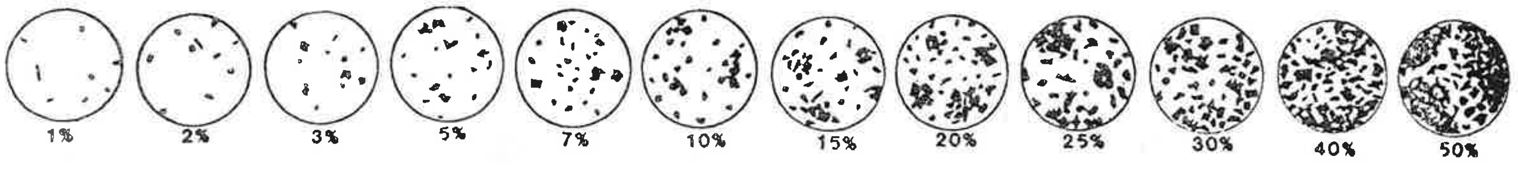


Date 6 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. DR11
Property White Mesa Mill Project cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5582

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 115.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface Soil (unconsolidated)
5.0						mdst, sh	rdbn, ltpk											VS			surface soil (unconsolidated, Mancos shale @ 4.0'
7.5						sndy sh	rdbn	m	f	r								VS			
10.0						sh, qtz ss	rdbn - ltpk	m	m	r								VS			
12.5						sh, qtz ss	ltpk - vlttn	m	m	r								VS			Upper Dakota Fm Ct. @ 12.0'
15.0						qtz ss	ltgybn	m-c	m	r								S			
17.5						qtz ss	lt yw	m-vc	f	a		L						N			abund. lt colored chert frags.
20.0						qtz ss	ltgytn	m-c	f	r								N			
22.5						qtz ss	ltgytn	m	w	r								N			
25.0						qtz ss	ltgytn	f-m	w	r								N			
27.5						qtz ss	ltgytn	M	W	R								N			
30.0						qtz ss	ltgytn	c	w	r								N			
32.5						qtz ss	lttn	f	w	r								N			
35.0						qtz ss	lt tn	f-c	P	a								N			some dk chert grains.
37.5						qtz ss	gytn	m-c	M	r								N			abund. dk chert grains
40.0						qtz ss	lt tn	M	W	R								N			
42.5						qtz ss	lt tn	m-c	m	a								N			
45.0						qtz ss	lt tn	m	W	R								N			
47.5						qtz ss	ltgytn	c	w	R								N			
50.0						qtz ss, sh	tn-ltgn	c-peb	P	A								N			multi colored chert frag & grit
52.5						qtz ss	tn	m-vc	M	r								N			" " " " "
55.0						qtz ss	tn	m-c	m	r								N			
57.5						qtz ss, sltst	lt blgy	m-peb	f	o								N			chert pebble frags.
60.0						sltst, qtz ss	lt blgy	f vc	P	a								N			
62.5						sltst, qtz ss	lt blgy	f-vc	P	a								N			
65.0						qtz ss, sltst	lt blgy - lt tn	m-c	m	a								N			
67.5						qtz ss	tn	m-c	m	a								S			
70.0						qtz ss, cgl	tn bn	m-peb	P	a								M			multi colored chert frags.
72.5						qtz ss, cgl	tn bn	c-peb	P	a								N			
75.0						qtz ss	ltgytn	m-c	m	a								N			
77.5						qtz ss	ltgy tn	m-vc	f	a								N			
80.0						qtz ss	ltgytn	f-m	W	r								N			moisture first noted @ 80.0
82.5						qtz ss	ltgy tn	m-c	w	r								N			
85.0						qtz ss	ltgy tn	m	W	R								N			
87.5						qtz ss	ltgytn	f-m	m	r								N			
90.0						qtz ss	ltgytn	f-m	m	r								N			
92.5						qtz ss	gytn	m-peb	f	r								N			
95.0						qtz ss	gytn	c-peb	m	r								N			
97.5						qtz ss, cgl	gy tn	c-peb	m	r								N			
100.0						qtz ss, cgl	gy tn	m-c	M	r								N			very hard drilling
102.5						qtz ss, cgl	tn bn	m-peb	P	o								N			" " " abund. dkgy chert frags.
105.0						qtz ss, cgl	tn bn	m-peb	P	a			tr					N			" " " gy chert frags.
107.5						qtz ss, sh	wh-gygn	f-peb	P	a								N			Brushy Basin Ct. @ 106.0' good contact chert frags.
110.0						sh	gygn						<1%	A/C				N			some masses of sulfide (pyrite?)
112.5						sh	gygn											N			
115.0						sh	gygn-bpbn											N			T.D. mottled cuttings
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

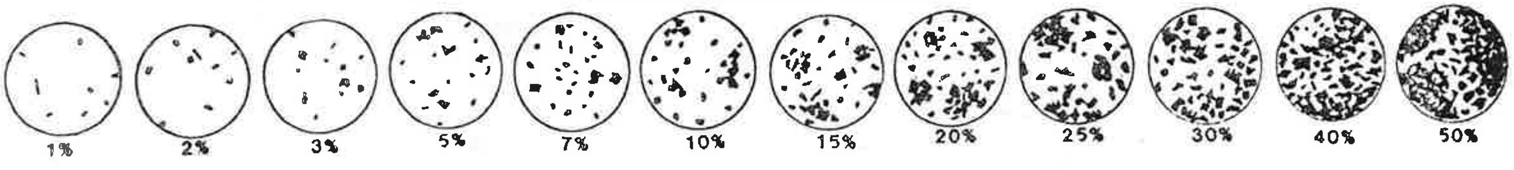


Date 28 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR12
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5584

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 100.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface Soil unconsolidated fat clay w/sand CH
5.0						mdst	rdbn											VW			Surface Soil " " " " CH
7.5						sh	ltpktn											VS			Mancos Shale Fm. consolidated. Lean clay w/sand CL
10.0						sh	ltpktn											VS			" "
12.5						sh	ltpktn											S			" "
15.0						qtz ss, sh	lt bn	m	w	r		L						N			Upper Dakota Ct @ 12.5'
17.5						qtz ss	tn	m	w	r		L						N			
20.0						qtz ss	ltortn	m	w	r		L						N			
22.5						qtz ss	tn	m	w	a								N			
25.0						qtz ss	tn	m	w	a								N			
27.5						qtz ss	ltgytn	m	w	r								N			some chert grains
30.0						qtz ss	tn	m-c	m	r								N			" " "
32.5						qtz ss	tn	m-c	m	r								N			
35.0						qtz ss	tn	m-c	m	r								N			
37.5						qtz ss	ltortn	m	w	R		L						N			
40.0						qtz ss	tn	m	w	R								N			
42.5						qtz ss	tn	m-peb	f	a								N			some chert grains
45.0						qtz ss	lt bn	f-peb	p	a								N			" " "
47.5						qtz ss, sh, Cgl	tn-gn	f-peb	p	a								N			" " "
50.0						qtz ss, sh, Cgl	gn-tn	m-peb	p	A								N			" " "
52.5						qtz ss, sh	gn-tn	m-peb	p	a								N			abund. chert frags. grains
55.0						qtz ss	tn	m-peb	p	a		L						N			" " " "
57.5						qtz ss	tn	f-c	p	a		L						N			
60.0						qtz ss	tn	f-c	p	a								N			
62.5						qtz ss	ltgytn	m	w	r								N			
65.0						qtz ss	ltgytn	m	w	r								N			
67.5						qtz ss	ltgytn	m	w	r								N			
70.0						qtz ss	tn	m	w	r								N			
72.5						qtz ss	ltgytn	m	w	r								N			
75.0						qtz ss	lt bn	m	w	a								N			
77.5						qtz ss	ltgytn	m	w	a								N			
80.0						qtz ss	tn	f-m	m	r								N			
82.5						qtz ss	tn	M	W	a								N			
85.0						qtz ss	tn	m-c	m	a			tr	C				N			
87.5						qtz ss, sh	gn-tn	f-c	m	a			tr	C				N			
90.0						qtz ss, sh	wh-ltgn	f-m	m	r			tr	C				N			
92.5						qtz ss, sh	wh-ltgn	f-m	m	r								N			Brushy Basin Ct @ 92.0 ft.
95.0						sh	gn, rdbn											N			
97.5						qtz ss, sh	wh-gn	f-m	m	R								N			
100.0						sh	gn-rdbn											N			T.D. Mottled Frags.
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



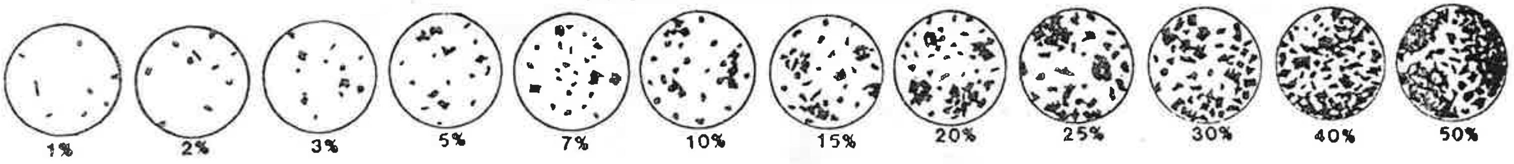
Changed pt Ct. from 82

Date 27 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR13
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. 5575

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 90.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface Soil. unconsolidated - lean clay w/sand CL
5.0						mdst	rdbn											S			surface Soil - unconsolidated - lean clay w/sand CL
7.5						qtz ss	ortn	m-peb	p	A								N			upper Dakota Ct @ 5.0' abund. chert frags, pebbles,
10.0						qtz ss, cgl	gyortn	m-peb	p	A								N			abundant chert frags & pebbles.
12.5						qtz ss	ortn	m-peb	p	r		L						N			" " " "
15.0						qtz ss, sh	ltgytn	m-peb	p	a								N			Some chert frag. & pebbles sandy fnt clay Ct
17.5						qtz ss, sh	ltgygntn	m-peb	p	a								N			" " " "
20.0						qtz ss, cgl	ltgytn-rd	m-peb	p	a								N			" " " "
22.5						qtz ss	lttn	m-c	m	a								N			
25.0						qtz ss, sh	lttn-ltgn	m-vc	f	a								N			
27.5						qtz ss, sh	lttn-ltgygn	m-peb	p	a								N			
30.0						qtz ss	tn	m	w	r								N			
32.5						qtz ss	tn	m	w	a								N			
35.0						qtz ss	ltbn	m-peb	p	a								N			
37.5						qtz ss, cgl	dkbn	m-peb	p	a								W			
40.0						qtz ss	tn	m	w	R								N			
42.5						qtzs	tn	m-peb	p	r								N			
45.0						qtz ss	tn	f-peb	p	a								N			
47.5						qtz ss	tn	m	w	r								N			
50.0						qtz ss	tn	m	w	r								N			
52.5						qtz ss	vlttn	m	w	r								N			
55.0						qtz ss	vlttn	m	w	r								N			
57.5						qtz ss	lttn	m	w	r								N			
60.0						qtz ss, cgl	gytn	m-peb	p	a		L						N			abund multi colored chert frags + grains
62.5						qtz ss, cgl	ltgytn	m-peb	p	a		L						N			" " " " " "
65.0						qtz ss	lttn	m	w	r								VS			
67.5						sh, qtz ss	ltblgy	m-peb	p	a								VW			
70.0						qtz ss, sh	wh-blgy	vf-m	f	r								N			
72.5						qtz ss	wh-ltgy	f	w	r								N			
75.0						qtz ss	wh-ltgy	f	w	r								N			
77.5						qtz ss	wh-ltblgn	f	w	r								N			
80.0						qtz ss	wh-ltblgn	f	w	r								N			sparse chert pebble frags.
82.5						sh	gy-rdbn											N			Brushy Basin Fm Ct @ 80.0'
85.0						sh	blgy-rdbn											N			
87.5						sh	blgy-rdbn											N			
90.0						sh	pprdbn-gn											N			TD
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



Date 29 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR14

Property White Mesa Mill Project CELL 4B Unit No. ___ Sec. ___ Twp. ___ Rge. ___

County San Juan State Utah Location ___ Elev. ≈ 5546

PAGE 1 OF 1

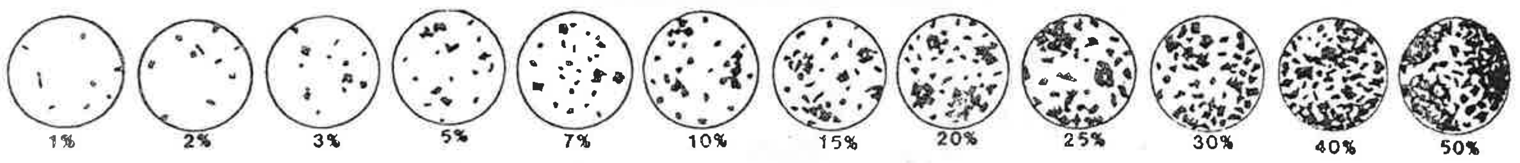
T.D. PROBE ___

T.D. DRILL 100.0

FLUID LEVEL ___

DEPTH	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																
2.5	mdst	rdbn											N			Surface Soil.
5.0	mdst	rdbn											VS			Mancos Shale
7.5	qtz ss	tn	m	w	a								w			Upper Dakota Fm Ct. @ 5.0'
10.0	qtz ss	tn	m	w	a								N			
12.5	qtz ss	lttn	m	w	a								N			
15.0	qtz ss	wh-lttn	m	w	a		L						N			
17.5	qtz ss	wh-lttn	m-c	m	a								N			some chert grains
20.0	qtz ss	tn	f-c	f	a								N			
22.5	qtz ss, cgl, sh	ltgy	m-peb	f	a								N			abund. dkgy chert frags.
25.0	qtz ss	tn	m	w	r								N			
27.5	qtz ss	tn	m-c	m	r								N			
30.0	qtz ss	tn	m-c	m	r								N			
32.5	qtz ss	tn	m	w	r								N			
35.0	qtz ss	tn	f-m	m	r		H						N			
37.5	qtz ss	tn	m	w	a								N			
40.0	qtz ss	ltortn	m	w	r								N			
42.5	qtz ss	gytn	m-peb	m	r								N			
45.0	qtz ss, sh	ltgytn	f-m	m	r								N			
47.5	qtz ss	ltgytn	f-m	m	r			1%	A				N			
50.0	qtz ss	ltortn	f	w	r								N			
52.5	qtz ss sltst	ltgytn	f-m	m	a								N			
55.0	qtz ss	ltpktn	m	w	r		H						N			
57.5	qtz ss	tn	m	w	r								N			
60.0	qtz ss	tn	m c	m	r								N			
62.5	qtz ss	dkgytn	c-vc	m	a								N			
65.0	qtz ss	ltgytn	m	w	a								N			
67.5	qtz ss	ltgytn	m	w	r								N			
70.0	qtz ss	lttn	m-c	m	r								N			
72.5	qtz ss	lttn	m-c	m	r								N			
75.0	qtz ss	lttn	m	w	r								N			
77.5	qtz ss	lttn	m	w	r								N			
80.0	qtz ss	ltgytn	m-c	m	r								N			
82.5	qtz ss	ltgybn	m-peb	m	r								N			
85.0	qtz ss	gytn	f-m	m	r		L						N			
87.5	qtz ss	tn	f-m	m	r		L						N			
90.0	qtz ss	tn	f-m	m	a								N			
92.5	qtz ss	tn	m	w	r								N			
95.0	qtz ss, sh	wh-tn, gn	m	w	r		L	tr	c				N			Brushy Basin Fm Ct @ 94.0' good ct.
97.5	sh	ppbn											N			
100.0	sh	ppbn-gn											N			T.D.
102.5																
105.0																
107.5																
110.0																
112.5																
115.0																
117.5																
120.0																
122.5																
125.0																

PERCENTAGE COMPOSITION IMAGE

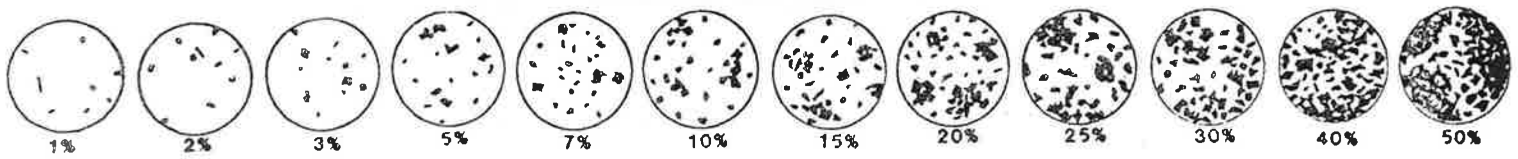


Date 28 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR15
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ______ Elev. ≈5571

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 100.0 T.D
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
2.5						mdst	rdbn											S			Surface Soil - unconsolidated - sandy lean clay CL
5.0						mdst	rdbn											S			Surface Soil - unconsolidated " " " CL
7.5						sh	ltpktn											VS			mancos sh sandy fat clay CH
10.0						sndy sh	ywgy	f-m	f	a								S			mancos sh
12.5						qtzss, sh	vltbn	f	w	r								W			Upper Dakota Ct. @ 11.0'
15.0						qtz ss	ltywbn	vf-c	m	r								N			
17.5						qtzss	ltywbn	f-m	m	r		L						N			
20.0						qtzss	gytn	f	w	r								N			
22.5						qtzss	ltywbn	f	w	r		L						N			
25.0						qtzss	lttn	m	w	r								N			
27.5						qtzss	tn	m	w	r								N			
30.0						qtz ss	tn	m-c	m	r								N			some chert frags. and grains
32.5						qtzss	ltortn	f-m	m	r		L						N			
35.0						qtz ss	tn	f	w	r								N			
37.5						qtzss	tn	m	w	a								N			
40.0						qtz ss	tn	m-c	m	a								N			
42.5						qtz ss	tn	m-c	m	r								N			
45.0						qtz ss	tn	m-c	m	r								N			
47.5						qtz ss	tn	m-c	m	r								N			Some chert frags and grains
50.0						qtz ss, sh	ltbn, gn	m-peb	m	r								N			some gn shale frags.
52.5						sh	ywgygn											N			
55.0						sh, qtzss, cgl	ltgygn	m-peb	p	a								N			abund chert frags and grains.
57.5						qtz ss	tn	m-vc	p	a								N			" " " " "
60.0						qtz ss	tn	m	w	r								N			
62.5						qtzss	tn	m	w	R		L						N			
65.0						qtz ss	ltortn	m	w	R		L						N			
67.5						qtzss	ltortn	m-vc	m	r		L						N			abund chert frags and grains
70.0						qtz ss, cgl	dkgyortn	m-peb	f	r								N			50% chert frags, grains, and pebbles.
72.5						qtz ss	lttn	m-vc	f	a								N			some " " "
75.0						qtz ss	vlttn	m	w	r								N			
77.5						qtz ss	ltgytn	m-peb	m	a								N			10% chert frags, grains.
80.0						qtz ss, cgl	gy-dkgy	m-peb	m	a								N			50% chert frags grains and pebbles.
82.5						qtz ss	tn	m	w	R								N			
85.0						qtz ss	tn-gy	m-peb	f	a								N			some chert
87.5						qtzss, cgl	gy	m-peb	f	a								N			60% chert frags, grains and pebbles.
90.0						qtzss, cgl	gy	m-peb	f	a								N			note: some material is a qtzite - hard drilling!
92.5						qtzss	ltpktn	m	w	r								N			qtzite - hard drilling.
95.0						qtz ss	lttn - wh	m	w	r								N			
97.5						qtz ss sh, cgl	gn - wh	m-peb	p	a			tr.	C				N			Brushy Basin Ct @ 96.0 pyrite assoc. w/qtz.
100.0						sh,	gn											N			T.D
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



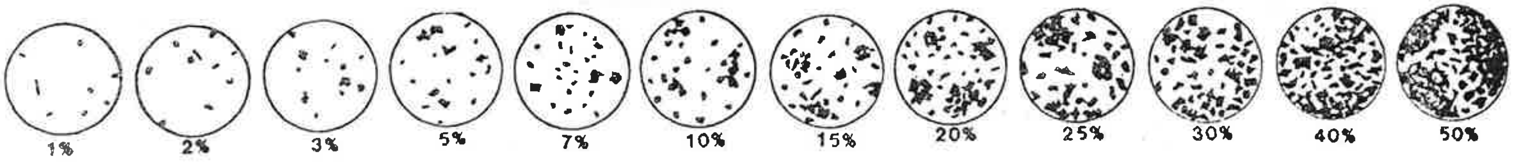
Dakota Cr. to 9.5 from 10.0'

Date 28 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR16
Property White Mesa mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5555

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 105.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																				
2.5					mdst	rdbn											W			Surface Soil-unconsolidated-sandy lean clay CL
5.0					mdst	rdbn											W			Surface Soil-unconsolidated-sandy lean clay CL
7.5					mdst limysh	rdbn-pktn											VS			Mancos Shale @ 6.0 ft.
10.0					limysh-qtzss	pktn-wh	m	w	r								VS			Mancos Shale ss is qtzitic
12.5					qtz ss	ortn	m	w	r		V						S			Upper Dakota Fm Ct @ 9.5'
15.0					qtzss	tn	m	w	R								N			
17.5					qtzss	tn	f-m	m	r								N			
20.0					qtz ss	tn	f-m	m	r								N			
22.5					qtzss	tn	f	w	r								N			
25.0					qtz ss	tn	m	w	R								N			
27.5					qtzss	tn	vf-f	m	R								N			
30.0					qtzss	tn	m	w	R								N			
32.5					qtzss	tn	m	w	R								N			
35.0					qtzss	tn	vf	w	R								N			
37.5					qtz ss	ltgytn	m-c	m	a								N			
40.0					qtz ss	tn	m	w	a								N			
42.5					qtzss	tn	m	w	a								N			
45.0					qtzss	tn	m-peb	p	a								N			
47.5					sh-qtz ss	ywgygn	m-vc	p	a								N			
50.0					qtzss, sh	ywgy-tn	m-peb	p	a								N			abund, multi colored chert frags, grains + pebbles
52.5					qtzss	gytn	m-peb	p	a								N			" " " " " " "
55.0					qtzss	ltortn	m-c	m	a		L						N			
57.5					qtzss	ltortn	m-c	m	a		L						N			
60.0					qtzss	tn	m	w	r								N			
62.5					qtzss	tn	m	w	r								N			
65.0					qtzss, sh	ltgytn	m c	m	a								N			
67.5					qtz ss	ltgytn	m c	m	r								N			
70.0					qtz ss	tn	f-m	m	r								N			
72.5					qtz ss	tn	m-vc	p	a								N			chert grains
75.0					qtz ss	ltortn	m-c	m	r								N			
77.5					qtzss, cgl	ltbn	m-peb	p	a								N			50% chert grains + frags.
80.0					qtzss	ltgytn	m-vc	p	a								N			
82.5					qtz ss	ltgytn	m-vc	p	a								N			
85.0					qtzss	ltgytn	m-vc	p	a								N			
87.5					qtzss, cgl	gybn	m-peb	p	a								N			50%+ chert grains, fragments + grains
90.0					qtzss	tn	m	w	r								N			
92.5					qtzss, cgl	gybn	m-peb	p	a								N			50%+ chert grains, frags. + grains
95.0					qtz ss, cgl	gybn	m-peb	p	a								N			75% chert grains, frags + grains
97.5					qtzss	tn	m	w	r								N			
100.0					qtzss	tn-gn	m-c	m	a			tr	C				W			Brushy Basin Ct @ 100.0, pyrite assoc. w/qtz
102.5					sh	gn-vltgn											N			
105.0					sh	gn-pkbn											N			telltale small red chert grains T.D.
107.5																				
110.0																				
112.5																				
115.0																				
117.5																				
120.0																				
122.5																				
125.0																				

PERCENTAGE COMPOSITION IMAGE

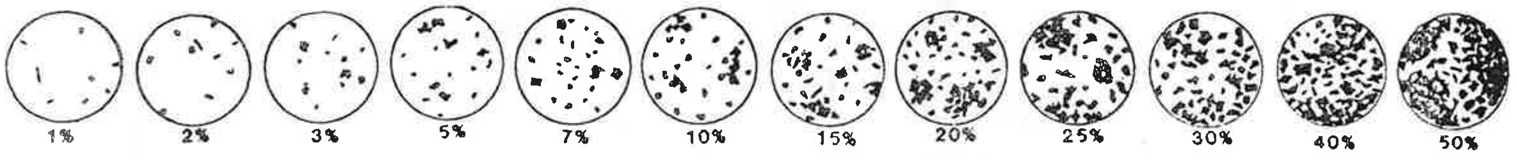


Date 29 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. DR17
Property White Mesa Mill Project CELL 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 85.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											N			Surface Soil - unconsolidated - lean sandy clay CL
5.0						mdst	rdbn											W			Surface Soil - unconsolidated - lean sandy clay CL
7.5						qtz ss	ortn	m	w	r		L						N			Upper Dakota Fm Ct @ 5.0'
10.0						qtz ss	tn	m-c	m	r								N			
12.5						qtz ss	tn	m	w	r								N			
15.0						qtz ss	ltgytn	m	w	R								N			
17.5						qtz ss	ltgytn	m-c	m	r								N			Some dk chert frags.
20.0						qtz ss	ltgytn	f-c	f	a								N			
22.5						qtz ss	tn	m	w	a								N			
25.0						qtz ss	tn	m-c	m	a								N			
27.5						qtz ss, sh	vlttn	f-vc	p	a								N			
30.0						cgl, qtz ss	tn-dkgybn	m-peb	p	a								N			dkgy chert pebbles & frags, 75%
32.5						sh, qtz ss	ltgygntn	m-vc	f	a								N			
35.0						sndy sltst	ltortn	vf-m	f	a								N			
37.5						sndy sh	ltgytn	vf-m	p	a								N			
40.0						sndy sh	ltgytn	vf-f	f	a								N			
42.5						sndy sh, ss	ltgy-ltortn	vf-f	f	a								N			
45.0						qtz ss	tn	m-c	m	r								N			
47.5						qtz ss	vltgy	vf-f	m	r								N			
50.0						qtz ss, sltst	vltgy	vf-m	f	r								N			
52.5						qtz ss	tn	f-c	f	a								N			
55.0						qtz ss	tn	f-m	m	a								N			
57.5						qtz ss	lttn	m-peb	p	a								N			Some light colored chert frags. and pebbles
60.0						qtz ss, cgl	ltgytn	m-peb	p	a								N			" " " " " " "
62.5						qtz ss	ltgytn	m-vc	p	a								N			
65.0						qtz ss	ltgytn	f-m	m	a								N			
67.5						qtz ss	tn	f-m	w	r								N			
70.0						qtz ss	tn	f-m	w	r								W			Brushy Basin Ct @ 70.0'
72.5						sh cgl	gn	peb										N			some dk chert pebbles.
75.0						sh cgl	gn	peb										N			" " " " tell tale red chert frags.
77.5						sh	gn											N			
80.0						sh	gn											N			red chert frags.
82.5						sh	gn-ltgy											N			
85.0						sh	gn						tr	A				N			T.D. red chert frags, pyrite as small aggre.
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

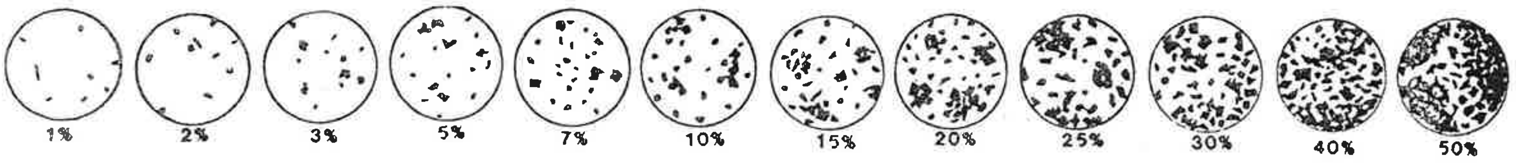


Date 4 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. DR 18
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≃ 5536

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 70.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface Soil- unconsolidated - sndy slt ML
5.0						mdst	rdbn											m			Surface soil- unconsolidated - sndy slt ML
7.5						qtz ss	bn	m-vc	p	A								N			Upper Dakota Fm Ct. @ 5.0' wh-gy chert frags.
10.0						qtz ss	wh-gybn	m-vc	p	A								N			abund chert frags.
12.5						cgl, qtz ss	gybn	m-peb	p	a								N			75% multi colored chert frags. & grains
15.0						qtz ss	dkgy	m	w	a								N			
17.5						qtz ss	tn	f	w	r								N			
20.0						qtz ss	lt or tn	m	w	r								N			
22.5						qtz ss	tn	m-c	m	r								N			
25.0						qtz ss	tn	m-vc	f	r								N			
27.5						cgl, qtz ss	gytnbn	m-peb	p	a								N			
30.0						qtz ss	tn	m	w	R								N			moisture first noticed @ 30.0'
32.5						qtz ss	tn	m	w	R								N			
35.0						qtz ss	tn	m c	m	R								N			
37.5						qtz ss	tn	m c	m	R								N			
40.0						qtz ss	lt or bn	m-vc	f	r								N			abund chert frags. & grains
42.5						qtz ss	vltgytn	m	w	a								N			
45.0						qtz ss	vltgytn	m-c	m	a								N			
47.5						qtz ss, qtzite	wh	m-c	m	a		L						N			very hard drilling some small chert grains
50.0						qtz ss, qtzite	wh	m-c	m	a		L						N			" " "
52.5						qtzite	wh-vlttn	m-vc	p	a								N			" " "
55.0						qtzite	wh-vlttn	m-vc	p	a								N			" " "
57.5						qtzite, sh	rdgybn-ltgn	m-peb	p	A			tr					N			Brushy Basin Ck. @ 57.0' chert breccia.
60.0						sh	ywgygn					H						N			
62.5						sh	blgy					L						N			some chert grains
65.0						sh	blgy											N			telltale red chert grains
67.5						sh	blgy											N			
70.0						sh	blgy											N			T.D.
72.5																					
75.0																					
77.5																					
80.0																					
82.5																					
85.0																					
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

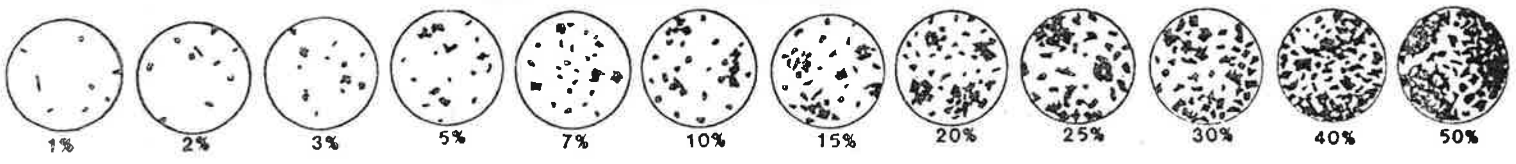


Date 3 May 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR19
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5513

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 75.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											N			Surface soil-unconsolidated
5.0						mdst	rdbn											S			Surface soil-unconsolidated
7.5						sndysltst	rdbn-pk	vf-f	m	r								VS			mancos Sh @ 6.0'
10.0						sndysltst	rdbn-pk	vf-m	f	r								VS			" "
12.5						qtz ss	ywtn	f-m	m	r								N			Upper Dakota Fm Ct. @ 10.0'
15.0						qtz ss	lt or bn	m	w	a		L						N			
17.5						qtz ss, sh	gytn-vdkgy	m-c	m	a								N			
20.0						qtz ss	ltgytn	m	w	a								N			sparse gy chert grains
22.5						qtz ss	tn	m	w	r		L						N			" " " "
25.0						qtz ss, cgl, qtzite	gy-wh	m-peb	f	r								N			25% lt-dkgy chert pebbles & frags.
27.5						qtz ss	wh-gybn	m-peb	f	a								N			abund chert frags. & pebbles.
30.0						qtz ss	ltgytn	m	w	r								N			
32.5						qtz ss, sh	wh-ltgytn	m-peb	m	a								N			
35.0						qtz ss	ltgytn	m-vc	f	a								N			
37.5						qtz ss	ltgytn	m-c	m	a								N			
40.0						qtz ss	vltgytn	m	w	r								N			
42.5						qtz ss	vltgytn	f-m	m	r								N			
45.0						qtz ss	vltgytn	f	w	r								N			
47.5						qtz ss	vltgytn	m	w	r								N			
50.0						qtz ss	lt pk tn	m-vc	m	r		H						N			abund chert frags.
52.5						qtz ss	ltgytn	m-c	f	a								N			
55.0						qtz ss	ltgytn	m-c	f	a								N			
57.5						qtz ss	wh-ltgytn	m-vc	f	a								N			
60.0						qtz ss, cgl	dkgytn	c-peb	p	a								N			50% lt & dk gy chert pebbles & frags.
62.5						qtz ss	tn-dkgy	m-peb	p	a								N			
65.0						cgl, qtz ss	tn bn	c-peb	p	a								N			75% multicolored chert pebbles & frags.
67.5						sh, qtz ss	bn-gy	m-c	m	r								N			Brushy Basin Ct @ 66.0'
70.0						sh	ltgygn											N			
72.5						sndy sh	blgn											N			
75.0						sh	blgn											N			T.D. some red chert grains
77.5																					
80.0																					
82.5																					
85.0																					
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

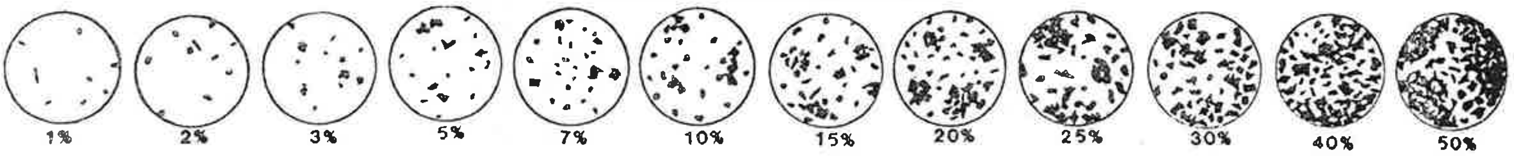


Date 2 MAY 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. DR 20
Property white mesa mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5499

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL ____
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											N			Surface Soil-unconsolidated sndy lean clay CL
5.0						mdst	rdbn											N			Surface soil-unconsolidated- sndy lean clay CL
7.5						qtzss, sh	pktn	m-pel				L						VS			upper Dakota Fm Ct. @ 6.0' some chert frags.
10.0						qtzss	ltrdbn	m-c	m	r		H						N			
12.5						qtzss	vltgytn	m-c	m	a								N			
15.0						qtzss	vltgytn	m	w	a								N			
17.5						qtzss	ltgytn	m	w	a								N			
20.0						qtzss	tn	m	w	a								N			
22.5						qtzss	tn	m-c	m	a								N			
25.0						qtzss	lttn	f	w	a								N			
27.5						qtzss	tn	m-c	m	a								N			some chert frags
30.0						qtzss	ltgy	m-c	m	a		H						N			" " "
32.5						qtzss	ltgytn	m-c	m	a								N			
35.0						qtzss-sh	ywgnbn	f-m	m	r		L						N			
37.5						sndy sh	ltblgy	m	w	r								N			sparse chert grains
40.0						sndy sh	ltblgy	f-m	m	r								N			
42.5						sh	ltblgy											N			
45.0						sh	blgy-bn											N			sparse chert frags.
47.5						qtzss, sh	gybn	vf-m	f	a								N			
50.0						sh, qtzite	gybn	vf-m	f	a								N			
52.5						sndy sh	gygn	m-pel	f	a								N			sparse chert pebbles + grains
55.0						Sh, qtzss	ltgngy	m	w	a		L						N			
57.5						sndy sh	ltgytn	f m	m	r			tr					N			
60.0						qtz ss, sh	ywgybn	f-m	m	r								N			
62.5						sndy sh	lt blgy	f-m	m	r								N			
65.0						sh	gygn											N			sparse red-bn chert frags.
67.5						sh	gygn											N			
70.0						qtzite, sh	wh-gy	f-m	m	r								N			some red-bn chert grains + frags.
72.5						qtzss, sh	wh-gy	f-c	p	a								N			
75.0						qtzss, sh	wh-gygn	f m	m	a								N			Brushy Basin Ct @ 73.0' abund. rd-gy chert pebbles
77.5						sh	gygn											N			
80.0						sh	gygn-ppbn											N			mottled shale frags.
82.5						sh	gygn											N			
85.0						qtzss, sh	wh-gygn	m-c	m	a								N			micaceous ss, (muscovite?)
87.5						sndy sh	gy-gygn	f-m	m	r								N			
90.0						sh	ltgy						tr					N			T.D.
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

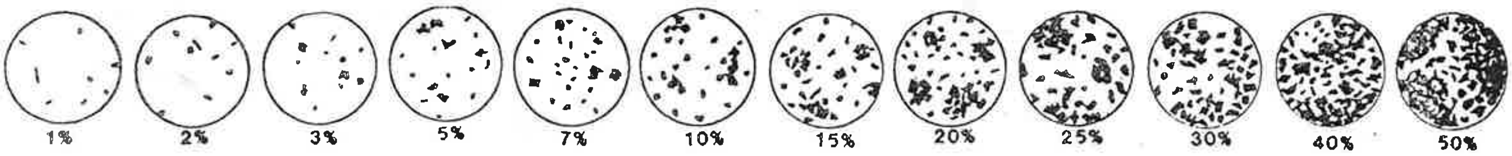


Date 2 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc Hole No. DR 21
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈5530

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL ______
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											W			Surface soil-unconsolidated-sndy lean clay CL
5.0						mdst	rdbn											S			Surface soil-unconsolidated-sndy lean clay CL
7.5						sndysh	rdbn-ltpk	m	w	a								VS			Mancos Shale @ 8.0'
10.0						sh	pktn											VS			
12.5						sh	ywgy											VS			
15.0						sh	ywgy											m			
17.5						sh	ywgy											m			
20.0						sndysh	ywgy	f	w	a								M			
22.5						sndy sh	ywgy	m	w	a		L						VW			
25.0						sndy sh, ss	tn	f-m	m	a								VW			Upper Dakota Fm Ct @ 24.0'
27.5						qtz ss	tn	m	w	a								N			
30.0						qtz ss	tn	m	w	a								N			
32.5						qtz ss	tn	m	w	a								N			
35.0						qtz ss	tn	f-m	m	a								N			
37.5						qtz ss	tn	m	w	a								N			
40.0						qtz ss	tn	f	w	a								N			
42.5						qtz ss	tn	m	w	a								N			
45.0						qtz ss, sh	dkbn	m	w	a		L						N			
47.5						qtz ss	tn	m-c	m	a								N			
50.0						qtz ss	gytn	m-vc	p	a								N			abund multicolored chert frags.
52.5						qtz ss	tn	m-vc	p	a								N			" " " " "
55.0						qtz ss	tn	m-c	f	a								N			" " " " "
57.5						sh	ltgy-gybn											N			chert pebbles & frags
60.0						sh	ltgy											N			
62.5						sndy sh	vltgytn	vf-m	f	a								N			
65.0						qtz ss	tn	m	w	a								N			
67.5						qtz ss	tn	m-c	m	a								N			
70.0						qtz ss	tn	c	w	r								N			
72.5						qtz ss, cgl	ltgytn	m-peb	f	r								N			
75.0						qtz ss	ltgytn	c	w	r								N			some gy chert grains
77.5						qtz ss	tn	c	w	r								N			
80.0						qtz ss	tn	m-c	m	a								N			
82.5						qtz ss	tn	m	w	r								N			
85.0						qtz ss	tn	f-m	m	r								N			
87.5						qtz ss	ltpktn	vf	w	r								N			
90.0						qtz ss	tn	f-m	m	r								N			
92.5						qtz ss	tn	m	w	r								N			
95.0						qtz ss, cgl	tn	m-peb	f	a								N			some gy chert frags.
97.5						qtz ss	wh-vlttn	m-vc	m	a								N			abund. wh-lt colored qtzite & chert frags.
100.0						qtz ss	wh-vlttn	m-vc	m	a								N			" " " " " "
102.5						qtz ss	wh-tn	m-peb	f	a								N			" " " " " "
105.0						qtz ss	wh-tn	m-peb	f	a								N			hard drilling, abund rusting steel frags.
107.5						qtz ss, qtzite	wh-tn	m-peb	f	a								N			" " " " " "
110.0						qtz ss, qtzite	wh-tn	m-peb	f	a								N			50% of grains are chert
112.5						qtz ss, cgl	gytn	m-peb	f	a								N			
115.0						qtz ss, cgl, sltysh	ywtn-gygn	m-peb	f	a		L						N			Brushy Basin Ct. @ 114.0
117.5						slty sh	gn-ppbn											N			
120.0						sltysh	gn-ppbn											N			T.D.
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

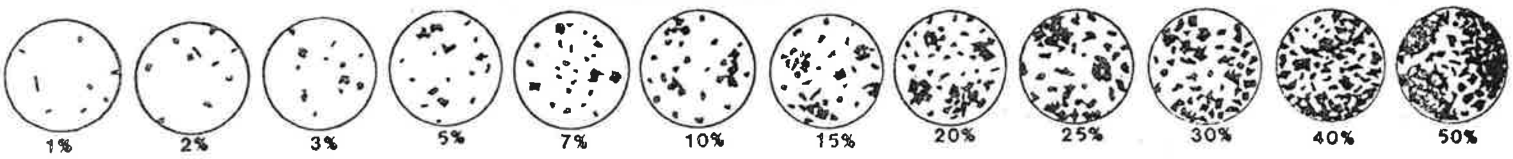


Date 3 May 2011 Geologist L. Casebolt Drilling Co. Boyles Exploration Inc. Hole No. DR 22
Property White mesa mill Project cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. 5488

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 85.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											W			Surface Soil-unconsolidated - sndy lean clay CL
5.0						mdst	rdbn											W			Surface Soil-unconsolidated-sndy lean clay CL
7.5						qtz ss	ltgytn											N			Upper Dakota Ct @ 5.0'
10.0						qtz ss cgl	ltgytn	m-peb	f	r								N			abund gray chert frags.
12.5						qtz ss,	ltgytn	m	w	r								N			
15.0						qtz ss, sh	wh-ltgytn	m-c	m	r								N			
17.5						qtz ss	wh-ltgytn	m-vc	m	r								N			some chert frags.
20.0						qtz ss	ltgytn	m-c	m	r								N			
22.5						qtz ss, cgl	gytn	m-peb	f	a								N			50% chert grains + frags.
25.0						qtz ss, cgl	gytn	m-peb	f	a								N			" " " "
27.5						qtz ss,	tn	m	w	a								N			
30.0						qtz ss cgl	gytn	m peb	f	a								N			abund light colored chert grains.
32.5						qtz ss	ltgytn	m-c	m	R								N			
35.0						qtz ss	ltgytn	m	w	R								N			
37.5						qtz ss	ltgytn	m	w	r								N			
40.0						qtz ss	ltgytn	m-c	m	a								N			
42.5						qtz ss	ltgytn	m	w	r								N			
45.0						qtz ss	ltgytn	m-c	m	r								N			
47.5						qtz ss	ltgytn	m	w	r								N			
50.0						qtz ss	ltgytn	m-c	m	r								N			
52.5						qtz ss	ltgytn	m-c	m	a								N			
55.0						qtz ss	ltgy	m-c	m	a								N			
57.5						qtz ss	ltgy	m-c	m	a								M			
60.0						sh	ltgy-ltgn											N			Brushy Basin Ct @ 57.5' some chert Grains
62.5						sh	wh-ltgygn											N			
65.0						sh	gybn											N			some red chert grains
67.5						sh	gn-ppbn											N			Extremely hard drilling (chert) from 67.5
70.0						sh, qtz	ortn-gn											N			To 72.5' chert pebbles + frags.
72.5						sh, qtzite	wh-ltgn	m-peb										N			
75.0						sh	blgy											N			red chert frags.
77.5						sh	blgy	peb										N			" " " + pebbles
80.0						sh	blgy											N			
82.5						sh, qtz ss	blgy	f-m	m	a			tr	C				N			
85.0						qtz ss, sh	ltgy	vf-m	f	a								N			TD
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

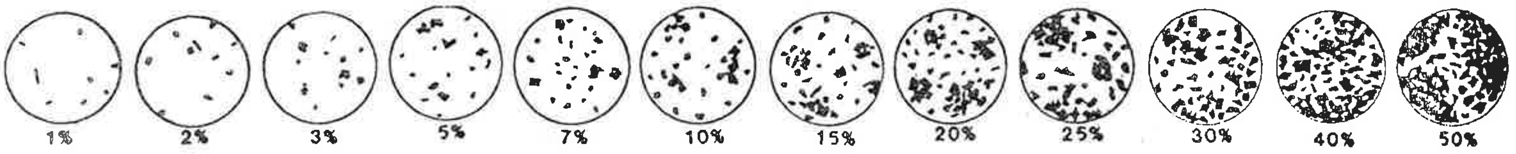


Date 4 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. DR 23
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5491

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 85.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											S			Surface soil. Mancos Shale @ 2.0'-unconsolidated
5.0						sndysh	rdbn-ltpktn	vf-f	w	r								VS			Mancos Sh
7.5						sndysh, qtzss	pktn-ywbn	f-m	m	r								VS			Upper Dakota Ct @ 7.0'
10.0						qtz ss	wh-ywtn	m-c	m	r		L						N			
12.5						qtz ss	tn	m-c	m	r		L						N			
15.0						qtz ss	tn	m-c	m	a								N			
17.5						qtz ss	tn	f-m	m	a								N			
20.0						qtz ss	tn	m	w	a		L						N			
22.5						qtz ss	tn	m	w	r								N			
25.0						qtz ss	tn	mc	m	a								N			
27.5						qtz ss	lt	mc	m	r								N			
30.0						qtz ss	ltgytn	m	w	R								N			
32.5						qtz ss	ltgytn	m	w	r								N			
35.0						qtz ss	ltgytn	m	w	r								N			
37.5						qtz ss	ltgytn	m-c	m	r								N			
40.0						qtz ss	ltgytn	m-c	m	a								N			
42.5						qtz ss, cgl	gytn-dkgy	m-peb	f	a								N			30% chert pebbles & grains
45.0						qtz ss	gytn	m-c	m	r								N			
47.5						qtz ss	gytn	m-c	m	r								N			Some chert frags.
50.0						qtz ss	gytn	m-c	m	r								N			
52.5						qtz ss	vltgy	vf-m	f	r								N			
55.0						qtz ss	wh-ortn	f-m	m	r		L						N			
57.5						qtz ss	wh	f	w	a								N			
60.0						qtz ss	wh	m	w	r								N			
62.5						qtz ss	vltgy	m	w	r								N			
65.0						qtz ss	vltgy	m	w	r								N			
67.5						qtz ss	vltgy	m	w	r								N			quite moist @ 67.5
70.0						qtz ss	vltgy	m	w	r								N			
72.5						qtz ss	vltgy	m-c	m	r								N			Some gy chert grains & frags.
75.0						qtz ss, sh	ywbn-tnbn	m-c	m	r		L						N			
77.5						qtzss, sh	wh-tn-gn	m-peb	p	a			tr	c				N			Brushy Basin Ct @ 77.0' good contact
80.0						sh	gygn											N			some red chert grains
82.5						sh	gygn											N			
85.0						sh	gn											N			T.D.
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

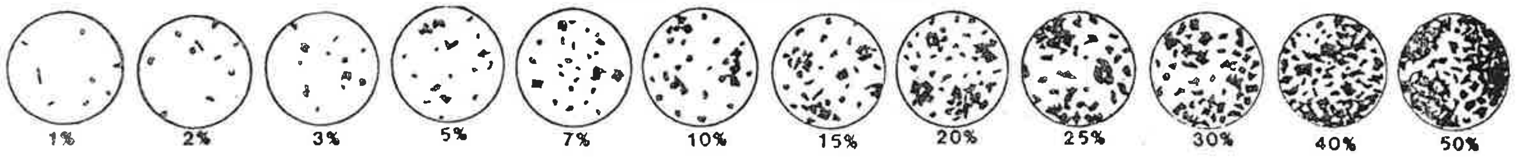


Date 3 MAY 2011 Geologist L. Casebolt Drilling Co. Byles Exploration Inc. Hole No. DR 24
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5469

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 80.0'
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											W			Surface Soil-unconsolidated - sndy lean clay-CL
5.0						mdst	rdbn											W			surface soil - unconsolidated - sndy lean clay - CL
7.5						sndy sh	pktn	c-vc	p	r								VS			mancos Sh
10.0						qtz ss	gytn	m-peb	f	r								N			Upper Dakota Fm Ct @ 7.5' chert pebbles + grains
12.5						qtz ss	gytn	m-vc	f	a								N			light colored chert frags. + grains
15.0						qtz ss	gytn	m-peb	f	a								N			" " " " "
17.5						qtz ss	ltgytn	f-m	m	r								N			
20.0						qtz ss	ltgytn	m-c	m	a								N			
22.5						qtz ss	ltgytn	m	w	r								N			
25.0						qtzss	ltgytn	m	w	r								N			
27.5						qtz ss	gytn	m-c	m	R								N			
30.0						qtzss	ywgytn	m-vc	f	a								N			abund white chert frags.
32.5						qtz ss	ltgytn	m-c	m	r								N			
35.0						qtz ss	ltgytn	m	w	r								N			moisture 1st noticed 35.0'
37.5						qtz ss	ltgytn	m	w	r								N			
40.0						qtz ss	ltgytn	m	w	r								N			
42.5						qtz ss	ltgytn	f	w	r								N			
45.0						qtz ss	ltgytn	f-m	m	r								N			
47.5						qtzss	gytn	f-c	f	a								N			
50.0						qtzss	ltywtn	m-vc	f	a		L						N			
52.5						qtz ss	ywgytn	m-peb	f	a		L						N			abund light colored chert pebbles + grains
55.0						qtzss, cgl	orgytn	m-peb	p	a		L						N			30% " " " " "
57.5						qtzss	ywgytn	m-vc	f	a								VS			
60.0						qtzss	gy	f-c	f	a			tr.					VS			
62.5						sh	gn											N			Brushy Basin Ct @ 60.0' some ppbn chert pebbles.
65.0						sh	gn						tr					N			Some ppbn-red chert frags.
67.5						Sh	gygn											N			
70.0						Sh	gygn-ppbn											N			some mottled cuttings
72.5						sh	gn											N			
75.0						sh	gn											N			some red chert grains
77.5						sh	gn											N			
80.0						sh	gygn											N			T.D.
82.5																					
85.0																					
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

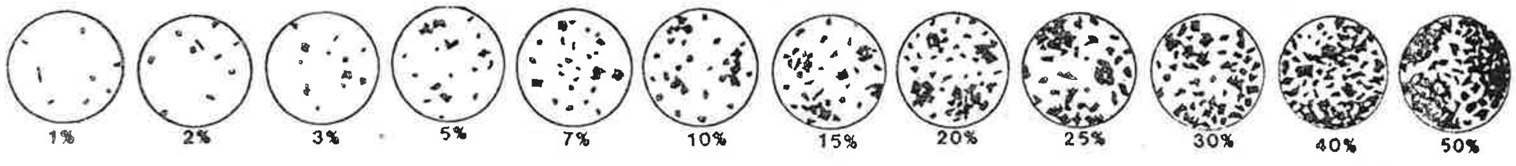


Date 2 May 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. DR 25
Property White Mesa Mill Project Cell 4B Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5462

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 80.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
2.5						qtz ss, mdst	ltorbn	m-c	m	a		L						VW			Surface Soil to 1 foot, Upper Dakota Fm Ct @ 1.0'
5.0						qtz ss	orgybn	c-vc	m	a		L						N			30% chert frags.
7.5						qtz ss	tn	m-c	m	a								N			20% " "
10.0						qtz ss	ortn	m-c	m	a								N			Moisture First noted @ 7.5' 30% chert.
12.5						qtz ss, sh, cgl	ywtn	m-peb	p	a								N			
15.0						qtz ss	tn	m-c	m	r								N			30% chert grains
17.5						qtz ss, cgl	orbn	c-peb	p	a								N			80%+ " " & pebbles
20.0						qtz ss, cgl	orbn	c-peb	p	a		L						N			90%+ " " "
22.5						qtz ss, cgl	orgybn	c-peb	p	a		L						N			90%+ " " "
25.0						qtz ss, cgl	orgybn	c-peb	p	a		L						N			90%+ " " "
27.5						qtz ss, cgl	gybn	c-peb	p	a		L						N			90%+ " " "
30.0						qtz ss, cgl	orgybn	c-peb	p	a								N			90%+ " " "
32.5						qtz ss, cgl	orbn	c-peb	p	a								N			70%+ " " "
35.0						qtz ss, cgl	gybn	c-peb	p	a								N			90%+ " " "
37.5						qtz ss	tn	m	w	R								N			
40.0						qtz ss	ltortn	f m	m	r		L						N			
42.5						qtz ss	tn	f-m	m	r								N			
45.0						qtz ss	tn	m	w	r								N			
47.5						qtz ss	tn	f-m	m	r								N			Some chert frags.
50.0						qtz ss	tn	m	w	R								N			
52.5						qtz ss	tn	m-c	f	a								VW			some gy chert frags, & grains
55.0						qtz ss	ltgytn	m-vc	f	a								N			abund. " " " "
57.5						qtz ss, cgl	ltgytn	m-peb	p	a								N			30% wh-gy chert pebbles, & frags.
60.0						qtz ss	lt tn	m-peb	p	a			Tr.	A				N			some " " " " "
62.5						qtz ss	lt tn	m	w	R								N			
65.0						qtz ss, cgl	ortn	m-peb	p	a								N			40% multi colored chert pebbles, frags, & grains
67.5						qtz ss, cgl	gytn	m-peb	p	a								N			80% " " " " " "
70.0						qtz ss	vltgy	m-c	f	a								N			
72.5						qtz ss	vltgy	m	w	r								N			
75.0						qtz ss	vltgy	f-m	m	r								N			Well began producing water @ 72.5'
77.5						qtz ss, cgl, sh	ywtn-blgn	m-peb	p	a			1%	C				N			Brushy Basin Ct. @ 76.0' (good contact)
80.0						sh	blgn						tr.	A				N			T.D. some ppbn chert pebbles
82.5																					
85.0																					
87.5																					
90.0																					
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



APPENDIX A.2

MW - SERIES

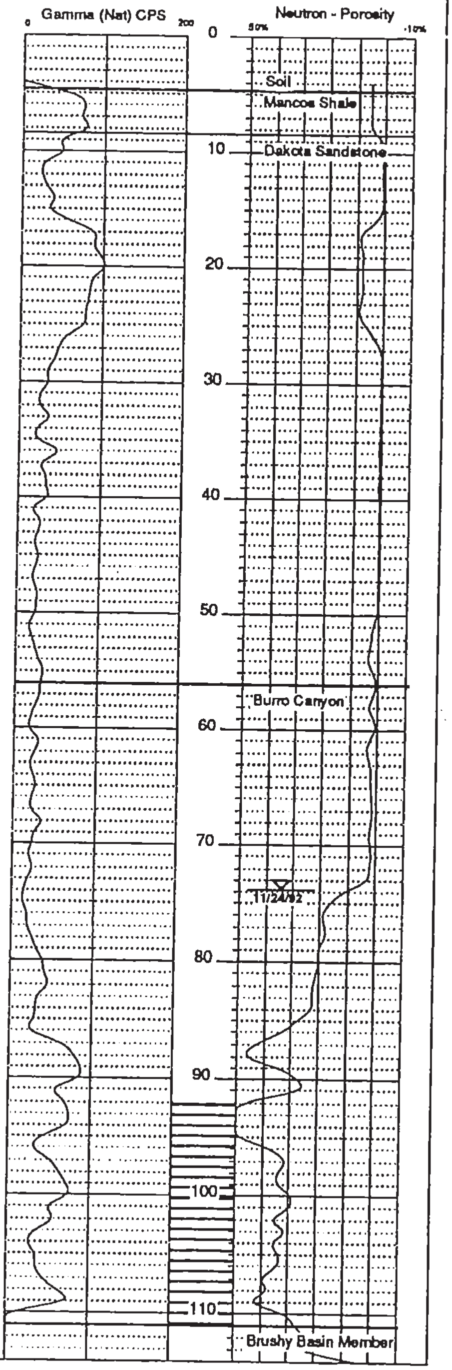
Umetco Minerals Corporation

Location: San Juan County, Utah
Date: 11/24/92

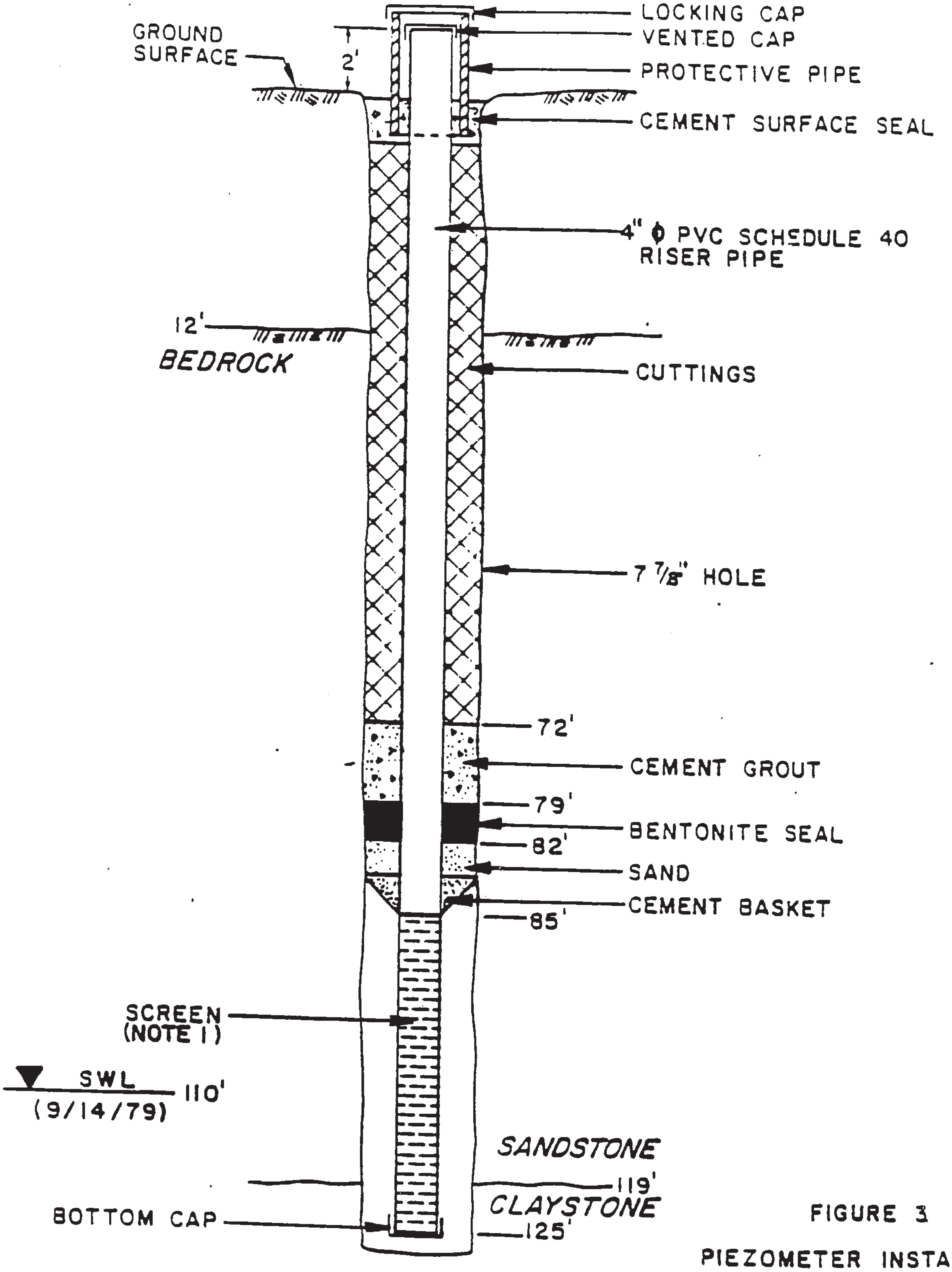
Gamma (Nat) - Neutron Porosity

Gd. Elev. 5642.2
T.D. 114

WMMW-1



BY
9-27-79
APPROVED BY
MJT
11/16/79
NUMBER RM10-682-HJ



NOT TO SCALE

FIGURE 3

PIEZOMETER INSTALLATION
WELL NO. 2
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

ION'
EVISED
20-82
2/23/82

Umetco Minerals Corporation

Location: Montrose County

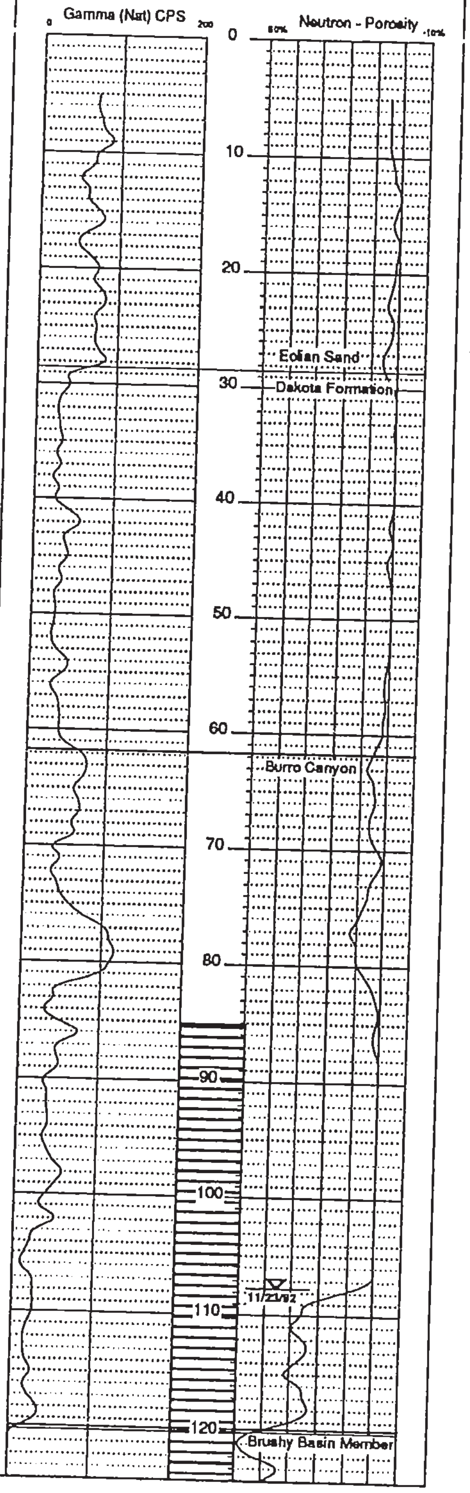
Date: 11/23/92

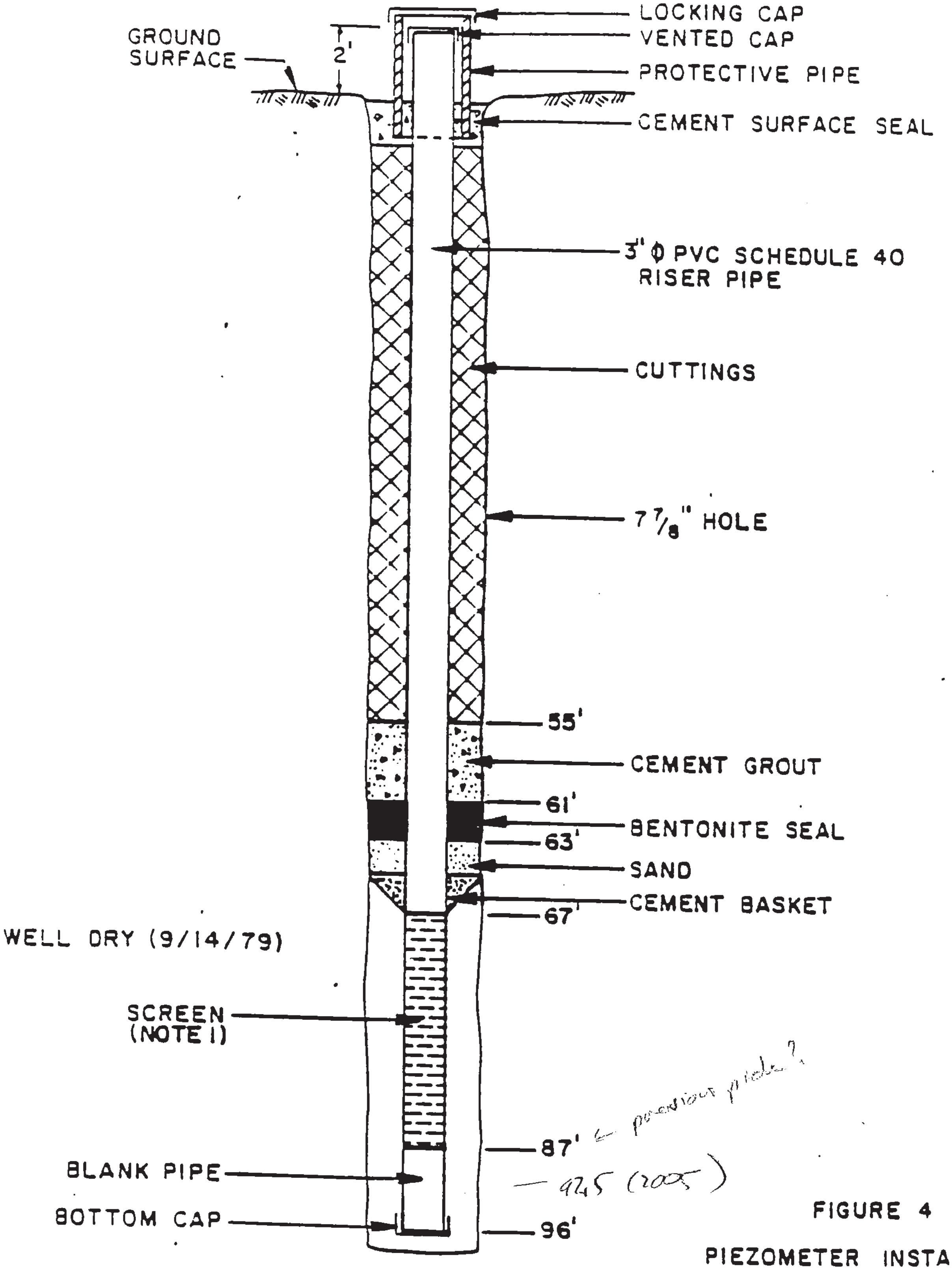
Gamma (Nat) - Neutron Porosity

Gd. Elev. 5611.6

T.D. 124

WMMW-2





← previous probe?

— 94.5 (2005)

NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 4

PIEZOMETER INSTALLATION
WELL NO. 3
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

Date 4-19-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-3A
Property White Mesa Mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 95.0
FLUID LEVEL ______

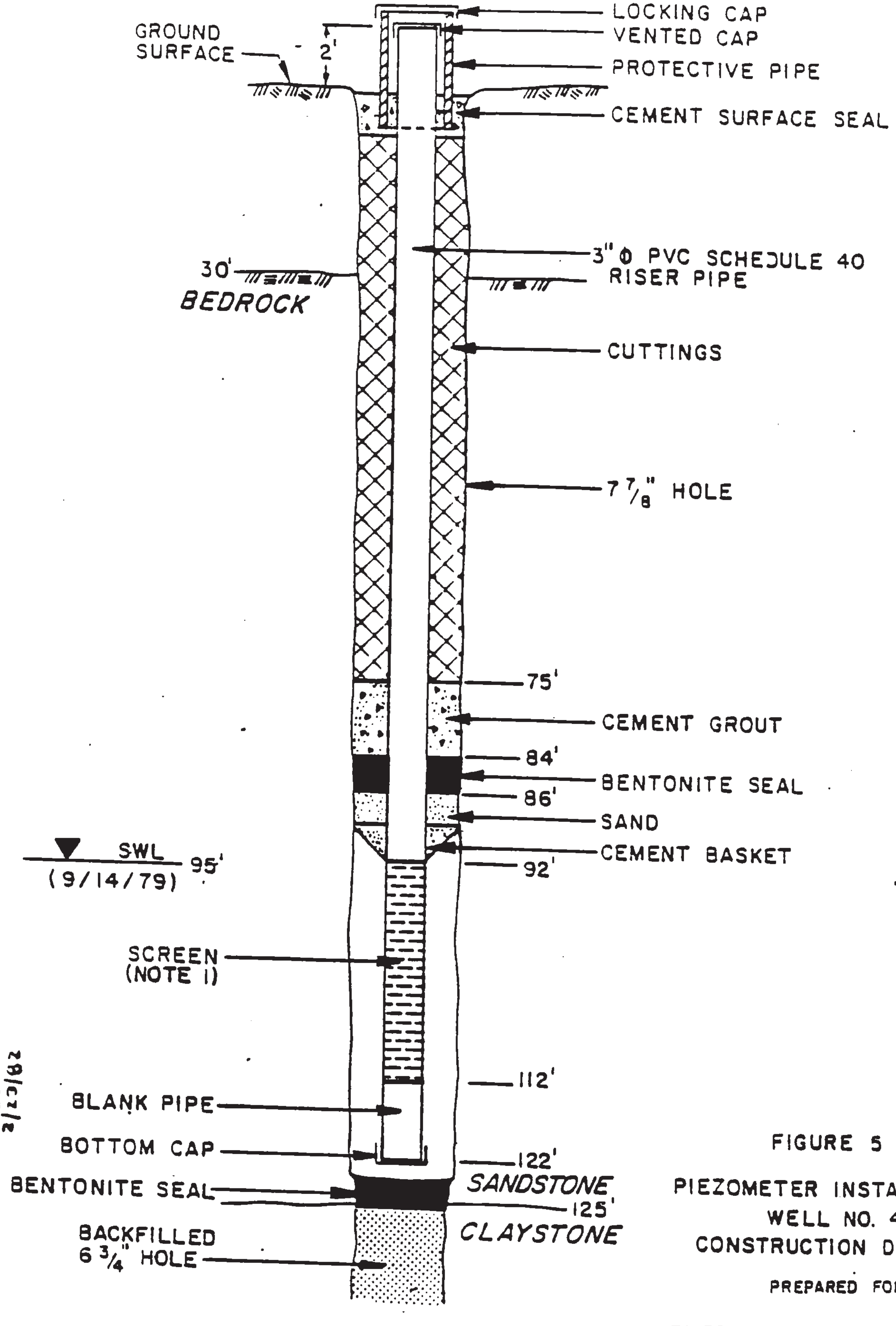
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sndy sh	rdbn	vf-m	P									VS			Surface soil/Shale
5.0						Sndy sh	rdbn-tn	vf-m	P									VS			
7.5						ss-sltst	rdbn	vf f	m									Vs			
10.0						qtz ss	vltgy-wh	f	w	sa								W			Upper Dakota Fm Ct @ approx 7.5 ft.
12.5						qtz ss	lttn	f	w	sr								N			
15.0						qtz ss	ltgytn	f cr	P	sr								N			sparse pk-wh chert grains
17.5						qtz ss	ltgytn	f m	P	sr								N			
20.0						qtz ss	ltgytn	f m	P	sr								N			
22.5						qtz ss	ltgytn	f	w	sr								N			
25.0						qtz ss	lttn	f m	P	sr								N			sparse multicolor chert grains
27.5						qtz ss	lttn	f m	w	sr								N			
30.0						qtz ss	tn	m-v cr	P	sa								N			abnt. multicolor chert grains
[illegible]						qtz ss-peb	tn	m-v cr	P	a								N			congl. zone abnt chert frags.
35.0						qtz ss-sh	tn-blgy	m cr	P	sr								N			blgy shale frags
37.5						qtz ss, sh, l	blgy-tn	m-v cr	P	sa								N			blgy shale frags, chert frags, congl. zone
40.0						qtz ss	tn	vf-v cr	P	sa								N			chert frags
42.5						qtz ss	tn	m-v cr	P	sr								N			
45.0						qtz ss, cgl	tn	f-v cr	P	sr								N			congl. zone
47.5						qtz ss, cgl	tn	f-v cr	P	sr								N			congl. zone
50.0						qtz ss	tn	m-vcr	P	sr								N			
52.5						cgl, qtz ss	dkgytn	cr-vcr	P	a								N			cgl. zone abnt. chert frags
55.0						qtz ss	tn	f-m	P	sr								N			
57.5						qtz ss, sh	vltgy	vf	w	r								N			sparse blgy sh
60.0						sltst, ss, cgl	ltblgy	f-peb	P	sa								N			cgl. zone, sparse chert frags
62.5						qtz ss	lttn-	f-cr	P	sr								N			some chert frags
65.0						qtz ss	ltgytn	f-vcr	m	r								N			" " "
67.5						qtz ss	ltgytn	f-v cr	m	r								N			" " "
70.0						qtz ss	ltgytn	f-v cr	P	sr								N			qtz ss, begin coring
72.5						qtz ss	dkgybn	m-vcr	f	sr		LT						N			abnt. chert frags
75.0						qtz ss	dkgybn	m-vcr	f	sr		LT						N			
77.5						qtz ss	ltgy	vf-m	P	sa								N			abnt. wh chert grains
80.0						qtz ss	ltgy	vf-cr	P	sa								N			
82.5						qtz ss	ltgy	f-cr	P	sr								N			
85						qtz ss	ltgy	f-m	f	sr								N			
87.5						qtz ss	ltgy	m-vcr	P	sa								VW			25% chert frags, trace blgy sh
90.0						qtz, ss	gytn	vcr-peb	P	sa								VW			
92.5						cgl, qtz ss	gytn	vcr-peb	P	sa								N			Upper Brushy Basin Mbr. Ct @ 92.5 ft (from core)
95.0						sh, cgl	gybl-bn	cr-peb	P	sa								N			95.0 T.D.

PERCENTAGE COMPOSITION IMAGE

Core Log of Well No. MW-3A

Cored Interval 70.0 ft. to 95.0 ft. T.D.

Depth	Description
70.0 - 74.0	Core barrel blocked, 75% core recovery, quartz sandstone, very light tan - white, med. to very coarse grained, chert pebble zone at 71.3 ft., sparse chert grains, calcareous cement at 72.3 - 73.0 ft., abund. hematite/limonite disseminated at 73.2 - 73.8 ft., possible replacement of earlier pyrite.
74.0 - 80.0	Core recovery 67%, quartz sandstone from 76.0 ft.-77.5 ft., white, medium grained, sub rounded, 77.5 ft. - 78.4 ft., quartz sandstone, very light tan, fine to medium grained, sub rounded, 78.4 ft. - 80.0 ft., quartz sandstone, very light tan, fine to medium grained, sub rounded, clay cement.
80.0 - 85.2	Quartz sandstone fine grained subrounded to rounded clay cement (non calcareous) occasional chert pebble, grit size zone from 82.5 - 82.8 and from 84.5 - 84.9 ft..
85.0 - 87.5	No core recovery.
87.5 - 90.0	Quartz sandstone / grit, calcareous cement white to light gray green, coarser zones contain light green shale fragments and chert pebbles, green clay gall noted from 88.0 - 88.2 ft., conglomerate from 89.5 - 90.0 feet.
90.0 - 95.0	Core recovery 97%, quartz sandstone / conglomerate, light gray green, contains abundant chert pebbles and grit, zone from 90.0 - 92.5 ft. contains numerous low angle partings due to friable character of the core, no weathered or mineralized surfaces noted. Upper Brushy Basin contact at 92.5 ft.. Conglomerate in direct contact with undisturbed green shale below. End of Core



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ ROW/FT. PIPE

FIGURE 5

PIEZOMETER INSTALLATION
WELL NO. 4
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

DRAWN BY B.K.H. 9-28-79
CHECKED BY CEO 10/29/79
APPROVED BY
DRAWING NUMBER RA 682

REVISION: REVISED 2-20-82 CEO 2/23/82

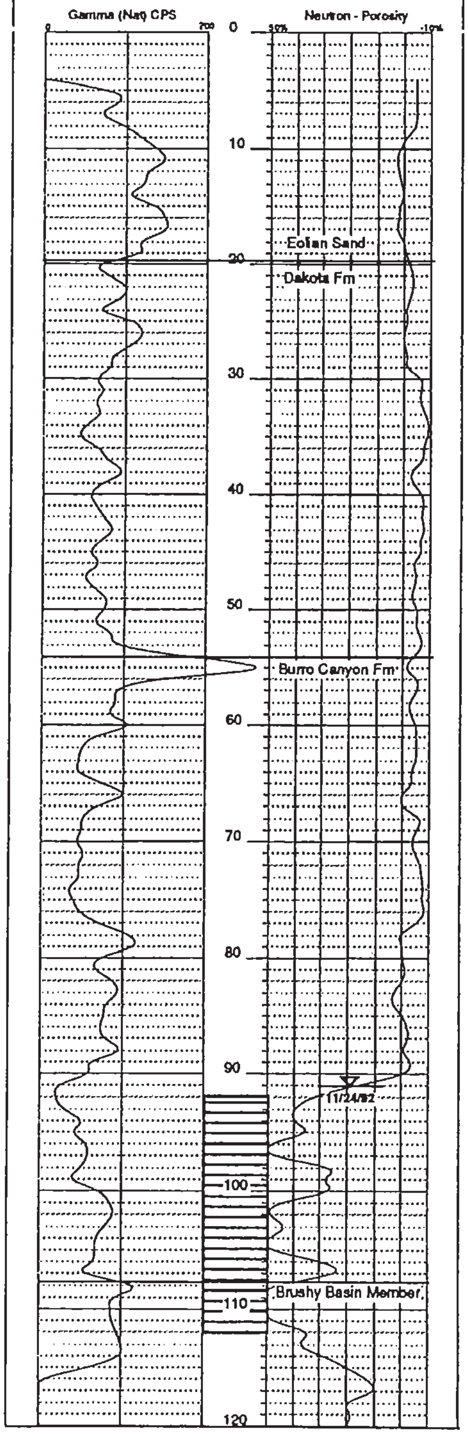
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/24/82

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5621
T.D. 120

WMMW-4



DRAWN BY SL.T. 11-20-80
CHECKED BY CEO 2/23/82
APPROVED BY 3/23/82
DRAWING NUMBER RM78-682-A44

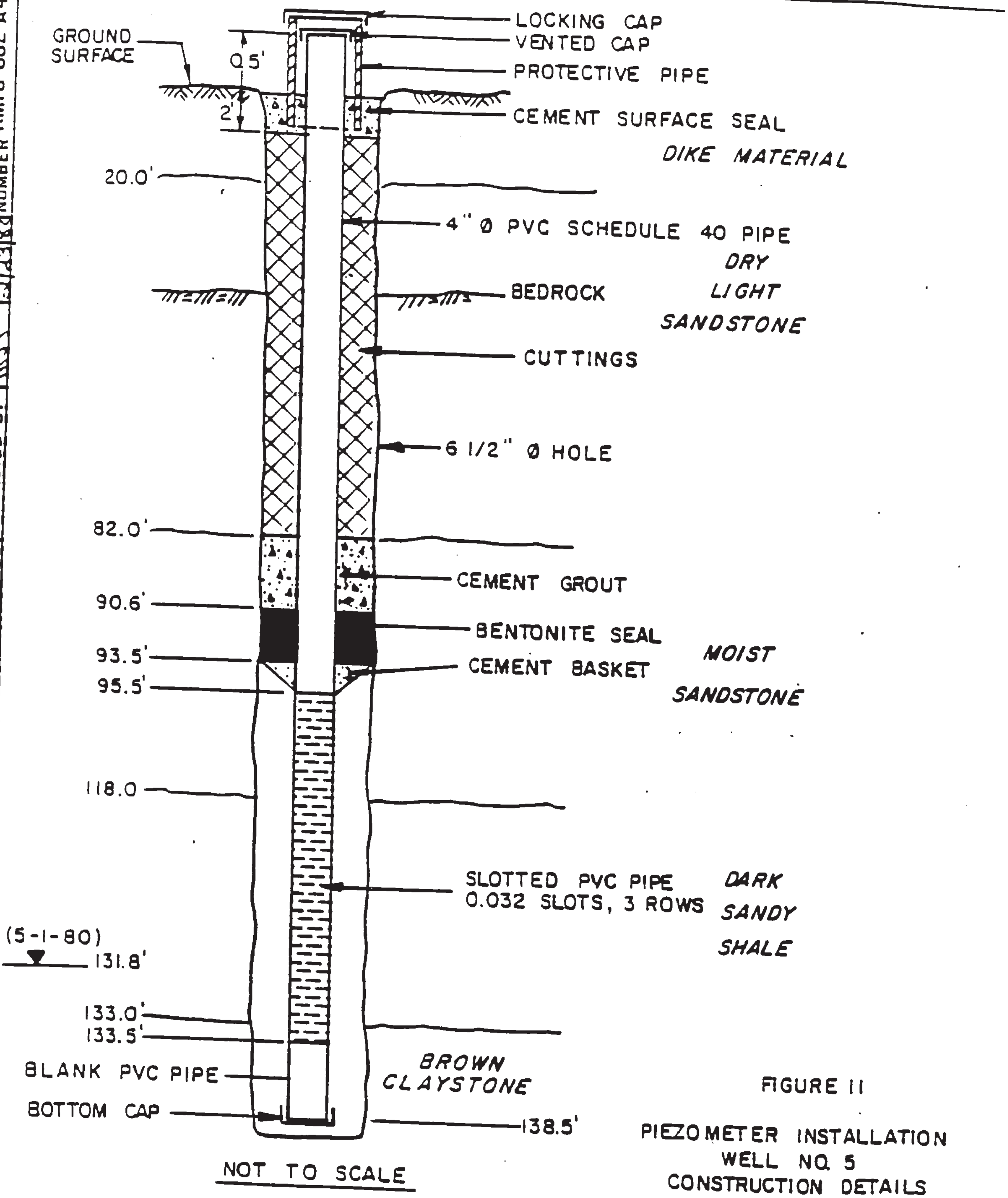


FIGURE 11

PIEZOMETER INSTALLATION
WELL NO. 5
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

D'APPOLONIA

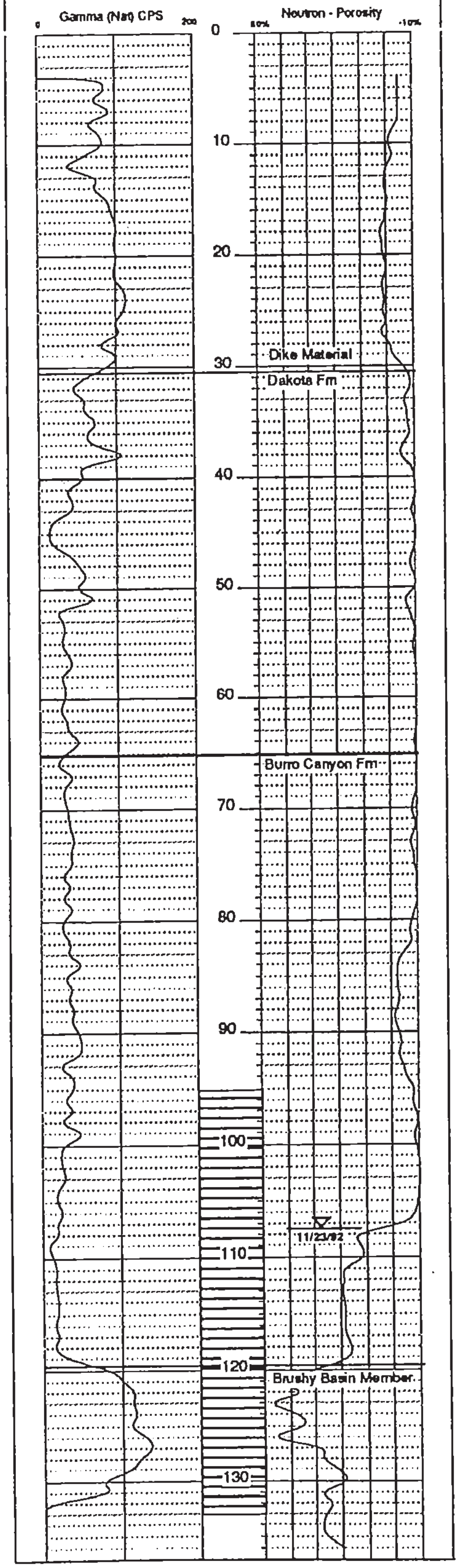
Umetco Minerals Corporation

Location: San Juan County, Utah **Date:** 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5606.9
T.D. 136

WMMW-5



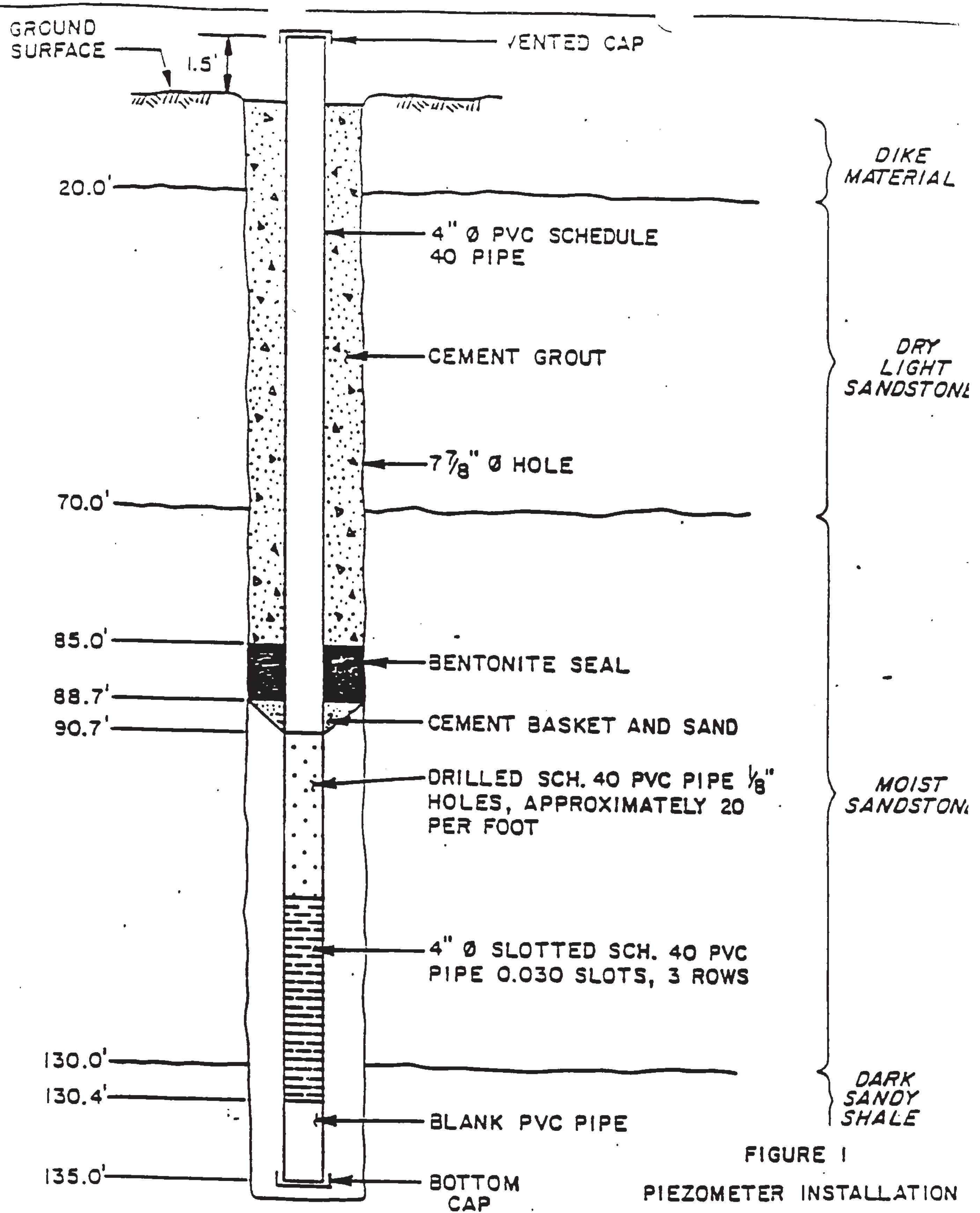


FIGURE 1
PIEZOMETER INSTALLATION
WELL NO. 11
CONSTRUCTION DETAILS
PREPARED FOR
ENERGY FUELS NUCLEAR, IN
DENVER, COLORADO

DRAWN 10-28-82
CHECKED BY
APPROVED BY
11-1-82
DRAWING NUMBER 2-2039-A1

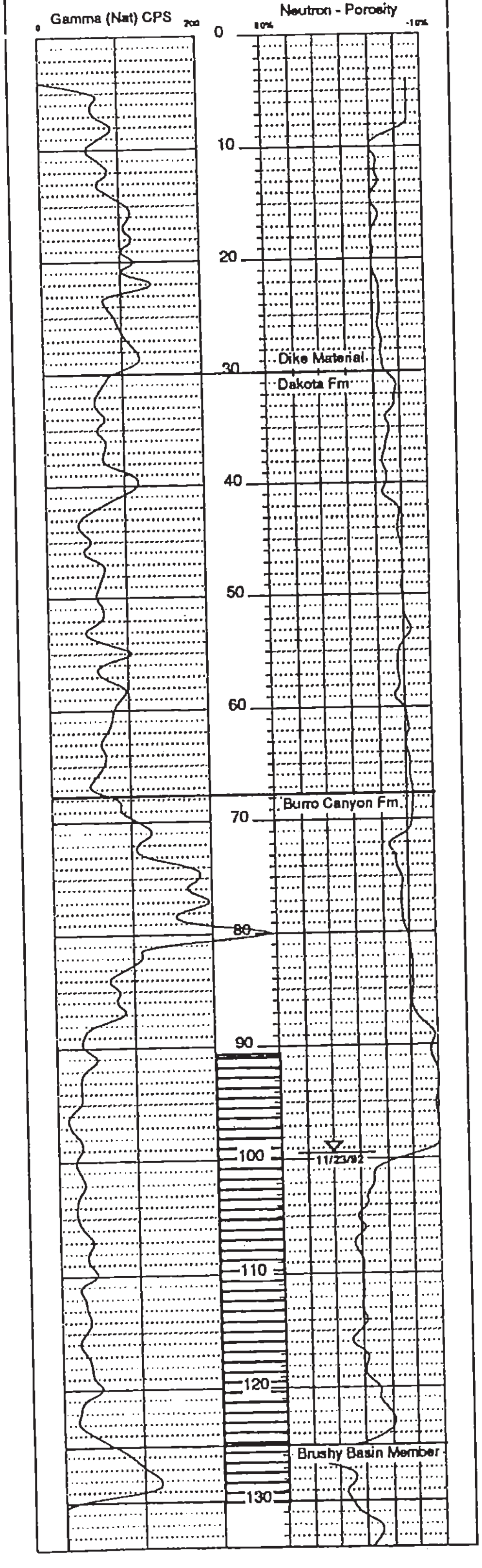
Umetco Minerals Corporation

Location: San Juan County, Utah **Date:** 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5608.6
T.D. 134

WMMW-11



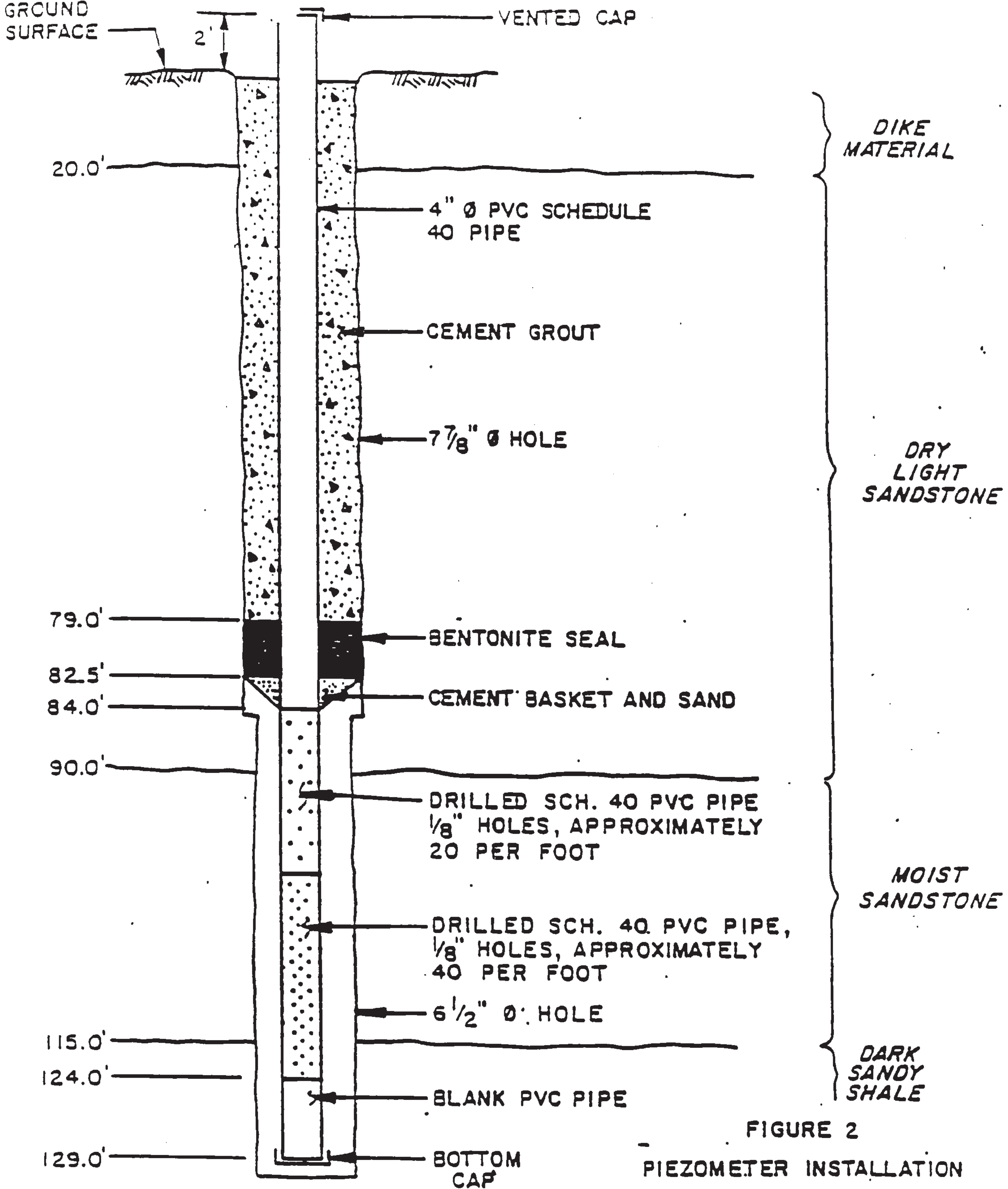


FIGURE 2

PIEZOMETER INSTALLATION
WELL NO. 12
CONSTRUCTION DETAILS
PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

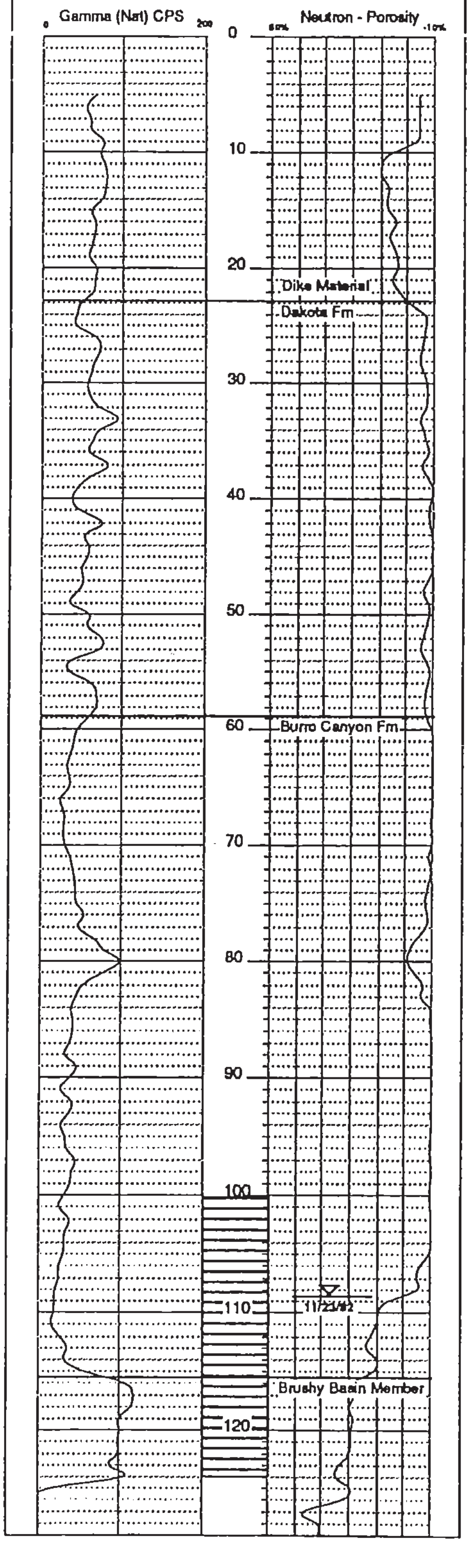
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5608.5
T.D. 129

WMMW-12



Umetco Minerals Corporation

Location: San Juan County, Utah

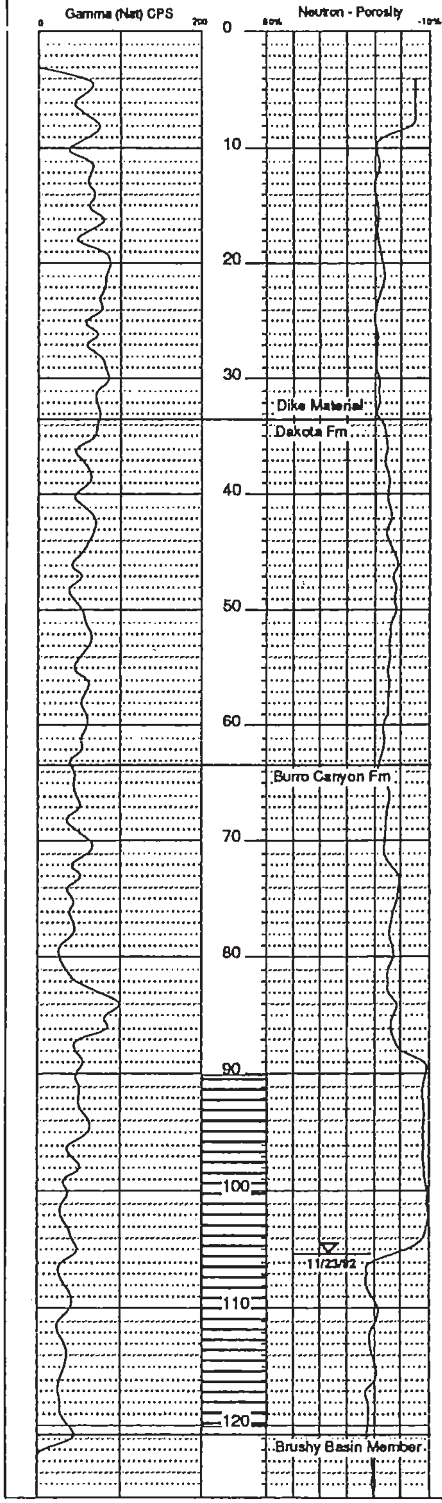
Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5596

T.D. 127

WMMW-14



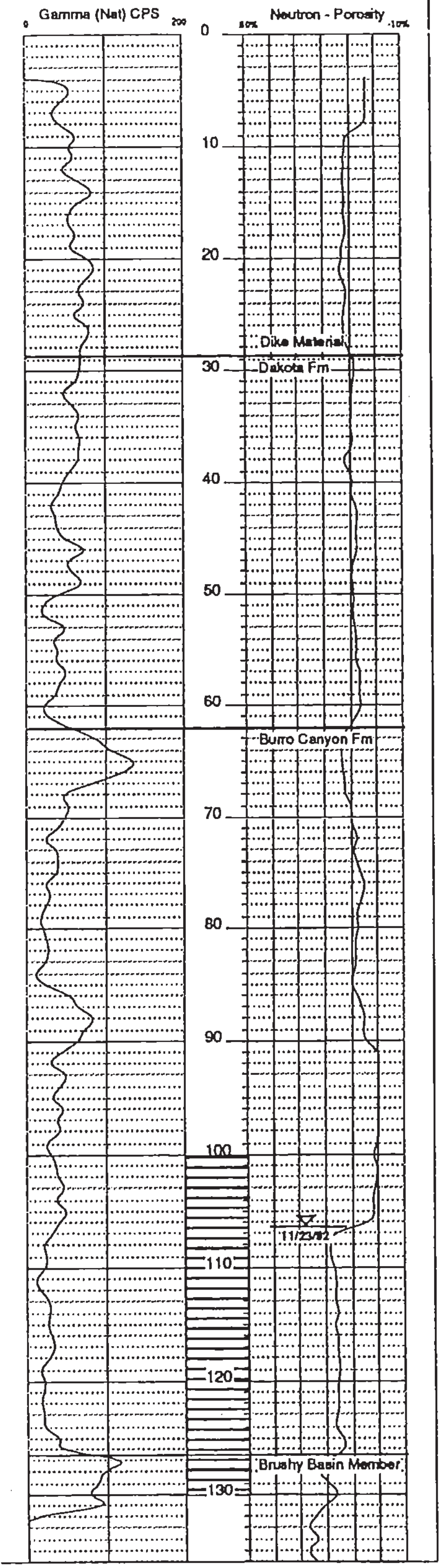
Umetco Minerals Corporation

Location: San Juan County, Utah Date: 11/23/92

Gamma (Nat) - Neutron Porosity

Gd. Elev. 5596.8
T.D. 136

WMMW-15

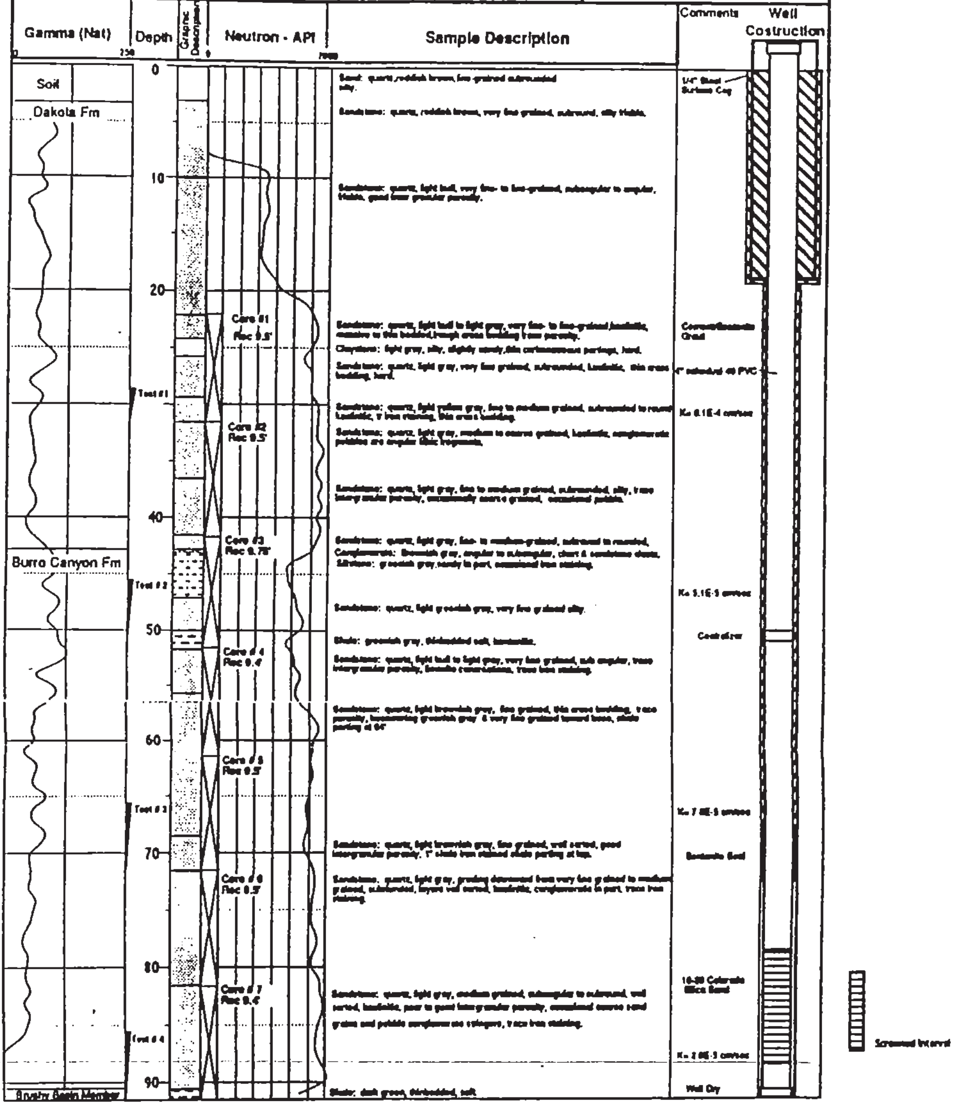


PEEL Environmental Services
Arvada, CO (303)432-8116

Bore Hole No. : WMMW-16

UMETCO Minerals Corporation

Project: White Mesa	Surface Elev. 5588.18	T. D. = 91.5
Date: 12/07/92	Depth to Water: Dry	Geologist: F. A. Peel



Sample Description

Sand: quartz,reddish brown,fine grained subrounded silty.

Sandstone: quartz, reddish brown, very fine grained, subround, silty friable.

Sandstone: quartz, light buff, very fine- to fine-grained, subangular to angular, friable, good inter granular porosity.

Sandstone: quartz, light buff to light gray, very fine- to fine-grained kaolinitic, massive to thin bedded,trough cross bedding, fair porosity.

Claystone: light gray, silty, slightly sandy,thin carbonaceous partings, hard.

Sandstone: quartz, light gray, very fine grained, subrounded, kaolinitic, thin cross bedding, hard.

Sandstone: quartz, light yellow gray, fine to medium grained, subrounded to round kaolinitic, [illegible] iron staining, thin cross bedding.

Sandstone: quartz, light gray, medium to coarse grained, kaolinitic, conglomeratic pebbles are angular lithic fragments.

Sandstone: quartz, light gray, fine to medium grained, subrounded, silty, trace intergranular porosity, occasionally coarse grained, occasional pebble.

Sandstone: quartz, light gray, fine- to medium-grained, subround to rounded,
Conglomerate: Brownish gray, angular to subangular, chert & sandstone clasts,
Siltstone: greenish gray,sandy in part, occasional iron staining.

Sandstone: quartz, light greenish gray, very fine grained silty.

Shale: greenish gray, thin bedded soft, bentonitic.

Sandstone: quartz, light buff to light gray, very fine grained, sub angular, trace intergranular porosity, limonite concretions, trace iron staining.

Sandstone: quartz, light brownish gray, fine grained, thin cross bedding, trace porosity, becoming greenish gray & very fine grained toward base, shale parting at 64'

Sandstone: quartz, light brownish gray, fine grained, well sorted, good intergranular porosity. 1" shale iron stained shale parting at top.

Sandstone, quartz, light gray, grading downward from very fine grained to medium grained, subrounded, layers well sorted, kaolinitic, conglomeratic in part, trace iron staining.

Sandstone: quartz, light gray, medium grained, subangular to subround, well sorted, kaolinitic, poor to good intergranular porosity, occasional coarse sand grains and pebble conglomerate stringers, trace iron staining.

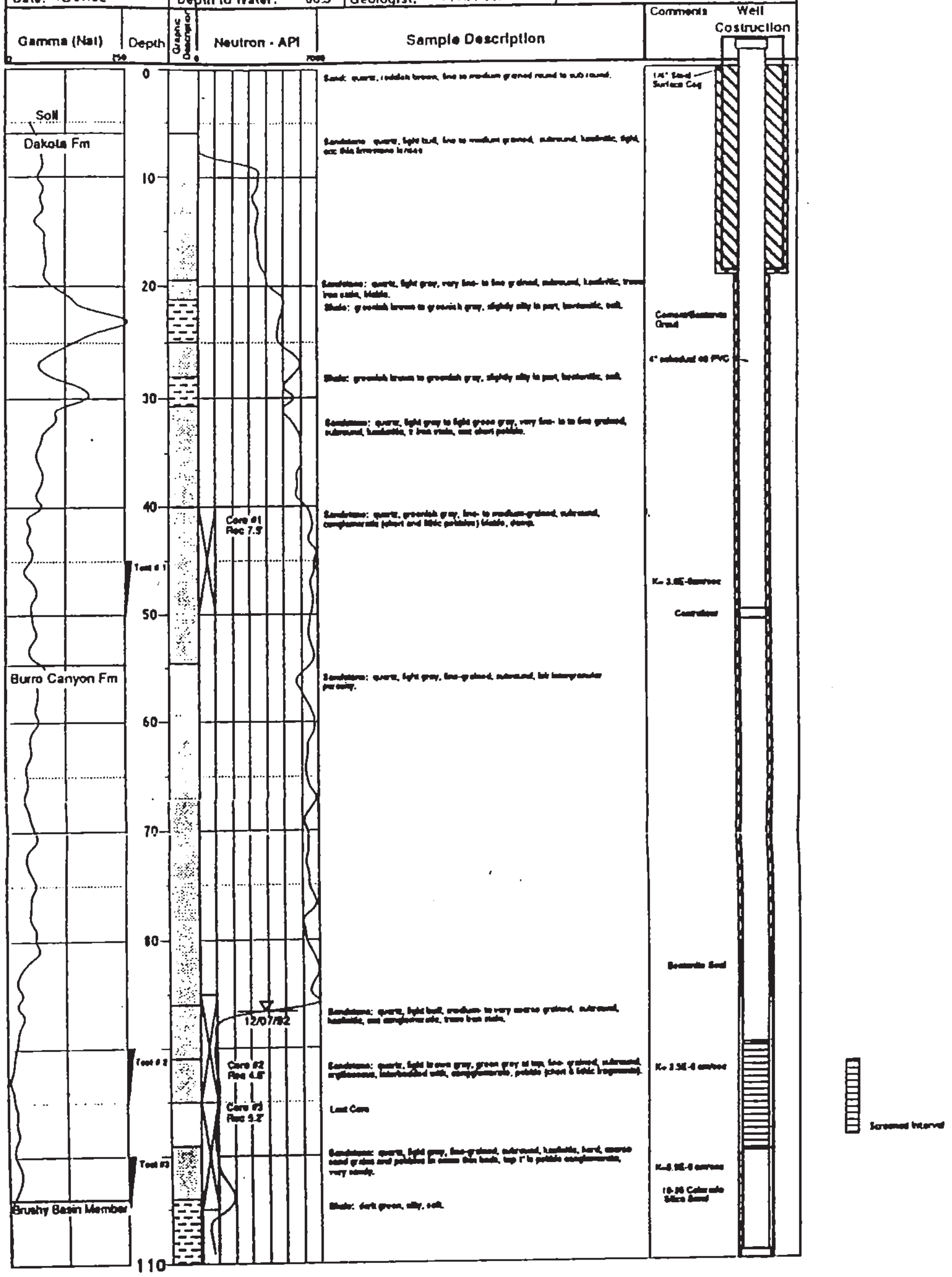
Shale: dark green, thin bedded, soft

PEEL Environmental Services
Arvada CO [illegible]

Bore Hole No. :
WMMW-17

Project: White Mesa
Surface Elev. 5575 06
T. D. = 110'
UMETCO Minerals Corporation

Date: 12/07/92
Depth to Water: 86.5'
Geologist: F. A. Peel



Sand: quartz, reddish brown, fine to medium grained round to sub round.

Sandstone: quartz, light buff, fine to medium grained, subround, kaolinitic, tight, occ thin limestone lenses

Sandstone: quartz, light gray, very fine- to fine grained, subround, kaolinitic, trace iron stain, friable.

Shale: greenish brown to greenish gray, slightly silty in part, bentonitic, soft.

Shale: greenish brown to greenish gray, slightly silty in part, bentonitic, soft.

Sandstone: quartz, light gray to light green gray, very fine- to to fine grained, subround, kaolinitic, tr iron stain, occ chert pebble.

Sandstone: quartz, greenish gray, fine- to medium-grained, subround, conglomeratic (chert and lithic pebbles) friable, damp.

Sandstone: quartz, light gray, fine-grained, subround, fair intergranular porosity.

Sandstone: quartz, light buff, medium- to very coarse grained, subround, kaolinitic, occ conglomeratic, trace iron stain.

Sandstone: quartz, light brown gray, green gray at top, fine- grained, subround, argillaceous, interbedded with, conglomeratic, pebble (chert & lithic fragments).

Lost Core

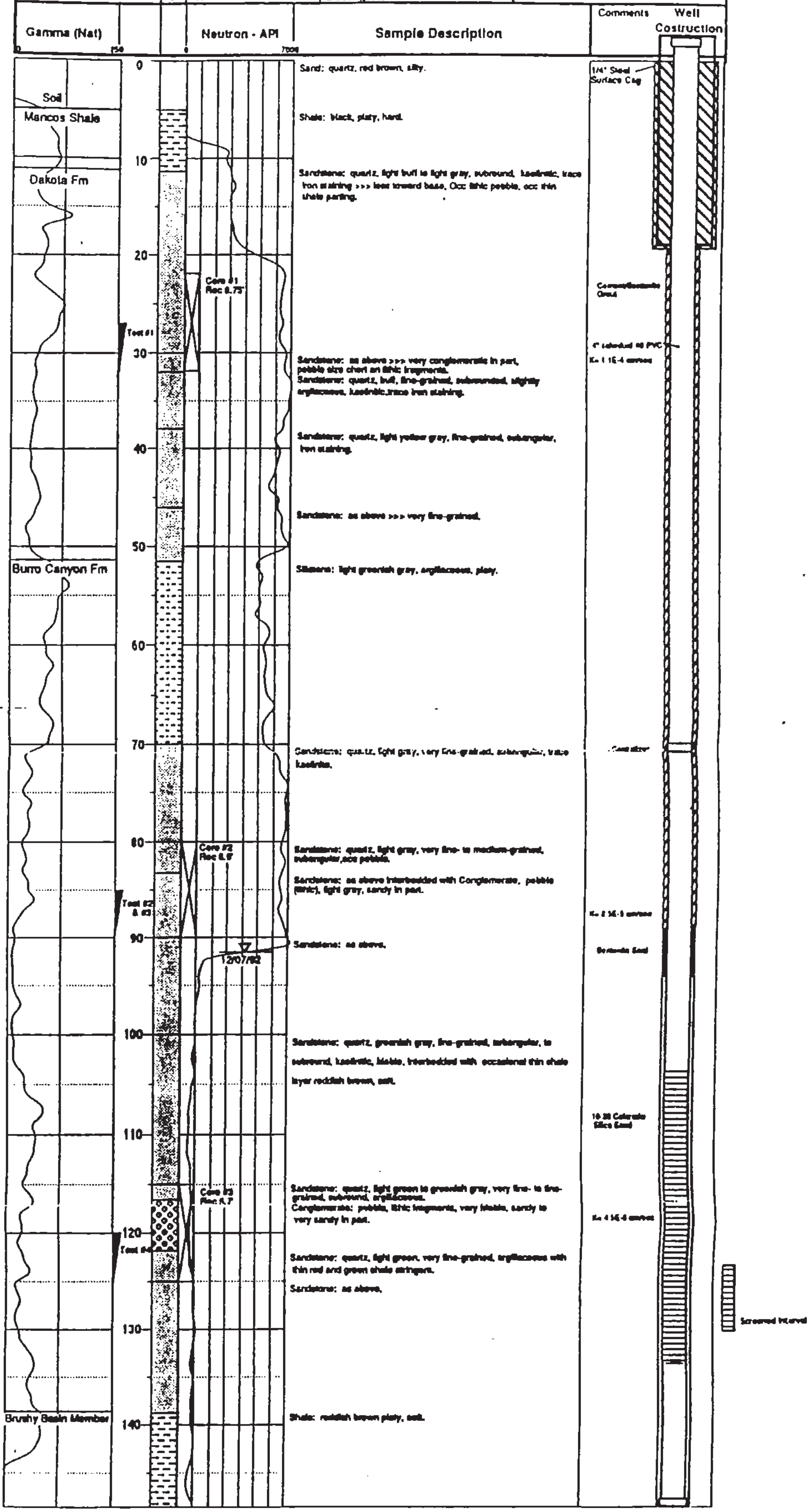
Sandstone: quartz, light gray, fine-grained, subround, kaolinitic, hard, coarse sand grains and pebbles in some thin beds, top 1' is pebble conglomeratic, very sandy.

Shale: dark green, silty, soft.

PEEL Environmental Services
Arvada, CO (303)422-4116

Bore Hole No. :
WMMW-18

Project: White Mesa	Surface Elev. 5657.58	T. D. = 148.5'	UMETCO Minerals Corporation
Date: 12/07/92	Depth to Water: 92'	Geologist: F. A. Peel	



Sample Description

Sand: quartz, red brown, silty.

Shale: black, platy, hard.

Sandstone: quartz, light buff to light gray, subround, kaolinitic, trace iron staining >>> less toward base. Occ lithic pebble, occ thin shale parting.

Sandstone: as above >>> very conglomeratic in part, pebble size chert an lithic fragments.

Sandstone: quartz, buff, fine-grained, subrounded, slightly argillaceous, kaolinitic,trace iron staining.

Sandstone: quartz, light yellow gray, fine-grained, subangular, iron staining.

Sandstone: as above >>> very fine-grained.

Siltstone: light greenish gray, argillaceous, platy.

Sandstone: quartz, light gray, very fine-grained, subangular, trace kaolinite.

Sandstone: quartz, light gray, very fine- to medium-grained, subangular,occ pebble.

Sandstone: as above interbedded with Conglomerate, pebble (lithic), light gray, sandy in part.

Sandstone: as above.

Sandstone: quartz, greenish gray, fine-grained, subangular, to subround, kaolinitic, friable, interbedded with occasional thin shale layer reddish brown, soft.

Sandstone: quartz, light green to greenish gray, very fine- to fine-grained, subround, argillaceous.
Conglomerate: pebble, lithic fragments, very friable, sandy to very sandy in part.

Sandstone: quartz, light green, very fine-grained, argillaceous with thin red and green shale stringers.

Sandstone: as above.

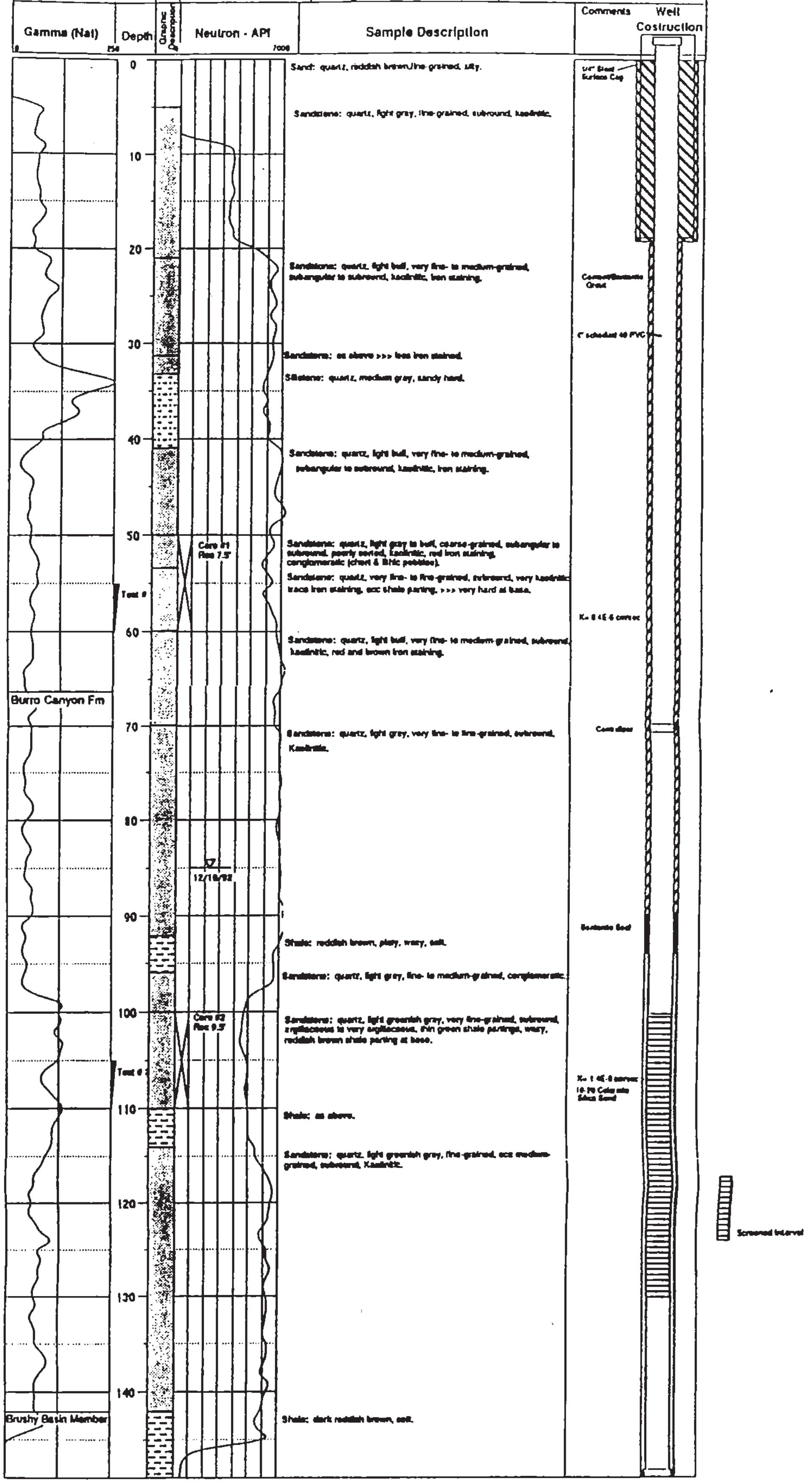
Shale: reddish brown platy, soft.

PEEL Environmental Services
Arvada, CO (303)432-5116

Bore Hole No. : WMMW-19

Project: White Mesa
Surface Elev. 5655.05
T. D. = 149
UMETCO Minerals Corporation

Date: 12/07/92
Depth to Water: 150
Geologist: F. A. Peel



Sample Description

Sand: quartz, reddish brown, fine-grained, silty.

Sandstone: quartz, light gray, fine-grained, subround, kaolinitic.

Sandstone: quartz, light buff, very fine- to medium-grained, subangular to subround, kaolinitic, iron staining.

Sandstone: as above >>> less iron stained.

Siltstone: quartz, medium gray, sandy hard.

Sandstone: quartz, light buff, very fine- to medium-grained, subangular to subround, kaolinitic, iron staining.

Sandstone: quartz, light gray to buff, coarse-grained, subangular to subround, poorly sorted, kaolinitic, red iron staining, conglomeratic (chert & lithic pebbles).

Sandstone: quartz, very fine- to fine-grained, subround, very kaolinitic trace iron staining, occ shale parting, >>> very hard at base.

Sandstone: quartz, light buff, very fine- to medium-grained, subround, kaolinitic, red and brown iron staining.

Sandstone: quartz, light grey, very fine- to fine-grained, subround, Kaolinitic.

Shale: reddish brown, platy, waxy, soft.

Sandstone: quartz, light grey, fine- to medium-grained, conglomeratic.

Sandstone: quartz, light greenish gray, very fine-grained, subround, argillaceous to very argillaceous, thin green shale partings, waxy, reddish brown shale parting at base.

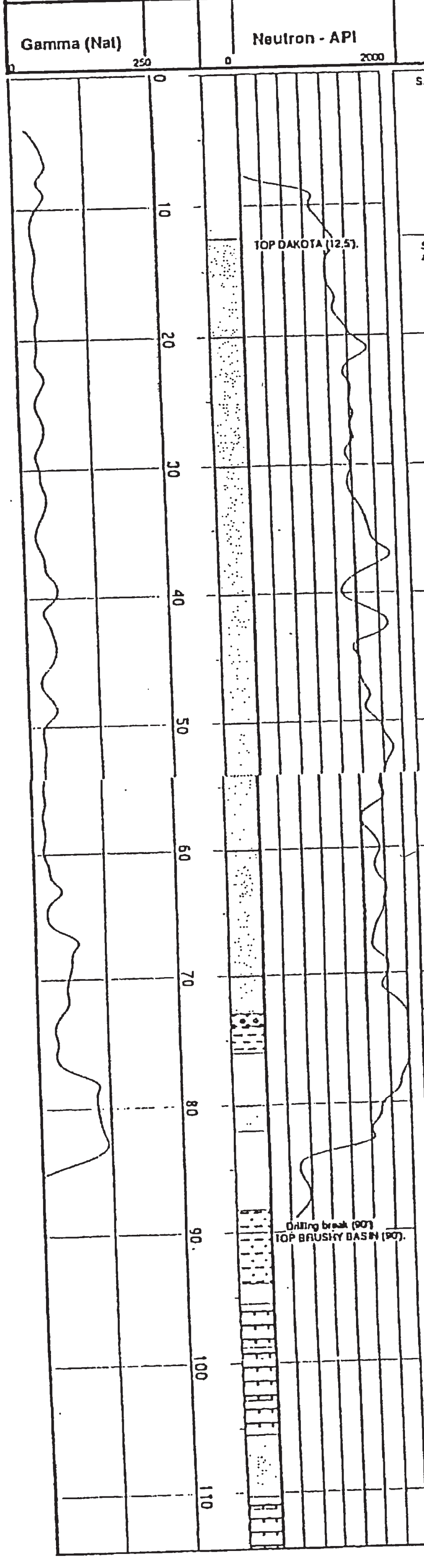
Shale: as above.

Sandstone: quartz, light greenish gray, fine-grained, occ medium-grained, subround, Kaolinitic.

Shale: dark reddish brown, soft.

Note: well was logged before the well recharged

PEEL Environmental Services Arvada, CO (303)422-5116			Bore Hole No. : WMMW-20
Project: White Mesa	Surface Elev. 5538 Est.	T. D. = 114.5	PBTD = 90'
Date: 8/4/94	Depth to Water: 86.4	Geologist: C. Bilgood	



Sample Description

Sand: quartz, reddish brown, silty, argillaceous, aeolian.

Sandstone: quartz, light gray to buff, very fine to fine grained, argillaceous, subangular, soft.

Sandstone: quartz, light gray, fine- to medium-grained, argillaceous, soft, trace iron staining, trace pinpoint porosity.

Sandstone: as above, conglomeratic in part with dark gray chert clasts.

Sandstone: quartz, light gray, argillaceous, fine- to medium grained, firm.

Sandstone: as above, conglomeratic in part, dark gray and white chert clasts.

Sandstone: as above, becoming less argillaceous, light brown gray, medium-grained, well sorted, fair intergranular porosity.

Sandstone: quartz, light gray, medium-grained, occasionally coarse-grained, subangular to subrounded becoming very argillaceous, shale clasts from 72.0 to 72.9'.

Conglomerate: lithic, pebble, shale and chert clasts, very sandy, poorly sorted, subrounded.

Shale: olive green, waxy, soft, top 0.2' blocky, sandy.

Missing Core

Sandstone: quartz, dark reddish green to gray, fine-grained, very argillaceous, subrounded, scattered iron staining, massive, hard, tight, becoming dark reddish gray, thin bedded and platy at base

Missing Core

Siltstone: dark reddish brown, sandy in part, argillaceous, thin stringers of dark red brown silty shale at top.

Siltstone: green, waxy, brittle, occasional vertical tension joints, silty in part, iron staining along 2" near vertical fractures.

Missing Core

Claystone: dark greenish gray with reddish cast, poorly developed horizontal plating, waxy, filled vertical joints, becoming lighter in color at base.

Claystone: light green gray, silty to sandy, hard to very hard.

Claystone: red, silty to sandy, hard, mottled green top and bottom, poorly developed horizontal plating.

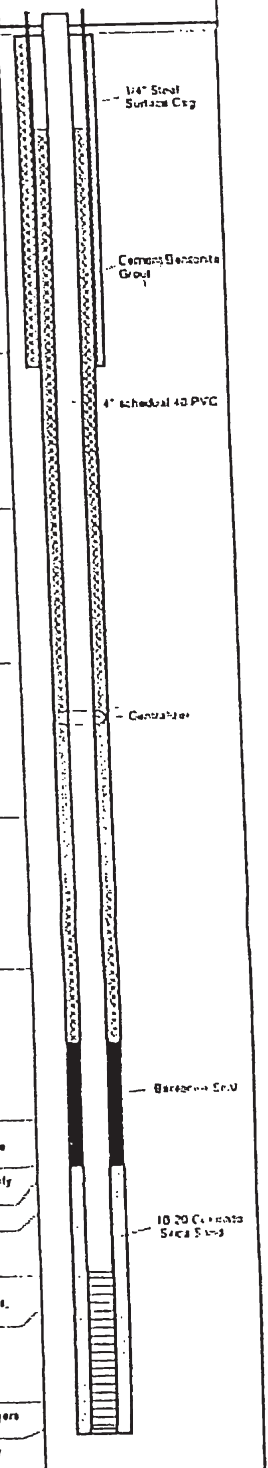
Claystone: dark reddish purple with occasional green tinge, blocky, 2" vertical fracture at base filled with white clay.

Claystone: earthy red, poorly developed horizontal plating, some thin vertical 2" to 4" hairline fractures filled and altered to light green in color

Sandstone: quartz, light gray green, very fine- to medium grained, very argillaceous, subangular, silty, poorly sorted in part grading downward into light green gray siltstone and light green gray shale, very hard and tight, very argillaceous and sandy.

Claystone: dark red brown, massive, hard.

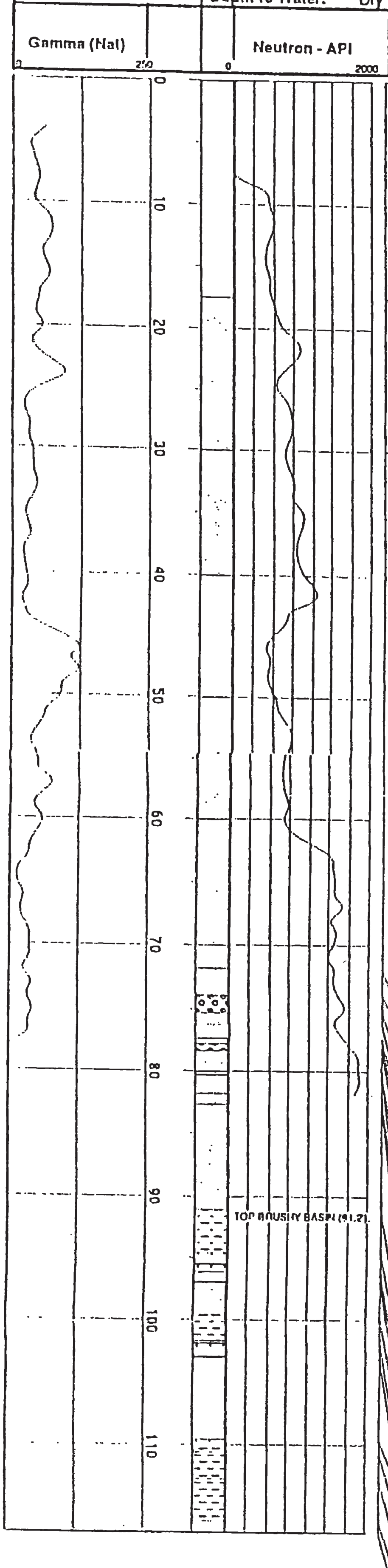
Claystone: light gray green, poorly developed horizontal plating, hard, sharp contact with overlying red shale.



PEEL *Environmental Services*
Arvada, CO (303)422-5116

Bore Hole No. : WMMW-21

Project: White Mesa
Surface Elev. 5558 Est.
T. D. = 117.0'
PBTD = 90.0'
Date: 8/12/94
Depth to Water: Dry
Geologist: C. Bilgood



Sample Description

Sand: aeolian sand, quartz, reddish brown.

Sandstone: quartz, light gray, fine- grained, angular to subangular to rounded, well sorted, argillaceous, some light tan to gray poorly sorted fine- to medium-grained sandstone.

Sandstone: quartz, light tan, fine- to medium-grained, argillaceous, limonitic staining, abundant chert fragments (probable conglomerate).

Sandstone: quartz, light tan, fine- to medium-grained, friable, well sorted, olive green soft claystone clasts.

Sandstone: quartz, light gray to greenish gray, fine- to medium grained, sub angular to subrounded, poorly sorted, argillaceous, abundant varicolored chert fragments, conglomeratic in part, pyritic.

Sandstone: quartz, gray to light gray, fine- to medium-grained, subrounded, argillaceous, well sorted, abundant pyrite and pyrite crystals probably developed along fractures.

Missing Core

Sandstone: quartz, light grey, medium-grained, subrounded, very argillaceous, conglomeratic,chert fragments, angular to subangular, occasional subrounded pebble, black chert fragments.

Missing Core

Conglomerate: black pebble, chert, very sandy, quartz, medium-grained, subrounded, very argillaceous.

Sandstone: quartz, conglomeratic grading downward to sandy conglomerate.

Missing core

Conglomerate: chert pebble, argillaceous, sandy, hard, tight.

Sandstone: quartz, light gray, fine- to medium grained, subangular to subrounded,conglomeratic, argillaceous, hard, tight.

Sandstone: quartz, light gray, fine- to medium grained, rounded to subrounded,slightly conglomeratic, very hard and tight, well sorted, siliceous cement, no visible porosity.

Sandstone: as above with large vertical fractures filled with pyrite.

Sandstone: quartz, light gray, fine- to medium-grained, subrounded to rounded, very hard and tight, siliceous cement, no visible porosity.

Sandstone: quartz, light gray, very fine- to medium-grained, poorly sorted, conglomeratic, siliceous cement, parting along bedding planes, numerous vertical or near vertical fractures filled with pyrite, very hard and tight, no visible porosity.

Siltstone: very light gray green, pyritic, near vertical fractures, some horizontal bedding parting, hard, becoming more Shaley at base.

Claystone: light gray green, sandy, near vertical fractures, pyritic, blocky in part.

Missing Core

Sandstone: quartz, light gray green, very fine-grained, vertical fractures,occasional small chert pebbles, some horizontal parting.

Shale: grey-green, slightly sandy, bedding plane and vertical tension fractures

Claystone: gray green, waxy, soft.

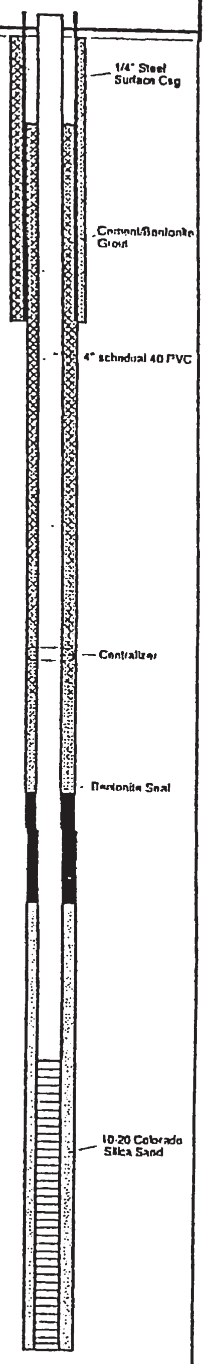
Missing Core

Siltstone: Light gray green with very fine-grained sandstone stringers, chert fragments, argillaceous, very sandy.

Shale: brownish grey, becoming grey green, soft very platy, random tension fracturing.

Shale: light greenish gray to green-grey, very sandy, very silty, tension fracturing, trace soft, red shale at base.

Missing Core



PEEL Environmental Services
Arvada, CO (303)422-3116

Bore Hole No. :
WMMW-22

Project: White Mesa
Surface Elev. 5516 Est
T. D. = 140'
PBTD = 120'
Date: 8/4/94
Depth to Water: 76
Geologist: C. Bilgood

Sample Description

Sandstone: aeolian sand, quartz, reddish brown.

Conglomerate: chert, light gray to dark gray, occasional translucent, interbedded with light gray quartz sandstone, rounded, thin bedded.

Conglomerate: sandstone and conglomerate as above.

Sandstone: quartz, white to very light gray, fine- to medium-grained, argillaceous

Sandstone: quartz, white to very light tan, fine-grained, well cemented, hard, tight

Sandstone as above, very hard, siliceous cement

Sandstone as above with trace light gray chert fragments, trace iron staining

Sandstone. quartz, light gray to light tan, very fine-grained, subangular, chert clasts to 1/2", siliceous cement, well cemented, hard, iron staining, occasionally light green in color.

Sandstone: as above with increase in chert clasts.

Missing Core

Sandstone: quartz, light tan to light gray, fine- to medium-grained, subangular to subrounded, siliceous cement, tight, becoming very conglomeratic at base, hard, well cemented.

Sandstone: as above becoming conglomeratic at base. Conglomerate pebbles sub angular to subround, varicolored

Missing Core

Conglomerate: varicolored as above, chert and claystone fragments.

Sandstone: quartz, very light gray, very fine-grained, argillaceous, subrounded, occasional rock clasts, trace intergranular porosity, some horizontal bedding parting, some cross bedding

Missing Core

Sandstone: quartz, light gray to light green gray, fine- to very coarse-grained, subangular to rounded, poorly sorted, large 1" green gray claystone clasts, fair to good intergranular porosity, very friable.

Sandstone: quartz, very light gray, fine- to medium-grained, subangular to subrounded, very friable, good intergranular porosity, massive, well sorted.

Sandstone quartz, light green gray, fine grained, argillaceous, rounded, fair intergranular porosity, friable

Missing Core

Sandstone quartz, light green gray, fine- to coarse-grained, argillaceous at base, conglomeratic, varicolored, with green claystone, chert and other lithic fragments

Claystone green, waxy

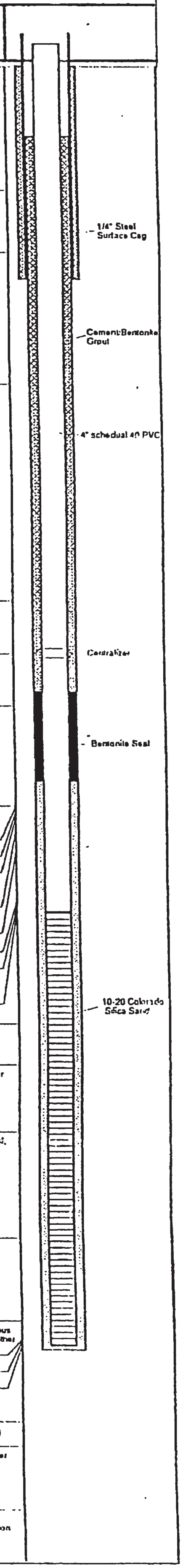
Missing Core

Claystone red brown, mottled green, some horizontal parting

Claystone gray green to bright green, some red mottling and banding

Siltstone, light gray green, hard, very argillaceous, slightly sandy, lower 1' grading into light green claystone.

Claystone light gray mottled, with red brown claystone, hard, some platyness, some 3" to 10" vertical fractures, some sealed, some iron [illegible]



Date 4-4-05 Geologist L Casebolt Drilling Co. Bayles Exploration

Property White Mesa Project MW-23 Hole No. MW-23

County San Juan State Utah Unit No. ____ Sec. 32 Twp. ____ Rge. ____

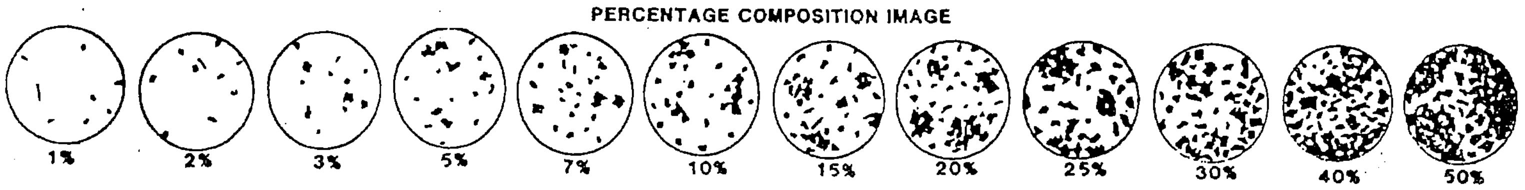
Location ____ Elev. ≈ 5608

PAGE 1 OF 2
T.D. PROBE ____
T.D. DRILL 132
FLUID LEVEL ____

REMARKS drilled with foam & air

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst	ltrdbn											m			Surface soil.
5.0						sndy sltst	ltrdbn											VS			
7.5						sndy sltst	ltrdbn											S			
10.0						qtz ss, sltst	ltpkbn											VS			
12.5						sltst, sh	lt pk bn											VS			
15.0						slty sh	lt pk bn											VS			
17.5						slty sh	lt pk tn											S			
20.0						sndy sh	ltpktn											VS			
22.5						qtz ss, sltst	lt bn	f-m	p	sa								VS			Upper Dakota Fm. ct @ approx 21.0 ft
25.0						qtz ss	ltgybn	f	f	sa								VS			
27.5						qtz ss	ltgy bn	f-m	f	sa	1							S			
						qtz ss, sh	gy bn	vf-m	f	sa	1							VS			
32.5						qtz ss	ltgybn	m-cr	p	sa								S			
35.0						qtz ss	ltor bn	m-vcr	p	sa								m			
37.5						qtz ss	lt pk bn	m-cr	p	sa	1							S			
40.0						qtz ss	lt pk bn	m-cr	p	sa	1							M			
42.5						qtz ss	tn	m-vcr	p	a	1							M			abnt. light colored chert frags
45.0						qtz ss	tn	m-cr	f	sa	1							M			" light-dk chert frags.
47.5						qtz ss	tn	m-cr	f	sa	1							M			
50.0						qtz ss	tn	m-cr	f	sa	1							M			
52.5						qtz ss	lt tn	vf-f	w	sa								S			very clean sand.
55.0						qtz ss	lt tn	vf-m	w	sa								m			sparse chert fragments
57.5						qtz ss	lt gy tn	f	w	sa								W			
60.0						qtz ss	ltgytn	f	w	sr								VW			
62.5						qtz ss	lt tn	f-m	w	sr								N			
65.0						qtz ss	lt tn	f-m	w	sr								N			
67.5						qtz ss	lt tn	m-vcr	f	sa								N			abunt. light colored chert grains
70.0						qtz ss	lt tn	f-vcr	f	sa								N			
72.5						qtz ss	lt tn	f-m	f	sa								N			
75.0						qtz ss	ltgytn	f-m	f	sa								N			
77.5						qtz ss	ltgytn	f-m	f	sa								N			
80.0						qtz ss	ltgytn	m	w	sr								M			
82						qtz ss	ltgy	m	w	sr								N			
85.0						qtz ss	ltgybn	f-m	f	sr								N			
87.5						qtz-ss	ltgybn	m	w	sr								N			
90.0						qtz ss	ltgybn	m	w	sa								N			
92.5						qtz ss	lt bn	m-cr	f	sa								N			abunt. light colored chert grains
95.0						qtz ss	lt bn	m	f	sa								N			
97.5						qtz ss	tn	f	w	sr								N			
00.0						qtz ss	ywtn	m	w	sr								N			
102.5						qtz ss	ywtn	f-m	f	sr								N			
05.0						qtz ss	ywtn	f	w	sr								N			
107.5						qtz ss	yewtn	vf f	f	sr								N			
110.0						qtz ss	ywtn	f	w	sr								N			
12.5																					
15																					
17.5																					
20.0																					
22.5																					
25.0																					

PERCENTAGE COMPOSITION IMAGE

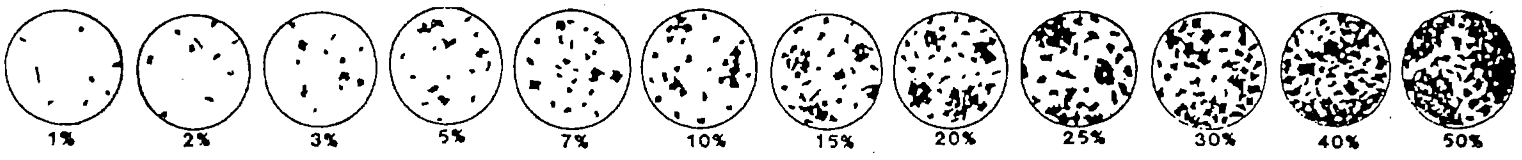


Date 4-4-05 Geologist L.Casebolt Drilling Co. Bayles Exploration Hole No. MW-23
Property White Mesa Mill Project MW-23 Unit No. ____ Sec. 32 Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 132
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
125.0																					Upper Brushy Basin Mbr. ct @ approx 126.8'
127.5																					(from core log - no cuttings below 110.0')
130.0																					
132.0																					

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. MW-23

Cored Interval 49.0 ft. to 132.0 ft. T.D.

Depth	Description
49.0 - 59.5	Core recovery 100%, 49.0 - 59.5 ft., quartz sandstone, fine - medium grained, tan, non calcareous cement, cross-bedded, very uniform, most partings occur along cross beds and are mechanical (broken during drilling), no mineralized or weathered surfaces.
59.5 - 70.0	Core recovery 95%, 59.5 - 61.5 ft., quartz sandstone, fine - medium grained, tan, non calcareous, cross-bedded as above, lower contact is 45 degree angle erosional surface. 61.5 - 64.0 ft., quartz sandstone, very light gray, medium grained, very clean sandstone, no mineralized partings, grades downward into conglomerate. 64.0 - 69.5 ft., quartz sandstone, medium - grit sized grains, very coarse chert pebble conglomerate from 67.0 - 69.5 ft.. 69.5 - 70.0 ft., quartz sandstone, medium - coarse grained, very light gray.
70.0 - 80.0	Core recovery 90%, 70.0 - 70.5 ft., no core recovered, 70.5 - 73.5 ft., siltstone, very light gray- green, soft core, low angle parting with limonite at 73.0 ft.. 73.5 - 80.0 ft., quartz sandstone, light gray-tan to light pink-tan, limonite stained low angle parting at 73.7 ft., grit zone at 75.0 ft., and from 75.5 - 76.5 ft., small limonite blebs after sulfides at 77.5 - 78.0 ft., some manganese dendrites from 78.5 - 79.5 ft., calcareous zone from 78.5 to 79.5 ft..
80.0 - 90.0	Core recovery 87%, 80.0 - 84.5 ft., quartz sandstone, light gray-tan, fine - medium grained, non calcareous cement, no mineralized partings. 84.5 - 85.7 ft., quartz sandstone, pink-tan to yellow orange, medium - grit sized grains, abundant disseminated limonite at 85.5 - 85.7 ft.. 85.7 - 87.0 ft., core not recovered. 87.0 - 89.0 ft., quartz sandstone, pink-tan, medium - grit sized grains. 89.0 - 90.0 ft., quartz sandstone / gritstone, some disseminated limonite.
90.0 - 100.0	Core recovery 40%, 90.0 - 96.0 ft., no core recovered. 96.0 - 100.0 ft., quartz sandstone / gritstone, medium - very coarse, light tan - yellow-orange, abundant disseminated limonite from 97.8 - 98.2 and from 99.5 - 100.0 ft., mechanical partings along un-mineralized bedding planes, non calcareous.
100.0 - 110.0	Core recovery 100%, 100.0 - 102.3 ft., quartz sandstone, fine - medium grained, light yellow-orange to pink-tan, abundant limonite from 100.0 - 101.0, hematite from 101.5 - 102.3. 102.3 - 105.5 ft., quartz sandstone, fine - medium grained, light gray,

Core log of well MW- 23 Cont.

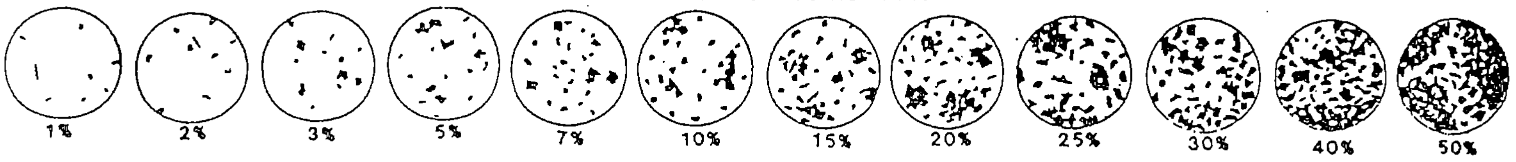
	unmineralized mechanical partings. 105.5 - 106.0 ft., disseminated limonite zone, yellow-orange. 106.0 - 110.0 ft., quartz sandstone, fine - coarse grained, light gray to orange-yellow.
11.0 - 120.0	Core recovery 100%, 110.0 - 111.2 ft., no core recovered. 111.2 - 113.5 ft., quartz sandstone / conglomerate, fine - grit size grains, light gray to light gray-green, green clay blebs plus dark chert fragments and pebbles. 113.5 - 114.5 ft., quartz sandstone / gritstone, abundant hematite mineralization, yellow-orange. 114.5 - 120.0 ft., quartz sandstone / gritstone, cross-bedded, gray-tan, chert fragments and pebbles at 115.0 - 116.5, 117.5 - 118.5, and 119.0 - 120.0 ft., non calcareous.
120.0 - 130.0	Core recovery 91%, 120.0 - 120.9.0 ft., no core recovered. 120.9 - 126.8 ft., quartz sandstone / gritstone, gray-tan to dark gray, dark gray chert fragments and pebbles, no mineralized partings observed, calcareous zone from 124.2 - 126.8 ft., upper Brushy Basin Mbr. contact at 126.8 ft. 126.8 - 129.7 ft., shale, green. 129.7 - 129.8 ft., gritstone as above.
130.0 - 132.0	Core recovery 100%, shale, green, non calcareous, T.D.

ate 4-7-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. MW-24
Property White Mesa Mill Project ____ Unit No. ____ Sec. 32 Twp. 37S Rge. ____
County San Juan State Utah Location ____ Elev. ≈5620

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 120 ft.
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltysh	orbn											S			
5.0						sltysh	wh-ltorbn											VS			
7.5						sltysh	ltrdbn											VS			
10.0						sltysh	lttn-ltrdbn											VS			
12.5						sltysh	ltpk-wh											VS			
15.0						sltysh, qtzss	ltorbn	f-cr	p	a								M			upper contact Dakota Fm. @ approx 13.0 ft.
17.5						qtzss	tn	m	w	sr		L						N			
20.0						sh	ltpogy											N			
22.5						qtzss	ltgytn	vf-f	f	sa		L						N			Note coring began @ 20.0'
25.0						qtzss, sh	ltgytn-wh	f-m	f	sa								N			
27.5						qtz ss, sh	ltgytn-wh	vf-m	p	sa								N			
30.0						qtz ss	lttn	vf-f	f	sa								N			
3						qtz ss	ltgy	vf	w	sa								N			
3.						qtz ss	ltgy	vf-f	f	sa								N			
37.5						qtz ss	ltgy	f-m	f	sr								VW			
40.0						qtz ss	ltgy	f-cr	f	sr								VW			
42.5						qtz ss	ltgy	m	w	sr								N			
45.0						qtz ss	ltgy	m-cr	f	sr								N			
47.5						qtz ss	ltgy	m-cr	f	sr								N			
50.0						qtz ss	ltgy	m	w	r								N			
52.5						qtz ss	ltgytn	m-cr	f	sr								N			
55.0						qtz ss	ltorbn	m-cr	f	sa								N			multi colored chert frags as grains
57.5						qtz ss, sh	ltgygn-ltbn	m-cr	p	sa								N			
60.0						qtz ss	gy	vf-f	f	sr								N			
62.5						qtz ss, sh	gybn	vf-f	f	sr								N			
65.0						qtz ss, sh	ltgybn	vf-f	f	sr								N			
67.5						qtz ss	ltgybn	f	w	sr								N			
70.0						qtz ss	gybn	f	w	sr								N			
72.5						qtz ss	gybn	f	w	sr								N			
75.0						qtz ss	gybn	f-c	p	sa								N			some chert fragments as sand grains
77.5						qtz ss, sh	gy	vf-f	p	sr								VW			
80.0						qtz ss	ltgy	f-m	f	sr								VW			
82.5						qtz ss	ltgy	f	f	sr								N			
85.0						qtz ss	ltgytn	m-cr	f	sr								N			
8						qtz ss	ltgy	m-cr	f	sr								S			
0.0						qtz ss	tnbn	f-m	f	sr		L						S			
2.5						qtz ss	ltgytn	m-cr	f	sr								W			
5.0						qtz ss	ltgy	m-vcr	p	sr								VW			Some light colored chert frags. as grains
7.5						qtz ss	ltgy	m-cr	w	r								VW			" " " " " " "
00.0						qtz ss	ltgy	m-cr	w	r								VW			" " " " " " "
2.5						qtz ss	ltorgy	m-cr	f	sa								N			" " " " " " "
5.0						qtz ss	ltgy	m-cr	f	sr								N			" " " " " " "
7.5						qtz ss	lt tn	f	w	sr								N			
0.0						qtz ss	lt tn	f-m	w	sr								N			
2.5						qtz ss	lttn	f-m	w	sr								N			
5.0						qtz ss	ltgytn	m	w	sr								N			
75						qtz ss	ltgytn	m	w	r								N			
2						qtz ss, sh	ltgytn-gn											VW			upper Brushy Basin Ct. @ 118.5 ft.
0.																					

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. MW-24

Cored Interval 20.0 ft. to 120.0 ft. T.D.

Depth	Description
20.0 - 29.0	Quartz sandstone, very fine - fine grained, non calcareous cement, some chert pebbles from 20.0 - 20.5 ft.. 20.5 - 23.5 quartz sandstone, very fine - fine grained, gray to light tan brown, weathered contact at 23.5 ft. with hematite/limonite. 23.5 - 27.5 siltstone/shale, very light gray, high angle parting with slickensides at 25.5 ft. 27.5 - 29.0 quartz sandstone, very fine grained, light gray tan, some low angle parting with hematite/limonite coatings.
29.0 - 38.0	Quartz sandstone, very fine - fine grained, light gray with disseminated hematite/limonite staining from 29.0 - 29.2 ft. and from 29.0 - 29.2 and 29.3 - 29.4 ft., also some low angle partings with hematite staining. 30.0 - 34.0 quartz sandstone, very fine - fine grained, light gray tan, non calcareous. 34.0 - 34.5 quartz sandstone, fine - medium grain, abundant disseminated limonite. 34.5 - 38.0 quartz sandstone, fine - medium grained, very light gray tan, non calcareous cement, some low angle partings.
38.0 - 48.0	Core recovery 100%, 38.0 - 39.9 ft., quartz sandstone, very fine grained, very light gray, well sorted. Non calcareous cement. 39.9 - 48.0 quartz sandstone, very light gray - white, medium grained, well sorted, some disseminated limonite patches from 47.0 - 47.5 ft., non calcareous cement. No mineralized partings.
48.0 - 58.0	Core recovery 88%, 48.0 - 51.5 ft., quartz sandstone, light gray, fine - coarse grained, non calcareous cement, disseminated limonite at 48.5 and 50.5 - 51.2 ft. 51.5 - 56.0 ft., quartz sandstone / conglomerate, medium - grit sized grains, consists of chert fragments and pebbles, conglomerate zones at 51.5 - 52.0 ft., 53.7 - 54.0 ft., 55.5 - 56.0 ft., non calcareous. 56.0 - 58.0 ft., siltstone / shale, light gray-green.
58.0 - 69.0	Core recovery 93%, 58.0 - 69.0 ft., quartz sandstone / siltstone, very fine grained, light tan, rounded grains, disseminated limonite from 58.9 - 59.5 ft., and 60.5 - 61.0 ft., low angle partings with hematite / limonite coatings at 62.7 ft., and 66.0 ft., grain size increases to fine from 67.0 - 69.0 ft., two small 2 - 4 cm patches of limonite after pyrite with remnant pyrite in center of patchs at 68.5 ft.
69.0 - 80.0	Core recovery 73%, 69.0 - 70.0 ft., quartz sandstone, fine - medium grained, light tan, very clean sandstone, non calcareous cement. 70.0 - 72.0 ft. core not recovered.

Core log of well MW- 24 Cont.

	72.0 - 72.2 ft., green shale. 72.2 - 76.0 ft., quartz sandstone / conglomerate, fine - medium grained, grading downward into conglomerate from 75.0 - 76.0 ft., light gray-tan to tan. 76.0 - 78.0 ft., quartz sandstone, very fine grained, light purple-pink to yellow-tan. 78.0 - 79.5 ft., shale, gray-green, poor recovery. 79.5 - 80.0 ft., quartz sandstone, fine - medium grained, gray, abundant disseminated limonite, some manganese dendrites.
80.0 - 90.0	Core recovery 100%, 80.0 - 80.2 ft., shale, gray-green. 80.2 - 90.0 ft., quartz sandstone, medium - grit size grains, light gray-tan, abundant 2 - 3 cm diameter spherical patches of disseminated black mineral from 80.2 - 83.0 ft., no mineralized partings observed. conlomerate zones at 84.0 - 84.3 ft., 84.5 - 85.0 ft., and 87.7 - 88.2 ft., non calcareous cement.
90.0 - 100.0	Core recovery 90%, 90.0 - 95.0 ft., quartz sandstone, fine - grit sized grains, light gray-tan, conglomerate zones at 90.2 - 91.0 ft., 92.3 - 95.0 ft., non calcareous cement, some disseminated limonite. 95.0 - 97.0 ft., quartz sandstone, fine - medium grained, light gray. 97.0 - 98.0 ft., quartz sandstone, medium - grit sized grains, light yellow-gray, some conglomerate zones. 98.0 - 99.0 ft., core not recovered. 99.0 - 100.0 ft., quartz sandstone, medium grained, light gray-tan, very friable.
100.0 - 110.0	Core recovery 70%, 100.0 - 105.0 ft., quartz sandstone / conglomerate, fine - grit sized grains, light gray to tan, conglomerate zones from 100.0 - 100.2 ft., 102.5 - 103.5 ft., 103.5 - 105.0 ft., quartz sandstone, medium grained, non calcareous cement. 105.0 - 110.0 ft., quartz sandstone, medium grained, some disseminated limonite, very soft and friable.
110.0 - 120.0	Core recovery 100%, 110.0 - 114.5 ft., quartz sandstone, yellow-tan to gray-pink, medium grained, abundant disseminated limonite in this zone. 114.5 - 116.7 ft., quartz sandstone, medium grained, light gray. 116.7 - 117.5 ft., abundant disseminated limonite. 117.5 - 118.5 ft., quartz sandstone, fine - medium grained, gray, calcareous cement. 118.5 - 118.6 ft., conglomerate / shale, green, upper Brushy Basin Mbr. contact at 118.5 ft., contact is high angle. 118.6 - 120.0 ft., shale, green. T.D.

ate 4-9-05 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. MW-25
Property White Mesa Mill Project ______ Unit No. ______ Sec. 33 Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5610

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 115.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sndy sltst	rdbn	vf-f	p	sa								M			Surface soil
5.0						Sndysltst	rdbn	vf-f	p	sa								M			Mancos Shale
7.5						Sndy sltst	rdbn	vf-f	p	sa								N			
10.0						Sndysltst	rdbn	vf-m	p	sa								M			
12.5						sltst, sh	rdbn-vlttn											VS			
15.0						sltst, sh	rdbn-vlttn											VS			
17.5						sh	ltpktn											VS			
20.0						sh	ltywtn											VS			
22.5						sh	ltywtn											VS			
25.0						Sh	ltywtn					L	T					VS			
27.5						Sh	ltywgy											S			
30.0						Sh	ltywgy											VS			
32.5						Sh	ltywgy											M			Sparse selenite (gyp) xls
3						Sndy Sltst	ywgy	vf-f	p	sa		L	T					VW			Sparse selenite (gyp) xls
37.5						Sndy Sltst	ywgy	vf-f	p	sa		L	m					N			Sparse selenite (gyp) xls
40.0						Sndy Sltst	ywgy	vf-f	p	sa		L	m					N			Sparse Selenite (gyp) xls.
42.5						Sltst, qtzss	ywgy	f-m	f	sa		L	m					N			Upper Dakota Fm contact @ approx 42.0 ft.
45.0						qtzss, chert	tn bn	f-vcr	p	sa		L	T					N			
47.5						Sh, qtz ss	gy-tn	m	p	sa								N			Sparse selenite xls.
50.0						slty sh	gy-ortn					L/H	T					N			
52.5						qtzss	tn	f-m	f	sa		L	T					N			
55.0						qtz ss, chert	tn	m-vcr	p	sa								N			
57.5						qtz ss, chert	tn bn	m-vcr	p	sa								N			
60.0						qtz ss	ortn	f-cr	f	sa		L	T					N			
62.5						qtz ss	vlttn	f-m	f	sr								N			
65.0						qtz ss	vlttn	f-m	f	sr								N			
67.5						qtz ss	tn	m-cr	f	sr		L	m					N			
70.0						qtzss	tn	vf-m	f	sa								N			
72.5						qtz ss	tn	m	w	sr								N			
75.0						qtzss	tn	m	w	sr								N			
77.5						qtzss	tn	m	w	sr								N			
30.0						qtz ss	tn	m-cr	f	sr								VW			
32.5						qtzss, sh	tn-gy	f-m	f	sa								VW			
25.0						qtz ss.	tn	f-cr	f	r								VW			
[illegible]						qtz ss	tn-blgy	f-m	f	sr								S			Sparse blgy sh frags.
10.0						qtz ss	vltblgy	vf-f	f	sr								VW			weakly cemented
2.5						qtz ss	vltblgy-wh	vf-f	f	sr								VW			〃 〃
15.0						qtzss, cgl	vltblgy-wh	vf-peb	p	sa								VW			sparse dk gy chert pebbles
7.5						qtz ss	vlttn	vf-f	f	sa								N			
0.0						qtzss	vlttn-wh	vf-f	f	sa								N			
2.5						qtz ss	wh	f m	f	sr								N			
5.0						qtz ss, cgl	ltgytn	f-peb	p	sr								N			abnt. multicolored chert pebbles & frags.
7.5						qtz ss.	vltgy-wh	m	w	r								W			Moisture first noted
0.0						qtz ss	vlttn-wh	vf-m	f	sr								W			
2.5						qtzss, cgl	v.lttn-wh	f-m	w	sr								W			Sparse dk chert frag.
5.0						qtz ss, cgl, sh	wh-blgn	f-peb	p	r								N			upper Brushy Basin Ct. @ approx 113.0 ft.
																					T.D

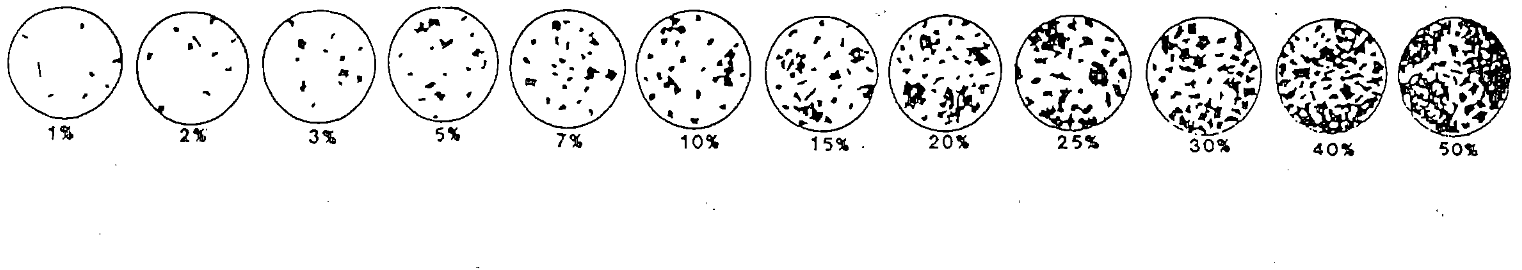
PERCENTAGE COMPOSITION IMAGE

ate 4-5-05 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. MW-27
Property White Mesa Mill Project ______ Unit No. ______ Sec. 28 Twp. 37S Rge. ______
County San Juan State Utah Location ______
Elev. ~5625

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 95.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						Sndy Sltst	rd bn	vf cr	p	a								N			Surface soil.
5.0						Sndy Sltst	rd bn	vf cr	p	a								W			
7.5						Sltst	rd bn											W			
10.0						Sltst, ss	yw bn	f m	P	sa								S			
12.5						qtz ss	tn	m	w	sr		LT						VW			
15.0						qtz ss, sh	vltgy-ltpk	vf-m	p	sa		LT						N			
17.5						sltst	vltgy-wh											N			
20.0						sltst	vltgy-wh											N			
22.5						sltst	vltgy-wh											N			
25.0						qtz ss, chert	ltpktn	vf vcr	p	a								N			Upper contact Dakota Fm @ approx. 23.0 ft.
27.5						qtz ss	lttn	f-m	w	sr								N			Moisture First noted 27.0′
30.0						qtz ss	ltpktn	f-m	w	sr		LT						N			
32.5						qtz ss, chert	ltpktn	f-vcr	p	a								N			
3						qtz ss	lttn	f-vcr	p	a		LM						N			
37.5						qtz ss, chert	ltgytn	f-vcr	p	a		LT						N			
40.0						qtz ss, chert	gytn	f-vcr	p	a		LT						N			abnt. multicolored chert frags.
42.5						qtz ss, chert	gytn	f-vcr	p	a								N			" " " " "
45.0						qtz ss	tn	m-cr	f	sa								N			
47..5						qtz ss	tn	m-cr	f	sa								N			
50.0						qtz ss	vlttn-wh	f-cr	p	sa								N			
52.5						qtz ss cgl.	tn-ltgy	m-peb	p	sa								N			abnt multicolored chert frags. & pebbles
55.0						qtz ss	tn	m-cr	w	sr								N			
57.5						qtz ss, cgl.	tn-gy	m-peb	p	a		LT						N			
60.0						qtz ss	lttn	m-cr	w	sr								N			
62.5						qtz ss, sltst	tn-gy	vf-cr	p	sa								N			trace manganese dendrites
65.0						sh	pp gy											N			
67.5						Sh, qtz ss	blgy-wh	vf f	w	sa								N			
70.0						qtz ss, sh	wh-vltgy	vf-f	f	sa			T	C				N			
72.5						qtz ss	wh	m	w	sr								N			
75.0						qtz ss	wh	f m	f	sr								N			
77.5						qtz ss	wh	vf f	f	sr								N			
80.0						qtz ss	wh	m cr	f	sr			T	C				N			
82.5						qtz ss, chert	vlttn	m cr	f	sr			T	C				N			sparse dk chert frags & grains
85.0						qtz ss	vlttn-wh	m	w	sr								N			
8'						qtz ss	vltgytn	m cr	f	sr			A	C				N			
90.0						qtz ss, sh	ltgy-blgy	f-vcr	p	sr								M			upper Brushy Basin Ct @ approx. 88.0 ft.
92.5						sh, sltst	gygn											N			
95.0						sh	gygn											N			TD

PERCENTAGE COMPOSITION IMAGE

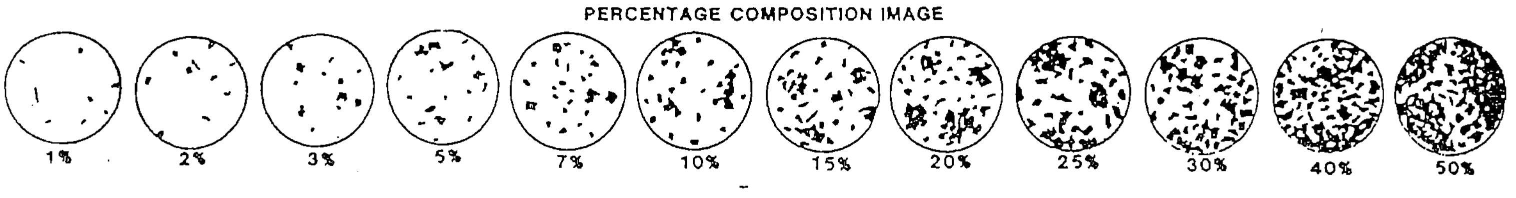


ate 4-5-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co Hole No. MW-28
Property White Mesa Mill Project ______ Unit No. ______ Sec. 33 Twp. 37S Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5618

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst-sh	lttn-gy											VS			
5.0						sltst-sh	ltrdbn											VS			
7.5						sltysh	ltrdbn											VS			
10.0						sltysh	ltrdbn											VS			
12.5						sltysh	ltrdbn											VS			
15.0						sltysh	ltrdbn											VS			abunt. selenite xls (gypsum)
17.5						sltysh	dkrdbr											VS			
20.0						sh	rdbr-ltywgy											S			
22.5						sh-qtz ss	vltgy-wh	vf f	f	sa								M			Significant Color Change
25.0						qtz ss	vlttn-wh	f-m	f	sa								N			Upper Dakota Fm Contact @ approx 22.0ft.
27.5						qtz ss	wh-lttn	vf-f	f	sa		L						N			
30.0						qtz ss sltst	ltgy-lttn	m-cr	f	sa		L						N			
3						qtz ss	tn	m-cr	w	sr								N			
35.0						qtz ss	ywtn	f-m	f	sa								N			
37.5						qtz ss	lttn	f-m	f	sr								N			
40.0						qtz ss	ltywtn	m	w	sr								N			
42.5						qtz ss	ywtn	m-cr	f	sr								N			
45.0						qtz ss	ltgytn	f-vcr	p	sa								N			
47.5						qtz ss	lttn	m-cr	f	sr								N			
50.0						qtz ss	ltywtn	f-m	f	sr								N			Moisture first noticed
52.5						qtz ss	ywtn	f-m	f	sa								VW			
55.0						qtz ss	ywtn	m	w	sr								N			
57.5						qtz ss	ywtn	m	w	sr								N			
60.0						qtz ss	tn	f-m	f	sr								N			
62.5						qtz ss	tn	m-cr	f	sr								N			multi colored chert frags.
65.0						qtzss-sh	tn-ltbn	m-cr	f	sr								N			
67.5						qtzs-sh	tn-ltbn	f-m	f	sr								N			
70.0						qtzss-cgl.	tn-gy	m-grit	p	sa								W			abunt multicolored chert frags.
72.5						gritst cgl.	rdgytn	cr-grit	p	a								N			" " " " "
75.0						gritst, cgl	rdgytn	m-grit	p	a								N			
77.5						qtzss, grit	rdgytn	m-grit	p	a								N			
80.0						qtz ss	tnrdgy	f-vcr	p	sa								N			
82.5						qtz ss	tn	f-cr	p	sa								N			
85'						qtz ss	tn	m	f	sr								N			
87.						qtz ss	tn	m-cr	f	sr								N			
90.0		X																X			No cuttings
92.5						qtzss	tn	f-m	f	sr								N			
95.0						qtz ss	tn	m	w	sr								N			
97.5						qtzss	tn	m-cr	w	r								N			
00.0						qtz ss	tn	m-cr	w	r								N			
02.5						qtz ss cgl	tn-gy	m-grit	p	a								N			
05.0						qtz ss cgl sh	tn-gy	m-grit	p	a								N			upper Brushy Basin Ct @ appox 104.0ft.
07.5						qtz ss, sh	tn-gy	m-vcr	p	a								N			(note contact from core)
10.0						qtzss, sh	tn-gn	m-cr	f	sr								N			T.D.

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. MW-28

Cored Interval 49.0 ft. to 110.0 ft. T.D.

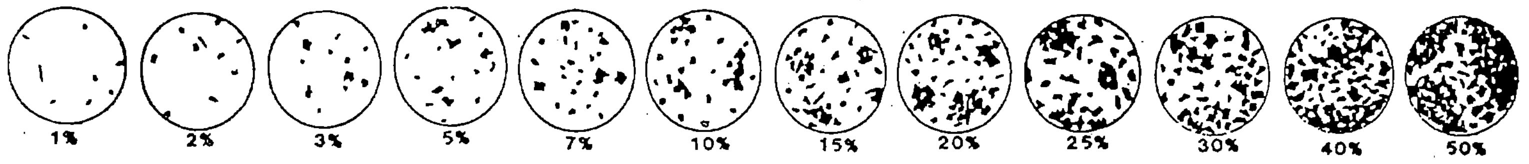
Depth	Description
49.0 - 60.0	Core recovery 55%, 49.0 - 54.0 ft., no core recovered. 54.0 - 54.3 ft., conglomerate, non calcareous. 54.3 - 60.0 ft., quartz sandstone, fine - medium grained, yellow-orange to tan, no mineralized or weathered surfaces, disseminated limonite zones from 55.0 - 56.0 ft., and 57.8 - 59.8 ft..
60.0 - 70.0	No core recovered from this interval.
70.0 - 80.0	Core recovery 22%, 70.0 - 77.8 ft., no core recovered, 77.8 - 80.0 ft., quartz sandstone, fine - medium grained, yellow-tan, cross-bedded with some grit sized grains occuring along bedding planes, very friable, non calcareous.
80.0 - 90.0	Core recovery 63%, 80.0 - 83.8 ft., no core recovered. 83.8 - 86.3 ft., quartz sandstone, medium - grit sized grains, yellow-tan, sharp contact with underlying shale. 86.3 - 86.5 ft., shale, yellow-gray. 86.5 - 90.0 ft., quartz sandstone, medium grained, yellow-tan to gray, non calcareous, very friable.
90.0 - 100.0	Core recovery 82%, 90.0 - 91.7 ft., no core recovered. 91.7 - 93.5 ft., quartz sandstone, fine - medium grained, gray-tan to light tan, several nonmineralized mechanical partings, non calcareous. 93.5 - 100.0 ft., quartz sandstone / gritstone, yellow-gray, grit zone from 95.5 - 97.5 ft., conglomerate zone from 99.9 - 100.0 ft., non calcareous, core becomes almost unconsolidated from 91.7 - 100.0 ft..
100.0 - 110.0	Core recovery 67%, 100.0 - 103.3 ft., no core recovered. 103.3 - 103.5 ft., conglomerate with chert pebbles up to 1 1/2 inch diameter. 103.5 - 104.0 ft., quartz sandstone, fine - medium grained, yellow-gray, some limonite on contact at 104.0 ft., upper Brushy Basin Mbr. contact. 104.0 - 110.0 ft., shale, green to purple-brown, some carbonaceous patches at 105.0 - 105.4 ft., purple -brown mottling from 106.5 - 108.5 ft. End of core at 110.0 ft., T.D.

Date 4-4-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-29
Property White Mesa Mill Project ______ Unit No. ______ Sec. 32 Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5612

PAGE 1 OF 2
T.D. PROBE ______
T.D. DRILL 130.0
FLUID LEVEL ______

													PYRITE						CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						sndy sh	ltywbn	vf													Dike fill material
5.0						sndy sh	lt tn	vf													Dike fill material
7.5						Sndy sh	lt pk tn	vf													Dike fill material
10.0						Sndy sh	lt tn	vf													Dike fill material
12.5						Sndy sh	lt tn	vf													Possible in place material
15.0						Sndy sh	lt bn	vf f													
17.5						Sndy sh	lt tn	vf f													
20.0						Sndy sh, ss	lt tn	vf f													Upper Dakota Fm Ct @ approx 19.5 ft.
22.5						qtz ss, sh	tn bn	m-cr	p	sa											
25.0						qtz ss	tn	m-vcr	p	sa		La									
27.5						qtz ss	ywtn	m-cr	p	sa		La									
30.0						qtz ss, cgl	gytn	m-peb	p	sa											Some dk gy-blk chert frag.
32.5						qtz ss, cgl.	ywtn	f-peb	p	sa											" " " " "
0						qtz ss	tn	f-m	f	sa											
37.5						qtz ss, cgl	gytn	f-vcr	p	sa											
40.0						qtz ss, cgl	ltgytn	f-vcr	p	sa											
42.5						qtz ss	lt tn-wh	vf-cr	p	sa											
45.0						qtz ss	lt tn-wh	vf-m	p	sa											
47.5						qtz ss	vltn	f-m	f	sr											
50.0						qtz ss	vltn-wh	vf-m	f	sr											
52.5						qtz ss	wh	m	w	r								N			sparse frag. blgn sh.
55.0						qtz ss	vltgy	m-cr	f	sr								N			Some multicolored chert frag.
57.5						qtz ss	vltgy	m	w	sr								N			
60.0						qtz ss	vltgy-wh	m	f	sr								N			
62.5						qtz ss	gy-pk	m-cr	f	sa								N			30% chert frags. & grains
65.0						qtz ss	ltgytn	f cr	p	sa		LT						N			
67.5						qtz ss	ltywgy	f-peb	p	sa								N			some dk gy chert frags.
70.0						qtz ss	ltgy	f-m	f	sa								N			
72.5						qtz ss	ltgy	f-m	w	sr								N			
75.0						qtz ss	ltgy	m	w	sr								N			
77.5						qtz ss	gy	m	f	sa								N			
80.0						qtz ss, cgl.	gy	m-peb	p	sa								N			cgl. zone, dk chert frags.
82.5						qtz ss	ltywgy	m-cr	f	sr								N			
85.0						qtz ss	ltgy	vf-m	f	sr		LT						N			
87						qtz ss	ltgy	m-cr	f	sr								N			some chert frags.
90.0						qtz ss, cgl.	ltgytn	m-peb	p	sa								N			cgl. zone, chert frag.
92.5						qtz ss	ltgytn	f-cr	p	sa								N			abnt chert grains
95.0						qtz ss	vltgy	m	w	sr								N			
97.5						qtz ss	vltgy-wh	m	w	sr								N			
00.0						qtz ss	ltgytn	f-m	f	sr		LT						N			
02.5						qtz ss	vltgytn	m-vcr	p	sa								N			some multicolored chert frags.
05.0						qtz ss	vltgy	m-vcr	p	sa								N			some multicolored chert frags
07.5						qtz ss	wh	f-cr	f	sr								N			
10.0						qtz ss	wh	m	w	r								N			
12.5						qtz ss	wh	f-m	w	r								N			
15.0						qtz ss	wh-vltgy	f-m	w	sr								N			
17.						qtz ss	wh	f-m	w	r								N			
20.0						qtz ss	wh	f-m	w	r								N			
22.5						qtz ss	wh	f-m	w	r								N			
25.0						Sh, qtz ss	dkgybl-pp	m	p	sr			T	C				N			Upper Brushy Basin Mbr. Ct @ approx 123.0 tr. pyrite

PERCENTAGE COMPOSITION IMAGE

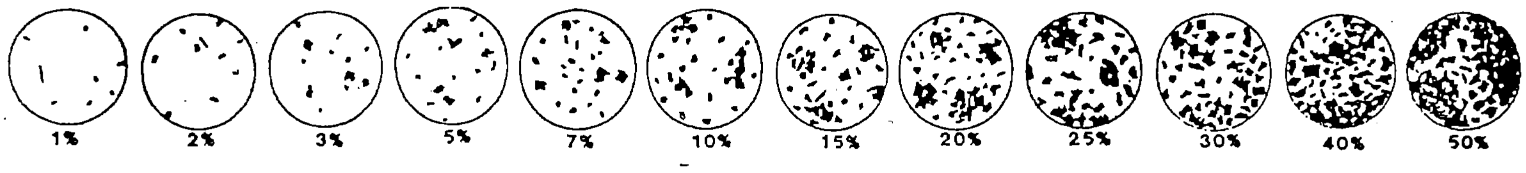


Date 4-12-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-29
Property White Mesa mill Project ____ Unit No. ____ Sec. 32 Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5612

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 130
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0						Sh	ltpp-ltgybn											N			
127.5						Sh	ltpp-ltrdbn											N			
130.0																					T.D.

PERCENTAGE COMPOSITION IMAGE

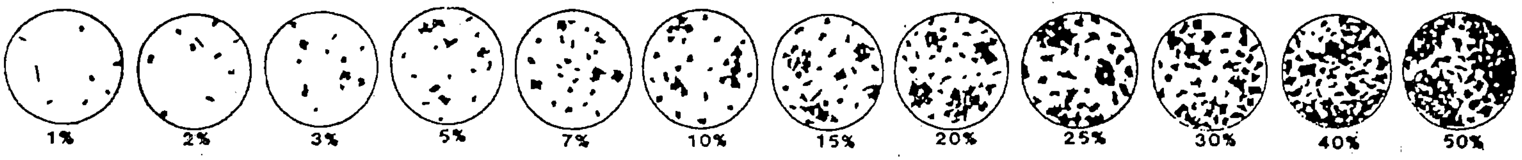


Date 4-6-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-30
Property White Mesa Mill Project ______ Unit No. ______ Sec. 33 Twp. 37S Rge. ______
County San Juan State Utah Location ______ Elev. ≈5612

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						sndy sh	ltywbn											VS			Surface soil/fill, frags. of flyash from mill
5.0						Sndy sh	lt bn											VS			Possible fill material
7.5						Sndy sh	ltywbn											VS			Possible fill material
10.0						Sh	lt yw											VS			possible bedrock contact, abnt. gyp. (selenite) frags.
12.5						Slty sh	lt bn											VS			trace selenite
15.0						Sh	ltgnyw											VS			trace selenite
17.5						Sh	ltyw-gy											VS			
20.0						Sh	ltywgy											S			Trace selenite
22.5						Sh, qtz ss	ltppbn-	vf-m	p	sa								S			upper Dakota Fm. ct. @ approx 22.0ft.
25.0						qtz ss	ltywtn	f-m	f	sa								S			
27.5						qtz ss, cgl	wh-lttnbn	f-vcr	p	sa								S			dk chert fragments.
30.0						qtz ss, cgl	lttn-dkgy	m-vcr	f	sr								S			note: some contamination with flyash
-						qtz ss, cgl	ltgy-lttn	f-vcr	f	sr								S			
35.0						qtz ss	ltgytn.	m-vcr	w	sr								S			
37.5						sltst, sh.	lttn-ltgy	vf										N			
40.0						sltst, sh	ltgy-vlttn	vf										W			
42.5						sltst, qtz ss	wh-vltgy	vf-f										m			
45.0						qtz ss,	vltgy-wh	f										M			
47.5						sltst-qtz ss	ltgy	vf-f										M			
50.0						qtz ss	vlt bn	vf										m			
52.5						Sndy sltst	ltppbn	vf f	P	sa								VS			
55.0						Sltst, qtz ss	rdbn-ltgy	vf m	P	sa								S			
57.5						Sltst, qtz ss	rdbn-gy	vf m	P	sa								S			
60.0						qtz ss, cgl	tn-gy	f-peb	p	sa								W			abnt. multicolored chert frags. & pebbles
62.5						qtz ss, cgl.	gytn	m-peb	p	sa								VW			" " " " "
65.0						qtz ss	ortn	m-vcr	p	sa	L	T						N			" " " " "
67.5						sltst, sh, ss	ywtn-gy	vf f	f	sa	L	T						N			
70.0						sltst, sh, ss	gybn	vf f	f	sa	L	T						N			
72.5						qtz ss-sltst	vltgy	vf f	f	sa								N			
75.0						qtz ss-	wh	vf f	f	sa								N			
77.5						qtz ss	wh-vltgy	vf-f	f	sa								N			frags. very soft & friable
80.0						qtz ss	lttn	f-m	f	sa								N			
82.5						qtz ss, sh	ltgygn-rd	f-m	p	sa								N			frags soft & friable
ε						qtz ss, sh	ltgygn-wh	f-m	p	sa								N			
8/.5						qtz ss	vlttn-wh	f-m	f	sr								N			
90.0						qtz ss	vlttn-wh	f-m	w	sr								N			some dk chert grains
'2.5						qtz ss	wh	f-m	w	sr								N			
15.0						qtz ss	wh	f-m	w	sr								N			
17.5						qtz ss	wh	f-m	w	sr								N			
'00.0						qtz ss	wh	f m	w	sr								N			
02.5						qtz ss	wh	f m	w	sr								N			
05.0						qtz ss cgl	vltgywh	m-peb	p	sa								N			abnt dk chert frags.
07.5						sh	blgn											N			Upper Brushy Basin Mbr @ approx 105.0 ft.
10.0						sh	blgn											N			T.D.

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. MW-30

Cored Interval 20.0 ft. to 60.0 ft.

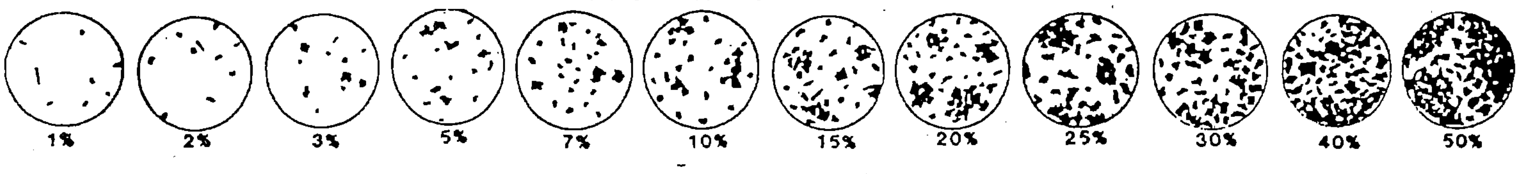
Depth	Description
20.0 - 30.0	Core recovery 36%, 20.0 - 20.3 ft., quartz sandstone / siltstone, very fine grained, yellow-pink- tan, calcareous cement. 20.3 - 27.0 ft., no core recovered. 27.0 - 30.0 ft., quartz sandstone, medium grained, pink-tan to tan-brown, disseminated limonite from 27.0 - 28.0 ft..
30.0 - 40.0	Core recovery 100%, 30.0 - 40.0 ft., quartz sandstone, cross-bedded, medium - grit sized grains, tan, non calcareous, grit zone from 31.3 - 31.7, dark gray clay galls from 32.1 - 33.0 ft., no mineralized partings.
40.0 - 50.0	Core recovery 67%, 40.0 - 40.7 ft., quartz sandstone, tan, medium - grit sized grains, grit zone from 40.7 - 41.0 ft., contact with weathered surface at 41.0 ft., manganese dendrites. 41.0 - 45.2 ft., quartz sandstone, light gray, fine - medium grained. 45.2 - 46.6 ft., quartz sandstone, yellow-gray to yellow-tan, low angle limonite mineralized parting at 46.3 ft. 46.6 - 50.0 ft., no core recovered.
50.0 - 60.0	Core recovery 95%, 50.0 - 51.0 ft., siltstone, yellow-gray-tan. 51.0 - 52.5 ft., quartz sandstone / siltstone, dark gray-brown. 52.5 - 55.5 ft., shale, purple-red. 55.5 - 60.0 ft., siltstone, yellow-brown, very soft, lower contact is low angle parting, grades into quartz sandstone to 60.0 ft., tan to yellow-orange conglomerate zones at 57.0 - 57.3 ft., 58.0 - 58.7 ft., and 59.8 - 60.0 ft., end of core.

Date 4-5-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-31
Property White Mesa Mill Project Unit No. Sec. 33 Twp. 37S Rge.
County San Juan State Utah Location Elev. ≈ 5614

PAGE 1 OF 2
T.D. PROBE
T.D. DRILL 130
FLUID LEVEL

														PYRITE					CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						sndy sltst	lt rdbn	vf-m	p	sa								S			possible fill material from dike
5.0						sndy sltst	lt pktn	vf-m	p	sa								S			possible fill material from dike
7.5						sndy sh, ss	lt pktn	vf-m	p	sa								S			possible fill material from dike
10.0						Sndy sh,	lt pk-vlt tn	vf m	p	sa								S			possible fill material from dike
12.5						Sndy sh,	lt pktn	vf m	f	sa								VS			Mancos Shale Fm.
15.0						Sndy sh	rdbn-ywtn	f m	f	sa								VS			
17.5						Slty sh	rdbn-ywtn	vf f	p	sa								S			
20.0						Sh	ywgy-ltpk											S			
22.5						Sh	ywgy-ltpk											m			
25.0						Sh	ywgy											S			
						Sh	ywgy											m			
30.0						qtz SS, sh	ywgy	vf-f	p	sa	LM							VW			
32.5						Sndy sltst	gybn	vf f	p	sa								W			
35.0						Sndy sltst	gybn	vf f	p	sa								W			
37.5						qtzss, sh	gy-tn	vf-m	f	sa								VW			Upper contact Dakota Fm. @ approx 36.0
40.0						qtz ss	tn	m	f	sa	LM							N			
42.5						qtz ss	tn	m-cr	f	sa	LT							N			
45.0						qtz ss	gytn	m-vcr	p	a								N			
47.5						qtz ss	lt bn	m-vcr	p	a								N			sparse chert frags.
50.0						qtz ss	lt bn	m-vcr	p	a								N			sparse chert frags.
52.5						qtz ss	lt ywbn	m-peb	p	a								N			abnt. chert frags.
55.0						qtz ss	lt tn	m	w	sr								N			
57.5						qtz ss	lt tn	m	w	sa								N			
60.0						qtz ss	lt tn	m	w	sr								N			
62.5						qtz ss	lt tn	m-cr	f	sa								N			
65.0						qtz ss	lt tn	m	f	sa								N			sparse wh chert grains
67.5						qtz ss	lt tn	m	f	sr								N			
70.0						qtz ss	lt tn	m-cr	f	sa								N			some dk gy chert grains
72.5						qtz ss	lt tn	m-cr	f	sa								N			" " " " "
75.0						qtz ss, cgl.	lt tn	m-peb	p	sa								W			" " " " pebbles
77.5						qtz ss, cgl	yw gy	m-peb	p	a								W			" " " " "
[illegible]						qtz ss, cgl	lt tn	m-vcr	p	sr								N			abnt. multicolored chert frags & pebbles
82.5						qtz ss cgl	gytn	m-peb	p	a								W			" " " " " "
85.0						qtz SS, cgl	gytn	m-peb	p	a								W			" " " " " "
87.5						qtz ss, cgl	gytn	cr-peb	p	a								W			" " " " " "
90.0						qtz ss	tn	m	w	sr								N			
92.5						qtz ss, sltst	lt gy-lt blgy	f-m	f	sr								N			
95.0						qtz ss, sltst	lt tn-lt blgy	vf m	f	sr								N			
97.5						qtz ss	vlt tn-wh	f-m	f	sr	LT	T	C					N			
100.0						qtz ss	vlt tn-wh	m	w	sr								N			
102.5						qtz ss	vlt tn	m-cr	f	sr								N			dk gr chert frags
105.0						qtz ss	vlt tn	m-cr	f	r								N			" " " "
107.5						qtz SS	vlt tn-wh	m	w	r								N			
1						qtz ss	vlt tn-wh	m	w	r								N			
11						qtz ss -	vlt tn-wh -	m	w	r								N			
15.0						qtz ss	vlt tn-wh	m	w	r								N			
17.5						qtz ss	vltn-wh	m	w	r								N			
20.0						qtz ss, chert	lt tn-dk gy	cr-peb	p	a								N			cgl. zone multicolored chert frags & pebbles
122.5						qtz ss, chert	lt tn-tn	m-peb	p	a								N			" " " " " " "
25.0						qtz ss, chert	lt tn-tn	vcr	p	sr		T	C					N			" " " " " " "

PERCENTAGE COMPOSITION IMAGE



ate 4-1-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-31
Property White Mesa Mill Project ______ Unit No. ______ Sec. 33 Twp. 37S Rge. ______
County San Juan State Utah Location ______ Elev. ≈ 5614

PAGE 2 OF 2
T.D. PROBE ______
T.D. DRILL 130
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						qtz ss, cgl, sh	wh-gygn	m-peb	p	a								m			Upper Brushy Basin Mbr Ct @ approx 126.0 ft.
130.0						sh	gygn-ppbn											W			

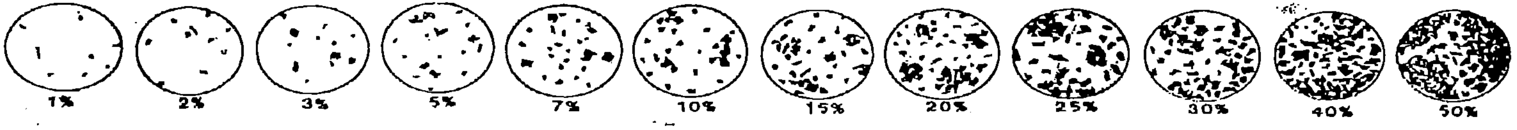
PERCENTAGE COMPOSITION IMAGE

Date 8-31-16 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-33
Property White Mesa Mill ~~[illegible]~~ Tailings Cell Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL Dry Hole

													PYRITE						CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						mdst	rd bn											S			surface soil
5.0						mdst	rd bn - lt pk											VS			mancos shale fm.
7.5						sndy mdst	rd bn - lt pk	m-cr	m	a								VS			
10.0						sndy mdst	rd bn	m	m	a								VS			
12.5						mdst	rd bn											S			
15.0						sh	vlt pk											VS			
17.5						sh, qtz ss	lt pk	m-cr	m	a								VS			Dakota fm. contact @ 16.0 ft.
20.0						qtz ss	tn	m cr	m	a								S			
22.5						qtz ss	rd bn - tn	m-cr	m	r								M			
25.0						qtz ss	lt gy bn	m	w	r								m			
27.5						qtz ss	lt gy bn	m-cr	m	a		L						N			
30.0						qtz ss	gy bn	m-cr	p	a		L						vw			
32.5						qtz ss	gy bn	f-vcr	p	a								VW			
35.0						qtz ss	gy bn	m-vcr	p	a								N			
37.5						qtz ss	gy bn	m-cr	p	a								N			
40.0						qtz ss	gy bn	m-gr	p	a								N			
42.5						mdy qtz ss	lt rd bn	f-cr	p	a								S			mdst is believed to be material from 12.5' above
45.0						qtz ss	tn	f-gr	p	a								S			multi colored chert grains and frag.
47.5						qtz ss, sh	tn	f-gr	p	a								m			some chert grains and fragments
50.0						qtz ss, sh	tn - lt gy	f-gr	p	a								vw			some chert grains and fragments.
52.5						qtz ss, sh	tn - lt gy	f-gr	p	a								w			abunt chert grains
55.0						qtz ss, sh	tn - lt gy	f-gr	p	a								w			" " "
57.5						sh												w			
60.0						sltst.												w			
62.5						sndy sh	lt gy tn	f-m	m	a								N			
65.0						sndy sh	lt gy tn	f-m	m	a								N			
67.5						sltst	lt tn											N			
70.0						qtz ss, sh	lt tn - lt gy	f-m	m	a								S			
72.5						sh	lt gy											w			
75.0						sh	bl gy - yw or					L						vw			
77.5						sh	bl gy											N			
80.0						sltst-ss	tn	vf-f	m	r								N			
82.5						qtz ss, sh	gy tn - yw or	m	w	r		L						N			
85.0						qtz ss	vlt gy tn	m-cr	m	a								w			qtz ss
87.5						qtz ss, sh	vlt tn - lt gn	m-cr	m	a								N			
90.0						qtz ss	lt tn	m-cr	m	a								w			
92.5						qtz ss	lt tn	cr-vcr	m	a								m			
95.0						qtz ss, sh	lt tn - lt gn	m-cr	p	a								N			
97.5						qtz ss	lt tn	m-vcr	p	a								N.			sparse chert grains
100.0						qtz ss	tn	m-gr	p	a								vw			" " " some contamination from up hole cuttings
102.5						qtz ss	tn bn	m-cr	m	a		L						m			
105.0						sh	gy gn - pp bn											N			Brushy Basin Ct @ 102.5
107.5						sh	gy gn - pp bn											vw			
110.0						sh	gy gn - pp bn											N.			T.D. Well bore was dry to T.D.

PERCENTAGE COMPOSITION IMAGE



Date 8-31-10 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. MW-34
Property White Mesa Project Tailings Cell Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location Tailings cell DIKE Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 115.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											VS			Compacted fill material for cell dike
5.0						mdst	rdbn-ywbn											VS			" " " " " "
7.5						mdst	rdbn											VS			" " " " " "
10.0						mdst	rd bn											VS			" " " " " "
12.5						mdst	rd bn											VS			" " " " " "
15.0						mdst	rd bn											VS			" " " " " "
17.5						mdst	pkbn											VS			" " " " " "
20.0						sndy mdst	ywgybn	f-m	p	a								VS			" " " " " "
22.5						sndy mdst	rdbn	f-m	p	a								VS			" " " " " "
25.0						sndy mdst	lt rdbn	f-m	m	a								VS			" " " " " "
27.5						sndy mdst	lt rdbn	f-m	m	a								VS			" " " " " "
30.0						sndy sh	lt pktn	f-m	p	a								VW			" " " " " "
32.5						qtz ss	tn-	m	m	a		L						VW			Mancos Shale fm.
35.0						sndy sh	ywgybn	m-cr	m	a								N			" " "
37.5						qtz ss	lt bn	m-cr	m	a		L						N			Dakota fm contact @ 35.0 ft.
40.0						qtz ss	ltgybn	f-cr	p	a								m	tr	Hy	poss. tr of hydrocarbon
42.5						qtz ss	vlttn-wh	f-vcr	p	A								VW			Very hard drilling
45.0						qtz ss	vlttn	f-m	m	a								N			" " "
47.5						qtz ss	wh	m-vcr	p	A								N			" " " sparse chert grains
50.0						qtz ss	wh	m-gr	p	A								VW			" " " chert grains
52.5						qtz ss	vlttn	f-vcr	p	A								VW			
55.0						qtz ss	tn	m	w	R								N			
57.5						qtz ss	tn	f-m	m	a								N			
60.0						qtz ss, sh	lttn-vltgn	m-vcr	p	a								N			
62.5						qtz ss, sh	lttn-ltgn	cr-gr	p	a								N			abund multi colored chert grains & frags.
65.0						qtz ss, sh	lttn-ltgn	m-gr	p	a								N			" " " " " "
67.5						sh, cgl	dkgy-ltgygn	gr	p	a								N			" " " " " "
70.0						qtz ss, sh	ywtn-gygn	f-cr	p	a			tr					N			dissem. pyrite
72.5						qtz ss	dktn	f-cr	p	a		L						N			sparse chert grains
75.0						qtz ss	tn	f-cr	p	a								S			sparse chert grains
77.5						qtz ss, sh	tn-ltgy	f-cr	p	a		L						S			
80.0						qtz ss	tn	m-cr	p	a								S			
82.5						qtz ss	tn	f-m	m	r								N			
85.0						qtz ss	tn	f	w	r								S			sparse chert grains
87.5						qtz ss	tn	f	w	r								N			
90.0						qtz ss, sh	vltgytn	f	w	r								VW			
92.5						qtz ss	vlttn	f-m	m	r								N			
95.0						qtz ss	vlttn	m	m	r								N			
97.5						qtz ss	vlttn	m	w	r								N			
100.0						qtz ss	vlttn	m	w	a								N			
102.5						qtz ss, sh	vlttn-wh	f-m	m	r								S			
105.0						qtz ss	gybn	m-vcr	p	a								S	tr	hy	
107.5						qtz ss	gybn	m-vcr										M			Moisture first noted @ 107.5
110.0						sh, qtz ss	gybn	v-vcr										M			Brushy Basin fm contact @ 107.5
112.5						sh	ltgygn -											N			
115.0						sh	gygn-ppbn											N			mottled frags.

PERCENTAGE COMPOSITION IMAGE

Date 9-1-10 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. MW-35
Property White Mesa ~~Project~~ Tailings Cell Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 1
T.D. PROBE 127.0'
T.D. DRILL 127.5
FLUID LEVEL 112.6 (9-2-10)

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						mdst	rdbn											w			surface soil
5.0						sndy mdst	rdbn	f	p	a								s			Mancos Shale fm.
7.5						sndy mdst	ltrdbn	f-m	p	a								vs			
10.0						qtz ss	ltrdbn	vf-m	p	a								vs			
12.5						mdst	rdbn											vs			
15.0						mdst-sh	rdbn-ltpktn											vs			
17.5						shale	wh											vs	tr	HY	
20.0						sndy sh.	ltpktn	f-m	p	a								vs			
22.5						sndysh	ltpktn	f-m	p	a								vs			
25.0						sndysh	ywgybn	f m	p	a		L						s			
27.5						sndysh	ywgybn	f-m	p	a		L						w			
30.0						qtzss	tn	m	m	a		L						N			Dakota Ct. @ 27.5
32.5						qtzss	lttn	m	m	a								N			
35.0						qtzss	lttn	m	m	a								N			
37.5						qtzss	v.ltbn	m-cr	p	a								N			
40.0						qtz ss	vltbn	m-cr	p	A								N			
42.5						qtz ss	bn	f-m	m	a								N			
45.0						qtz ss	tn	f	w	r								N			
47.5						qtz ss	gybn	f-m	w	r								N			
50.0						qtz ss.	vlttn	f	w	r								N			
52.5						qtzss	vlttn	f	w	r								N			
55.0						qtz ss	tn	f-m	m	a								N			
57.5						qtzss	tn	m-cr	p	a								N			abund wh-pk chert grains
60.0						qtzss	tn	f-m	m	r								N			some wh chert grains
62.5						qtzss	tn	f-m	m	r								N			
65.0						qtz ss	gytn	m	w	r								N			some wh-dkgy chert frags.
67.5						qtzss	gytn	m-vcr	p	a								N			abund wh-dkgy chert frags.
70.0						sndy sh	ltywgy	vf f	p	a		L						N			thin shale lens
72.5						qtzSS	tn	f-m	m	a								N			
75.0						qtzSS	tn	m	w	r								N			
77.5						qtz ss	tn	f-m	m	r								N			
80.0						qtzSS	tn	m	m	r								N			
82.5						qtz SS	tn	m	w	r								N			
85.0						qtz SS	tn	m	w	r								N			
87.5						qtzss, sh.	ltgygn	m	m	r								N			
90.0						sndysh	ltgygn	f	m	r								N			
92.5						sh	ltgn											N			
95.0						sh	ltgn						tr	c				N			py
97.5						sh	ltgygn						tr	c				N			py
100.0						qtzss	ltpktn	f-m	m	a			tr	c				N			py
102.5						qtz ss	ltgy	m	w	r								U			
105.0						qtz ss.	ltgy	m	w	r								w			
107.5						qtz ss	ltgy	m-cr	m	r								w			
110.0						qtz ss	ltgy	m-cr	m	r								w			
112.5						qtz ss	ltgy	f-m	m	r								vs			Moisture first noted 112.5
115.0						qtz ss	ltgybn	m-cr	m	r								N			tr hydrocarbon
117.5						qtzss, cgl	dkywgy	m-cr	p	r								N			abund dk chert frags & grains
120.0						qtzss, cgl	wh-dkgy	v cr	p	r			tr	c				N			" " " " "
122.5						qtzss cgl	wh-dkgy	v cr	p	a								N			" " " " "
125.0						cgl-sh	gy-gn	v cr	p	a			tr	c				N			Brushy Basin Contact @ 123.6'
127.5 TD.						sh	gn											N			

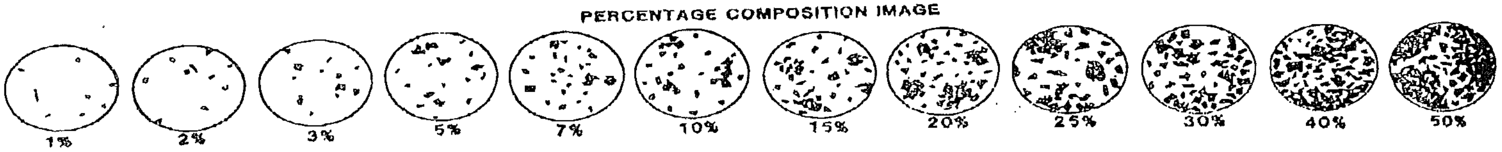
PERCENTAGE COMPOSITION IMAGE

Date 26 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. MW 36
Property White Mesa Mill Project Cell 4B Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈5615

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 120.0
FLUID LEVEL ____

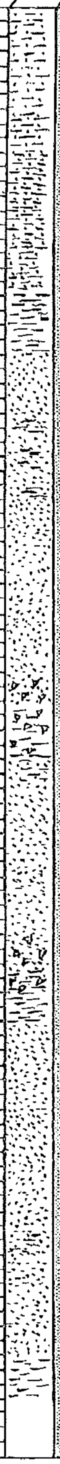
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											S			Surface soil-unconsolidated CL
5.0						mdst, sh	rdbn-ltpk											VS			Mancos Sh CL
7.5							rdbn											VS			CL
10.0							rdbn											S			
12.5							rdbn											S			
15.0							rdbn-ltpk											VS			
17.5							ltpk											VS			
20.0							ltywtn											VS			
22.5						sltst	ltpktn											S			
25.0						qtz ss	ywtn	m	w	r								N			Upper Dakota Ct @ 22.5 ft.
27.5						qtz ss	tn	m	w	r								N			
30.0						qtz ss	tn	m	w	r		L						N			
32.5						qtz ss	tn	m	w	a		L						N			
35.0						qtz ss	tn	m	w	a								N			
37.5						qtz ss	tn	m	w	a								N			
40.0						qtz ss	tn	m-c	m	a								N			
42.5						qtz ss, sh	tn-gy	m-c	m	a								N			
45.0						qtz ss	tn	m	w	r								N			
47.5						qtz ss	tn	f-m	m	r								N			
50.0						qtz ss	tn	m	w	R								N			
52.5						qtz ss	tn	m-c	m	r								N			
55.0						qtz ss	tn	m	w	r								N			
57.5						qtz ss	tn	m	w	R								N			
60.0						qtz ss	ltbn	m-c	m	r								N			some wh-gy chert grains and frags.
62.5						qtz ss	tn	m-vc	f	r								N			″
65.0						sh, sltst	gy-lttn											N			CL
67.5						sh	ltgytn											N			CH
70.0						qtz ss	vltgy	vf-f	m	r								N			
72.5						qtz ss	ltywbn	m	w	r		L						N			
75.0						qtz ss	lttn-ltywbn	m	w	r		L						S			
77.5						qtz ss	wh-lttn	m	w	r		L						W			CH
80.0						sh	ltblgy											N			
82.5						sh	pprdbn											N			
85.0						sh	pprdbn											N			mottled cuttings
87.5						sh	ltblgy, pprdbn											N			
90.0						sh	ltblgy						1%	A				VW			
92.5						qtz ss	vlttn	vf	w	r								N			
95.0						qtz ss	vltn	vf	w	r								N			
97.5						qtz ss	vltn	f-m	m	r		L						VW			
100.0						qtz ss	vlttn	f-m	m	r								N			
02.5						qtz ss	wh	m	w	r								N			
05.0						qtz ss	vlttn	m	w	R		L						N			
07.5						qtz ss	vlttn	m	w	r								N			
10.0						qtz ss	vlttn	m	w	r								N			
12.5						qtz ss	vlttn	f-m	m	a								W			moisture first noted
15.0						qtz ss	vlttn	f-m	m	r			Tr	C				S			Brushy Basin Ct. @ 115.0
17.5						sh	blgn											N			
20.0						sh	blgn											N			T.D.
22.5																					
25.0																					

PERCENTAGE COMPOSITION IMAGE



Date 25 APR 2011 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. MW-37
Property White Mesa Mill Project Cell 4B Unit No. ___ Sec. ___ Twp. ___ Rge. ___
County San Juan State Utah Location CELL 4B DIKE Elev. 5618 ≈

PAGE 1 OF 1
T.D. PROBE ___
T.D. DRILL 120.0
FLUID LEVEL ___



DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst	rdbn											VS			Compacted Tailings Cell Dike Material
5.0						mdst	rdbn											VS			"
7.5						mdst	rdbn											VS			"
10.0						mdst	rdbn											VS			"
12.5						mdst	rdbn											VS			"
15.0						mdst	rdbn											VS			"
17.5						mdst	rdbn											VS			"
20.0						mdst	rdbn											VS			"
22.5						mdst	rdbn											VS			"
25.0						mdst	rdbn											VS			"
27.5						sh	ywbn											VS			Mancos Sh
30.0						sh-mdst	rdbn-ltpk											VS			Mancos Sh.
32.5						qtzss, sh	tn	f- m	m	r								VS			upper Dakota Ct @ 30.0'
35.0						qtzss	tn	f- m	m	r								VW			
37.5						qtz ss sh	tn	f- m	m	r								N			
40.0						qtzss, sh	gybn	m	m	r								N			
42.5						qtzss, sh	wh-ltorbn-dkgy	m	m	r								N			
45.0						qtzss	wh-ltorbn	f- m	m	r		L						N			
47.5						qtz ss	vlttn	m	w	R		L						VW			
50.0						qtzss, qtzite	wh	m	w	R								N			very hard drilling
52.5						qtzss-qtzite	wh	f- m	w	r								N			extremely hard drilling
55.0						qtz ss-qtzite	wh-lttn	f- m	w	r								N			moisture first noted @ 54'
57.5						qtzss	tn	f- m	w	r								N			abund. chert grains
60.0						qtzss, cgl	lttn	m- peb	p	a								N			very abund chert grains and pebbles.
62.5						cgl-sh	ltywgygn	pe	p	a								N			some chert pebble frags.
65.0						sh-cgl	ltgn-tn	peb	p	a								N			" " " "
67.5						sltst, qtz ss	lt tn	vf- peb	p	a								N			
70.0						qtz ss	lttn	vf- peb	p	r								N			
72.5						qtz ss	lttn	f- peb	p	r								VW			
75.0						qtz ss	lttn	m- peb	p	r								S			
77.5						qtz ss	vlttn	m- peb	p	r		L						VW			abund chert frags.
80.0						qtz ss	vltbn	m	w	r		L						N			
82.5						qtz ss, cgl	wh-vdkgy	m peb	p	r		L						N			Abund. water @ 80.0' abund chert frags & pebbles.
85.0						sh, qtz ss, cg	lttn-gn	f- peb	p	r		L						N			abund chert frags and pebble.
87.5						sh, qtzss	gn-wh	f- peb	p	r								N			
90.0						qtz ss	wh	m- peb	m	r								N			
92.5						qtz ss	ltgy bn	m- peb	m	r		L						N			
95.0						qtz ss	vlttn	m	w	R		L						N			
97.5						qtz ss	vlttn	m- peb	p	r								N			
100.0						qtz ss	lttn	m- c	p	r								N			
02.5						qtz ss	lttn	f- m	m	r								W			
05.0						qtz ss	lttn	f- m	m	r								N			
07.5						qtzss, sh	lttn-gn	f- peb	p	r								N			
10.0						qtz ss	wh-tn	m	w	R			tr	c				N			
12.5						qtz ss	vlttn	m	w	R			3%	c				W			
15.0						qtz ss	wh-blgn	f- m	m	r			1%	c				W			
17.5						qtzss, sh	wh-blgn											N			Brushy Basin Ct @ 117.0' (good contact)
20.0						sh	blgn-gybn											N			120.0 T.D.
22.5																					
25.0																					

PERCENTAGE COMPOSITION IMAGE

APPENDIX A.3

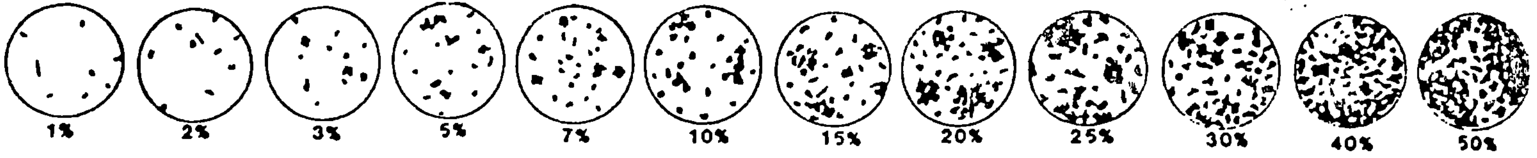
PIEZ - SERIES

Date 12-18-2001 Geologist L.Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. PIEZOMETER WELL #1
Property White Mesa Mill Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 107.5 TD.
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						Sltst, sh	rdbn											VW			Soil
5.0						sltst, sh	rd bn											S			Soil
7.5						sltst, sh	rdbn-lttn											VS			
10.0						sltst, sh	ltpktn											VS			
12.5						sltst, sh	ltpk-ltgy											VS			
15.0						sltst, qtz ss	lttn	f-m	f	sr								N			Upper Burro Cyn Fm. Contact @ 14.5 ft.
17.5						qtz ss	lt tn	vf-f	m	sr								N			
20.0						qtz ss	lttn	vf-f	m	sr								VW			
22.5						qtz ss	tn	f-m	f	sr								N			
25.0						qtz ss	tn	f-m	f	r								N			
27.5						qtz ss	tn	f-m	m	r								N			
30.0						qtz ss	tn	f-m	p	sa								W			
32.5						qtz ss	tn	f-m	p	sa								VW			
35.0						qtz ss	lttn	vf f	f	sr								N			
37.5						qtz ss	lttn	f-m	f	sr								VW			
40.0						qtz ss	lttn	f m	f	sr								N			
42.5						qtz ss	tn	f-m	f	sr								N			
45.0						qtz ss	gy	f-m	p	sr								N			
47.5						qtz ss	ltgytn	f-m	m	r								N			
50.0						qtz ss	ltbn	f-m	m	r								N			
52.5						qtz ss	lttn	m	w	r								N			
55.0						qtz ss	ltgytn	m-c	m	r								N			
57.5						qtz ss	ltgytn	f-vc	p	sr								N			
60.0						qtz ss	ltgy	vf-f	f	sr								N			
62.5						qtz ss	vltgy	f-c	f	sr								N			
65.0						qtz ss	vltgy	vf	w	sr								N			
67.5						qtz ss	vltgy	vf-m	f	sr								N			
70.0						qtz ss	vlttn	vf-m	f	sr								N			
72.5						qtz ss	vlttn	f-m	w	sr								N			
75.0						qtz ss	vlttn	f	m	sr								N			
77.5						qtz ss	vlttn	f	m	sr								N			
80.0						qtz ss	vlttn	f-m	m	r								N			
82.5						qtz ss	ltgy-multicolor	f-vc	p	r								N			abnt. chert frags.
85.0						qtz ss	ltgy-multi-color	m-vc	f	r								N			" " "
87.5						qtz ss	ltgy-multi-color	m-vc	f	r								N			" " "
90.0						qtz ss, cgl	multi-color	m-vc	f	r								N			" " " high perm zone
92.5						qtz ss, cgl	wh-multicolor	m-vc	f	r								N			" " "
95.0						qtz ss	wh	m-vc	f	r								N			abnt chert frags
97.5						qtz ss, cgl	multicolor	m-vc	p	r								N			" " "
100.0						qtz ss, cgl	multicolor	m-vc	p	r								VW			" " "
102.5						qtz ss	wh-vltgn	m-vc	p	sr								N			Burro Cyn / Brushy Basin Fm Ct @ 102.5
105.0						sh, sltst	gn											N			
107.5						sh	gn-pp											N			T.D.
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



Date 12-17-2001 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. piezometer well #2
Property White Mesa Mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 100.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS BIT DIA. 4.75"
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst, sh	rd bn											S			
5.0						sltst.	rd bn											S			
7.5						sltst, ss	ywbn-rdbn	f-m	f	sr								W			Upper Burro Cyn Contact @ 6.0 feet
10.0						sltst, ss	ywbn-rdbn	f-m	p	sr								VW			
12.5						qtz ss	tn	vf-f	f	sr								N			
15.0						qtz ss	tn	f	w	sr								N			
17.5						qtz ss	vltgy	f	w	sr								N			
20.0						qtz ss	ltgy	f-m	m	sr								N			
22.5						qtz ss	wh-ltgy	f-m	m	sr		Hem						N			Encounter water @ 21 feet, begin injection
25.0																					No sample
27.5						qtz ss	dkgy	vf-f	f	sr								N			
30.0						qtz ss	dkgy	vf-f	f	sr								N			
32.5						qtz ss, cgl	wh-multicolor	m-vc	p	sr								N			abnt. chert frag.
35.0						qtz ss, cgl	multi-color	f-vc	p	sr								N			" " "
37.5						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
40.0						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
42.5						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
45.0						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " " tr. hem after pyrite
47.5						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
50.0						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
52.5						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " " high perm zone
55.0						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
57.5						qtz ss, cgl	multi-color	m-vc	p	sr								N			" " "
60.0						qtz ss, cgl	wh-multicolor	m-vc	p	sr								N			
62.5						qtz ss	yw	f-m	f	sr								N			
65.0						qtz ss	wh	f-m	f	sr								N			
67.5						qtz ss	wh-lt bn	f-m	f	sr								N			
70.0						qtz ss	bn	vf-c	p	sr								N			
72.5						qtz ss	wh-bn	f-m	p	sr								N			
75.0						qtz ss	wh-bn	f-m	p	sr								N			
77.5						qtz ss	bn-multi.color	m-vc	p	sr								N			abnt chert frags.
80.0						qtz ss	bn	f-m	f	sr								N			
82.5						qtz ss	bn	f-m	f	sr								N			
85.0						qtz ss	wh-lttn	f-m	f	sr								N			
87.5						qtz ss	wh	m-cr	p	sr								N			
90.0						qtz ss	wh	m-cr	p	sr								N			some chert frag.
92.5						qtz ss, sh	ltbn-gygn	vf-m	p	sr								N			Burro Cyn/Brushy Basin Fm ct @ 92.0 feet
95.0						sltst, sh	gy														
97.5						sltst, sh	gy														
100.0						sltst, sh	gy														T.D
102.5																					
105.0																					
107.5																					
110.0																					Note: this well was initially drill without
112.5																					surface casing, to a depth of 80.0 feet.
115.0																					The top 6 feet of the well sloughed excessively,
117.5																					distributing this material throughout the resulting
120.0																					cuttings. Surface casing was installed resulting
122.5																					in improved cutting recovery and quality.
125.0																					

PERCENTAGE COMPOSITION IMAGE

Date 12-17-2001 Geologist L. Casebolt Drilling Co. Boyles Exploration, Inc. Hole No. piezometer well #3
Property White Mesa Mill Project ________ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ________ Elev. ______

PAGE 1 OF ____
T.D. PROBE ________
T.D. DRILL 100.00
FLUID LEVEL ________

REMARKS Bit dia. 4.75"

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst, sh	rd bn											S			Soil
5.0						sltst, sh	rd bn											S			Soil
7.5						sltsh, sh	lt pk bn											VS			
10.0						Sltst, sh	lt pk bn											VS			
12.5						sltsh, sh.	lt pk bn											VS			
15.0						Sltst, sh	lt pk bn											VS			
17.5						sltst, sh	lt tn											VS			
20.0						sltst, sh	lt yw gy											S			
22.5						qtz ss	lt tn	f-c	f	r								M			Upper Burro Cyn Fm. Ct. @ 20.0 feet
25.0						qtz ss	lt tn	m-c	m	sr								VW			
27.5						qtz ss	tn	m	w	r								VW			
30.0						qtz ss	tn	f-m	f	sr								N			
32.5						qtz ss	tn	f-m	f	sr								N			
35.0						qtz ss	tn	f	m	sr								N			
37.5						qtz ss	tn	f	m	sr								N			
40.0						qtz ss	lt tn	f	m	sr								N			
42.5						qtz ss	lt gy	f-m	f	sr								N			
45.0						qtz ss	lt tn	f-c	f	sr								N			
47.5																					No sample
50.0																					No Sample
52.5																					No Sample
55.0																					No Sample
57.5																					No Sample
60.0						qtz ss, cgl	wh-multicolor	f-m	f	r								N			abnt. chert frag.
62.5						qtz ss, cgl	multicolor	f-m	f	r								N			" " "
65.0						qtz ss, cgl	multicolor	f-vc	p	a-r								N			" " "
67.5						qtz ss, cgl	multicolor	f-vc	p	a-r								N			" " "
70.0						qtz ss, cgl	multicolor	vc	p	a								N			" " "
72.5						qtz ss, cgl	multicolor	vc	p	a								N			" " "
75.0						qtz ss, cgl	multicolor	f-vc	p	a-r								N			" " "
77.5						qtz ss.	tn-multicolor	f-vc	p	r								N			" " "
80.0						Sltst, cgl	gn-multicolor											N			Burro Cyn/Brushy Basin Ct. @ 79 feet
82.5						sltst, cgl	gn											N			
85.0						sltst	gn											N			
87.5						Sltst, cgl	gn-gy tn											N			
90.0						sltst, sh	gn											N			
92.5						sltst, ss	gn-tn											N			
95.0						sltst, cgl	gn-wh											N			
97.5						sltst, sh	gn-wh											N			
100.0						Sltst, cgl	gn-multicolor											N			T.D.
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

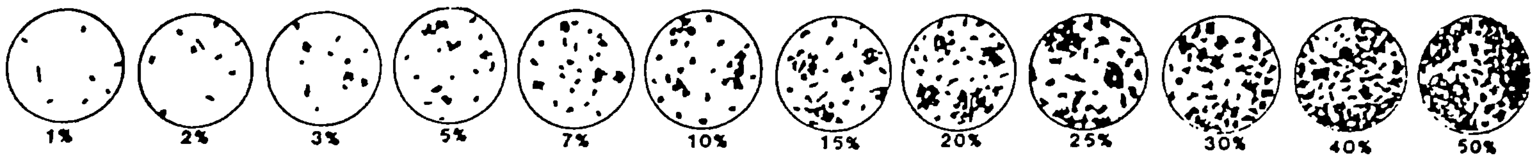
Date 12-18-2001 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. Piezometer well #4
Property White Mesa Mill Project ________ Unit No. ______ Sec. _____ Twp. _____ Rge. _____
County San Juan State Utah Location ________ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 90.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS Bit dia. 4 3/4"
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst,sh	ltrdor											S			soil
5.0						sh	ltpktn											VS			
7.5						sh	ltpktn											VS			
10.0						sh	ltywtn											VS			
12.5						qtz ss, sh	ltywtn	vf-f	f	sr								VS			
15.0						qtz ss, sh	ltywgy	vf-f	f	sr								m			Upper Burro Cyn Fm ct. @ 14 feet
17.5						qtz ss	tn	f	m	sr								N			
20.0						qtz ss	ltgytn	f	m	sr								N			
22.5						qtz ss	tn	f-m	f	sr								N			
25.0						qtz ss	tn	f	m	r								N			
27.5						qtz ss	tn	f-m	f	r								N			
30.0						qtz ss	lt tn	f-m	f	r								N			
32.5						qtz ss	lttn	f-m	f	sr								N			
35.0						qtz ss	ltgy	f-cr	p	sr								N			
37.5						qtz ss	vltgytn	vf-f	m	sr								N			
40.0						qtz ss	lttn	vf-m	f	sr								N			
42.5						qtz ss	lttn	vf-m	f	sr								N			
45.0						qtz ss	tn	f-m	f	sr								N			
47.5						qtz ss cgl	multicolor	f-vc	p	sr								N			abnt chert frag.
50.0						qtz ss cgl	multicolor	f-vc	p	sr								N			" " "
52.5						qtz ss cgl	multicolor	f-m	f	sr								N			" " "
55.0																					No Sample
57.5						qtz ss, cgl	wh-multicolor	f-cr	p	r								N			abnt. chert frag.
60.0						qtz ss, cgl	multicolor	f-vc	p	r								N			" " "
62.5						qtz ss, cgl	multicolor	vc	p	r								N			" " "
65.0						qtz ss, cgl	multicolor	f-vc	p	r								N			" " "
67.5						qtz ss, cgl	multicolor	vc	p	r								N			" " "
70.0						qtz ss, cgl	multicolor	m-vc	p	r								N			" " "
72.5						qtz ss, cgl	wh-multicolor	m-c	m	r								N			chert frag.
75.0						qtz ss, cgl	multicolor	m-c	m	r			tr					N			trace pyrite chert frag
77.5						qtz ss, cgl	multicolor	f-vc	p	r								N			chert frag.
80.0						qtz ss, cgl	multicolor	f-vc	p	r								N			" "
82.5						qtz ss, cgl	multicolor	f-vc	p	r		Hem	tr					N			trace pyrite / hem. after pyrite chert
85.0						qtz ss, cgl	multicolor	f-vc	p	r								N			chert
87.5						qtz ss cgl	wh-multicolor	f-vc	p	r								N			chert.
90.0						qtz ss, cgl, sh	multicolor-gn	f-vc	p	r								N			Burro Cyn/Brushy Basin Ct @ 89 feet. T.D.
92.5																					
95.0																					
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

high perm. zone

PERCENTAGE COMPOSITION IMAGE



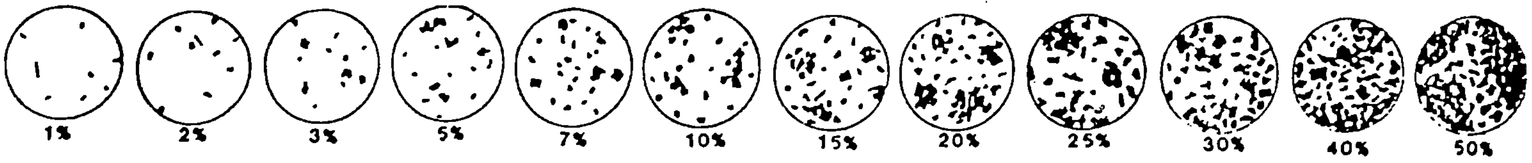
Date 12-18-2001 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. Piezometer well #5
Property White Mesa Mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 107.5
FLUID LEVEL ______

REMARKS Bit dia. 4 3/4"

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst,sh	rdbn											m			Soil
5.0						sltst,sh	ltpktn											VS			
7.5						sltst,sh	ltpktn											VS			
10.0						qtzss sltst	ltpktn	f-m	p	sa								S			
12.5						qtzss, sltst	ltywgy	vf-f	p	sa								VS			
15.0						qtzss, sltst	ltywgy	vf-f	p	sa								m			
17.5						qtzss, sltst	ltywgy	vf-f	f	sa								VW			
20.0						qtz ss, sltst	lt ywgy	vf-f	f	sa								VW			
22.5						qtzss	ltgytn	f	w	sr								N			Upper Burro Cyn Fm. Ct. @ 20 feet
25.0						qtzss	ltgytn	vf-f	m	sr								N			
27.5						qtzss	ltgytn	f-m	m	sr								N			
30.0						qtzss	ltgytn	f-m	m	sr								N			
32.5						qtzss	ltgytn	f-m	f	sr								N			
35.0						qtzss	lttn	f-m	m	sr								N			
37.5						qtzss	ltgytn	vf-f	m	sa								N			
40.0						qtzss,cgl	gy-ltorbn	f-cr	f	sr		lim						N			chert frag.
42.5						qtzss,cgl.	ltpkgy	f-vc	p	sr		lim						N			" "
45.0						qtzss	ltpkgy	f-c	f	sr								N			
47.5						qtzss	ltpkgy	f-c	f	sr								N			
50.0						qtzss	ltpkgy	f-m	m	sr		lim						N			
52.5						qtzss,cgl	ltpkgy	f-m	f	sr								N			Multi colored chert frag
55.0						qtzss,cgl		m-vc	f	sr								N			" " " "
57.5						qtzss,cgl		m-vc	p	sr			1%					N			notable pyrite, chert frag.
60.0						qtzss,cgl	multicolor	m-vc	p	sr		lim	tr					N			trace pyrite " "
62.5						qtzss,cgl	multicolor	m-c	f	sr								N			" "
65.0						qtzss,cgl	multicolor	m-vc	f	r								N			" "
67.5						qtzss,cgl	wh-multicolor	m-c	f	r								N			" "
70.0						sltsh,sh	vltgy											N			" "
72.5						qtzss	ltgytn	m-c	m	r								N			" "
75.0						qtzss cgl.	multicolor	m-c	m	r								N			" "
77.5						qtzss,cgl	multicolor	c	m	r								N			" "
80.0						qtz ss,cgl	multicolor	c	m	r								N			" "
82.5						qtzss,cgl	multicolor	c	m	r								N			" "
85.0						qtzss	wh-lttn	m-vc	f	r								N			" "
87.5						qtzss	wh-lttn	m-vc	f	r								N			" "
90.0						qtzss	wh-lttn	m-c	f	r								N			" "
92.5						qtzss	wh-lttn	m-c	f	r								N			" "
95.0						qtzss	wh-lttn	m-vc	f	r								N			" "
97.5						qtzss,cgl	multicolor	m-c	p	sr								N			abnt. chert frag.
00.0						qtzss,cgl	multicolor	m-vc	p	r								N			" " "
02.5						qtzss	wh	f-m	f	r								N			" "
05.0						qtzss	wh-multicolor	f-c	f	r								N			abnt. chert frag.
07.5						qtzss,sh	wh-gn	f-m	f	r								N			Burro Cyn/Brushy Basin Ct B 106 feet, T.D 107.5'
10.0																					
12.5																					
15.0																					
17.5																					
20.0																					
22.5																					
25.0																					

PERCENTAGE COMPOSITION IMAGE



APPENDIX A.4

TW4 - SERIES

DEC 13 '99

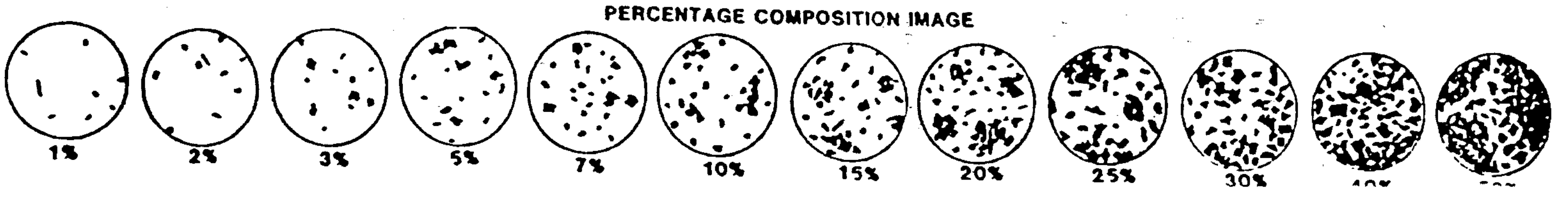
DEC 13 1999

Date 11-5-99 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC Hole No. #1
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County SAN JUAN State UTAH Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						Sh, Sltst	dk rd bn 10 R 3/4											W			
5.0						Sh, Sltst	rd bn - prd bn											VS			
7.5						Sh, Sltst	rd bn - prd bn											VS			
10.0						Sh, Sltst.	lt yw gy											VS			Noteable color change
12.5						Sh	yw gy											VS			
15.0						Sh,	dk yw bn 10 YR 4/2											S			
17.5						Sh, Sltst	dk yw bn 10 YR 4/2					HL						N			
20.0						Sh, Sltst	yw gy bn					H						N			Noteable selenite (gypsum) crystals
22.5						Sh	dk yw gy											N			Noteable selenite (gypsum) crystals
25.0						Sh	dk yw gy											N			
27.5						qtz Ss	yw bn	M-F	F	SR		H						N			
30.0						qtz Ss	tn	M-F	F	SR		H						N			TOP of Burro Cyn Fm.
32.5						qtz Ss	tn	M-F	F	SR		H						N			Sparse dark rock fragments
35.0						qtz Ss	lt tn	M	G	R		H						N			
37.5						qtz Ss	lt tn	M-F	F	SR								N			
40.0						qtz Ss	lt tn	C-F	P	SR								N			
42.5						qtz Ss	lt tn	M-F	F	SR		H						N			sparse hematite
45.0						qtz Ss	lt tn	M-F	G	R								N			
47.5						qtz Ss	lt tn	M	G	R								N			
50.0						qtz Ss	lt tn	M	G	R								N			
52.5						qtz Ss	lt tn	M	G	R								N			
55.0						qtz Ss	lt yw tn	C-M	G	WR								N			Begin Coring @ 55.0'
600						qtz Ss, sh	lt tn - lt gy	C-M	G	WR								N			
65.0						qtz Ss	lt gy tn	C-M	G	WR								N			
70.0						qtz Ss, Congl.	lt gy tn	M-F	F	SR								N			1% Dark brown-tn chert & rock fragments
75.0						qtz Ss, Congl	tn - lt bn	C-M	P	SR								N			3% Dark brown-tn chert & rock fragment
80.0						Congl	tn, dk gy - blk	VC	P	SR								N			large (≥ 1/4") chert rock fragments & pebbles
85.0						Congl, qtz Ss	dk rd bn - lt tn	C	P	SR								N			Congl. 60% SS 40%
90.0						qtz Ss, Congl	lt tn - lt pk	C	P	SR								N			Ss 60% Congl. 40%
95.0						qtz Ss, Congl	lt tn - lt pk	C	F	SR								N			Ss 75% Congl. 25%
100.0						qtz Ss	lt yw bn	M-F	F	R								W			
105.0						qtz Ss, sh.	lt gy tn - lt gy bl	M	F	R								N			5% gray blue shale fragments, Base Burro Cyn
110.0						qtz Ss, sh	tn - lt gy bl	M-F	P	SR								N			10% gray blue shale fragments
T.D.																					

PERCENTAGE COMPOSITION IMAGE

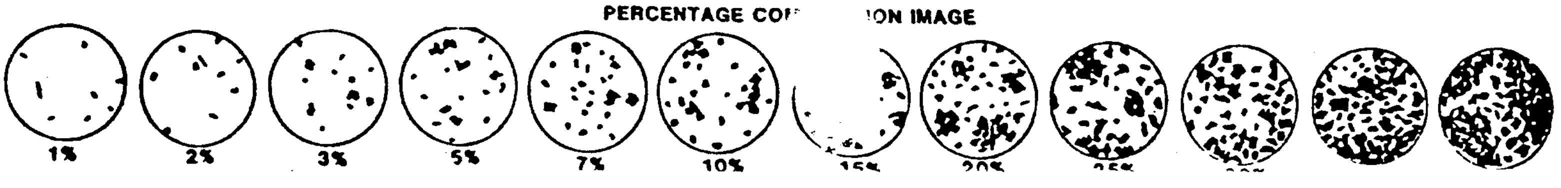


Date 11-02-99 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc Hole No. #2
Property White Mesa Mill Project MW-4 Phase 2 Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE ____ OF ____
T.D. PROBE ____
T.D. DRILL 120.5
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sh	rdbn-bn											N			Soil
5.0						Sh	rdbn-											S			Soil
7.5						Sh	rdbn-ltrdbr											VS			
10.0						Silty sh	rdbn-ywtn											VS			Noteable color change silty shale
12.5						Sh	ywgy											VS			Clean shale
15.0						Sh	ywgy											VS			
17.5						Sh, sltst	ywgy					H						S			sparse hematite, sparse clear-white qtz grains
20.0						Sh.	ywgy					H						S			Clean shale
22.5						Sh, sltst	ywgy											S			Silty
25.0						Sh, sltst	ywgy											VS			Silty, noteable selenite crystals
27.5						Sh, sltst	ywgy					H						m			Shale, siltstone w/ coarse selenite crystals
30.0						Sh, sltst	ywgy											VS			Silty.
32.5						Sh	yw											S			
35.0						Sh	ywgy											S			
37.5						qtzss, sltst	ywbn	C	P	R		H						S			Top of Dakota/Burro Cyn Fm.
40.0						qtz ss, sltst	lt tn	C-M	P	R		H						W			
42.5						Sh-qtz ss	gy-yw bn	C	W	R		H	SP					VW			Sandstone-shale w/ v sparse pyrite
45.0						qtz Ss	vlt tn	M	W	R								N			
47.5						qtz ss	lt ywtn											N			Sparse Hematite F-VF
50.0						qtz ss	lt ywtn	F-VF		SR		H						N			Sparse Hematite F-VF
52.5						qtz ss	lt tn	M-F										N			
57.5						qtz ss	lt tn	M-F										N			Begin Core at 52.5'
62.5						qtz ss	lt tn, gy	M-F										N			Color change to gray @
67.5						qtz ss	lt gy tn	C-F										W			
72.5						qtz ss	lt tn	M-F	G	R								N			
77.5						qtz ss	tn	M	VG	WR								N			1% Dark brown-tan chert fragments possible conglom
82.5						congl, ss	tn	VC-M	P	WR								N			5% Dark brown-tan chert fragments first water show
87.5						Congl, ss	tn	VC-M	P	WR								N			3% Dark brown-tan chert fragments - first wet sump
92.5						Congl, Ss	tn	VC-M	P	R			SP					N			15% Multi colored chert & rock fragments
97.5						Congl, Ss, Sh	rdbn-gygn-tn.	C-M	P	R								N			
102.5						Ss, Sh	lt tn-gygn	C-M	P	R								N			3% Broken Rock Fragments
107.5						Ss, Sh	lt tn-gygn	C-M	P	R								N			Brushy Basin Ct. @ 105'
112.5						Ss, sltst.	lt tn-gygn	F-VF	P	SR								N			
117.5						Sltst, sh	lt gygn											N			
120.5						Sltst, sh	lt gygn											N			
T.D.																					

PERCENTAGE CO ION IMAGE

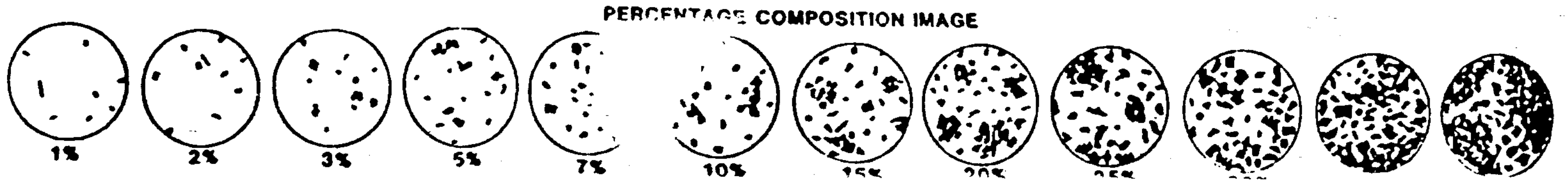


Date 11-16-99 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC. Hole No. #3
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County SAN JUAN State UTAH Location ______ Elev. ______

PAGE 1 OF ______
T.D. PROBE ______
T.D. DRILL ______
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						Sh, qtz Ss	ltrdbn											S			Soil, frosted qtz grains, vegetation
5.0						Sltst, sh	ltrdbn-ppk											S			
7.5						sh	lttn - rdbn											VS			noteable color change
10.0						sh	lttn											VS			
12.5						sh	lt ywbn											VS			
15.0						Sh	ywbn											VS			
17.5						Sh	dkgybn											VS			silty, sparse manganese dendrites on surfaces
20.0						sh	dkgy bn											VS			
22.5						Sh	dkgybn											VS			
25.0						Sh	dkgybn											VS			1% gypsum (selenite) crystals
27.5						Sh	dkgy bn											VS			2% " " "
30.0						sh Sltst	dkgybn											VS			1% " " "
32.5						Sh, sltst, Ss	dkgy-dkrdbn	VF	P	SA								VS			
35.0						Sltst	dkgybn											W			
37.5						Sltst	dkgybn					H						N			
40.0						qtz Ss	ltgytn	m	F	SR		H						N			Top of Burro Cyn Fm.
42.5						qtz Ss	lt tn	m	G	SR		L						N			
45.0						qtz Ss.	lttn	M	G	SR								N			
47.5						qtz Ss.	lt tn	m	G	SA		H						N			
50.0						qtz Ss	bn	m-CR	F	SA		H						W			Abundant hematite
52.5						qtz Ss	tnbn	m-CR	P	SA		H						N			" "
55.0						qtz Ss	tn	m-CR	P	SA		H						N			" "
57.5						qtz Ss	tn	F-m	F	SA								N			
60.0						qtz Ss.	lt lngy	M	G	SR								N			Dark gray rock fragments 2%
62.5						qtz Ss.	lttn	F-m	F	SR								N			
65.0						qtz Ss	lt tn	m	G	SR								N			
67.5						qtz Ss	lttn	F-m	G	SR								N			
70.0						qtz Ss	lt tn	F-m	F	SA								N			
72.5						qtz Ss,	lt bn	F-m	F	SR								N	SP	P	Sparse carbon from plant fragments
75.0						qtz Ss.	lt bn	F-m	P	SA								N			
77.5						qtz Ss, Cgl	lt bn	F-CR	P	A								W			Broken rock fragment
80.0						qtz Ss, Cgl	lt blgy	F-CR	P	A								VS			
82.5						Sh,	lt blgy											S			contains qtz grains & rock frag. from 77.5 feet.
85.0						qtz Ss.	lttn	M	G	R								N			
87.5						qtz Ss	lttn	m	G	R								N			
90.0						qtz Ss	lt tn	F m	F	SR								N			
92.5						qtz Ss.	lt tn	m	G	R								N			
95.0						qtz Ss	lt tn	m-CR	F	SR								N			
97.5						qtz Ss, Sh	lttn - lt blgy	F	F	SA								W			Lower contact Burro Cyn Fm.
100.0						Sh, qtz Ss	lt blgy	F CR	P	SA								W			Brushy Basin Mbr. Morrison Fm.
102.5						Sltst, Sh	lt blgy											m			
105.0						Sltst, Sh	lt blgy-wh											N			
107.5						Sh.	lt blgy-wh											N			
110.0						Sh, qtz Ss	lt blgy-wh	F m	P	SA			SP					N			Noteable pyrite (<1%)
112.0						Sltst, qtz Ss	lt blgy-wh	F m	P	SA			SP					N			Sparse pyrite
115.0						Sltst, qtz Ss	blgy	F	P	SA			SP					N			sparse pyrite
117.5						Sh, Sltst	blgy											N			
120.0						Sltst	blgy						SP					N			Sparse pyrite
122.5						Sltst, qtz Ss	blgy	F m	P	SR			SP					N			Sparse pyrite, chert fragment
125						Sltst, qtz Ss	blgy-gy	VF-m	P	SR								N			Some chert fragment

PERCENTAGE COMPOSITION IMAGE



Date 11-17-99 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC. Hole No. #3

Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ____ Sec. ____ Twp. ____ Rge. ____

County SAN JUAN State UTAH Location ____ Elev. ____

PAGE ____ OF ____

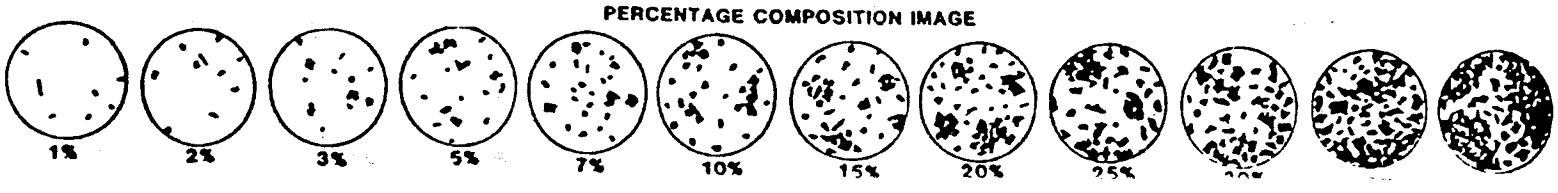
T.D. PROBE ____

T.D. DRILL ____

FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
125.0																					
127.5						qtz Ss, Cgl.	Wh- ltblgy	m-CR	P	SA			SP					VW			Sparse pyrite, Some blgy sltst. Multicolored chert
130.0						qtz Ss, Cgl	Wh	m-CR	P	SA								M			Multicolored chert & qtzite fragments
132.5						qtz Ss, Cgl	Wh	m-CR	P	SA								VW			" " " " "
135.0						qtz Ss, Sh	Wh-dkppbn-blgn	m-CR	P	SR								N			Ss 50%, Sh 50%
137.5						Sh	dkppbn											N			
140.0						Sh	dkppbn											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE



Date 5-11-2000 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC Hole No. TW4-4

Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ______ Sec. ______ Twp. ______ Rge. ______

County SAN JUAN State UTAH Location ______ Elev. ______

PAGE 1 OF 1

T.D. PROBE ______

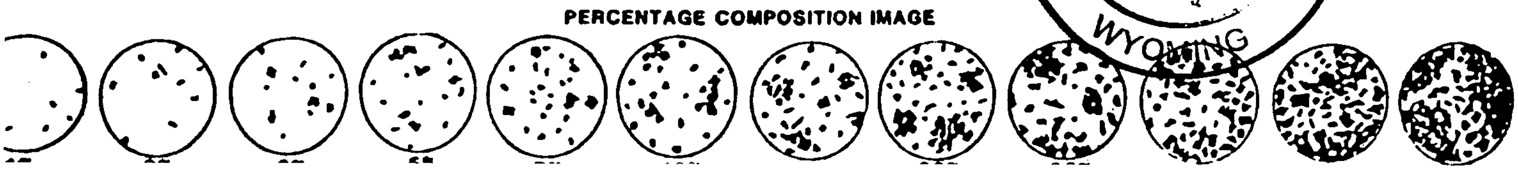
T.D. DRILL 112.0

FLUID LEVEL DRY WELL

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
						Sltst, Caliche	dk rd bn-wh											VS			Soil/caliche w/ wood & plant frag.
						Sltst, Qtz Ss.	rd bn	F	F	SA								VS			
						Qtz Ss	lt bn	F	F	SA								VS			
						Qtz Ss	lt bn	F	F	SA								S			
						Sh,	lt yw bn	m-F	P	SA								S			
						Sh,	lt yw bn	m-F	P	SA								S			
						Sh,	lt yw bn	M-F	P	SA								S			
						Qtz Ss,	lt tn	M-F	P	SA								N			Upper Burro Cyn Contact @ 17.5' noteable color change
						Qtz Ss	v lt tn	M-F	F	SA								N			
						Qtz Ss	lt tn	F	F	SA								N			
						Qtz Ss,	lt tn	m-F	P	SA								VW			
						Qtz Ss	lt tn	M-F	P	SA								S			
						Qtz Ss	lt tn	M	F	SA								S			
						Qtz Ss	v lt tn	m	G	SR								N			
						Qtz Ss	v lt tn	m	G	SR								N			noteable absence of hematite in this zone.
						QtzSs	v lt tn	m	G	SR								N			
						Qtz Ss	lt tn	m	G	SR								N			
						Qtz Ss	lt tn	m	G	SR								N			
						Qtz Ss	lt tn	F	G	SR								N			
						Qtz Ss	lt tn	F	G	SR								N			
						Qtz Ss	lt or tn	m-F	G	SR								N			
						Qtz Ss	lt gy tn	m	G	R								N			Multicolored chert & rock frag.
						Qtz Ss	lt gy tn	m	G	SR								N			
						Qtz Ss	lt gy tn	m	G	SR								N			
						Qtz Ss	lt gy tn	m	F	SR								N	SP	P	Sparse carbon frag.
						Qtz Ss	lt gy tn	m	F	SA								N	SP	P	Sparse carbon and wh chert fragments
						Qtz.Ss	lt tn	M	F	SA								N			wh-bk chert fragments
						Qtz Ss	lt tn	m	F	SA								N			
						Qtz SS	tn	m	F	SA								N			
						Qtz SS	tn	m	F	SA								N			dkgy-bk chert frag.
						Qtz SS, Cgl	lt or tn	m	F	A		SP						S			Abund. dkgy-wh chert frag. poss congl. sp hematite
						Sh	lt blgy											N			
						Qtz SS	v lt tn	F	G	SR								S			
						Qtz Ss	v lt tn	F	G	SR								N			
						Qtz Ss	v lt tn	F	G	SR								W			
						Qtz Ss	v lt tn.	F	G	SR								W			Basal Burro Cyn Fm. contact at 90.0 feet.
						Sh, Qtz Ss	blgy	m-F	P	SA								N			dk rdbn qtzite rock fragments/poss cgl.
						Sh,	blgy											N			sp dk rdbn qtzite rock fragments.
						QtzSs, Sh	v lt blgy	m-F	P	SA								N			
						Sh,	blgy											N			very sparse chert fragments
						Sh	blgy											VW			
						Sh	blgy											VW			
						Sh, Qtz SS.	lt gy	F	F	SA								N			
						Sh, Qtz SS	lt gy	F	F	SA								N			
						Sh	lt gy-dk pp bn											N			
T.D.																					

LAWRENCE CASEBOLT
PG-3218

PERCENTAGE COMPOSITION IMAGE



Date 12-15-99 Geologist L. CASEBOLT Drilling Co. BOYLES EXPLORATION, INC Hole No. 99-09-002-M-05
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. Sec. Twp. Rge.
County SAN JUAN State UTAH Location Elev.

PAGE ___ OF ___
T.D. PROBE
T.D. DRILL
FLUID LEVEL

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0						Sltst	dkrdbn											VS			Soil (plant fragments)
2.5						Sltst	rdbn-ltpk											VS			ltpk fragments caliche
5.0						Sltst	ltpkbn											VS			
7.5						Sltst	ltrdbn											VS			
10.0						Sh	wh-vltpk											VS			
12.5						Sh, Sltst	wh-vltpk											VS			
15.0						Sh, Sltst	wh-lttn											VS			
17.5						Sh	ltywbn											VS			selenite crystals, manganese dendrites
20.0						Sh	ywbn											VS			
22.5						Sh	ywgybn											VS			selenite crystals
25.0						Sh	ywbn											VS			abundant selenite crystals, manganese dendrites
27.5						Sh	ywbn											S			" " " " "
30.0						Sh	ywgybn					H						S			" " "
32.5						Sh Sltst	ywgybn											m			
35.0																					Helper missed this sample - No data
37.5						qtz Ss	ltywbn	F-m	G	SR								VM			First show of Burro Cyn. Fm. Sandstone @ 38.0 feet
40.0						qtz Ss	lttn	F-m	F	SR								N			
42.5						qtz Ss	lttn	M	G	SR								N			
45.0						qtz Ss	lttn	m	G	SR								N			
47.5						qtz Ss	tn	F-m	F	SA								N			
50.0						qtz Ss	tn	F-m	F	SR								N			
52.5						qtz Ss	tn	F-m	F	SR								N			
55.0						qtz Ss	ltgytn	F	F	SA								N			
57.5						qtz Ss	ltgytn	VF F	F	SA								N			
60.0						qtz Ss	vlttn	VF	G	SR								N			
62.5						qtz Ss, Sltst	vlttn	VF	G	SA								N	T	P	
65.0						qtz Ss, Sltst	vlttn	VF	G	SA								N	T	P	trace carbon plant fragments
67.5						qtz Ss, Sltst	vltgytn	VF	G	SA								N	A	P	abundant " " "
70.0						qtz Ss.	gytn	VF F	G	SA								N	A	P	" " " "
72.5						qtz Ss	gytn	F	G	SA								N	A	P	" " " "
75.0						qtz Ss	tn	m CR	F	SR								N			trace carbon plant fragments, chert frag.
77.5						qtz Ss	lttn	F-m	F	SR								N			
80.0						qtz Ss	lttn	F-m	F	SR								N			
82.5						qtz Ss, Sh	wh-vltblgy	VF-F	F	SR								N			
85.0						Sh	ltblgy						T					N			
87.5						Sh	ltblgy-rdbn						T					N			
90.0						qtz Ss	lttn	F	F	SR								N			
92.5						qtz Ss	lttn	F-M	G	SR								N			
95.0						qtz Ss	tn	M	G	R								N			
97.5						qtz Ss Cgl	tn	CR	G	R								N			abundant dkgy chert fragments and pebbles
100.0						qtz Ss Cgl	tn-gy	CR	G	R								N			" " " " " "
102.5						Sh	blgy-rdbn											N			Upper Ct. Brushy Basin Fm. @ 102.5 feet
105.0						qtz Ss	lttn	VF-F	P	SR								N			
107.5						qtz Ss	lttn	M	F	SR			T					N			
110.0																					cuttings washed away - no sample
112.5						qtz Ss, Cgl	tngy	F-M	P	SR								N			dkgybn chert fragments and pebbles
115.0						qtz Ss Sltst	ltorbn	VF-F	F	SR								N			
117.5						qtz Ss, Sltst	ltorbn	VF-F	F	SR								N			
120.0																		N			

ACE COMPOSITION IMAGE

Date 5-11-2000 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC. Hole No. TW4-6
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County SAN JUAN State UTAH Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 97.5 FEET
FLUID LEVEL DRY WELL

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sh, Sltst, Ss	dk rd bn	C-M	VP									S			Soil, very sparse clear qtz grains, plant frag
5.0						Sh, Sltst	dk rd bn-lt rd t.											VS			
7.5						Sltst	lt p. tn											VS			
10.0						Sh, qtz Ss	lt ywgy	C-M	P	R		SP						VS			Noteable color change
12.5						Sh, Sltst	lt ywg											VS			
15.0						Sh, qtz Ss	lt ywgy	C-M	F	SR		SP						VS			Hematite as grains, and clusters, qtz grains
17.5						Sh, qtz Ss	lt ywgy	C-M	F	SR		SP						S			" Some sparse gypsum (selenite xls.)
20.0						Sh, Sltst	lt ywgy											W			
22.5						Sh, Sltst	lt ywgy											W			Upper Burro Cyn Fm. contact at 22.5 ft.
25.0						Qtz Ss	lt gy tn		G	SR		SP						VW			Qtz grains clear, sparse hematite as grains, ch
27.5						Qtz Ss	lt gy tn	F	P	SA		SP						N			Sparse dk gy chert frag, some gy shale.
30.0						Qtz Ss	lt tn			SR		SP						N			
32.5						Qtz Ss.	lt gy tn	C-M		SA		A						N			Abund. hematite, abund. wh-dkgy chert frag.
35.0						Qtz Ss.	tn	C-M		SA		S						N			Some hematite abund. wh-dkgy chert frag
37.5						Qtz Ss.	tn	C-M				S						VW			" "
40.0						Sh, Qtz Ss	gy	C-M		A		SP						VW			
42.5						Qtz Ss	tn	m	G	R		SP						N			Nice clean sand.
45.0						Qtz Ss	tn	m				SP						N			
47.5						Qtz Ss, Sh	lt gy tn	F-M	F			SP						N			Sparse shale frag.
50.0						Qtz Ss	lt tn	F	G	A		SP						N			
52.5						Qtz, Ss	lt tn	F	G									N	SP	P	Sparse carbon (plant fragments)
55.0						Qtz Ss, Sh	lt gy	F	F									N	S	P	Some carbon (plant fragments) wh chert frag
57.5						Qtz Ss	gy	F	F	S								N	VA	P	Abundant carbon, some wh chert frag.
60.0						Qtz Ss	gy	M-F	P	SA								N	A	P	
62.5						Qtz Ss	gy tn	M-F	F	SA								N	SP		
65.0						Qtz Ss	gy tn	m F	F	SA								N	SP		wh-bk chert fragments
67.5						Qtz Ss	lt tn	M-F	F	SA	SP							N			wh-bk chert fragments
70.0						Qtz Ss	tn	M F	G	SA								N			wh-bk chert frag.
72.5						Qtz Ss, Cgl	tn	C-F	P	SA								S			Coarse, multicolored chert & rock fragments poss.co
75.0						Qtz Ss	v lt tn	F	F	SA								N			very clean sand
77.5						Qtz Ss	v lt tn	F	F	SA								N			" " "
80.0						Qtz Ss	v lt tn	F	F	SA								N			" " "
82.5						Qtz Ss	v lt tn	F	F	SA		S						W			Some granular pyrite frag.
85.0						Qtz Ss	v lt gy tn	F	F	SA		SP						N			" " " "
87.5						Sh, qtz Ss	gy	M	P	SA		SP						N	SP		
90.0						Qtz Ss, Sh	gy	C-M	P	SA		SP						N	SP		Carbon & pyrite frag. with multi colored chert fr
92.5						Qtz Ss	lt or tn	M	G	SR								N			nice clean sand
95.0						Qtz Ss	lt or tn	M	G	SR								VW			Basal Burro Cyn. Fm contact @ 95.0 feet,
97.5						Sh, Cgl	blgy-tn	C	VP	SA		S						N			upper Brushy Basin contact, pyrite grains w/
T.D.																					gy chert fragments. noteable color change

PROFESSIONAL GEOLOGIST
LAWRENCE CASEBOLT
PG-3246
WYOMING

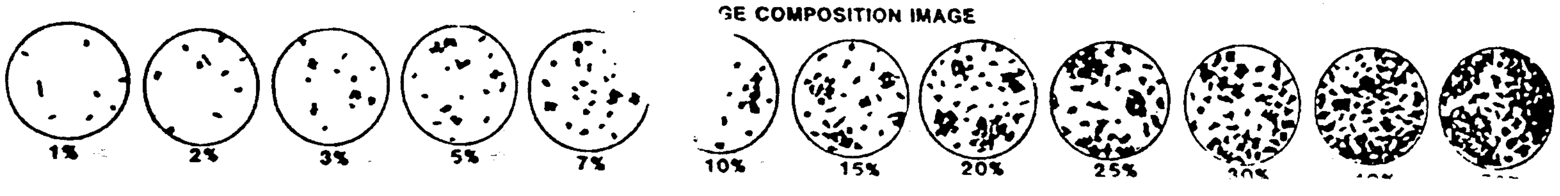
PERCENTAGE COMPOSITION IMAGE

Date 11-17-99 Geologist L Casebolt Drilling Co. BAYLES EXPLORATION, INC Hole No. #7
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County SAN JUAN State UTAH Location ____ Elev. ____

PAGE 1 OF ____
T.D. PROBE ____
T.D. DRILL ____
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst, Sh	dkrdbn											N			Soil
5.0						sltst, Sh	dkrdbn-ltpktn											VS			noteable color change
7.5						sltsh, Sh	ltpktn											VS			
10.0						Sh	ywgy											VS			notecble color change, some manganese dend
12.5						Sh	ywgy											W			
15.0						Sh	ywgy					L						VS			sparse limonite
17.5						Sh	ywgy											S			gypsum (selenite) crystals
20.0						qtz Ss, Sltst	ywgy	VF	P	SA		L						S			20% gypsum (selenite) crystals
22.5						Sltst, sh	ywgy					L						N			2.0% gypsum (selenite) crystals
25.0						sltst, sh	ywgy					H						N			10% gypsum (selenite) crystals
27.5						Sltst, Sh	ywgy											N			
30.0						qtz Ss	lt tn	F-M	F	SA								N			Top of Burro Cyn. Fm.
32.5						qtz Ss	lt tn	F-m	F	SA								N			
35.0						qtz Ss	lt tn	m	G	SR		L						N			Sparse limonite
37.5						qtz Ss	lt tn	m	G	SR		L						N			Sparse limonite
40.0						qtz Ss	lt tn	F-m	F	SA								N			
42.5						qtz SS	tn	F-m	F	SA								N			
45.0						qtz SS	ltgytn	F	F	SA								N			
47.5						qtz Ss	lt tn	F	F	SR								N			
50.0						qtz ss	lt tn	F-M	F	SR								N			
52.5						qtz Ss	vlt tn	F	G	SR								N			
55.0						qtz ss	vlt tn	VF-F	G	SA								N			
57.5						qtz Ss	lt tn	VF-F	F	SA								N			
60.0						qtz Ss, Sh	tnbn-gy	F-m	F	SA								N			
62.5						qtz Ss, Sh	dkgybn											N			
65.0																					Lost circulation at this depth - no cuttings
67.5						no cuttings										-					" " " " " " "
70.0																					" " " " " " "
72.5																					" " " " " " "
75.0						qtz Ss	lt bn	m	G	SA								N			Began H2O injection w/ foam
77.5						qtz Ss, Cgl	lt gwtn	m-CR	P	SA		H						N	S	P	Sparse carbon as plant frag. chert fragments
80.0						qtz ss, Cgl	lt gy-wh	m-CR	P	SA		H						N			Chert & qtzite rock fragments sparse hemati
82.5						qtz Ss, Cgl	lt tn	m-CR	P	A		H						N			" " " " " "
85.0						qtz ss, Cgl	tn-rdbn	m-CR	P	A		H						N			abundant rd & bk chert fragments
87.5						qtz Ss, Cgl.	tn-multicolor	CR	P	A		H						N			Very large & abundant chert fragments
90.0						qtz Ss, Sh	lt tn-lt blgy	F-m	F	SA								N			lt bl shale fragments 5%
92.5						qtz Ss, Sh	lt tn bn-lt blgy	F-m	F	SA			SP	mtx				N			Sparse pyrite as cement/matrix around qtz grain
95.0						qtz Ss	lt tn-lt orbn	F m	F	SA		H	SP	mtx				N			" " " " " " " "
97.5						qtz ss	vlt tn	F m	F	SA								N			Base of Burro Cyn Fm.
100.0						Sltst,	wh											N			
102.5						Sh, Sltst	lt blgy											N			
105.0						Sh, Sltst	dkrdbn-blgy											N			Shale frag, mottled, reduced from rdbn-blgy
107.5						Sh, Sltst	dkppbn-blgy											N			
110.0						Sltst, Cgl	lt blgy											N			Dark gray chert frag. & pebbles
112.5						qtz ss, Cgl, Sh	lt blgy	m-CR	P	A								N			coarse, clear qtz grains, large rock fragments & pebbl
115.0						Sh, Sltst	vl blgy											N			
117.5						Sh	lt blgy											N			
120.0						Sh	lt blgy											N			

GE COMPOSITION IMAGE

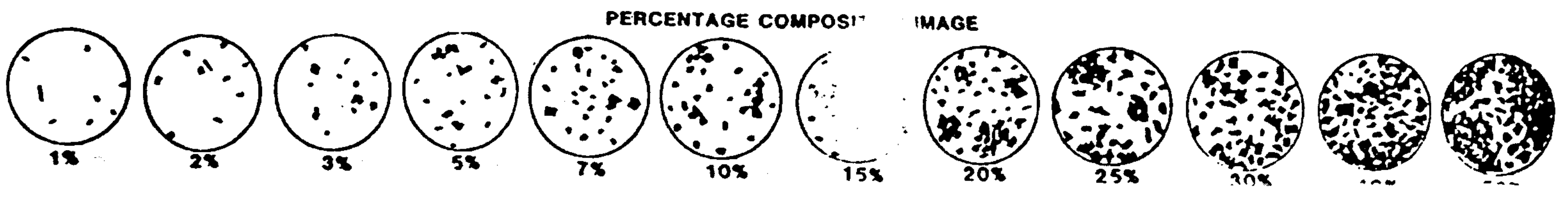


Date 11-17-99 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION INC. Hole No. #8
Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County SAN JUAN State UTAH Location ______ Elev. ______

PAGE 1 OF ______
T.D. PROBE ______
T.D. DRILL ______
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst-Sh	rdbn											S			Soil
5.0						sltst-Sh	rdbn-ltpktn											S			
7.5						Sltst-Sh	rdbn-ltpktn											VS			
10.0						Sltst-Sh	lt tn-rdbn											VS			noteable color change
12.5						Sh	dkywbn											S			
15.0						Sh	dkywbn											VS			manganese dendrites on surfaces
17.5						Sh	dkywbn					L						VS			trace selenite (gypsum) fragments
20.0						Sh	dkywbn					L						S			3% selenite fragments
22.5						Sltst-Sh	dkywbn					L						S			
25.0						Sltst-Sh	dkywbn					L						N			
27.5						sltst-Sh	ywbn					L/H						N			
30.0						qtz Ss	ltgytn	m-F	P	SR								N			Top of Burro Cyn Fm. @ 27.5'
32.5						qtz Ss	ltortn	F	G	R								N			
35.0						qtz Ss	lt tn	F-VF	P	SR		H						N			
37.5						qtzSs, Congl	dktn	vc F	P	A		H						S			
40.0						qtzSs, Congl	dktn	vc F	P	A		H						VS			Sparse shale fragments
42.5						qtzSs, Sltst	dkgytn	F-VF	P	SR		L						N			
45.0						qtzSs, Sltst	dktn	F-VF	P	SR		L						N			
47.5						qtz Ss	lt tn	VF	G	SR								N			
50.0						qtz Ss	lt tn	F	G	R								N			
52.5						qtz Ss	tn	VF	F	SR								N			
55.0						qtz Ss	lt tnbn	VF	F	SR		L						N			
57.5						qtz Ss	gybn	VF	F	SR								N	T		
60.0						qtz Ss	gybn	VF	F	SR								N	1%		
62.5						qtz Ss	gy bn	F-VF	P	SR								N	T		
65.0						qtz Ss	dk tn	VF	F	SR								N	T		
67.5						qtz Ss	gytn	F-VF	F	SR						-		N			
70.0						qtz Ss	gytn	m-VF	F	SR								N			
72.5						qtz Ss	gytn	F VF	F	SR								N			
75.0						qtz Ss	tn	F	W	SR								N			
77.5						qtz Ss	tn	F	W	SR								N			Trace dk chert fragments
80.0						qtz Ss	tn	m-F	P	SR		H						S			3% lt blgn shale fragments
82.5						Sltst	lt blgn											N			
85.0						qtz Ss	lt tn	F	G	SR								N			
87.5						qtz Ss	ltgy	F	G	SR								N			
90.0						qtz Ss	ltgy	VF	F	SR								N			
92.5						Slt st	lt blgy											N			
95.0						qtzSs Sltst	lt blgn	m-F	F	SR								N			
97.5						qtz Ss	ltgy-lt blgn	m	W	R								N			15% blgn shale frag. &
100.0						qtz Ss, Congl	gy	vc-c	P	SR								N			50% multi colored rocks & chert fragments
102.5						qtzSs,	ltgy	vc-m	F	SR								N			1% dkgy-wh rock fragments, Burrow Cyn/Brushy Basin
105.0						Sltst, Congl	gygn											N			Sparse lt tn-rd chert fragments
107.5						Sltst, Congl	gygn											N			sparse, colored chert fragments, pebble fragments
110.0						Sltst, Congl	gygn											N			Sparse colored chert fragments
112.5						Sltst, Congl	gygn	-										N			
115.0						Sltst, qtz Ss	gygn	VF										N			Sparse ltgy Ss fragments
117.0						Sltst, qtz Ss.	gygn	VF										N			Sparse ltgy Ss fragments
120.0						Sltst, Congl	ltgygn											N			Sltst 75% tn chert fragments 25%
122.5						Sh	dkpprd-gygn											N			
125.0 T.D.						Sh	dkpprd											N			

PERCENTAGE COMPOSI IMAGE



Date 12-15-99 Geologist L. CASEBOLT Drilling Co. BAYLES EXPLORATION, INC. Hole No. 99-09-003-M-09

Property WHITE MESA MILL Project MW-4 PHASE 2 Unit No. ____ Sec. ____ Twp. ____ Rge. ____

County SAN JUAN State UTAH Location ____ Elev. ____

PAGE ____ OF ____

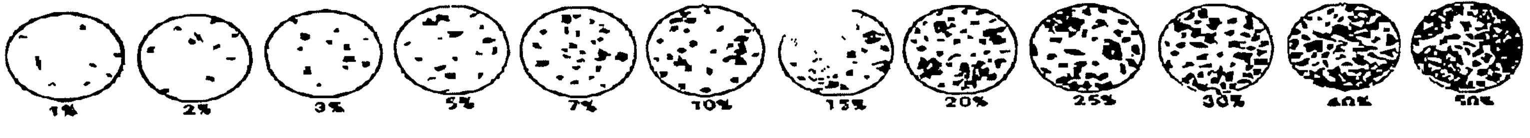
T.D. PROBE ____

T.D. DRILL 120.0

FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.0						SHst.	dkrdbn											S			soil (plant fragments)
5.0						SHst, Ss	ltpkbn-ltpk	VF	P	A								VS			ltpk fragments caliche
7.5						sltst, ss	ltpkbn- ltpk	VF	P	A								VS			" " "
10.0						Sltst	ltrdbn											VS			
12.5						Sh	wh											VS			
15.0						Sh, Ss	ltywbn	F	P	SR								VS			
17.5						Sh	vltywgy											S			
20.0						Sh	vltywgy-gy											VS			sparse gypsum (selenite crystals)
22.5						Sh	ltywgy-gy											VS			" " " "
25.0						Sh	ywgy-gy											S			increasing gypsum (selenite crystals)
27.5						Sh	ywgy-gy											S			" " " "
30.0						Sh	ltywgy-gy											S			gypsum (selenite crystals 2%)
32.5						Sltysh	ltywgy-gy											W			selenite 1% sparse manganese dendrites
35.0						Sltysh	ywgy-gy bn					H						W			sparse hematite
37.5						Sltysh	ywgybn					H						W			hematite 2%
40.0						Sltysh, Ss	ywgybn	F	F	R		H						N			Upper Ct. Burro Cyn. Fm. @ 38.0 feet
42.5						qtz Ss	ltywbn	VF F	F	R								N			
45.0						qtz Ss	lttn	F M	F	SR		L						N			
47.5						qtz Ss	lt tn	F-M	m	SR								W			
50.0						qtz ss	lttn	VF-F	F	SA								N			
52.5						qtz Ss	lt tn	VF-F	P	SA								N			
55.0						qtz Ss	lttn	VF-F	P	SA		H						N			sparse hematite
57.5						qtz Ss, Sh	ltgybn	VF-F	P									N	SP	P	sparse carbon plant fragments
60.0						qtz ss	vlttn	VF	F	SR								N			
62.5						qtz Ss	vltgy-wh	VF	F	SR								N			
65.0						qtz Ss	vltgy-wh	VF-F	F	SR								N			
87.5						qtz Ss	vltgy	VF F	F	SR								N			
70.0						qtz Ss	ltgy	F	G	SR								N	SP	P	sparse carbon plant fragments
72.5						qtz Ss	gy	VF-m	F	SR								N			2% carbon plant fragments
75.0						qtz Ss	ltgybn	VF-m	P	SR								N			" " " "
77.5						qtz Ss, Cgl	ltgytn	F-CR	P	SR								N			dkgy-pk chert fragments
80.0						qtz ss, Cgl	lttn	F-CR	P	SA								N			" " " "
82.5						qtz Ss, Cgl	lttn	F-CR	P	SA								N			" " " "
85.0						Sh, Ss, Cgl	vltblgy	m CR	P	A								N			Sh 80% - Ss, Cgl 20% dkgy-tn chert frag.
87.5						Sh	lt blgy											N			
90.0						qtz Ss,	lttn	m	F	SR								N			Some dkgy chert fragments
92.5						qtz Ss, Cgl	tn	m CR	F	SR								N			" " " "
95.0						qtz Ss, Cgl	tn	m-CR	F	SR								N			" " " "
97.5																					No cuttings -
100.0						Cgl, qtz Ss	dkgy, rd, lttn	CR	P	A								N			chert fragments
102.5						qtz Ss, Cgl	lttn	m-CR	F	R								N			"
105.0						qtz Ss, Sltst	lttn - ltblgy	m	F	SR								N			Upper Ct. Brushy Basin Fm. @ 104.0 feet
107.5						Sltst	ltblgy											N			
110.0						Sltst	ltblgy						S	G				N			sparse pyrite (granular)
112.5						Sltst, Cgl	ltblgy	-										N			dkgy chert fragments
115.0						Cgl, qtz ss	wh - ltblgy	m CR	F	R			S	G				N			Cgl unit in Brushy Basin Fm-high perm-zone
117.5																					no cuttings
120.0						qtz Ss	lttn	m	G	R								N			
TD.																					

PERCENTAGE COM[illegible]ON IMAGE

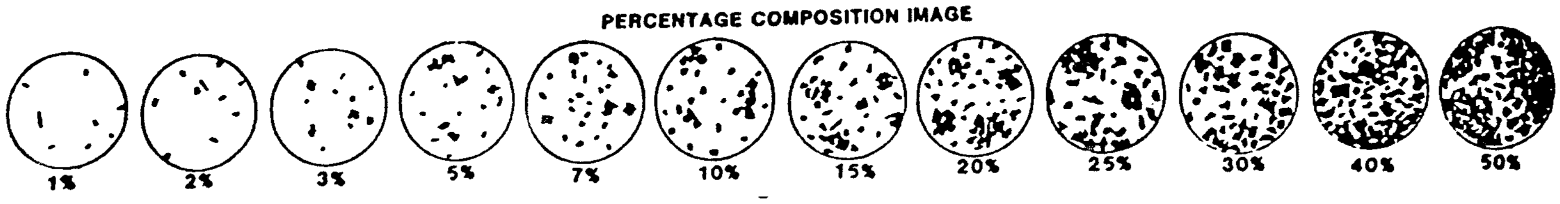


Date 12-20-2001 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TW4-10
Property White Mesa Mill Project MW-4 Phase 3 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst,sh	rdbn											S			soil
5.0						sltst,sh	rdbn											S			soil
7.5						sh, qtzss	vlttn	cr	p	sr								VS			
10.0						Sh	ltywtn											VS			manganese dendrites
12.5						sh	ltywtn											VS			" " selenite crystals
15.0						sh	ltywgy											VS			
17.5						Sh	ltywgy											S			selenite crystals
20.0						sh	lt ywgy											S			
22.5						sh	lt ywgy											VS			
25.0						sh	lt ywgy											S			
27.5						Sh	lt ywgy											VS			selenite crystals
30.0						Sh	lt ywgy											S			
32.5						Sh, sltst.	lt ywgy											W			abnt. selenite crystals
35.0						sh, sltst.	ywgy											VW			
37.5						sltst,sh	ywgy											N			
40.0						sltst,sh	dkgy-ywgy											N			Upper contact Burro Cyn Fm @ 40.0'
42.5						qtzss	tn	f-m	m	sr								N			
45.0						qtzss	tn	f-m	m	sr								N			
47.5						qtzss	tn	f-m	m	sr								N			
50.0						qtzss	tn	f-m	m	sr								N			
52.5						qtzss	tn	m	f	sa								N			
55.0						qtzss	tn	f-m	m	sa								N			
57.5						qtzss	tn	f-m	m	sa								N			
60.0						qtz.ss	tn	vf-f	m	sr								N			
62.5						qtz.ss	ltgytn	f	w	sr								N			
65.0						qtz.ss	tn	f	w	sr								N			
67.5						qtzss	dkgy	f-m	p	sa								N	10%		abnt. 10% carbon wood frags sp. wh chert. frag.
70.0						qtzss	vdkgy		p	sa								N	20%		abnt. 20% carbon wood frag. " " " "
72.5						qtzss,sh	vlttn	f-m	f	sr								N			moisture first noted @ 72.5'
75.0						qtzss,sh	vlttn	f-m	f	sr								N			
77.5						qtzss,sh	vlttn	f-m	f	sr								N			Water injection begin @ 75.0 feet
80.0						ss,cgl	wh-blk	m-vc	p	sr								N			multi-colored chert frag. high perm.
82.5						sh,sltst cgl.	ltgy	vc	p	sr								N			" "
85.0						ss	wh	f-m	m	sr								N			clean sand
87.5						ss	wh	f-m	f	sa								N			" "
90.0						ss,cgl	wh	m-c	p	sr								N			
92.5						ss,cgl.	wh-multicolored	vc	p	sr								N			chert frag. } high perm zone
95.0						ss,cgl	multicolored	vc	p	sr								N			chert pebble conglomerate
97.5						ss,sh cgl	wh-lttn	m-vc	p	sr			tr	xls				N			abnt multicolored chert frag. tr. pyrite
100.0						ss,slt,sh	wh-gygn	f-m	f	sr								W			chert frags.
102.5						ss	wh	f-m	f	sr								N			
105.0						ss	wh	f	w	sr			tr	xls				N			trace dkgy-pk chert frag. tr. pyrite
107.5						ss,sltst,sh	wh-gygn	vf-f	w	sr								N			Burro Cyn Fm / Brushy Basin Fm. Ct. @ 106 feet
110.0						sltst, sh	gygn											N			Total Depth -
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

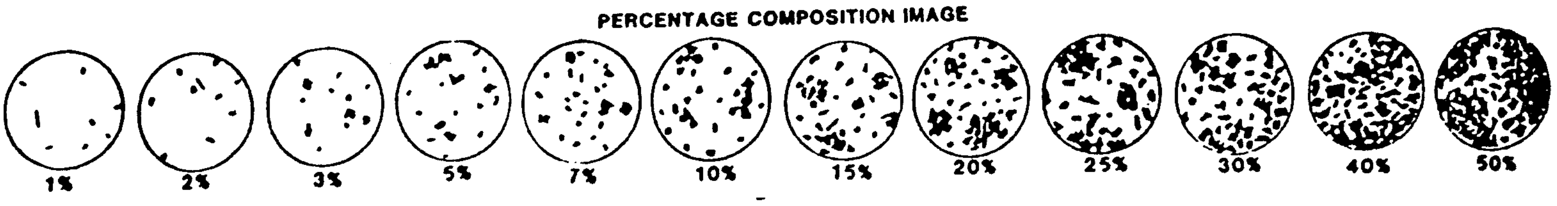


Date 12-19-2001 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TW4-11
Property W Project MW-4 Phase 3 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 97.5
FLUID LEVEL 90

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite Amount	Pyrite Habit	Pyrite Alter.	Metallic	Non-Metallic	React.-10% HCL	Carbon Amount	Carbon Type	Remarks
0																					
2.5						sltst,sh	ltpktn											VS			soil
5.0						sh	ltywtn											S			
7.5						sh	ltywtn											S			
10.0						sh	ltywtn											S			very abnt. selenite crystals
12.5						sh	ltywtn											S			
15.0						sh	ltywgy											S			
17.5						sh	ltywgy											S			
20.0						sh	ltywgy											S			Noteable selenite Crystals
22.5						sh sltst	ywgy											m			" " "
25.0						sh, sltst	ywgy											S			
27.5						sh, sltst	ywgy											W			selenite crystals
30.0						sh,sltst	ywgybn											N			
32.5						sh,sltst	dkywbn											N			
35.0						sltst,sh	vdkgybn											N			Dakota/Burro Cyn Fm. Contact @ 35.0 feet
37.5						qtz ss	tn	f-m	f	sr								N			
40.0						qtz ss	tn	f-m	f	sr								N			
42.5						qtz ss	tn	f-m	f	sr								N			
45.0						qtz ss	tn	f-m	m	sr								N			
47.5						qtz ss	tn	f-m	m	sr								N			
50.0						qtz ss	vltgy	m	w	r								N			
52.5						qtz ss	vltgy-wh	m	w	r								N			
55.0						qtz ss	vlttn	f-m	f	r								N			
57.5						qtz ss	tn	f-m	f	sr								N			
60.0						qtz ss	tn	vf-f	f	sr								N			
62.5						qtz ss	vdkgy	f	m	sr								N	10%		Noteable color change, abnt. carbon wood frag.
65.0						qtz ss	dkgy	f	m	sr								N	3%		some carbon wood fragments
67.5						qtz ss	gybn	m	w	r								N			
70.0						qtz ss	vltgytn	m	m	r								N			
72.5						qtz ss	vltgytn	f-m	F	r								N			
75.0						qtz ss	vltgytn-wh	f-m	W	r								N			Moisture first noted
77.5																		N			No Cuttings - Begin H2O injection
80.0						qtz ss	wh	m-cr	p	sa								N			chert frag.
82.5						qtz ss,cgl	wh-multicolor	m-vc	p	sr								N			" " } high perm zone
85.0						qtz ss,cgl	wh-multicolor	c-vc	p	sa								N			" "
87.5						cgl,sltst	lttn,gn											N			Basal Contact Burro Cyn.Fm @ 86.0 feet
90.0						sltst,cgl	ltgn,multi color											N			
92.5						sltst	ppbn-ltgy											N			
95.0						sltst	ltgn											N			
97.5						sltst,ss cgl	ltgn	f-m										N			Total depth
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
25.0																					

PERCENTAGE COMPOSITION IMAGE



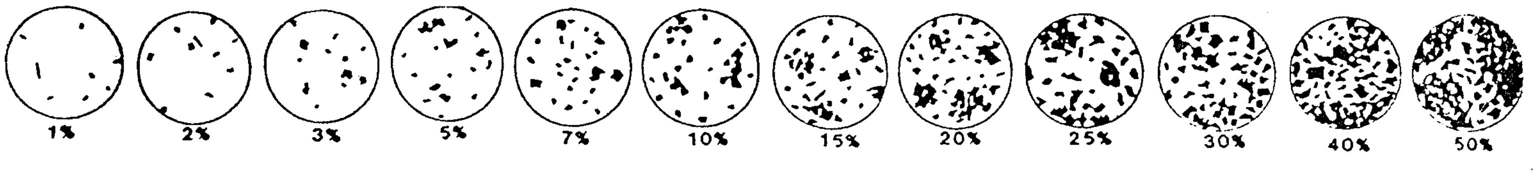
Date 7-1-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-12
Property White Mesa Mill Project Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 1
T.D. PROBE
T.D. DRILL 107.5
FLUID LEVEL 43.3 below casing

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst	rdbn	vf										S			Surface Soil
5.0						Sltst	rdbn	vf										S			
7.5						Sltst	rdbn	vf										S			
10.0						Sltst	rdbn	vf										S			
12.5						Sltst	rdbn-lttn	vf										S			
15.0						Sltst	rdbn	vf										VS			
17.5						Sltst	pktn	vf										VS			
20.0						Slty Sh	ywgybn	vf										VS			
22.5						Slty Sh	ywgybn	vf										VS			
25.0						Sndy Sltst	ltbn f	m	p	sa								m			
27.5						Qtz Ss, Sltst	bn vf	f	p	sa								W			
30.0						Sndy Sltst	bn vf	f	p	sa								N			
32.5						Qtz Ss	tn vf	m	p	sa								N			Ct. Top of Dakota Fm @ 31.0 feet
35.0						Qtz Ss	tn f	m	p	sa		H						N			hematite coating of quartz grains
37.5						Qtz Ss	tn f	m	p	sa								N			
40.0						Qtz Ss	pktn	m	p	sa		H						N			
42.5						Qtz Ss	tn	f	m	sa		H						N			
45.0						Qtz Ss, Sh	gy-pprd	f	m	sa		H						N			
47.5						Qtz Ss,	vltgy	f	f	sa								N			
50.0						Qtz Ss,	vltgy	f	f	sa								N			
52.5						Qtz Ss	vltgy	f	f	sa								N			
55.0						Qtz Ss	vltgy	f	f	sa								N			
57.5						Qtz Ss	ltgy-vdkgy vf	f	f	sa								N	3%	I	carbonaceous material
60.0						Qtz Ss	vltgy-lttn vf	m	p	sa		L						N	Tr	I	" "
62.5						Qtz Ss	ltgy-blk vf	m	p	sa								N	50%	I	" "
65.0						Qtz Ss, Cgl	dkgy-blk vf	vcr	p	a								N	50%	I	abund. white to dkgray chert frag.
67.5						Qtz Ss	vltgy-blk vf	m	f	sa			Tr.					N			
70.0						Qtz Ss	dkgy-blk vf	m	f	sa			Tr					N			disseminated pyrite
72.5						Cgl, Qtz Ss	gy m	vcr	p	a			1%					N			" " multicolored chert frags.
75.0						Cgl, Qtz Ss	gy m	vcr	p	a			Tr					N			" " " "
77.5						Cgl, Qtz Ss	gy m	vcr	p	a								N			chert frag.
80.0						Qtz Ss, Cgl	gy m	vcr	p	sa								N			chert frags
82.5						Cgl, Qtz Ss	gy m	vcr	p	sa			Tr.					N			chert frag.
85.0						Cgl, Qtz Ss	gy m	vcr	p	a								N			" "
87.5						Cgl, Qtz Ss	gy m	vcr	p	a								N			" "
90.0						Cgl, Qtz Ss	gy m	vcr	p	a			Tr					N			" "
92.5						Qtz Ss, Cgl	vltgy vf	vcr	p	a			Tr					N			" "
95.0						Qtz Ss,	vltgy-wh vf	cr	f	sa			1%					N			disseminated & massive pyrite, chert frag.
97.5						Qtz Ss, Cgl	wh vf	cr	f	sa								N			
100.0						Qtz Ss	wh vf	f	m	sa			Tr					N			
102.5						Qtz Ss, Sltst	ywbn-ppbr	vf-f	f	sa								N			Upper Brushy Basin Fm. contact @ 101.0 feet.
105.0						Qtz Ss, Sh	wh-ltgn vf	f	f	sa								W			
107.5						Qtz Ss, Sh	wh-ltgn ppbn	vf-f	p	sa			Tr					W			

REMARKS

PERCENTAGE COMPOSITION IMAGE

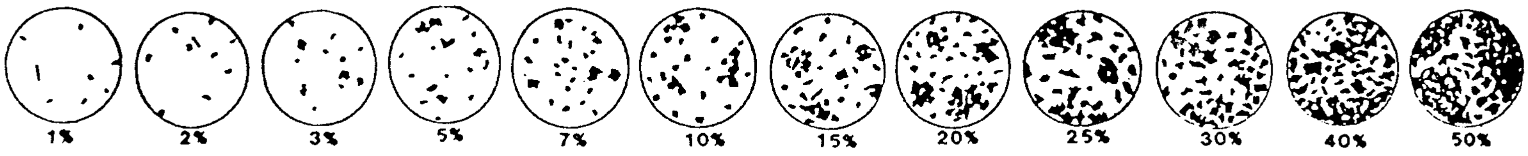


Date 7-1-02 Geologist L. Casebolt Drilling Co. Bayles Exploration Co Hole No. TW4-13
Property White Mesa Mill Project MW4 Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 102.5
T.D. DRILL 102.5
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Slty Sh	dkrdbn	vf										W			Soil
5.0						Slty Sh	rdbn-pk	vf										S			
7.5						Slty Sh	rdbn-pk	vf										VS			
.0						Slty Sh	rdbn	vf										VS			
.5						Slty Sh	rdbn-ywbn	vf										S			
.0						Sh	ywgybn	vf				tr						S			Noteable color change sparse hematite
5						Sh, Qtz Ss	ywgybn	f	p	sa								S			
0						Sh, Qtz Ss	ywgybn f	m	p	sa								S			
5						Sh, Qtz Ss	ywgybn f	m	p	sa								S			
5.0						Slty Sh	ywgybn	vf										S			
27.5						Slty sh	ywgybn	vf										S			
30.0						Slty sh	ywgybn	vf										W			
32.5						Qtz Ss	ortn f	m	m	sa		tr						N			Upper Dakota Fm. contact @ 30.0' limonite coating
35.0						Qtz Ss	ortn f	m	p	sa		tr						N			
37.5						Qtz Ss	tn f	m	f	sa		tr						N			
40.0						Qtz Ss	lt tn	f	f	sa								N			
425						Qtz Ss	tn	m	f	sa								N			
45.0						Qtz Ss	tn	f	f	sa								N			
47.5						Qtz Ss, Sh	tn-gy vf	f	p	sa								N			
50.0						Qtz Ss	wh vf	f	m	sr								N			Clean sandstone
52.5						Qtz Ss	lt tn vf	f	m	sr								N			
55.0						Qtz Ss	lt tn vf	f	m	sr								VW			
57.5						Qtz Ss	ywtn vf	f	f	sa								W			
60.0						Sh, Sltst	dkgy-blk	vf										N	50%		abund. carbonaceous material
2.5						Qtz Ss	ltgy f	m	m	sr			tr					N	1%		sparse carbon material, trace pyrite
5.0						Qtz Ss	ltgy	m	w	r								N	<1%		
7.5						Qtz Ss	ltgy f	m	m	r								N	<1%		
70.0						Qtz Ss, Sh	ltgy		m	r								N	<1%		
72.5						Qtz Ss	lt tn vf	f	m	r								N			
75.0						Qtz. Ss.	lttn-lt gn f	m	m	sr								N			some gray chert fragments
77.5						Qtz Ss	lttn m-	cr	f	sa								W			multi colored chert frag.
0.0						Sh, Qtz Ss	ltgygn f	vcr	p	sa			1%					S			pyrite, multi colored chert [illegible]
2.5						Sh, Qtz Ss	ltgygn-wh	vf										N			some chert fragments
5.0						Sltst	ltgygn-wh	vf										N			
7.5						Sltst	ltgygn	vf										N			
0.0						Sltst	ltgygn	vf										N			
25						Sltst	ltgygn	vf										N			
5.0						Sltst	ltgygn	vf										N			
7.5						Qtz Ss	ltgy-wh	m	f	sr			3%					N			abund. pyrite fragments
00.0						Qtz Ss	ltgy-wh	m	f	sr			1%					S			Some pyrite fragments
025						Sh, Qtz Ss	gn-wh	m	f	sr			1%					N			Upper contact Brushy Basin Fm. @ 101.5'; Some pyrite, occurs as cubes and granular

PERCENTAGE COMPOSITION IMAGE

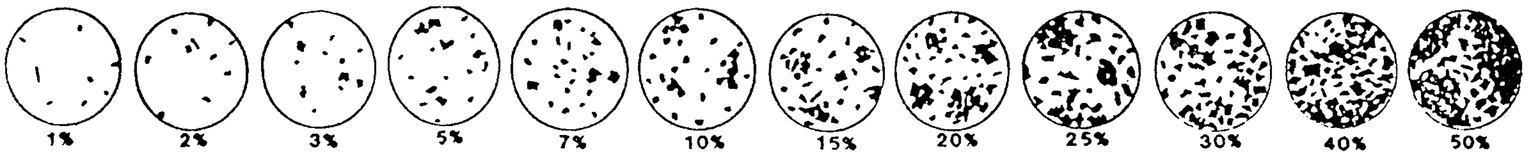


Date 7-2-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-14
Property White Mesa Mill Project MW4 Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 1
T.D. PROBE
T.D. DRILL 95.0
FLUID LEVEL

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						SndySltst. qtz	lt rdbr-or	vf	p	sa								S			Surface soil.
5.0						sndySh-qtz	lt pk-wh	vf	p	sa								VS			trace of plant fragment:
7.5						Sh-sltysh	wh-pk	vf	p	sa								VS			
0.0						Sndysh	ywgybn	vf-f	p	a		tr						VS			limonite/hematite coating on qtz grains
2.5						Slty Sh	ywgybn	vf	p	sa		tr						S			
5.0						Slty Sh	ywgybn	vf	p	sa		tr						W			hematite coating on qtz.
7.5						Slty Sh	ywgybn	vf	p	sa								N			
20.0						SltySh-qtzSs	ltgy-orbn	vf f	p	sa		tr.						N			Contact upper Dakota Fm. @approx. 18.0 feet.
22.5						Qtz Ss	tn	f-m	f	sr		tr.						N			Clean sandstone
5.0						Qtz Ss	tn	m	g	sr		tr.						N			
27.5						Qtz Ss	lt tn	m	g	sr		tr.						N			
0.0						Qtz SS	lt tn	m-cr	f	sr								N			
2.5						Qtz SS.	lt tn	f-cr	f	sr								N			
35.0						Qtz SS	lt tn	m-cr	f	sr		tr.						N			
37.5						Qtz SS	tn	m-vcr	p	sa								N			hematite coating on sandgrains, white chert frag.
40.0						Qtz SS-cgl	vlt tn	vf-cr	p	sa		3%						N			lt-dkgy quartz fragments.
42.5						Qtz SS	lt tn	f-cr	f	sa		1%						N			
5.0						Qtz SS	vlt tn	f	w	sr								N			very clean sandstone
47.5						Qtz SS	lt tn	f	w	sr								N			" " "
50.0						Qtz Ss.	lt pk tn	vf m	f	sr								N			
2.5						Qtz SS	lt pk tn	m cr	f	sr								N			sparce chert frag.
5.0						Qtz Ss.	lt tn	m	f	r								N			
57.5						Qtz Ss.	lt tn	m	w	r								N			very clean sandstone
0.0						Qtz Ss-Cgl	lt tn	vf-m	p	sa								N			dkgy to wh chert & qtz frag.
2.5						Qtz Ss	lt pk tn	f m	f	sa								N			
5.0						Qtz Ss.	lt pk tn	f	w	sr								N			
7.5						Qtz Ss.	lt tn	f	w	sr								N			
70.0						Qtz Ss	lt gy tn	f m	f	sa								N			
2.5						Qtz Ss-Cgl	gy tn-wh	f vc	p	sa								N			20% chert & quartz fragments-multicolor
75.0						Qtz Ss-Cgl	gy tn-wh	m-vcr	p	sa								N			20% chert & quartz fragments.
7.5						Qtz Ss-Cgl	tn	m cr	p	sr								N			
80.0						Qtz Ss-Cgl	multicolor	m vcr	p	sa								N			50% grit (wh-rd-blk chert frag.)
2.5						Qtz Ss	lt tn	m	w	r								N			clean sandstone
5.0						Qtz SS	lt tn	m	f	sr								N			2% dkgy quartz frag.
7.5						Qtz SS	lt tn	f m	f	r								N			
0.0						Qtz Ss-Cgl.	lt gy tn	f vcr	p	sr								S			tr, ltgn shale
2.5						Sh-Qtz Ss	lt gy gn	vf f	p	sa								N			Upper cont. Brushy Basin Fm @ 91.0 feet.
5.0						Slty Sh	ltgn	vf										N			
D.																					

PERCENTAGE COMPOSITION IMAGE



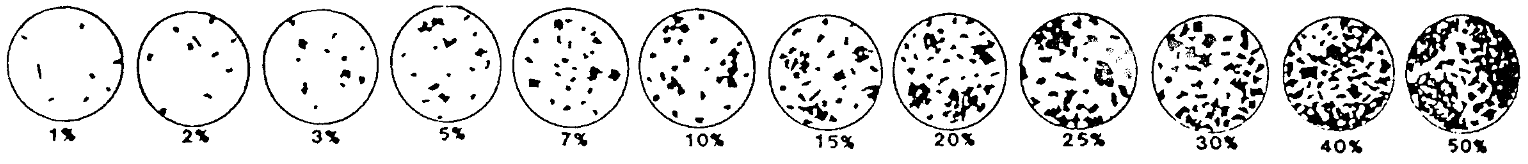
Date 7-2-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Co Hole No. TW4-15
Property White Mesa Mill Project MW4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 122.5
FLUID LEVEL ______

REMARKS 12¼" bit To 50.0 ft. 6¾" bit 50 To T.D.

Depth	Sample Taken	Graphic Log	Alteration	Gamma Anomaly	Breccia Pipe	Lithology	Color of Wet Sample	Grain Size	Sorting	Angularity	Cement Matrix	Iron Oxide	Pyrite			Metallic	Non-Metallic	React.-10% HCL	Carbon		Remarks
													Amount	Habit	Alter.				Amount	Type	
0																					
2.5						Qtz Ss,	tnbn vf	f	f	sa								S			Surface Soil.
5.0						Sh, Qtz SS	dkbn vf	m	p	sa								VS			
7.5						Slty Sh	ltrdbn vf	f										S			
10.0						Slty Sh	ltrdbn											S			
12.5						Slty Sh	ltrdbn											S			
15.0						Slty Sh,	ywgybn											VS			
17.5						Slty Sh	ywgybn											VS			
20.0						Slty Sh	ywgybn											S			
22.5						Sh	ywgybn											N			
25.0						Sh	ywgybn											W			
27.5						Sndy Sh	ywgy bn vf	m	p	sa								N			
30.0						Qtz SS, Sh	or bn f	m	f	sa								N			Upper contact Dakota Fm @ 28.0 feet.
32.5						Qtz SS	or bn m	Cr	p	a		L						N			limonite, chert frags
35.0						Qtz SS	or bn m	cr	p	a								N			
37.5						Qtz SS, Sh	gy m	Cr	p	a								N			
40.0						Qtz SS	tn f	m	f	sa								N			
42.5						Qtz Ss, Sh	ywtn-ltgy f	m	f	sa								N			
45.0						Qtz Ss	tn	f	f	sa								N			
47.5						Qtz Ss	tn	f	f	sr								N			
50.0						Qtz Ss	tn - ltgy	f	f	sr								N			
52.5						Qtz Ss	tn-dkgy vf	f	p	sa								N			
55.0						Qtz Ss, Cgl	tn vf	cr	p	sa								N			multi colored chert frags
57.5						Qtz Ss, Cgl	ltpktn m	vcr	p	Sa								N			" " " "
60.0						Qtz SS	ltpktn M	vcr	p	Sa								N			
62.5						Qtz SS	lttn f	m	f	Sa								N			
65.0						Qtz Ss	lttn m	cr	f	sr								N			
67.5						Qtz Ss	lttn	m	w	r								N			
70.0						Qtz Ss	lt tn	f	w	r								N			
72.5						Qtz Ss	lttn f	m	w	r								N			
75.0						Qtz Ss	lttn vf	m	p	sa								N			
77.5						Qtz Ss, Cgl	vlttn vf	m	p	sa								N			brown chert fragments.
80.0						Qtz SS Cgl	white f	m	m	Sr								N			
82.5						Qtz SS Cgl	lttn-ltgy f	m	m	sr			TR					N			disseminated pyrite
85.0						Qtz SS, Sh	vltgy-ltgn vf	f	f	sa								N			
87.5						Qtz Ss Sh	vltgy-ltgn vf	f	f	sa			Tr					N			
90.0						Qtz Ss, Sh	vltgy-ltgn vf	f	f	sa			Tr					N			
92.5						Qtz Ss, Sh	vltgy-ltgn vf	f	f	sa			1%					N			
95.0						Qtz Ss, Sh	wh-ltgn vf	f	f	Sa.			Tr					N			
97.5						Qtz Ss, Sh	wh-ltgn vf	f	f	sa			tr					N			
100.0						Qtz Ss Sh	wh-ltgn vf	m	f	sa			Tr					N			
102.5						Qtz Ss, Sh	wh-ltgn f	m	f	sr								N			
105.0						Qtz Ss	wh f	m	f	sr								N			
107.5						Qtz Ss	wh f	m	f	sr								N			
110.0						Qtz Ss, Cgl	vltgn f	vcr	p	sa								N			gray-brown chert fragments.
12.5						Qtz Ss	wh-ltgn vf	f	f	sa								N			
15.0						Qtz Ss	wh-ltgn vf	f	f	Sa								N			
17.5						Qtz Ss, Sh	wh-ltgn vf	m	p	sr			Tr					N			
20.0						Sh, Qtz Ss	gn-wh vf	m	p	sr								N			Upper contact Brushy Basin Fm. @ 118.0 feet
22.5						Sh,	gn-ppbn											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE

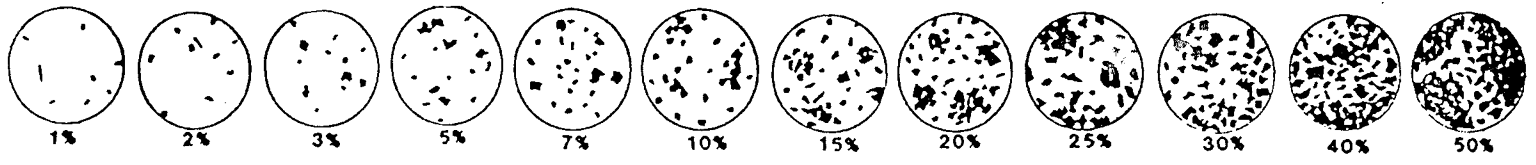


Date 7-2-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-16
Property White Mesa Mill Project ~~MW~~ TW4 Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 2
T.D. PROBE 149.0
T.D. DRILL 147.5
FLUID LEVEL 97.5
12¼" bit to 50'
6¾" bit 50'-147.5

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sh, Sltst.	ywgybn											VS			Surface soil.
5.0						Qtz Ss	ltpkor	vf f	p	sa								S			
7.5						Sltst, Sh	ltrdbn											S			
10.0						Sh, Sltst	ywgybn											VS			some chert frag.
12.5						Sh	ywgybn											VS			
15.0						Sh	ltgytn											VS			
17.5						Sndy Sh	ltgytn	vf f	p	sa								VS			
20.0						Sh	ywgybn											VS			
22.5						Sh.	ywgybn											VS			gypsum crystals (selenite)
25.0						Sh	ywgybn											VS			very abund gyp xls.
27.5						Sh	ywgybn											S			" " " "
30.0						Sh	ywgybn											M			" " " "
32.5						Sh	ywgybn											m			" " " "
35.0						Qtz Ss, Sh	ywgybn	vf f	f	sa								S			Upper contact Dakota Fm. @ 33.0 feet
37.5						Qtz Ss.	ltywbn	vf f	f	sa								W			
40.0						Qtz Ss	lt bn	vf	p	sa								W			
42.5						Qtz Ss	ltywbn	f m	p	sa								N			
45.0						Qtz Ss	lttnbn	f m	f	sr		L						N			some limonite coating.
47.5						Qtz Ss	tn	m	m	sr		L						N			
50.0						Qtz Ss	tn	f m	f	sr								W			
52.5						Qtz Ss	tn	f	f	sa								N			
55.0						Qtz Ss	tn	f	f	sa								N			
57.5						Qtz Ss	tn	f	f	sa								N			
600						Qtz Ss	tn	vf f	p	sa								N			
62.5						Sndy Sh	gybn	f m	p	sa								W			gypsum crystals as selenite
65.0						Qtz Ss	gybn	f m	f	sa								N			Some chert frag. as sand grains
67.5						Qtz Ss, Sh	ltgytn	vf f	m	sr								N			
70.0						Qtz Ss	tn	f	w	r								N			
72.5						Qtz Ss	gy	vf f	m	sr								N	1%	I	
75.0						Qtz Ss, Cgl	lt bn	f vcr	p	sa								N			white to dk gray chert fragments
77.5						Qtz Ss, Cgl	ltgytn	f cr	p	sa								N			" " " " " "
800						Qtz Ss, Sh, Cgl	ltgytn	f m	p	sa								N			
82.5						Qtz Ss, Cgl	tn	m vcr	p	a								N			chert fragments, white to bn to rd
85.0						Qtz Ss Cgl	tn	m vcr	p	a								N			multicolored chert frags.
87.5						Qtz Ss, Cgl.	Tn	m vcr	p	sa								N			multicolored chert frags wh-or-blk
90.0						Qtz Ss, Cgl	vlttn	vf m	p	sr								N			
92.5						Qtz Ss	vlttn	vf f	f	sr								N			Clean sandstone
95.0						Qtz, Ss	vlt tn-wh	vf f	w	sa								N			
97.5						Qtz Ss, Cgl	multicolor	m vcr	p	a			2%					N			pyrite desseminated around sand grains, chert frag.
100.0						Qtz Ss, Sh, Cgl	multicolor,	vf vcr	p	a								N			
102.5						Qtz Ss	wh	f m	m	sr								N			Clean white sandstone.
105.0						Qtz Ss	wh-vltgn	f m	m	sr								N			
107.5						Qtz Ss	wh-vltgn	f m	m	sr								N			
110.0						Qtz Ss	wh-vltgn	f m	f	sr			Tr					N			
112.5						Qtz Ss, Sh, Cgl	wh-vltgn	f m	f	sr			Tr					N			
15.0						Qtz Ss Sh, Cgl	bn-ltgn	f m	f	sr			Tr					N			
17.5						Qtz Ss, Sh Cgl	tn-ltgn	f m	f	sr								N			
1200						Qtz Ss, Sh, Cgl	wh-ltgn	vf vcr	p	sr								N			
122.5						Qtz Ss, Sh	wh-ltgn	f	f	sr								N			
125.0						Qtz Ss, Cgl	wh-gy	f vcr	p	sr								N			

PERCENTAGE COMPOSITION IMAGE

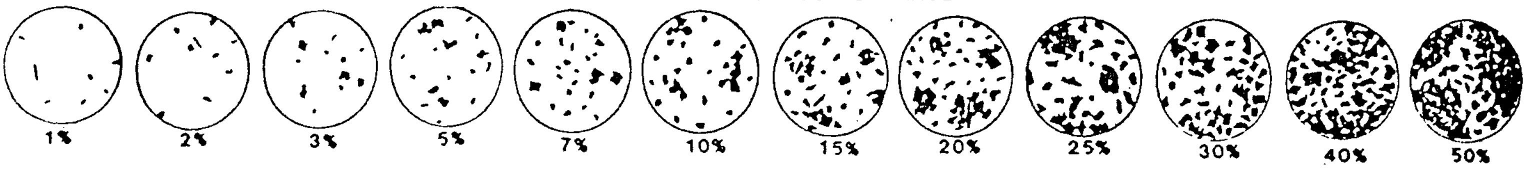


Date 7-2-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-16
Property White Mesa Mill Project MW4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 2 OF 2
T.D. PROBE 149.0
T.D. DRILL 147.5
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						Qtz Ss, Cgl	wh-multi color	f cr	f	sa								N			multi color chert fragments
130.0						Qtz Ss, Cgl	wh-multi color	m	p	sa								N			" " " "
132.5						Qtz Ss, Cgl	wh-multcolor	m	p	sa								N			" " " "
135.0						Qtz Ss Cgl	wh.	f vcr	p	sa								N			" " " "
137.5						Qtz Ss	wh	vf f	f	sr								N			
140.0						Qtz Ss	wh	f	f	sr								N			
142.5						Sh, Qtz Ss	wh-gn	f	f	sr								N			Upper Contact Brush Basin Fm @ 141.0 feet
145.0						Sh	gn											N			clean shale
147.5 T.D.						Sh	gn-rdgybn											N			clean shale

PERCENTAGE COMPOSITION IMAGE

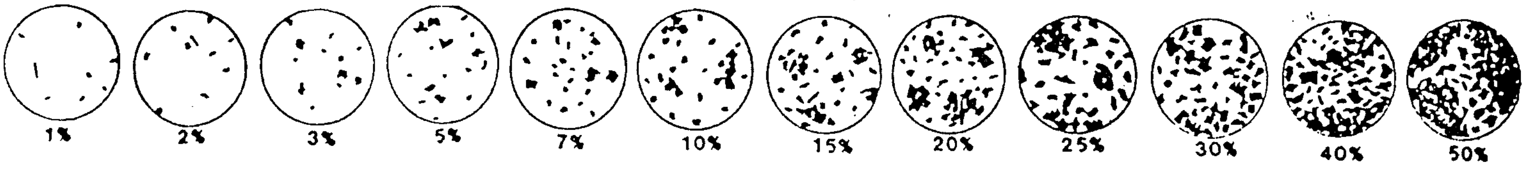


Date 7-2-02 Geologist L Casebolt Drilling Co. Bayles Exploration Hole No. TW4-17
Property White Mesa Mi Project MW4 Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 2
T.D. PROBE 132.9
T.D. DRILL 132.5
FLUID LEVEL 115.5

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE		GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS 12¼" bit to 52.5 6¾" 52.5 to T.D.
														AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																						
2.5						QtzSs, caliche	wh-tn bn	f	cr	p	sa								VS			caliche, surface soil
5.0						QtzSs, caliche	wh-tn	f	m	p	sa								VS			caliche, surface soil
7.5						Sltst, Sh	ltrdbn	vf	f	f	sa								VS			
10.0						Sltst	ltrdbn	vf	f	f	sa								S			
12.5						Sltst.	ltpkrd												S			
15.0						Slty Sh	ltpkbn												S			
17.5						Slty Sh	ltpkbn-ltywgy												VS			
20.0						Sh	ywgybn												VS			
22.5						Sh	ywgybn												VS			
25.0						Sh	ywgybn												S			
27.5						Sh	ywgybn												S			gypsum crystals as selenite
30.0						Sh	ywgybn												S			abund. gypsum crystals.
32.5						Sh	ywgybn												W			〃 〃 〃
35.0						Sh	ywgybn												W			
37.5						Sh	ywgybn												W			
40.0						Slty Sh	ywgybn						L						VW			Limonite
42.5						SltySh, QtzSs	ywgybn	vf	f	p	sr		L						VW			Contact Dakota Fm approx 42.0 ft.
45.0						QtzSs, Sh	ltortn	f	m	p	sr								N			
47.5						Qtz Ss	ltor-tn	f	m	p	sa								N			
50.0						Qtz Ss	ltgytn	f	m	p	sa		L						N			
52.5						Qtz Ss	tn	f	m	f	sr		L						N			
55.0						Qtz Ss	tn		f	f	sr		L						N			
57.5						Qtz Ss	tn	vf	f	f	sr								N			
60.0						Qtz Ss	tn	vf	f	p	sa								N			
62.5						Qtz Ss	tn	f	m	f	sr								N			
65.0						Qtz Ss	vlttn	f	m	f	sa								N			
67.5						Qtz Ss	vlttn	f	m	f	sr								N			
70.0						Qtz Ss, Sh	vlttn-vltgn	f	m	f	sr								m			
72.5						Qtz Ss	lttn	m	cr	f	sr								N			some ltgy chert grains
75.0						Qtz Ss	vlttn	f	m	m	sr								N			
77.5						Qtz Ss	lttn	f	m	m	sr								N			gray to tn chert fragments.
80.0						Qtz Ss, Cgl	lttn	m	vcr	m	sr								N			multi chert fragments
82.5						Qtz Ss	lttn	f	m	f	sr								N			
85.0						Qtz Ss Cgl	lttn	f	vcr	f	sr								S			multi color chert fragments
87.5						Sh	ltgn												N			
90.0						Qtz Ss	lttn		f	m	sr								N			clean sandstone
92.5						Qtz Ss	lttn	vf	f	m	sr								N			
95.0						Qtz Ss	wh		vf	f	sr								N			
97.5						Sh, Qtz Ss	wh-vltgy		vf	m	sr								N			
100.0						Qtz Ss, Sh	vltgy		vf	m	sr								N			
102.5						Qtz Ss	wh	f	m	m	sr								N			Clean sandstone
105.0						Qtz Ss, Cgl	wh-gy	f	m	m	sr			tr					N			chert fragments
107.5						Qtz Ss, Cgl	wh-gybn	m	cr	f	sr			tr					N			〃 〃
110.0						Qtz Ss	wh		m	W	r								N			
112.5						Qtz Ss, Cgl	wh-ltgy	f	cr	p	sr								N			
115.0						Qtz Ss, Cgl	wh-multicolor	f	cr	p	sr								N			multi color chert frag.
117.5						Qtz Ss, Cgl	ltgy-multico.	m	cr	f	sr								N			〃 〃 〃 〃
120.0						Qtz Ss, Cgl	ltgy	m	cr	f	sr								N			〃 〃 〃 〃
122.5						Qtz Ss, Cgl	ltgy-wh	m	cr	f	sr								N			〃 〃 〃 〃
125.0						Qtz Ss Cgl	wh	f	m	f	sr								N			〃 〃 〃 〃

PERCENTAGE COMPOSITION IMAGE



Date 7-2-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-17

Property White Mesa Mill Project MW4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______

County San Juan State Utah Location ______ Elev. ______

PAGE 2 OF 2

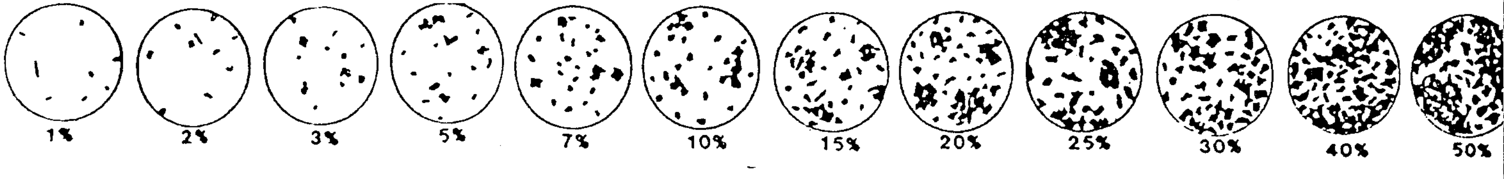
T.D. PROBE 132.9

T.D. DRILL 132.5

FLUID LEVEL 115.5

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						Sh, QtzSS, Cgl	gn-wh	m vcr	p	sr											Upper Brushy Basin Ct @ 126.0 feet
130.0						Sh	gn-pp bn														Clean shale
132.5						Sh	gn-pp bn														Clean shale
T.D																					

PERCENTAGE COMPOSITION IMAGE

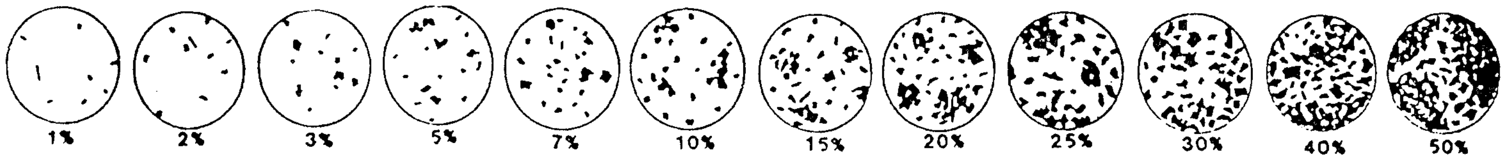


Date 7-8-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-18
Property White Mesa Mill Project mw4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 2
T.D. PROBE ______
T.D. DRILL 142.5
FLUID LEVEL 62 Feet

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS 7 7/8" bit, collar to T.D.
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst	rdbn	vf										S			Surface soils
5.0						Sltst	rdbn	vf										VS			
7.5						Sltst	rdbn-lt pkbn	vf										VS			
10.0						Sh	ltpktn											VS			
12.5						Sh	ltywtn											S			
15.0						Sh	ywgy											S			
17.5						Slty Sh	ywgy	vf										S			
20.0						Slty Sh	ywgy	vf										VS			
22.5						Slty Sh	ywgy	vf										m			
25.0						Slty Sh	ywgy	vf										VS			
27.5						Slty Sh	ywgy	vf										VS			gypsum as selenite crystals
30.0						Qtz Ss, Sltst	ywgybn vf	f	p	sa								VS			
32.5						Sltst	orbn					L						VS			limonite
35.0						Sltst	orbn					L						S			limonite
37.5						Sltsh	orbn					L						N			limonite
40.0						Sltst, QtzSs	orbn m	cr	p	sa		L/H						N			limonite/hematite, Upper Dakota Fm contact @ 39.5'
42.5						Qtz Ss	orbn m	cr	p	sa		L						N			limonite coating qtz grains
45.0						Qtz Ss	orbn m	cr	f	sr								N			" " " "
47.5						Qtz Ss	orbn m	cr	f	sa								N			" " " "
50.0						Qtz Ss	ortn f	m	f	sa								N			" " " "
52.5						Qtz Ss.	tn	m	f	sr								N			
55.0						Qtz Ss	tn	m	m	sr								VW			
57.5						Qtz Ss	tn f	m	f	sr								VW			
60.0						Qtz Ss, Sh	tn, ltgy f	m	f	sa								N			
62.5						Qtz Ss	tn vf	f	f	sa								N			
65.0						Qtz Ss	tn vf	f	f	sa								N			
67.5						Sltst	dkgy-blk vf	f	p	sa								N	30%	I	abund carbon frag.
70.0						Sltst, QtzSs	dkgy-blk f	m	P	sa								N	30%	I	" " "
72.5						Qtz Ss.	dkgybn	m	m	sr								N	2%	I	
75.0						Qtz Ss, Cgl	dkgybn	vcr	p	sr								N			chert, quartz frag. & pebbles
77.5						Qtz Ss	dktn f	m	m	sr								N			
80.0						Qtz Ss	dktn f	m	m	r								N			
82.5						Qtz Ss, Sh	tn-ltgygn f	m	f	sr								N			
85.0						Sh	ltgygn											N			
87.5						Sh	ltgygn											N			
90.0						Sh, Qtz Ss	ltgygn-ltortn	vf	m	sr								N			
92.5						Qtz Ss	lttn vf	f	m	sr								N			
95.0						QtzSs, Cgl, Sh	lttn-gygn f	m	p	sa								N			
97.5						Sltst	ltgygn	vf										N			
100.0						Sltst, Qtz Ss	ltgygn vf	f	m	sa								N			
102.5						Sltst, QtzSs	ltgygn-lttn vf	f	f	sa								N			
105.0						Qtz Ss	lttn	f	m	sa								N			
107.5						Qtz Ss	lttn	f	f	sa								N			
110.0						Qtz Ss	lttn	f	f	sa								N			
112.5						Qtz Ss	lttn f	m	f	sr								N			
115.0						Qtz Ss	lttn f	m	f	sr								N			
117.5																					no cuttings from this interval
120.0																					
122.5																					
125.0						Qtz SS	lttn	m	m	sa								N			

PERCENTAGE COMPOSITION IMAGE



Date 7-8-2002 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. TW4-18
Property White Mesa Mill Project MW4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 2 OF 2
T.D. PROBE ______
T.D. DRILL 142.5
FLUID LEVEL 62 Feet

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						Qtz Ss, Sltst	lt t - lt g f	m	f	sr								N			
130.0						Qtz Ss,	lt t f	m	p	sr								N			
132.5						Qtz Ss	lt t f	m	f	sr								N			
135.0						Qtz Ss	lt tn f	m	p	sr								N			
137.5						Qtz Ss, Sh	lt tr - ppbn f	m	p	sr								N			Upper Brushy Basin Fm. Contact @ 137.5'
140.0						Sh	ppbn-gn											N			
142.5						Sh	ppbn											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE

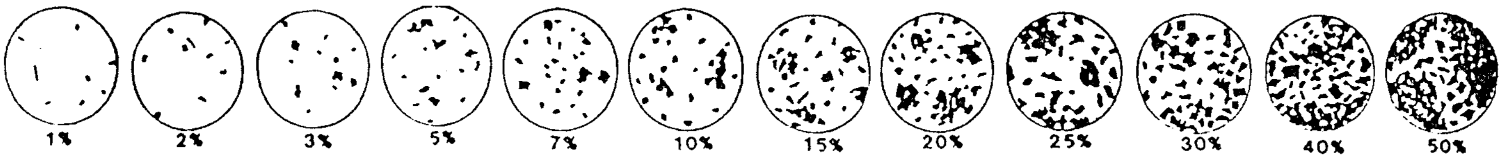
Date 7-9-02 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-19
Property White Mesa Mill Project MW4 Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location Next to office complex Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 125.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS 7⅞ [illegible]
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0.0																					
2.5						Slty Sh	ltrd bn	vf										S			Soil
5.0						Slty Sh	ltpk tn	vf										VS			
7.5						Sh	ltpk tn	vf										VS			
10.0						Sh	lt tn	vf										S			
12.5						Slty Sh	ltyw-gy	vf										S			sparse qtz grains
15.0						Qtz Ss-Sltst	yw-ybn	f	p	sa		tr						S			limonite and hematite coating on qtz grains
17.5						Slty Sh	gybn	vf										N			
20.0						Slty Sh	gybn	vf										N			
22.5						Qtz Ss Sltst	ltor bn f-	m	f	sa		1%						N			Upper Dakota Fm. Ct. @ approx 21.0 ft. limonite coating
25.0						Qtz Ss	ltor bn	m	f	sa		1%						N			limonite coating on qtz grains
27.5						Qtz Ss	ltor bn	m	f	sa		1%						N			
30.0						Qtz Ss	lt tn m	cr	f	sa								N			
32.5						Qtz Ss	lt tn f	m	f	sr								N			
35.0						Qtz Ss	lt tn	f	f	sr								N			
37.5						Qtz Ss	ltpk.tn	f	M	sr								N			
40.0						Qtz Ss	lt tn vf	f	p	sa								N			
42.5						Qtz Ss	ltpk tn vf	f	m	sa								N			Clean sandstone
45.0						Qtz Ss	ltpk tn vf	f	m	sa								N			
47.5						Qtz SS-Sh	tn-wh m	vcr	p	sa								N			
50.0						Qtz Ss-Sh	lt tn lt gy f	cr	p	sa								N			
52.5						Qtz Ss-	ltpk tn f	m	w	sr								N			Clean sandstone
55.0						Qtz Ss	ltpk tn f	m	M	sr								N			
57.5						Qtz Ss	ltpk tn	m	w	sr								N			
60.0						Qtz Ss	vltpk tn f	m	m	sr								N			
62.5						Qtz Ss	vltpk-wh f	m	m	sr								N			
65.0						Qtz Ss	vltpk-wh f	m	m	sr								N			
67.5						Qtz Ss	wh f	m	f	sa								N			
70.0						Qtz Ss, Cgl	lt tn f	vcr	p	sa		tr						W			multi color chert & qtz frag.
72.5						Qtz Ss, Cgl	tn f	vcr	p	sa		tr						W			hematite coating on qtz & chert frag.
75.0						Qtz Ss, Cgl	tn f	vcr	p	sa		tr						W			
77.5						Sh	lt blgy											N			
80.0						Qtz Ss	vlt tn vf	f	f	sa								N			
82.5						Qtz Ss, Sh	vlt tn-ltgygn vf	f	f	sa								N			
85.0						Sh-Qtz Ss	ltblgy-lt tn	f	f	sa								N			
87.5						Sh	ltgy-ltpp bn	vf										N			Mottled shale frags.
90.0						Sh	ltgy-ltpp bn	vf										N			" " "
92.5						Qtz Ss	vltgy vf	f	f	sa								N			
95.0						Qtz Ss, Sh	lt tn-lt gy	vf	f	sa								N			
97.5						Qtz Ss, Sh	lt tn-lt gy	vf	f	sa								N			
100.0						Qtz Ss, Cgl	ltgy-wh f	cr	p	sa		tr						N			
102.5						Qtz Ss, Cgl, Sh	ltgy m	cr	f	sa		tr						N			
105.0						Qtz Ss Cgl	vltgy-orbn m	cr	f	sa		tr						VW			
107.5						Qtz Ss	ltpk tn	m	m	sr		tr						N			
110.0						Qtz Ss, Sltst	lt tn-lt gy	m	m	sa								N			
112.5						Qtz Ss	lt gy	f	f	sr								N			
115.0						Qtz Ss	wh-lt gy vf	f	f	sa								N			
117.5						Qtz Ss, Sh	wh-lt gy vf	f	f	sa								N			
120.0						Qtz Ss Cgl	wh-ltgy-or f	vcr	p	sa								N			
122.5						Sh, Qtz Ss	pprd bn, gy-wh	m	f	sa								N			Upper Brushy Basin Fm. Ct. @ approx 121.0 feet
125.0						Sh	pprd bn-gygn											N			

T.D.

PERCENTAGE COMPOSITION IMAGE

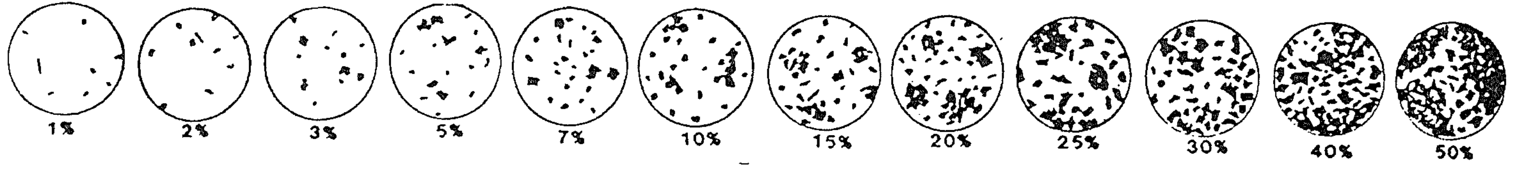


Date 4-9-05 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. TW4-20
Property White Mesa Mill Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈ 5627

PAGE 1 OF 1
T.D. PROBE
T.D. DRILL 107.5
FLUID LEVEL

													PYRITE						CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						sltysh	ywbn											S			Surface soil .
5.0						sltysh	dkrdbn											m			
7.5						sltysh	dkrdbn-rdbn											VS			
10.0						Sh	ywtn											VS			
12.5						Sh	yw bn											VS			
15.0						Sh	yw bn											VW			
17.5						Sltst	yw bn											VW			
20.0						Sndysltst	gybn	vf	m	sr								M			
22.5						Sndysltst	dkbn-dkgybn	vf	P									N			Upper Dakota Fm Ct. @ Approx 22.0ft.
25.0						qtz ss	ltpktn	vf-m	P	sr								N			
27.5						qtz ss	ywtn	vf-f	f	sr								N			
30.0						qtz ss	lttn	vf-f	f	sr								N			
:						qtz ss	lttn	f cr	P	sr								N			
35.0						qtz ss	lt tn	m cr	m	sr								N			
37.5						qtz ss	ltpktn	M	m	r	sP							N			Sparse Hematite, clay cement?
40.0						qtz ss	lttn	m	W	r								N			
42.5						qtz ss	lt tn	f-m	m	r								N			
45.0						qtz ss	vlttn	vf-f	M	r								N			
47.5						qtz ss	vlttn	vf-f	M	sr								N			
50.0						qtz ss, sh	lttn-ltgy	vf-f	P	sr								N			
52.5						qtz ss	vltgy	vf-f	P	sa								N			
55.0						qtz ss	vlttn	f cr	W	sr								N			dk chert frags.
57.5						qtz ss	vlttn-wh	m cr	W	r								N			" " "
60.0						qtz ss	vlttn-wh	m vcr	P	a								N			
62.5						qtz ss	vlttn-wh	m vcr	P	a								N			30% dk multi colored chert frags
65.0						qtz ss	wh-vlttn	m vcr	P	a								N			
67.5						qtz ss	wh-vlttn	m vcr	P	sa								N			
70.0						qtz ss; cgl	lttn-gy	m vcr	P	a								N			60% multi colored chert frags & peb
72.5						qtz ss cgl.	ortn-gy	vcr	P	sr								N			80% " " " " "
75.0						cgl, qtz ss	or gy	vcr	P	sa								N			80% " " " " "
77.5						Cgl, qtz ss	or gy	vcr	P	sa								N			80% " " " " "
80.0						qtz ss	vlttn-wh	vf f	m	sr								N			
92.5						qtz ss	vltln-wh	vf f	m	sr								N			
3						50% 50% sh, qtz ss	wh-ltbl	vf f	P	sr								N			
37.5						sh, sltst	wh-lt bl	vf	P	sr								N			
0.0						sh, sltst	wh-ltbl	vf	P	sr								N			
12.5						qtz ss	vltn-wh	vf	W	r								N			
5.0						qtz ss	vlttn-wh	vf	W	r								N			
17.5						qtz ss	vlttn-wh	vf	W	r								N			
00.0						qtz ss	vlttn-wh	vf	W	r								N			
02.5						qtz ss	wh-vlttn	f m	W	sr								N			
05.0						90% 10% qtz ss, sh	wh-gn	vf m	P	sr								N			upper BrushyBasin Ct @ 104.0
07.5						Sndy sh	gn-dkgygn	vf	P	sa								N			Brushy Basin Mbr
D																					

PERCENTAGE COMPOSITION IMAGE

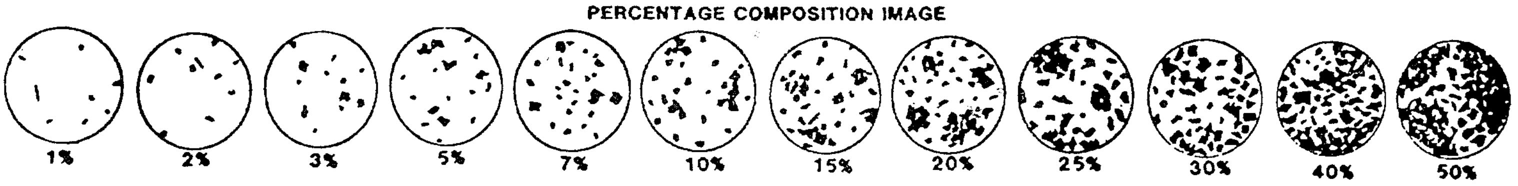


Date 4-19-05 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. TW4-21
Property White Mesa Mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 125.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						Sndy Sltst	rdbn	vf-f	P	sa								VS			Surface soil (mill yard-near change room)
5.0						Sndy sltst	rdbn-lttn	vf-f	P	sa								VS			mancos sh.
7.5						Sltst	ltpktn											VS			
10.0						sh	ywgy											VS			
12.5						sh	ywgy											S			
15.0						sh	ywgy											S			abnt. selenite xls. (gyp)
17.5						Sh	ywgy											m			" " " "
20.0						Sh, sltst	ywgy											W			
22.5						sltst, sh	ywgy											N			abnt. selenite xls.
25.0						sltst, sh	ywgy											N			
[illegible]5						sltst, sh	ywgy											N			
0						qtz ss	tn	f-m	w	sa								N			Upper Cr Dakota Fm @ 27.5'
32.5						qtz ss	ortn	f-m	w	sr		L	M					N			chert frags.
35.0						qtz ss	or tn	m	w	sr								N			
37.5						qtz ss	tn bn	m	w	sa								N			abnt. chert grains
40.0						qtz ss	tn bn	m-cr	w	sr								N			
42.5						qtz ss	tn	m-cr	w	sr								N			
45.0						qtz ss	tn	m cr	w	sr								N			Moisture first noticed in cutting
47.5						qtz ss	tn	f m	w	sr								N			
50.0						qtz ss, sh	tn-gy	f-m	w	sr								N			
52.5						qtz ss, sltst	vdkgy-ltgy	vf-f	f	sa								N			
55.0						sltst, sh, ss	vdkgy-vltgy	vf-m	f	sa								N			
57.5						qtz ss	ltpktn	m	w	sr								N			
60.0						sndy sltst	ltgybn	f-vcr	f	sa								N			
62.5						qtz ss-grit	ltgy	m-vcr	p	sr								N			abnt. light colored chert frags.
65.0						qtz ss	ltgytn	m-cr	f	sr								N			
67.5						qtz ss	ltgytn	m	w	r								N			
70.0						qtz ss	ltgytn	m	w	r								N			
72.5						qtz ss-grit	ltgytn	m-vcr	w	r								N			
75.0						qtz ss-grit	ltgytn	m-vcr	w	r								N			
77.5						qtz ss-cgl	gybn	m-peb	p	sr								N			cgl. zone, abnt chert frag. & pebbles
8						qtz ss-grit	gytn	m-vcr	p	sa								N			
8[illegible]						qtz ss-cgl	dkgytn	f-peb	p	sa								N			
85.0						qtz ss-sltst	dkgy	vf-cr	p	sa								N			Silty fg ss @ 84.0 ft.
87.5						qtz ss	gy	vf-f	f	sa								N			
90.0						qtz ss	gy	vf-f	f	sa								N			
92.5						qtz ss	gy	vf-f	f	sa								N			
95.0						qtz ss	gy-wh	vf-f	f	sa								N			
97.5						qtz ss	wh	f-m	f	sa								N			
100.0						qtz ss	wh	f-m	w	sr								N			
102.5						qtz ss	vlttn-wh	f-m	w	sr								N			
105.0						qtz ss	wh	f-m	w	sr								N			
107.5						qtz ss	wh-ltgn	m-vcr	f	r								N			sparse dkgy chert frag.
110.0						qtz ss	wh	f-m	w	r								N			
1.						qtz ss	wh –	f-m	w	sr		T	C					N			
115.0						qtz ss-sh	wh-ltgn	f-m	w	sr								N			Sparse gn sh frag.
117.5						qtz ss-sh	wh-gn	f-m	w	sr								N			Upper Brushy Basin Ct @ approx 117.0 ft. (116 from video)
20.0						sh	pp-gygn											N			
22.5						Sh	pp-gygn											N			
25.0						Sh	ppbn-dkgygn											N			TD

PERCENTAGE COMPOSITION IMAGE

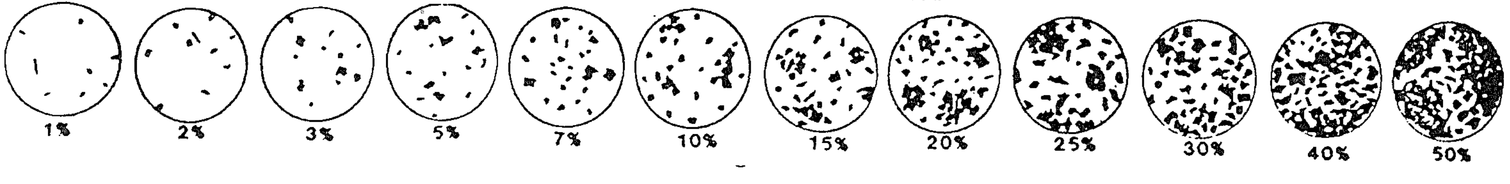


Date 4-9-05 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. TW4-22
Property White Mesa Mill Project ________ Unit No. ________ Sec. ________ Twp. ________ Rge. ________
County San Juan State Utah Location ________ Elev. ________

PAGE 1 OF 1
T.D. PROBE ________
T.D. DRILL 115.0
FLUID LEVEL ________

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS cored from 20'-115.0'
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sndysltst	or bn	f m	p	sa								M			Surface soil
5.0						qtz ss	or bn	vf-cr	p	sa								VS			
7.5						qtzss, sltst	tn bn	vf m	f	sa								VS			
10.0						sltst, qtz ss	vltrdbn	vf f	f	sa								VS			
12.5						sltst, qtz ss	vltrdbn	vf f										VS			
15.0						sltst, sh	vltrdbn											VS			
17.5						sltst, sh	lt ywgy											VW			
20.0						sndy sltst	lt ortn	vf-f	f	sa								W			
22.5						qtz ss	ywtn	f m	f	sa								N			upper Dakota Fm. ct @ approx 20.0 ft.
25.0						qtz ss	ywtn	f m	f	sr								N			
27.5						qtz ss	tn	m	w	sr								N			
-						qtz ss	tn	f-m	f	sr								N			
32.5						qtz ss	lt tn	f-m	w	sa								N			
35.0						qtz ss	lttn	f-m	f	sa								N			
37.5		X																			No Cuttings
40.0						qtz ss	tn	f-m	f	sa								N			
42.5						qtz ss	tn	f-m	f	sr								N			
45.0						qtz ss	tn	m	w	sa								N			
47.5						qtz ss	tn	f-m	f	sa								N			
50.0						qtz ss	tn	m	w	sr								N			
52.5						qtz ss	ywtn	m	f	sr								N			
55.0						qtz ss	tn	m	f	sr								N			
57.5						qtz ss	gytn	m-cr	f	sa								N			
60.0						qtz ss	gytn	f	w	sr								N			
62.5						qtz ss	lt bn	m-vcr	p	sa								N			
65.0						qtz ss	gytn	f	f	sa								N			
67.5						qtz ss	lt bn	m	w	sr								N			
70.0						qtz ss	ltgybn	m-cr	f	sr								m			
72.5						qtz ss	or bn	m-vcr	p	sa								S			
75.0						qtzss, cgl	tn	m-grit	p	a								N			multi colored chert frags. and pebbles
77.5						qtzss, cgl	tn	m-vcr	p	sa								N			
80.0						qtz ss	tn	f-cr	p	sr								N			
82.5						qtz ss	tn	f-m	f	sr								m			
8.						qtz ss	lttn	f-m	f	sr								N			
87.5						qtz ss	lttn	f-m	f	sr								N			
90.0						qtz ss	lttn	f-m	f	sr								W			
92.5						qtz ss, sh	tn-gybl	f-m	f	sr	L		Tr	C	L			W			sparse shale frags
95.0						qtz ss.	tn	f-m	f	sr								N			
97.5						qtz ss	tn	f-m	w	sr								N			
00.0						qtz ss,	vlttn-wh	f-vcr	p	sa								N			
102.5						qtz ss, cgl	vlttn-wh	f-grit	p	sa								N			Some multicolored chert pebbles and rock frags.
05.0						qtz ss, cgl	tn	f-grit	p	sa			Tr	C	T			N			
107.5						qtz ss, cgl	dkgytn	m-grit	p	sa								N			abunt multicolored chert pebbles
10.0						qtz ss, cgl	dkgytn	m-grit										N			
12.5						sndy sh, cgl	blgygn-rdbn	m-cr										N			upper Brushy Basin Ct @ approx 111.5 ft.
1						sndy sh	blgy	m	p	sa								N			

PERCENTAGE COMPOSITION IMAGE

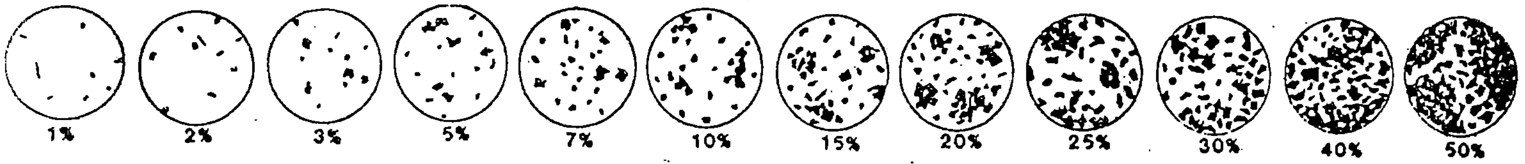


Date 5-1-07 Geologist Casebolt Drilling Co. Boyles Exploration Hole No. TW4-23
Property White Mesa Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 120.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS CORE ZONE 100-120
0																					
2.5						Sndy sltst	ltrdbr	f	P									S			Surface soil
5.0						Sh	ltrdbr											VS			Mancos Sh
7.5						Sh	ltpktn											VS			
10.0						sh	ltpktn											VS			
12.5						Sh	lt ywgy											VS			
15.0						Sh	ltywgy-gy											VS			abnt selenite xls
17.5						sh	ltywgy											VS			some selenite xls
20.0						sndysh	ltywgy	vf	P									S			very abnt selenite xls
22.5						Sh	ltywgy											M			sparce selenite xls.
25.0						sndysh	ywgy	vf	P									W			very large & abunt selenite frags.
27.5						sndysh	ywgy-dkgy	vf	P									N			abunt selenite
30.0						sndysh	gy	vf	P			L						N			some selenite
32.5						qtzss/sh	orgy	f-M	P	r		L						N			Upper Dakota Fm contact approx 31.0ft.
35.0						qtz ss	lt ln	f-cr	P	r		L						N			
37.5						Sh	gy					L						N			shale lens
40.0						qtz ss	lt tn	vf	W	R								N			
42.5						qtz ss	lt tn	vf	W	R								N			
45.0						qtz ss	lt tn	vf	W	R								N			
47.5						qtz ss	lt tn	vf	W	R								N			
50.0						qtz ss	lttn	vf	W	R								N			
52.5						qtz ss	lttn	vf	W	R								N			
55.0						qtz ss	lttn	vf	W	R								N			
57.5						sltysh	vdkgy-blk											N	S		carbon plant frag-
60.0						qtz ss/cgl	wh-dkgy	f peb	N	A								N			chert peb/ frags.
62.5																					No sample
65.0						qtz ss	lttn	f cr	P	a								N			
67.5						qtz ss/cgl	ltorgy	f peb	N	A								N			abnt multicolored chert frag & peb
70.0						qtz ss/cgl	tn	f cr	N	A								N			Some muti colored chert frag.
72.5						qtz ss	tn	f-m	M	R								N			
75.0						sndy sltst	lt blgy	vf-f										N			
77.5						sltst/sh	lt blgy											N			
80.0						sltst	lt blgy											N			
82.5						sltst	ltgy											N			
85.0						qtz ss	vlttn	f	W	WR								N			Moisture first noted
87.5						qtz ss	vlttn	f	W	WR								N			
90.0						qtz ss	vlttn	f	W	WR								N			
92.5						qtz ss	vlttn	m	W	WR								N			
95.0						qtz ss	vlttn	m	W	WR			T	A				N			
97.5						qtz ss	vlttn	m	W	WR								N			Trace blgy shale, sparce chert grains
00.0						qtz ss	lttn/sh	m	M	WR								N			Begin core run
02.5																					No sample
05.0						qtz ss	lt bn	f-m	M	R											
07.5						qtz ss	vlttn	f-m	M	R											
10.0						qtz ss/sh	lttn-vltblgy	f-CR	P	S											
12.5						qtzss/sh	tn-ywgr-ltbl	mc	P	S											Upper Brushy Basin Ct @ 111.5, from core
15.0						Sh-sltst	ywgr-bl-ppbr														
17.5						Sh-qtz ss	ppbr-bl	m cr	P	A											
20.0						Sh-qtz ss	ppbr-bl	m cr	P	A											Bottom in Brushy Basin TD 120.0

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. TW4-23

Cored Interval 100.0 ft. to 120.0 ft. T.D

Depth	Description
100.0 - 110.0	Core recovery 26%, 100.0 ft. - 105.5 ft. no recovery. 105.5 108.5 ft. quartz sandstone / gritstone, very light yellow-tan, fine to grit size quartz grains. Oxidized, some low angle partings occur along crossbeds and concentrations of grit sized grains. Coarse material consists of chert and shale fragments, no high angle fractures or joints observed. 108.5-110.0 ft. quartz sandstone / conglomerate, light gray - reduced, sparse pyrite grains, some low angle partings. Quartz sandstone / gritstone with abundant chert grains and fragments. No high angle fractures or joints observed. Competent core.
110.0 - 120.0	Core recovery 85%, 110.5-111.5 ft. No core recovery, upper Brushy Basin contact selected at 111.5 ft. 111.5-113.5 ft. Mottled green shale, some low angle partings, Brushy Basin Fm. 113.5-120.0 ft. Purple - brown shale, some low angle partings, no high angle fractures or joints observed, core consists of broken fragments and 2 to 4 inch long unbroken pieces. Core began to air slake soon after retrieval.

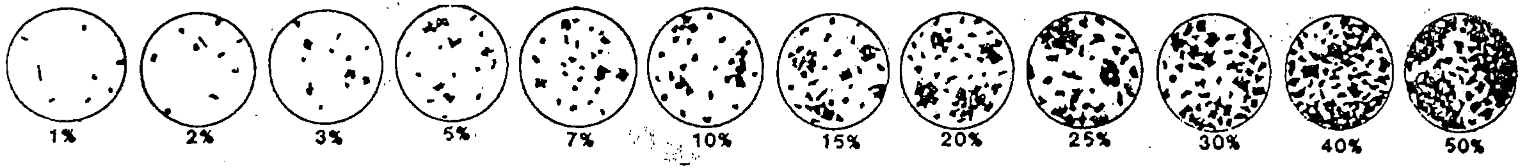
Date 5-2-07 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. TW4-24
Property White Mesa Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ≈

PAGE ____ OF ____
T.D. PROBE ____
T.D. DRILL ____
FLUID LEVEL ____

REMARKS CORE ZONE 100'-120'

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
2.5						Sndy Sltst	rd br	vf-CR	P	A		h						S			Surface soil - Some wh chert frags.
5.0						Sndy Sltst	rd br	vf-f	m	SA		h						VS			" " tr. selenite xl's
7.5						Sltst	rd br											N			
10.0						Sndy sltst	lt br	vf-f	m	SA		h						VS			
12.5						Sltysh	lt br											S			
15.0						Shale	lt ywbr											S			Mancos Shale
17.5						qtz Ss	tn	f-m	m	SR		l						N			Upper Dakota Fm contact at approx 15.0'
20.0						qtz Ss	ltgytn	m-CR	m	SA		l						N			Some wh chert frags.
22.5						qtz Ss	tn	m-CR	m	SA								N			
25.0						qtz ss	lttn	f-m	m	SA		l						N			
27.5						qtz ss	lttn	f-m	m	SA								W			
30.0						qtz ss, sh	lttn-gy	f-m	m	SA		l						N			some lt gy shale frags. (2%)
32.5						qtz ss, sh	lttn-gy	f-m	m	SA		l						N			" " " " (10%)
35.0						qtz ss, sh	lttngy	f	m	SA		l						N			ss/sh 50%/50%
37.5						qtz Ss, sh	wh-tn, gy	f	m	SA		l						N			ss/sh 50%/50%
40.0						qtz Ss, Sh	wh-tn, gy	f-m	m	SA		l						N			ss/sh 80%/20%
42.5						qtz Ss, Sh	wh-tn, gy	f-m	m	SA		l						N			ss/sh 90%/10%
45.0						qtz ss	tn	vf-m	P	SA		l						N			Clean Ss, sparse wh chert grains
47.5						qtz Ss	wh	vf-m	P	SA		l						N			some white chert grains
50.0						qtz Ss	wh	f-m	m	SR		l						N			Some wh+rd chert grains. Surface casing point
52.5						qtz ss, Cgl	lt tn	m-peb	P	SA		l						S			white chert frags, conglomerate zone
55.0						qtz ss, cgl	tn	m-peb	P	SA		l						N			white to gray chert frags
57.5						qtz ss	tn	m-CR	P	R		l						N			multi colored chert grains
60.0						qtz ss, cgl	tn	m-peb	P	SR		l						W			" " " "
62.5						qtz Ss	tn	f-m	P	SA		l						N			" " " "
65.0						qtz SS	tn	f-m	m	SR		l						N			" " " "
67.5						qtz SS	tn	m	W	R		l						N			
70.0						qtz Ss	tn	m-peb	P	SR		l						N			chert pebble frags. w/ tr limonite after pyrite
72.5						qtz Ss	lt tn	m-CR	m	SR		l						N			
75.0						qtz ss	vlttn	m-CR	m	SR								N			
77.5						qtz Ss	wh	m-CR	m	SR								N			
80.0						qtz Ss, sh	wh-ltgygn	m-CR	m	SR								N			ss/sh 60% /40%
82.5						slty sh	tn-gy											N			
85.0						qtz Ss	wh-ltgy	f-m	m	SA								W			
87.5						qtz ss, sltst	wh-ltgy	f-m	m	SA								VS			
90.0						qtz ss, sltst	lttn-ltgy	f-m	m	SA								W			
92.5						qtz SS	vlttn	f-m	w	SR								W			
95.0						qtz ss	vlt tn	f-m	m	SA								W			
97.5						qtz ss	vlt tn	f-m	m	SA								W			
00.0						qtz SS	vlt tn	m	w	R		l						N			some rounded chert grains - begin coring
102.5																					no cutting recovered below 100.0'
05.0																					
07.5																					
10.0																					
112.5																					
15.0																					

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. TW4-24

Cored Interval 100.0 ft. to 120.0 ft. T.D

Depth	Description
100.0 - 110.0	Core recovery 54%, 100.0 ft. - 104.8 ft. no recovery. 104.8- 108.4 ft. quartz sandstone / conglomerate, light tan, fine to grit size sub angular quartz and chert grains. Some very low angle crossbeds. Core is oxidized with limonite staining. Non calcareous. 108.4-110.0 ft. Quartz sandstone / conglomerate, some low angle partings.
110.0 - 120.0	Core recovery 100%, 110.0-110.2 ft. Quartz sandstone / conglomerate, very light tan to white to yellow, oxidized contact, contact is not gradational. Contact is approx. 15 to 20 degrees from horizontal. Chert pebbles to 1/4". 110.2-115.8 ft. Quartz sandstone / siltstone, some shale fragments, very fine to fine grained with occasional chert grains. Low angle partings. 115.8-118.2 ft. Purple-brown siltstone / shale, mottled appearance, high angle (45 degree) slickensided partings at 116.4 ft. and 118.2 ft. Striations indicate some normal movement. 118.2-120.0 ft. Light green siltstone / shale, some low angle partings.

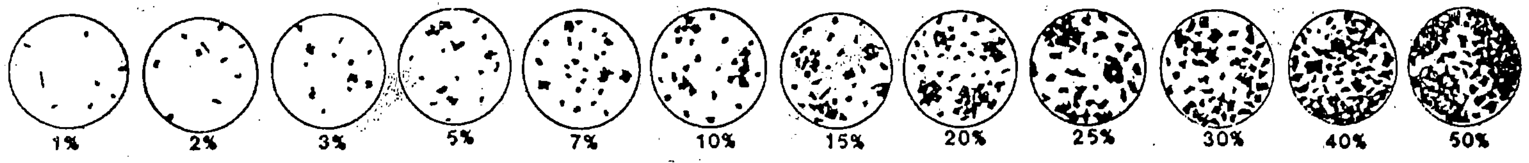
Date 4-30-07 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. TW4-25
Property White Mesa Mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈

PAGE 1 OF 2
T.D. PROBE ______
T.D. DRILL 140.0
FLUID LEVEL ______

REMARKS CORE ZONE 110.8'-140'

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						Sndy Sltst	rdbr	vf	P	SA		h						S			Surface Soil.
5.0						Sndy Sltst	rdbr	vf	P	SA		h						S			" "
7.5						Sltysh	lt br					l						VS			Mancos Shale Fm.
10.0						Slty sh	lt br					l						VS			
12.5						Shale	lt br-ltywgn					l						VS			
15.0						Shale	lt br-ltywgy					l						VS			
17.5						Shale	lt br-lt ywgy					l						S			
20.0						Sndy Sh	lt gy br	vf				l						S			
22.5						Sndy Sh	ltgybr	vf				l						W			
25.0						Sndy Sh	ltgybr	vf				l						VW			
27.5						sndy Sh	ltgy br	vf				l						N			Upper Dakota Fm contact at approx 27.5 ft.
30.0						qtz Ss	lt tn	f	m	SR		h						N			
32.5						qtz Ss	lt tn-lt gy	f-m	m	SR		h						N			
35.0						qtz Ss	lt tn	f-m	m	SR		l						N			
37.5						qtz Ss	lt tn	f-m	m	SR		l						N			
40.0						qtz Ss	lt tn	f-m	m	SR		l						N			
42.5						qtz Ss	v lt tn	f-m	m	SA		l	Tr					N			trace diss. pyrite
45.0						qtz Ss	v lt tn	f-m	m	SR		l						N			
47.5						qtz Ss	v lt tn	f-m	m	SR		l						W			
50.0						qtz Ss	v lt tn-v lt gy	f-m	m	SR		l						N			
52.5						qtz Ss	ltgytn	f-m	P	SA	A							N			
55.0						qtz Ss	wh-lt gy	f-m	P	SA	A							N			Some multi colored chert frags.
57.5						qtz Ss	vlttn	m	m	SR								N			Some gy chert frags.
60.0						qtz Ss	vlttn	f-cr	P	SR								N			dkgy chert frags.
62.5						qtz Ss	wh	f-m	P	SR								N			clean ss.
65.0						qtz Ss	wh	vf-CR	P	SA		l	Tr					N			abnt dk chert frags
67.5						qtz Ss	wh-lttn	vf-grnl	P	SA		l	tr					N			" lt chert frags
70.0						qtz Ss	vlttn	vf-m	m	SR		l	tr					N			
72.5						qtz Ss-Chert	wh-tn	m-CR	m	SR		l	Tr					N			
75.0						qtz Ss-Grit	wh-lttn	m-CR	P	SA		l	Tr					N			abnt multi colored angular chert frags.
77.5						qtz Ss-Cgl	tn	VCR-Cgl	P	A								N			" " " " " "
80.0						qtz Ss-Cgl	gytn	VCR-Cgl	P	A								N			" " " " " "
82.5						qtz Ss-Cgl	gytn	VCR-Cgl	P	A								N			" " " " " "
85.0						qtz Ss-Cgl	gytn	VCR-Cgl	P	A								N			" " " " " "
87.5						qtz Ss-Cgl	gytn	VCR-Cgl	P	A								N			" " " " " "
90.0						qtz Ss Cgl	lt tn	VCR-Cgl	P	SA								N			Some multi colored angular chert frags.
92.5						qtz Ss	vlttn	m-CR	m	SR								N			" " " " " "
95.0						qtz Ss	vlttn	f-CR	P	SR								N			" " " " " "
97.5						qtz Ss-Sh	vlttn-vltgn	vf-f	m	SR								N			Sparse shale frags.
100.0						Slty Sh	vltgn											N			
102.5						qtz Ss-Sh	lttn-ltgygn	vf-f	m	SA								N			sparse shale frags.
105.0						qtz Ss	lttn	f-m	m	SR								N			sand size chert grains
107.5						qtz Ss-Sh	lttn-ltgn	vf-f										N			some ltgn shale frags.
110.0						qtz Ss-Sh	lttn-ltgn	vf-f										N			" " " " Begin Coring @ 110.8'
112.5						qtz Ss.	lttn —	vf	W									N			
115.0						qtz Ss	lttn	vf	W									N			
117.5																					No Cuttings recovered below 115.0'
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



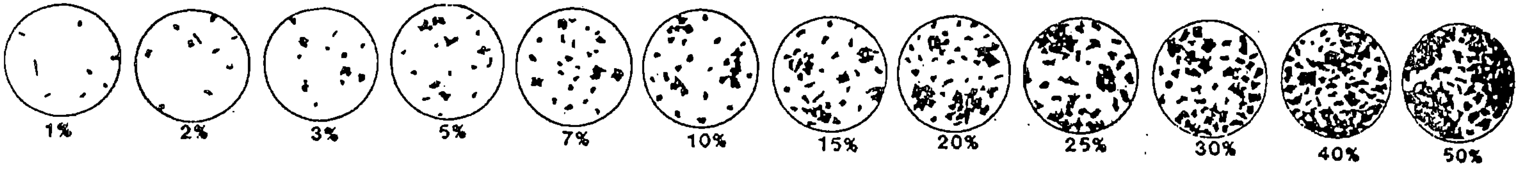
2742

Date 4-30-07 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. TW4-25
Property White Mesa mill Project ______ Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 2 OF 2
T.D. PROBE ______
T.D. DRILL 140.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0		X																			
127.5		X																			cored interval - no cuttings
130.0		X																			↓
132.5		X																			↓
135.0		X																			↓
137.5		X																			↓
140.0																					
T.D.																					

PERCENTAGE COMPOSITION IMAGE



Core Log of Well No. TW4-25

Cored Interval 110.8 ft. to 140.0 ft. T.D.

Depth	Description
110.8 - 120.0	Core recovery 100%, 110.8 - 116.0 ft. very light gray quartz sandstone, very fine grained, some low angle partings, mottled appearance, some light green shale fragments. Competent core, no high angle fractures or joints. 116.0-120.0 ft. quartz sandstone, fine to coarse grained, some low angle partings, no high angle fractures or joints. Grit sized material occurs along bedding planes, competent core.
120.0 - 130.0	Core recovery 100%, 120.0-127.8 ft. clean white quartz sandstone, fine to medium grained, well sorted and rounded, competent core. Low angle cross-bedded with gray green shale fragments concentrated at bedding planes. 127.8-128.5 ft. quartz sandstone / grit, coarse, poorly sorted, very light gray, sparse disseminated pyrite, some chert fragments and light green shale fragments. 128.5-130.0 ft. clean quartz sandstone, fine to medium grained, white, no high angle fractures or joints, competent core.
130.0 - 140.0	Core recovery 75%, 130.0-131.9 ft., Dakota sandstone, fine to medium grained quartz, well sorted, rounded grains, low angle cross-bedding, accessory grains include multi colored chert grains and shale fragments. Three inch zone of disseminated pyrite mineralization occurs from 130.7 to 130.9 ft. Core is white with dark gray patch of pyrite. Numerous low angle partings occur at bedding planes. No high angle fractures or joints are observed. Sandstone / Shale contact occurs at 131.9 ft. Upper Brushy Basin contact. 131.9-134.5 ft., core is missing, no recovery, presumed to be Brushy Basin. 134.5-135.0 ft., core material consists of fragments of light gray green shaly siltstone. 135.0-137.8 ft., light gray green siltstone, with some mottling, competent core. 137.8-139.5 ft., purple brown siltstone / shale, competent core. 139.5-140.0 ft., light gray green siltstone, no high angle fractures or joints. T.D.

Date 5-25-2010 Geologist [redacted] Casebolt Drilling Co. Boyles Exploration Hole No. TW4-26
Property White Mesa Mill Project Chloroform Investigation Unit No. ______ Sec. 33 Twp. 37S Rge. 22E
County San Juan State Utah Location 4154276 632571 Elev. ≈5602

PAGE 1 OF 1
T.D. PROBE 100.5
T.D. DRILL 100.0
FLUID LEVEL 63.5 @ 8:30 AM ON 5-26-2010

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Mdst	dkrdbn											S			Surface soil/mudstone
5.0						Sh	ltpktn											VS			Mancos Shale Fm.
7.5						Sndy sltst	ywbn											VS			" " "
10.0						Sndy sltst	ywbn											VS			" " "
12.5						Sltst	ywbn											VS			" " "
15.0						Sltst/qtz ss	gybn	f-cr	p	r		H						W			Upper contact Dakota Fm @ 13.0 ft.
17.5						qtz ss	gybn	m-cr	m	r								N			
20.0						qtz ss	gybn	m-vcr	p	s								N			abundt. dkgr chert grains
22.5						qtz ss	gybn	m-vcr	p	s								VW			abundt. white chert grains.
25.0						qtz ss	tn	f-m	W	r								N			clean sand
27.5						qtz ss	tn	f-m	w	r								N			clean sand
30.0						qtz ss/sh	tn - ltblgy	f-m	M	r								N			Shale layer
32.5						qtz ss	tn	f-m	w	r		L						N			clean sand
35.0						qtz ss	tn	f-cr	m	a								N			some dkgy-wh chert fragments.
37.5						qtz ss	lt tn	m	W	R								N			clean sand
40.0						qtz ss	lt tn	f	W	R								N			clean sand
42.5						qtz ss	lt tn	f-m	m	r								N			
45.0						qtz ss	lt tn-gy	f-m	m	r								N			
47.5						qtz ss	tn	m-cr	m	r								N			
50.0						qtz ss, sh	tn-gy	f-m	m	r								N			shale layer
52.5						qtz ss	lt tn	f-m	m	r		L						N			
55.0						qtz ss	lt tn	f	W	R								N			
57.5						qtz ss	lt ywtn	f-m	m	r								N			abundt chert grains
60.0						qtz ss	lt tn	m-cr	m	a								N			
62.5						qtz ss	tn-dkgy	m-peb	p	a								N			multi colored chert frags or grains
65.0						qtz ss	tn-dkgy	m-peb	p	a								N			Moisture first noted, abund chertgrains
67.5						qtz ss	tn-gy	m-peb	p	r								N			
70.0						qtz ss, sh	tn-lt blgy	m-vcr	m	r								S			Shale layer.
72.5						sltst, ss	ltgy	f	W	r								VW			
75.0						qtz ss, sltst	yWtn-ltgy	vf-m	m	r								N			
77.5						qtz ss, sh	vltbn	vf-m	m	r								N			
80.0						qtz ss	ywtn	vf-m	m	r		L						N			cuttings very damp, abunt. lim.
82.5						qtz ss	tn.bn	m-peb	P	r								N			Begin H2O injection - increased permeable
85.0						Sh, qtz ss	blgn-tn	m-cr	m	r								N			Brushy Basin Contact @ 83.0ft. chert frags
87.5						Sh	blgn											N			
90.0						Sh	blgn											N			
92.5						Sh, sltst	blgn-blgy											N			
95.0						Sh, sltst	blgn-blgy											N			
97.5						Sh	blgy											N			
100.0						Sh	blgn-ppbn											N			mottled frags.
T.D.																					

Date 10-18-11 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc Hole No. TW4-27
Property White Mesa Mill Project chloroform investigation Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 100.0
T.D. DRILL 100.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0						CL w/sand	rdbn	slt-vf	m	a								S			Surface soil. CL (Lean Clay w/ sand
2.5						CL w/sand	ltpkbn	slt-vf	m	a								S			Mancos Sh fm @ 6.0' CL
5.0						slty sh	ltgybn											VS			
7.5						slty sh	ltgybn											VS			
10.0						Snd sh	gybn	vf-f	m	a								VS			
12.5						Slty ss	ywbn	vf-f	m	a								S			
15.0						sndy sh-qtzss	ywbn	f	m	a								W			Dakota Ct. @ 17.0'
17.5						qtz ss	lttn	m	w	r								N			
20.0						qtz ss	ltortn	m	w	r		lim						N			
22.5						qtz ss	ltgytn	m	w	r		hem						N			tr hem. as cement
25.0						qtzss, sh	ltgytn	m-cr	M	r								N			
27.5						qtz ss	lttn	m	W	r								N			
30.6						qtz ss	lttn	m	W	r								N			
32.5						qtz ss	tn	f-m	M	r								N			moisture noted @ 35.0 ft.
35.0						qtzss, sh	tn-gy-pk	f-cr	m	r								N			some bright pinkred clay min as cement
37.5						qtz ss	vltgy	f-m	w	r								N			
40.0						qtzss, sh	vltgy	m-cr	m	r								N			
42.5						qtz ss	tn	m-cr	m	r								N			
45.0						qtz ss	tn	m	W	r								N			
47.5						qtz ss	tn	m-cr	m	r		lim						N			
50.0						qtz ss	ltortn	m	w	r								N			
52.5						qtz ss	ltgybn	m-cr	m	r								N			Some light colored chert frags and grains
55.0						qtz SS	ltgybn	m-cr	m	r								N			abund. light colored chert frags.
57.5						qtz ss	tn	m	w	R								N			
60.0						qtz ss	tn	f-m	m	R								N			
62.5						qtz ss	tn	f-m	m	R								N			
65.0						qtz ss	tn	f-m	M	R								N			light and dark chert frags.
67.5						qtz ss	tn	m	W	R								N			sparse dk grey chert frags.
70.0						qtz ss	or tn	m	m	R								N			some multi colored chert frag.
72.5						qtzss, cgl	tn-gybn	m-peb	w	A								N			abund. chert frags and pebbles. moisture noted.
75.0						qtzss	tn	m-cr	m	r								N			
77.5						qtz ss	tn	f	w	r								N			
80.0						qtz ss	tn	f	w	r								N			
82.5						qtz ss	ywtn	m-vcr	p	a								N			abund chert frags.
85.0						qtz ss	ywtn	m-cr	m	r								N			
87.5						qtz ss	ywtn	m-vcr	P	a								S			some chert pebbles
90.0						qtz ss, cgl, sh	ortn-blgn	m-peb	P	a			<1%c					VW			Brushy Basin Ct @ 91.0 ft. sparse sulfides
92.5						sndysh	blgn	m	m	r		LT						N			sparse chert peb.
95.0						sndysh	blgn	m	m	r								N			
97.5						sh	ltblgn-vltbn											N			T.D. no free water observed
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

Date 3-4-2013 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TW4-28
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location White Mesa mill Elev. ______

PAGE 1 OF 1
T.D. PROBE 114.0
T.D. DRILL 112.5
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
2.5						Clay w/sand	rdbn	slt-vf	m	a								S			Surface Soil
5.0						Clay w/sand	rdbn-ltrdbn	slt-vf	m	a								S			Surface Soil
7.5						Clay w/sand	ltrdbn	slt-vf	m	a								VS			Surface Soil
10.0						Clay w/sand	lt rd bn	slt-vf	m	a								VS			Surface Soil
12.5						Sh	pk-ltywbn											VS			Mancos Sh Ct. @ 11.0'
15.0						sh	ywbn											S			
17.5						sndy sh	ywbn	f-m	m	r								N			
20.0						sndy sh	ywbn	f-m	m	r								W			
22.5						sndy sh	ywbn	f-m	m	r								W			
25.0						sndy sh	ywbn	f-m	m	r								N			
27.5						sndy sh	ywbn	f-m	m	r								N			Dakota Fm ct @ 27.5'
30.0						qtz ss	lttn	m-cr	m	r								N			
32.5						qtz ss	lt or tn	m	w	a								N			
35.0						qtz ss	lt or tn	m	w	a								N			
37.5						qtz ss	lt or tn	m	w	a								W			
40.0						Sh	blk											N	Tr		
42.5						Sh	vdkgy											N			moisture first noted @ 40.0'
45.0						sndy sh	ltgy	f-m	m	a								S			
47.5						Sh-sndy sh	ltgy-dkgy	f-m	m	r								N			began H2O injection @ 45.0'
50.0						qtz ss/sndy sh	ltgy-dkgy	f-m	m	r								N			
52.5						qtz ss w/sh	ltgy-dkgy	m	m	a								N			
55.0						Sndy sh	vdkbn	vf-m	p	a								N			
57.5						qtz ss, sh	ltgy-blk	f-m	m	a								N			
60.0						qtz ss, sh	gy-blk	f-m	m	a								N	20%		Carbonaceous plant frag. abund.
62.5						qtz ss, cgl	dkgy	m-peb	p	A								N	10%		Some chert pebbles and frags.
65.0						cgl/qtz ss	ltgy-vdkgy	m-peb	p	A								N	10%		
67.5						cgl/qtz ss	dkgy	m-peb	p	A								N	1%		abund. dk gy chert pebbles and frags.
70.0						cgl/qtz ss	vdkgy	m-peb	p	A								N	1%		" " " " " " "
72.5						cgl/qtz ss	vdkgy	m-peb	p	A								N			" " " " " " "
75.0						cgl/qtz ss	vdkgy	cr-peb	p	A								N			
77.5						qtz ss/cgl	vltgy	cr-peb	p	A								VW			
80.0						slty sh	vltgy-vltblgy											N			
82.5						sndy sh	vltblgy	vf-f	m	a			tr	c				N			
85.0						slty sh	ltblgy											N			
87.5						sh	ltgygn											N			
90.0						sh	ltgygn											N			
92.5						slty sh	vltgy						tr	I				N			some disseminated pyrite xls.
95.0						slty sh	vltgygn											N			
97.5						sltst	vltgy											N			
100.0						sltst	vltgy-vltgygn											N			
102.5						sltysh	vltgygn						Tr					N			
105.0						Sh	blgn											N			Brushy Basin Ct. @ 102.5' small rd chert pebbles
107.5						slty sh	blgn											N			
110.0						slty sh	blgn											N			
112.5						sltysh	blgn-blgy											N			
114.0						sltysh	blgn-blgy											N			T.D. 114.0'

PERCENTAGE COMPOSITION IMAGE

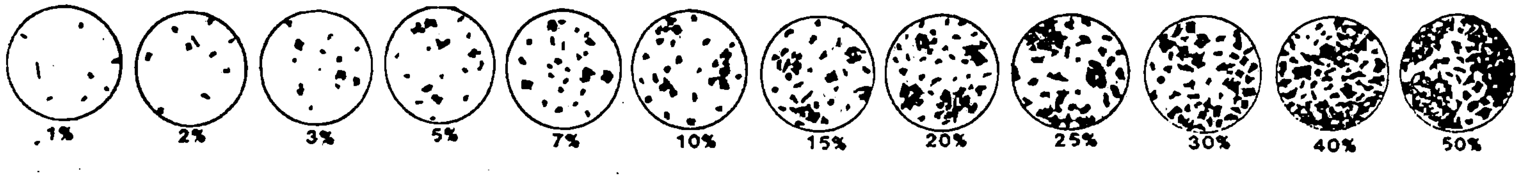
Date 3-4-13 Geologist L CASEBOLT Drilling Co. Boyles Exploration, Inc. Hole No. TW4-29
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ≈5605

PAGE 1 OF 1
T.D. PROBE 101.5'
T.D. DRILL 100.0'
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						clay w/slt	rdbn											W			Surface soil.
5.0						clay w/slt	rdbn-ltpktn											VS			Surface soil
7.5						clay w/slt	ltpktn											VS			Surface soil
10.0						sh	ywgy											S			Mancos Sh. ct. @ 7.5'
12.5						sh	ywbn											S			
15.0						sh/qtz ss	ywbn	f-cr	p	A								W			
17.5						qtz ss/sh	ywbn	f-m	m	a								N			
20.0						qtz ss/sh	ywbn	f-m	m	a								N			
22.5						qtz ss/sh	ywbn	f-m	m	a								N			
25.0						sndy sh	ywbn	f	w	a								N			
27.5						sndy sh	ywbn	f	m	a								N	Tr		
30.0						qtz ss	tn	m	m	a								N			Upper Dakota Ct @ 27.5'
32.5						sndy sh	ortn	vf-cr	p	a		L						N			
35.0						Sh	lt gy											N	1%		carbonaceous matter
37.5						qtz ss	ortn-rdbn	f-m	p	a								N	Tr		" "
40.0						qtz ss	ortn	m-cr	m	A		L						N	Tr		
42.5						qtz ss	tn	m	w	r								N			
45.0						qtz ss	ltgytn	m	w	r								N			
47.5						qtz ss	ltgytn	m	w	r								N			Moisture first noted @ 47.5'
50.0						qtz ss	tn	m	w	a								N			
52.5						qtz ss	dkpktn	m	w	r								N			
55.0						qtz ss	dktn	m	w	r								N			Some light colored chert frags.
57.5						qtz ss	ltbn	f-m	m	a								N			
60.0						qtz ss/cgl	ltgy-wh	m-peb	p	A								N	Tr		abund. chert pebbles and frags.
62.5						cgl/qtz ss	dkgy-tn	m-peb	p	A								N			" " " " "
65.0						cgl/qtz ss	tn-ltgy	m-peb	p	A								N			" " " " "
67.5						cgl/qtz ss	tn-gy	cr-peb	p	A								N			" " " " "
70.0						cgl/qtz ss	tn-gy	cr-peb	p	A								N			" " " " "
72.5						cgl/qtz ss	tn-dkgy	cr-peb	p	A								N			" " " " "
75.0						qtz ss/cgl	gytn	m-peb	p	A								N			
77.5						qtz ss/cgl	tn	m-peb	p	a								N			
80.0						qtz ss	tn	m-cr	m	r								N			
82.5						qtz ss	tn	m-cr	m	r								N			Begin H_2O injection
85.0						cgl/qtz ss	tngy	m-peb	p	A			Tr	I				N			limonite after pyrite, rare pyrite xls in shale frag.
87.5						cgl/qtz ss	tn-dkgy	m-peb	p	A			Tr	C				N			
90.0						Sh/qtz ss/cgl	tn-blgn	m-peb	p	A								N			Brushy Basin ct. @ 88.0 ft.
92.5						Sndy sh	blgn	f-m	m	a								N			Sparse rd chert pebbles.
95.0						Sndy Sh	blgn	f-m	m	a								N			Some rd chert pebbles
97.5						Sndy Sh	gygn	f-m	m	a								N			
100.0						Sndy Sh	ltblgn	f-m	m	a								N			T.D. @ 101.5' small (½-1mm) rd chert pebbles
102.5																					and qtz grains in matrix of blgy sh.

General Note: The fractured and fragmented condition of the chert and quartz pebbles may have resulted from the crushing action of carbide buttons of the tricone roller bits used to drill these wells.

PERCENTAGE COMPOSITION IMAGE

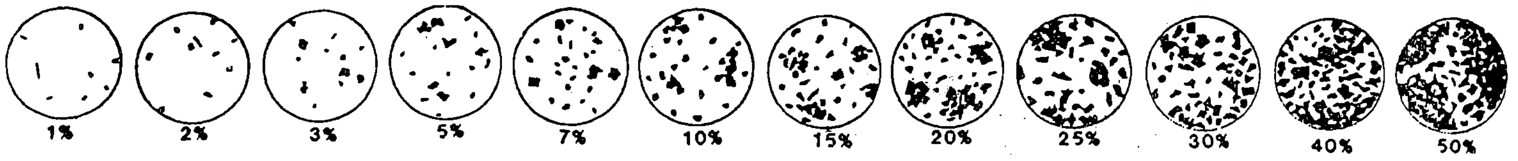


Date 3-5-13 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. TW4-30
Property White Mesa Mill Project Nitrate study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 96.0'
T.D. DRILL 95.0'
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						cl w/sand	rdbn	slt-vf	m	a								W			Surface soil.
5.0						cl w/sand	rdbn-lttn	slt-vf	m	a								W			Surface soil
7.5						slty sh	rdbn-ltywbn	slt-vf	m	a								VS			Macos Sh Ct @ 5.0'
10.0						sndy sh	ltywbn	slt-vf	m	a								VS			
12.5						snd sh	ywbn	f	m	r								VS			abund. selenite (gypsum xls.)
15.0						sndy sh	ywbn	f	m	r								N			some selenite xls.
17.5						qtz ss w/sh	ywbn	f	m	r								N			
20.0						qtz ss w/sh	ywbn	f	m	r								W			
22.5						qtz ss w/sh	ywbn	f	m	r								W			
25.0						sh	ywbn-gy											W			
27.5						sndy sh	ywgy bn	f	m	r			tr	I				W			
30.0						sndy sh	yw bn	f	m	a								N	tr		
32.5						qts ss/sh	lt or-tn	f	m	a								N	tr		Upper Dakota Ct @ 31.0'
35.0						qtz ss	ltgy-tn	f-m	m	r								N			
37.5						qtz ss/sh	gy-ortn	f-m	m	r		L						N			
40.0						qtz ss	tn	m	m	a								N			moisture 1st noted @ 37.5'
42.5						qtz ss	ltgytn	m-cr	p	a								N			
45.0						qtz ss	tn	m	w	a								N			Begin H_2O injection @ 45.0'
47.5						qtz ss	ywtn-rd	m-cr	m	a								N			
50.0						qtz ss/sh	ywtn-gy	m-cr	m	a								N			
52.5						qtz ss	tn-gyblk	f-m	m	a								N	15%		
55.0						qtz ss/cgl	tn-blk-rd	m-peb	p	A								N	15%		abund carbon as plant frags./chert frags.
57.5						qtz ss/cgl	tn-rdtn	m-peb	p	A								N			abund chert/qtz pebble frags.
60.0						qtz ss/cgl	tn-rdtn	m-peb	p	A								N			" " " " "
62.5						cgl/qtz ss	gy-tn	cr-peb	p	A								N			approx 80% chert frags.
65.0						qtz ss/cgl.	tn	m-cr	p	a								N			
67.5						qtz ss/cgl.	tn	m-peb	p	a								N			abund chert pebble frags
70.0						cgl/qtz ss	tn-dkgy	m-peb	p	a								N			
72.5						cgl/qtz ss	ortn-gy	m-peb	p	a								N			abund multi colored chert frags.
75.0						cgl/qtz ss	orgytn	cr-peb	p	a								N			" " " " "
77.5						cgl/qtz ss	orgytn	m-peb	p	A								N			
80.0						cgl/qtz ss	orgytn	cr-peb	p	A								N			mostly chert pebbles and frags.
82.5						qtz ss/cgl	tn-gy	f-peb	p	A								N			
85.0						qtz ss/cgl	tn	m-peb	p	A								N			
87.5						qtz ss/sh	ywtn-blgn	m-cr	m	R								N			Brushy Basin Ct @ 86.0'
90.0						qtz ss/sh	blgn	m	w	R			tr					N			tale tell rd chert grains
92.5						sh/qtz ss	blgn	f-m	m	a			tr					N			" " " " "
95.0						sh/qtz ss	blgn-ltgy	f-m	m	a			tr					N			T.D. @ 96.0'
97.5																					
100.0																					
102.5																					
105.0																					
107.5																					
110.0																					
112.5																					
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE



Date 3-5-13 Geologist L. Casebolt Drilling Co. Boyles Exploration, Inc. Hole No. TW4-31
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE 111.0
T.D. DRILL 110.0
FLUID LEVEL ______

													PYRITE						CARBON		
DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	AMOUNT	HABIT	ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	AMOUNT	TYPE	REMARKS
0																					
2.5						CL w/sand	rdbn	slt f	m	a								VS			Surface Soil. CL (lean clay w/ sand
5.0						CL w/sand	vlttn-wh	slt-vf	m	a								VS			Surface Soil CL (lean clay w/sand
7.5						Sltysh	ltgybn	slt-vf	m	a								VS			Mancos Sh Ct.@ 5.0'
10.0						Sndysh	ltywbn	f-m	m	a								S			
12.5						Sndysh	ltywbn	vf-m	m	a								VS			
15.0						qtzss w/sh	ltywbn	f-m	m	a								S			
17.5						qtzss w/sh	ltywbn	f-m	m	r								N			
20.0						qtzss w/sh	ltywbn	f-m	m	r								N			
22.5						qtzss	lt tn	f	w	r								W			Upper Dakota ct @ 20.0'
25.0						qtzss	lt tn	f	w	r								N			
27.5						qtzss	lt tn	f-m	m	r								S			
30.0						qtz ss	lt tn	f-m	w	r								S			some muscovite sheets as accessory minerals
32.5						sh	lt gy											N	<1%	I	sparse carbon material
35.0						sh-qtzss	or bn-gy	f-m	w	r		L						N	Tr	I	abund. limonite as cementing agent.
37.5						qtzss-sh	lt or bn-gy	f-cr	m	a								N			
40.0						qtz ss	lt tn	f-m	m	a								N			
42.5						qtz ss	ltgytn	m-cr	m	a								N			
45.0						qtzss	lt tn	m-cr	w	r								N			
47.5						qtzss	lt tn	f-m	m	a								N			
50.0						qtzss-sh	lt bn-dkgy	m-cr	m	r								N	5%	I	some carbon fragments
52.5						qtzss	bn	m	w	r								N	<1%	I	some carbonaceous material; sparse chert frags.
55.0						qtz ss	bn	m	w	r								N			Some chert frags.
57.5						qtzss	bn	m	w	r								N			
60.0						qtzss	bn	m-cr	m	a								N			Moisture 1st noted @ 60.0'
62.5						qtzss	lt pkbn	f-m	m	a								N			
65.0						qtzss	lt tn	f-m	m	a								N			
67.5						qtzss	tn	m-vcr	p	A								N			abund. light colored chert frags.
70.0						qtzss	tn	m-cr	p	A								N			abund. multi colored chert frags.
72.5						qtzss	tn	m-cr	p	a								N			
75.0						qtzss/cgl	tn-dkgy	m-peb	p	A								N			pebble cgl w/ abund. chert pebbles and frags.
77.5						qtzss/cgl	tn-dkgy	m-peb	p	A								N			" " " " " " "
80.0						qtzss	tn	m	m	r								N			
82.5						qtzss	tn	m	m	r								N			
85.0						qtzss	tn	m-cr	m	r								N			abund. multi colored chert frags
87.5						qtzss	tn	m	w	r								N			
90.0						qtzss/cgl	tn	m-peb	p	r								N			Some chert pebbles and frags.
92.5						qtz ss/cgl/sh	gytn	m-peb	p	r								N			abund. chert and qtz. pebbles and frags.
95.0						qtzss	gytn	m-peb	p	a								N			" " " " " " "
97.5						qtzss	tn	m	w	r								N			clean sand
100.0						qtz ss/cgl.	tn	m-peb	m	a								N			sulfides (marcasitic habit)
102.5						qtzss-sh	gy-blgn						2%	c/mt				N			Brushy Basin Ct @ 101.0 Began H_2O injec'd @ 100.0'
105.0						sh	gy-rd											N			shale frag. mottled gray w/pp bn, Sharp contact
107.5						sh/cgl	gygn-ppbn											N			large chert frag.
110.0						sh	ppbn-blgn											N			
112.5																		N			T.D. @ 111.0
115.0																					
117.5																					
120.0																					
122.5																					
125.0																					

PERCENTAGE COMPOSITION IMAGE

Date 9-9-2013 Geologist L. CASEBOLT Drilling Co. Bayles Exploration Co. Hole No. TW4-32
Property White Mesa Mill Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 119.5
T.D. DRILL 117.5
FLUID LEVEL 43.4
8.45 AM, 9-11-13

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
2.5						CL w/sand	rdbn	slt vf	m	a								N			Surface soil. CL (Lean clay w/ Sand)
5.0						CL w/sand	rdbn	slt vf	m	a								VS			Surface soil CL (Lean clay w/ sand)
7.5						CH w/sand	rdbn	slt vf	m	a								VS			Surface Soil CH (Fat Clay w/ Sand)
10.0						CH w/sand	lt rdbn-ywbn	slt vf	m	a								VS			Mancos Sh fm @ 9.0'
12.5						CL w/sand	lt rdbn-pk	slt f	m	a								S			Small sandstone pebble
15.0						qtz ss/sh	lt ywbn	f-m	m	a								VS			
17.5						qtz ss/sh	lt ywbn	f-cr	p	a								m			
20.0						qtz ss	tn	f-cr	p	a								VW			Upper Dakota Ct. @ 17.5' white chert frag - 1cm
22.5						qtz ss	tn	m	m	a		lim						VW			
25.0						qtz ss	tn	m-cr	m	a		lim						N			
27.5						qtz ss	tn	m	w	r		lim						N			
30.0						qtz ss	ywtn	m-cr	m	a		lim						N			
32.5						Sh	lt ppbn											N			
35.0						Sh/qtz ss	dk ppgy	cr	w	r								N			
37.5						qtz ss/sh	tn-gy	vf-f	m	r								N			
40.0						qtz ss	tn	f-m	m	r								N			
42.5						qtz ss/sh	tn	f-m	m	a								N			moisture first noted @ 42.5'
45.0						qtz ss	tn	m-cr	m	a								N			
47.5						qtz ss	tn	m	w	r								N			
50.0						qtz ss	tn	m-cr	m	r								N			Well began producing H2O @ 50.0'
52.5						qtz ss/sh	tn-ltgy	m	m	r								N			
55.0						qtz ss/sh	gy	f-peb	p	A								N	3%	I	abund. chert pebbles and frags.
57.5						sh/qtz ss	dk gy	m-cr	p	a								N	15%	I	Some chert peb. and frags
60.0						sndy sh	gy	m-cr	p	a								N		I	Began H2O injection @ 60.0' Some chert frags.
62.5						cgl/qtz ss	orgy	m-peb	p	a								N			Abund. multi colored chert peb. and frags.
65.0						cgl/qtz ss	orgy	m-peb	p	a								N			
67.5						qtz ss/cgl	tn gy	m-peb	p	a			3%	C/A				N			Abund. chert frags, abund sulfides as cement a disse
70.0						qtz ss/sltst	vltgygn	vf-f	w	a								N			
72.5						qtz ss	vltgygn	vf-f	w	a								N			
75.0						qtz ss/sh	vltgygn	vf-f	w	a								N			
77.5						qtz ss/sh	vltgygn	vf-f	w	a								N			
80.0						slty qtz ss	ltgygn	slt-vf	w	a								N			rd chert frags.
82.5						qtz ss/sh	ltgygn	vf-f	m	a								VW			
85.0						qtz ss/sh	ltgygn	vf-f	m	a								N			
87.5						qtz ss	ltgygn	f-m	m	a			1%	C/A				N			sparse sulfides
90.0						qtz ss	wh	f	w	a								VW			very hard/slow drilling beginning @ 87.5'
92.5						qtz ss	wh	f	w	a								N			
95.0						qtz ss/sh	wh-lt blgn	f-m	m	a								N			
97.5						qtz ss	wh	f-m	m	a			1%	C/A				N			Some chert frags. sulfides present.
100.0						qtz ss	vltgy	cr-grit	m	r								N			some chert frags.
102.5						qtz ss	vltgy	cr-grit	m	R								N			water flow increased to approx. 5gpm. chert pebbles & fr
105.0						qtz ss	vltgy-wh	m-cr	w	R								N			
107.5						qtz ss	vltgy-wh	m	w	r								N			
110.0						qtz ss	ltgy	cr	w	R								N			some chert frags.
112.5						qtz ss/sh	ltgy-gn-pprdbn	cr	m	r								S			Brushy Basin Ct. @ 111.0 mottled shale
115.0						sh	ltgn-pprdbn											S			mottled shale
117.5						sh	ltgn-pprdbn											N			T.D. 117.5

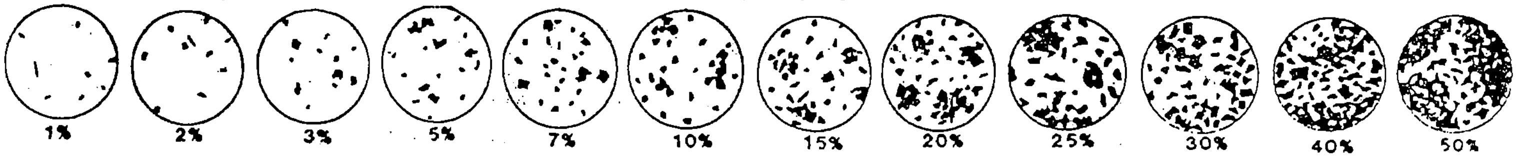
PERCENTAGE COMPOSITION IMAGE

Date 9-11-13 Geologist L. Casebolt Drilling Co. Boyles Exploration Co. Hole No. TW4-33
Property White Mesa Mill Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 90.0
T.D. DRILL 90.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						CL	rdbn											m			Surface soil. CL (lean clay)
5.0						CL/CL w/ ss	rdbn-ywbn	f-m	m	a								VS			Surface soil CL / Mancos shale @ 4.0'
7.5						Sndy sh	ywbn	f-m	f	a								VS			
10.0						Sndy sh	ywbn	f-m	f	a		L						VS			
12.5						qtz ss/sh	ywbn-tn	m	w	a		L						N			Upper Dakota Ct. @ 11.0'
15.0						qtz ss	lt or tn	m-cr	m	A		L						N			
17.5						qtz ss/sh	lt or gy	m-cr	f	A								W			
20.0						qtz ss/sh	lt or tn-gy	m-cr	f	A		L						N			
22.5						qtz ss	lt or tn	cr	m	A		L						N			
25.0						qtz ss	lt or tn	m	m	a								N			
27.5						qtz ss	lt tn	m	w	a								N			
30.0						qtz ss	tn	m	w	r								N			
32.5						qtz ss	tn	m	w	r		L						N			
35.0						qtz ss	lt tn	m	w	r								N			
37.5						qtz ss	lt or tn	m	w	r								N			
40.0						qtz ss	vlt bn	f-m	m	a								N			Some chert grains and frags
42.5						qtz ss	dk tn	m-cr	m	r								N			Some chert grains and frags.
45.0						qtz ss	dk gy bn	m	w	r								N	T	I	
47.5						qtz ss	lt gy tn	f-m	m	r								N			
50.0						qtz ss	gy tn	f-grt	p	a								N			some chert grains and frags.
52.5						cgl/qtz ss	gy tn	m-peb	p	a								N			abund. chert frags.
55.0						qtz ss	gy tn	m-grt	p	a								N			
57.5						qtz ss	gy tn	m-grt	p	a		L						N			
60.0						qtz ss	tn	f-m	m	a		L						N			
62.5						qtz ss	lt gy tn	m	w	r								N			
65.0						qtz ss	lt or tn	m-grt	p	r		L						N			Moisture first noted @ 65.0' abund. chert frags.
67.5						qtz ss	tn	m	w	r								N			
70.0						qtz ss	lt tn	m	w	R								N			
72.5						qtz ss	lt tn	m-cr	m	r								N			
75.0						qtz ss/cgl	lt or tn	m-peb	p	r								N			
77.5						qtz ss/cgl	lt tn	m-peb	p	r								N			
80.0						qtz ss/cgl		m-peb	p	r								N			
82.5						qtz ss/sh	lt tn-bl gn					L	1%					VW			Brushy Basin Ct. @ 82.0' sharp contact
85.0						sh	gy gn											N			
87.5						sh	gy gn											N			
90.0						sh	gy gn											N			TD @ 90.0'

PERCENTAGE COMPOSITION IMAGE

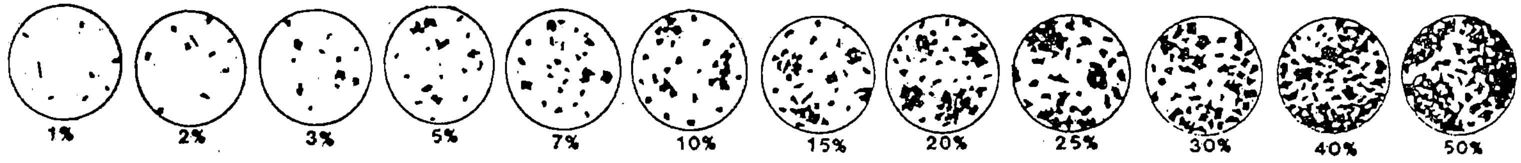


Date 9-11-13 Geologist L. Casebolt Drilling Co. Bayles Exploration Co. Hole No. TW4-34
Property White Mesa Mill Project ____ Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 97.9
T.D. DRILL 97.5
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						CL	rdbn											S			Surface soil CL (lean clay)
5.0						CL	rdbn-ltpktn											VS			Surface soil CL (lean clay)
7.5						Sndy sh	ywtn	m	m	a								VS			Mancos Shale @ 5.0'
10.0						Sndy sh	ywbn	f-m	m	a								VS			
12.5						Sndy sh	ywbn	f-m	m	a								VS			Some selenite
15.0						Sndy sh	ywbn	f-m	p	a		L						S			abund selenite (gypsum crystals)
17.5						qtz ss/sh	ywbn	f-m	m	a		L						S			friable ss
20.0						sndy sh	ywbn	f-m	m	a								m			
22.5						sndy sh	ywbn	f-m	m	a								m			
25.0						sndy sh	ywbn	f-m	m	a		L						N			
27.5						sndy sh	ywbn	f-m	m	a		L						N			
30.0						qtz ss	tn	m	w	r								N			Upper Dakota Ct @ 27.5'
32.5						qtz ss	tn-orbn	m	w	r		L						N			
35.0						qtz ss	tn-or bn	m	w	r		L						N			
37.5						qtz ss	tn	m	w	a		L						N			
40.0						qtz ss	tn	m	w	a								N			
42.5						qtz ss	lt tn	m	w	a								N			abund. chert grains
45.0						qtz ss	ltgytn	m	w	a								N			
47.5						qtz ss	tn	m	w	r								N			Moisture first noticed @ 47.5'
50.0						qtz ss	dktn	f-m	m	r								N			
52.5						qtz ss	dktn	f-m	m	a								N	5%	I	
55.0						qtz ss	tn-dkgy-blk	m	m	a								N	40%	I	Begin H_2O injection @ 52.5'
57.5						cgl/qtz ss	wh-pkbn	m-peb	p	A								N			abund. multi colored chert grains and peb.
60.0						cgl/qtz ss	wh-gybn	m-peb	p	A								N			" " " " " " "
62.5						cgl/qtz ss	wh-tn-dkgy	m-peb	p	A		H						N	10%	I	" " " " " " "
65.0						cgl/qtz ss	tn-dkgy	m-peb	p	A		H						N			" " " " " " "
67.5						cgl/qtz ss	tn-dkgy	cr-peb	p	A								N			" " " " " " "
70.0						cgl/qtz ss	tn-gy	cr-grt	p	A								N			" " " " " " "
72.5						cgl/qtz ss	tn-gy-wh	cr-peb	p	A								N			" " " " " " "
75.0						cgl/qtz ss	tn-gy	m-peb	p	A		L						N			" " " " " " "
77.5						cgl/qtz ss	tn-gy	m-peb	p	A								N			" " " " " " "
80.0						cgl/qtz ss	tn	m-peb	p	A								N			" " " " " " "
82.5						qtz ss/cgl	tn	f-grt	p	A								N			" " " " " " "
85.0						qtz ss/cgl	tn-ortngy	m-peb	p	A								N			" " " " " " "
87.5						cgl/qtz ss	tn-dkgy	m-peb	p	A								N			" " " " " " "
90.0						cgl/qtz ss	tn-gy	m-peb	p	A								N			" " " " " " "
92.5						qtz ss	tn	m-grt	m	a								S			
95.0						sh/cgl/qtz ss	rdbn-blgn-tn	m-peb	p	A								S			Brushy Basin Ct. @ 93.0'
97.5						sh	blgy											N			T.D.

PERCENTAGE COMPOSITION IMAGE



SAMPLE DESCRIPTION KEY

DEPTH SCALE

Scale is 1"-50' for drill samples and 1"-5' for core.

SAMPLE TAKEN

☒ ■ ☐ Mark through interval which special chip sample is saved, with an "X" mark through core interval with shading.

GRAPHIC LOG

Standard rock symbol for interval.

ALTERATION

|	Reduction
+	Dissolution
°	Oxidation

GAMMA ANOMALY (Probe)

T	3xBG - .009	Trace
1	.010 - .049	Low Mineral
2	.050 - .199	High Mineral
3	.200 >	Ore

BRECCIA PIPE

|	Definate
|	Unsure

LITHOLOGY

Standard abbreviation for rock type.

COLOR

GSA Rock-Color Chart of wet samples.

GRAIN SIZE

Sandstone		Carbonates
Peb	Pebble	
vc	Very Coarse	vc
c	Coarse	c
m	Medium	m
f	Fine	f
vf	Very Fine	vf

SORTING

W	Well-sorted
M	Moderately-sorted
P	Poorly-sorted
U	Un-sorted

ANGULARITY

VA	Very Angular
A	Angular
a	subangular
r	Subrounded
R	Rounded
WR	Well Rounded

CEMENT-MATRIX

A	Argillaceous
C	Carbonate
D	Dolomite
S	Silica
F	Ferruginous

IRON OXIDE

H	Hematite	A	Abundant
L	Limonite	M	Moderate
G	Geothite	T	Trace

PYRITE-MARCASITE

Amount - In percent.

Habit

A	Aggregate
C	Interangular cement
G	Globules
I	Individual
M	Massive
MT	Marcasitic texture
O	Organic replacement

Alteration

F	Fresh
T	Tarnished
P	Pseudomorphs after pyrite

METALLIC MINERALS

Mark with an "X" and clarify in remarks and metallic minerals observed. (MoS_2,NiS,PbS,UO_2,CU_2O,etc.)

NON-METALLIC MINERALS

Mark with an "X" and clarify in remarks any non-metallic minerals observed. (Barite, Anhydrite, Gypsum, Calcite, etc.)

REACTION -10% HCL

VS	Very Strong
S	Strong
M	Moderate
W	Weak
VW	Very Weak
N	None

CARBON MATERIAL

Amount - In percent

Type

C	Coal
F	Distinct woody fragments
H	Humic
HY	Hydrocarbon
I	Interbedded trash
L	Lignitic

BRECCIA NOMENCLATURE

See sample manual - use grain size, sorting and angularity columns for classification and description.

REMARKS

Use to clarify and expand on the columnar data. Explain anything not evident or any special characteristics such as: heavy minerals, tuffaceouness, cyclic sedimentation, fossils, sedimentary structures, formation picks, etc.

APPENDIX A.5

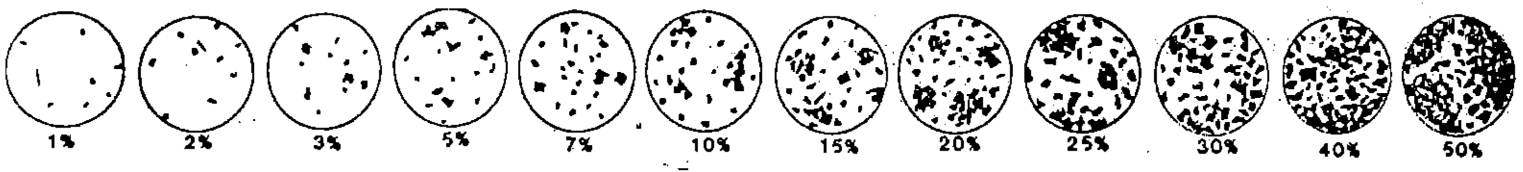
TWN - SERIES

Date 2-6-09 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TWN-1
Property WHITE MESA MILL Project NITRATE INVESTIGATION Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE 112.5
T.D. DRILL 112.5
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sndy Sltst	lt rdbn	vf	P	a	A							VS			well collared near old sample plant, old pad material
5.0						sndy Sltst	lt rdbn	vf	P	a	A							VS			
7.5						slty sh	rd bn											S			
10.0						Slty sh	rd bn											S			
12.5						Sh	lt rdbn											VS			
15.0						Sh	lt ywbn											S			Mancos Shale contact @ 112.5 ft.
17.5						sh	lt ywbn											m			
20.0						sh	ywbn											N			
22.5						sh	ywbr											N			
25.0						sh	ywbr											N			
27.5						sh, qtz ss	ywbn	f-cr	P	r		L						VW			Upper Dakota Contact @ 27.0 ft.
30.0						qtz ss	ywtn	m-cr	P	r		L						N			
32.5						qtz ss	tn	vf-f	f	r		L						N			1% wh chert grains
35.0						qtz ss	tn	vf-f	f	r		L						N			" " " "
37.5						qtz ss	tn	f-m	P	a		L						N			" " " "
40.0						qtz ss	tn	f-m	P	a		L						N			" " " "
42.5						qtz ss, sh	tn-blgy	f-m	f	r	A	L						N			
45.0						qtz ss, sh	tn-blgy	f-m	f	r		L						N			
47.5						qtz ss	tn	m	f	a		L						N			
50.0						qtz ss	vlt tn	f	m	r	a	L						N			
52.5						qtz ss	tn	f-m	m	a								N			
55.0						qtz ss	tn	f-m	m	a								N			
57.5						qtz ss	tn	f-m	m	a	A	L						N			
60.0						qtz ss	tn	f-m	m	a								N			
62.5						qtz ss	tn	m	m	r								N			multicolored chert grains and frags 2%
65.0						qtz ss	tn	m-cr	m	a		L						N			" " " " " " "
67.5						qtz ss	tn	m-cr	P	a								N			Chert content increasing to 5%
70.0						qtz ss/chert	tn	vcr-grit	P	A								N			" " 40%
72.5						qtz ss	tn	m-vcr	P	a								N			" " 25%
75.0						qtz ss	tn	m-vcr	P	a								N			" " 30%
77.5						Sh, qtz ss	vlt blgy	f-cr	P	a								N			some chert frags & grains
80.0						sh, cgl	lt blgy-dk tn	m-peb	P	a								N			Chert pebbles & frags
82.5						Cgl, qtz ss	tn	vcr-peb	P	a								N			multicolored chert pebbles
85.0						Cgl, qtz ss	tn	vcr-peb	P	a								N			multicolored chert grains and frag.
87.5						qtz ss, cgl	tn	m-peb	P	a								N			multicolored chert grains & pebbles
90.0						qtz ss	tn	m-vcr	P	a								N			chert fragments and grains 10%
92.5						qtz ss/sh	tn-lt gn	vf-cr	P	a								N			shale frags 30%
95.0						qtz ss	vlt gy	vf-f	f	r	A							N			
97.5						qtz ss, sh	vlt gy	vf-m	m	r	A							N			
00.0						qtz ss, sh	vlt tn-lt bl	vf-m	m	r	A							N			
025						qtz ss, sh	tn-lt bl	f-cr	m	r	A							M			Brushy Basin contact @ 102.0
05.0						sh	lt blgy											N			
07.5						sh	lt blgy-ppbn											N			
10.0						sh	lt blgy-ppbn											N			
12.5						sh	lt blgy-ppbn											N			T.D.

PERCENTAGE COMPOSITION IMAGE

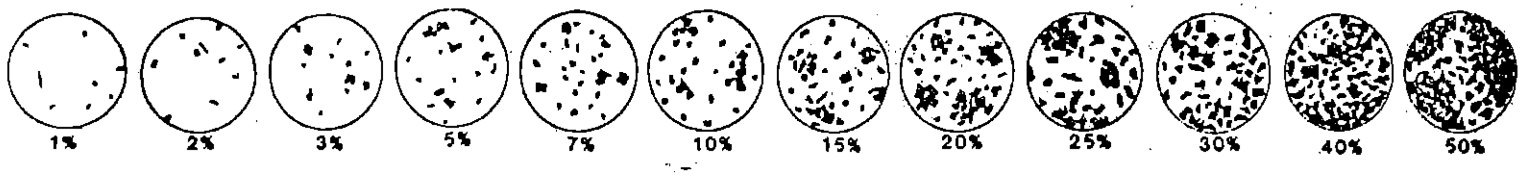


Date 2-4-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-2
Property White Mesa Mill Project Nitrate Investigation Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 95.0
T.D. DRILL 95.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sndy sh	gybn-blk	vf cr	f	a								S	>1	c	surface material derived from mill yard-con-
5.0						sndy sh	gybn-dkgy	vf cr	f	a								M			tains fragments of coal and clinker fragments
7.5						sndy sh	ltorbn —	vf- f	f	a								M			Left from coal burning steam plant. (abrupt
10.0						slty sh-sh	ltorbn-dk gy											M			color change) Mancos shale Contact @ 9.5'
12.5						slty sh-sh	ltbn-vdkgy											S			color 50%/50%
15.0						sh	dk gy											W			
17.5						qtz ss-sh	lttn-gy	f- m	f	r	A							VW			Upper Dakota contact @ 16.0 ft' some chert gns.
20.0						qtz ss	tn-yw	f- m	f	r	A							VW			
22.5						qtz ss	wh-ltywtn	vf- f	f	r	A							N			
25.0						qtz ss	wh-vltTn	vf- f	f	r	A							N			some multi colored chert frags + grains.
27.5						qtz ss	lttn	f- m	f	R	A							N			some white chert frag. and grains.
30.0						qtz ss	lttn	m- cr	m	R	A							N			abun. white chert frags + grains.
32.5						qtz ss	tn	m- cr	m	R	A							N			
35.0						qtz ss	tn	m- cr	m	r								N			
37.5						qtz ss	tn	m- cr	m	r								N			
40.0						qtz ss	tn	f- m	m	r								N			
42.5						qtz ss	lttn	f- m	m	r								N			
45.0						qtz ss	lttn	m- cr	m	r								N			sparse chert pebbles + frag.
47.5						qtz ss	wh-lttn	f- cr	p	r	A							N			" " " " "
50.0						qtz ss	wh-lttn	vf- cr	p	r	A							N			
52.5						qtz ss	wh-lttn	vf- f	m	r	A							N			
55.0						qtz ss	ywtn	f- m	m	r	A	L						N			some chert grains and frags.
57.5						qtz ss	ywtn	vf- peb	p	r	A	L						N			abund chert pebbles + frags.
60.0						qtz ss	ywtn	vf- peb	p	r	A	L						N			" " " "
62.5						qtz ss	ltgygn	vf- cr	p	r	A							N			abrupt color change red/ox contact.
65.0						qtz ss	ltgygn	vf- cr	p	r	A							N			
67.5						qtz ss	ltgygn	vf- m	p	r	A							N			
70.0						qtz ss	lttn	vf f	f	r	A							N			
72.5						qtz ss	lttn	vf f	f	r	A							N			
75.0						qtz ss	ltgygn	vf	f	r	A							N			
77.5						qtz ss	ltgygn	vf	f	r	A							N			
80.0						qtz ss	ltgygn	vf	f	r	A							N			
82.5						qtz ss	ltgygn	vf	f	r	A							N			
85.0						qtz ss	wh	f m	f	r	A		<1	c				N			
87.5						qtz ss	wh	f m	f	r	A		<1	c				N			
90.0						qtz ss	wh	f m	f	r	A		<1	c				N			
92.5						qtz ss, sh	wh, gn-ppbn	f m	f	r	A							N			Brushy Basin Contact @ 92.0 ft.
95.0						sh	ppbn											N			TD

PERCENTAGE COMPOSITION IMAGE

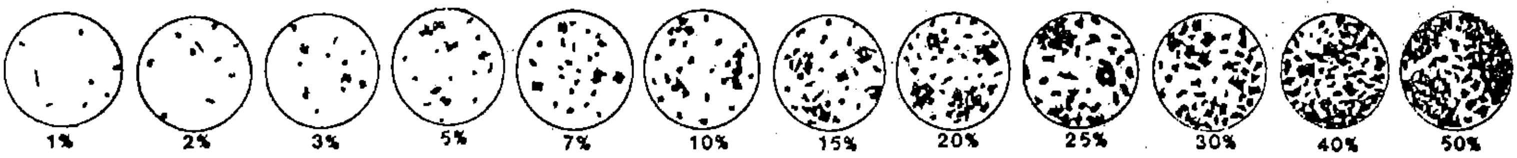


Date 2-3-09/2-4 Geologist L. Casebolt Drilling Co. Bayles Exploration Hole No. TWN-3
Property White Mesa Mill Project Nitrate Investigation Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 110.0
T.D. DRILL 110.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sndysh	ywtn-ltrdbn	vf-f	p	a								VS			surface soils
5.0						sndysh	ywtn-ltrdbn	vf-f	p	a								VS			Mancos shale @ 4.0 ft
7.5						sndysh	ywtn	vf-f	p	a								VS			
10.0						sndy sh-ss	ywtn	f-m	f	a		H						N			Color change @ 8.5' Upper Dakota Ct. sp. hem.
12.5						qtz ss	ywtn	f-m	p	a		L						m			
15.0						qtz ss	ywtn	f-m	p	a		L						W			
17.5						qtz ss	ywtn	f-m	f	s		L						N			
20.0						qtz ss	tn	f-m	f	s		L	S					N			sparse pyrite agg. within hematite cemented
22.5						qtz ss	tn	f-m	f	p		L						N			sandstone frags.
25.0						qtz ss	tn	f-m	f	s		L						N			
27.5						qtz ss	lt tn	f-m	f	s		L						N			
30.0						qtz ss	lttn	f-m	f	s		L						N			
32.5						qtz ss	lttn	f-m	f	s		L						N			
35.0						qtz ss	vlttn	vf-f	f	s		L						N			Trace limonite
37.5						qtz ss	vlttn	f-m	f	a		L						N			" "
40.0						qtz ss	vlttn	vf-m	p	a		L						N			
42.5						qtz ss	vlttn	f-m	f	r								N			
45.0						qtz ss	vlttn	f-m	p	r								N			sparse chert frags as sandgrains 1-2%
47.5						qtz ss	lttn	f-cr	p	a								N			
50.0						qtz ss-stlst	ltgytn	vf-f	p	a								N			
52.5						sndy sh	vltgy-vltgn	vf	f	a	a							N			
55.0						sndy sltst	vltgygn	vf	f	a	a							N			
57.5						sndy sltst	vltgygn	vf	f	a	a							N			
60.0						slty qtz ss	vltgygn	vf	f	o	a							N			
62.5						slty qtz ss	vltgygn	vf-f	f	a	a							N			
65.0						qtz ss-sh	ltgygn	f-m	f	a	a							N			
67.5						qtz ss	ltgygn	f-m	f	a	a							N			
70.0						qtz ss	ltgygn	vf-f	f	a	a							N			trace of chert frags.
72.5						qtz ss	ltgygn	vf-f	f	a	a							N			
75.0						qtz ss	ltgygn	vf-m	p	a	a							N			
77.5						qtz ss	ltgygn	vf-f	f	a	a							N			
80.0						qtz ss	vltgy	vf-f	f	a	a							N			
82.5						qtz ss	vltgy	f-m	f	a	a		S					N			Trace dissem. pyrite
85.0						qtz ss-sh	lttn-ltgn	f m	f	R								N			noted increase in grain size, some chert frags
87.5						qtz-ss	wh-ltgn	vf-f	f	r								N			
90.0						qtz ss-sh	wh-ltgn	f-m	f	r								N			
92.5						qtz ss-sh	wh-ltgygn-ppbn	f-m	f	r								N			Brushy Basin Contact @ 92.0 ft.
95.0						sh-qtz ss	ppbn-ltgn-wh	f-m	f	r								N			
97.5						sh	rdbn-ltgn											N			
100.0						sh-qtz ss	ltgn-vltgy	vf-m	p	r	a							N			
102.5						sndy sltst	ltgy-ltgn	vf-f	f	r	a							N			
105.0						sndy sltst	ltgy-ltgn	vf-f	f	r	a							N			
107.5						sndy sltst	ltgy-gn-rdbn	vf-f	f	r	a							N			
110.0						sndy sltst	gy-gybl	vf-f	f	r	a							N			T.D.

PERCENTAGE COMPOSITION IMAGE



Date 2-3-09 Geologist L. Casebolt Drilling Co. Boyles Exploration, Inc. Hole No. TWN-4
Property WHITE MESA MILL Project NITRATE Investigation Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 2
T.D. PROBE 136.0
T.D. DRILL 136.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						Sltst-Sh	lt rdbr-lt tn					H						S			
5.0						Sltst-Sh	lt rdbr-lt tn					H						VS			
7.5						Sltst-Sh	lt rdbr-lt tn					H						VS			
10.0						sltst-Sh	lt tn-lt rdbr					H						VS			Bottom of surface casing @ 9'4"
12.5						Sndy Sltst	lt pktn-lt ywgr					H						VS			Mancos Shale Ct @ 12.5'
15.0						Sndy Sh	lt ywgr					L						S			
17.5						Sndy Sh	lt ywgr					L						W			
20.0						Sndy SA	lt ywgr					L						M			
22.5						qtz Ss	ywgy	f-m	m	sr		L						N			Upper Dakota Fm. contact @ 20.0 ft.
25.0						qtz Ss	gytn	m	m	sr		L						N			
27.5						qtz ss	gytn	m	w	sr		L						N			
30.0						qtz ss-Sh	dktn-tn	f-m	m	sa		L						N			
32.5						qtz ss	tn	f-m	m	sr		L						N			
35.0						qtz ss	tn	f-m	m	sr								N			
37.5						qtz ss	tn	f-m	m	sr								N			
40.0						qtz ss	tn	f-m	m	sr								N			
42.5						qtz ss	tn	m	m	sr								N			
45.0						qtz ss	tn	m	m	sr								N			
47.5						qtz ss	tn	m	m	sr								N			
50.0						Sh-qtz ss	gy-gytn	m	m	sa		H						N			
52.5						Sh-qtz ss	gy-gytn	m	P	sa		H						N			
55.0						qtz ss-sh	lt tn-gy	m	m	sa								N	T	I	
57.5						qtz ss-cgl	ltgytn	m	m	sa								N			abun wh chert frags.
60.0						qtz ss-cgl	lt tn	m-cr	m	sr								N			abun multi colored chert grains and frag.
62.5						qtz ss-Cgl	ltgytn	m-vcr	P	sa								N			abun multi colored chert grains and frags.
65.0						qtz ss-peb	ltgy	m-Peb	P	sa		L						N			abun multi colored chert pebbles and frags
67.5						qtz ss-Peb	ltgy	m-Peb	P	sa		L						N			abund multi colored chert pebbles and frag.
70.0						qtz ss	ltgy	m-vcr	P	sa								N			abund chert frag.
72.5						qtz ss-sh	ltgy	vcr-Peb	P	sa								N	T	I	abund chert frag.
75.0						qtz ss-Cgl	ltgyor	vcr-Peb	P	sa								N			abund multi colored chert frags.
77.5						qtz ss-Cgl	lt gy or	vcr-Peb	P	r								N			qtz grains well rounded, chert frag angular
80.0						qtz ss-Cgl	lt gy or	vcr-Peb	P	r								N			" " " " " " "
82.5						qtz ss-cgl	lt gy or	vcr-Peb	P	r								N			" " " " " " "
85.0						qtz ss-Grit	lt tn	m-vcr	P	r								N			" " " " " " "
87.5						qtz ss-grit	lt tn	m-vcr	P	r								N			" " " " " " "
90.0						qtz ss-sh	ltgytn	m-vcr	P	sr								N			" " " " " " "
92.5						qtz ss	vlttn	vf-cr	P	sa								N			abund multi colored chert grains
95.0						qtz ss	vlt tn	m-cr	P	sr								N			" " " " "
97.5						qtz ss	vlttn	f-m	P	sr								N			sparse chert frags
100.0						qtz ss	lttn	f-m	m	sa								N			sparse chert grains and frags
102.5						qtz ss	lttn-ltgn	vf-m	P	sa								N			some chert pebbles and frags.
105.0						qtz ss	ltgytn	vf-f	P	sa								N			some chert pebbles and frags.
107.5						qtz ss	ltgytn	vf-m	P	sa								N			some chert pebbles and frags.
110.0						qtz ss	lt tn	f-m	m	sa								N			sparse chert pebbles and frags
112.5						qtz ss	lt tn	f-m	m	sa								W			
115.0						qtz ss	lt ortn	f-m	m	sa								N			sparse multi colored chert frags.
117.5						qtz ss	lt tn	f-m	m	sr								N			
120.0						sndy sltst	dkgy	vf-f	P	sa								N			
122.5						slty qtz ss	ywgy	vf-m	P	sa								W			
125.0						sltst-sh	gygn-rdbr											VW			Upper Brushy Basin Contact @ 122.5

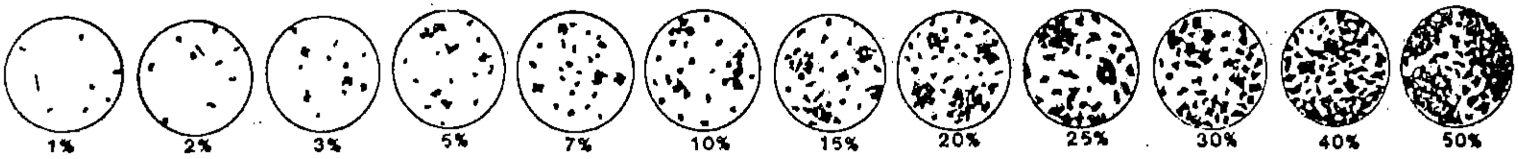
PERCENTAGE COMPOSITION IMAGE

Date 2-3-09 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. TWN-4
Property White Mesa Mill Project Nitrate Investigation Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE 136.0
T.D. DRILL 136.0
FLUID LEVEL 43.84

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL.	CARBON AMOUNT	CARBON TYPE	REMARKS
25.0						sndy sltst	gygn	vf-f	P	sa								N			
127.5						sndy sltst	vltgygn	vf-f	P	sa								N			
130.0						sltst-sh	gygn											N			
132.5						sndy sltst	gygn-wh	vf-f	P	sa								N			
135.0																					
136.0																					No cuttings were recovered from 135.0-136.0

PERCENTAGE COMPOSITION IMAGE

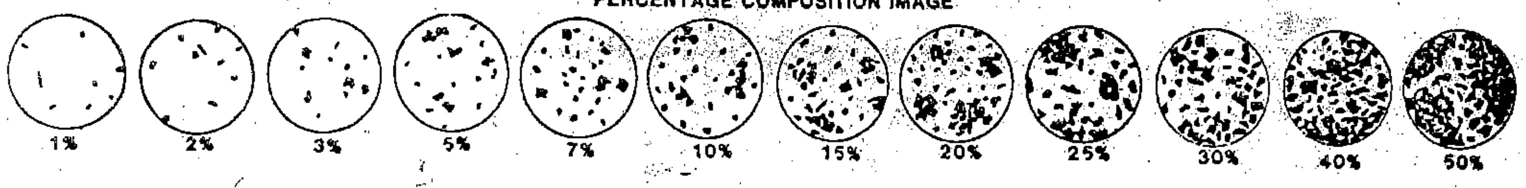


Date 8-19-09 Geologist L. CASEBOLT Drilling Co. Bayles Exploration Inc. Hole No. TWN-5
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 2
T.D. PROBE ______
T.D. DRILL 155.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst, mdst	rdbn											S			Surface soil
5.0						sltst-sh	rdbn-tn											VS			Surface soil
7.5						sltst, mdst	rdbn-tn											VS			Surface soil
10.0						qtz ss	rdbn	vf-f	m	a		H						VS			
12.5						sndy sh	pk ywbn	vf-m	P	a								VS			Mancos Shale ct @ 10.0'
15.0						sndy sh	ywbn	vf-m	P	a								W			
17.5						sndy sh	ywbn	f-m	p	a								N			
20.0						Sh	dkgybn											N			
22.5						Sh	dkgybn											N			
25.0						qtz ss, sh	gybn	f-m	P	a		L						N			
27.5						sh	gybn											N			
30.0						qtz ss	tn	f-m	m	a		L						N			Dakota Fm ct @ 27.5
32.5						qtz ss	vltgytn	f-m	m	a								N			
35.0						qtz ss	wh	f-m	m	a								N			
37.5						qtz ss	wh	f-m	m	a								N			
40.0						qtz ss	wh	f-m	m	a								N			
42.5						qtz ss	wh	f-cr	m	a								N			some chert frags & grains
45.0						qtz ss	wh	f-m	m	a								N			
47.5						qtz ss	wh	m	w	r								N			
50.0						qtz ss	wh	m-cr	m	a								N			
52.5						qtz ss	wh	m	w	a								N			
55.0						qtz ss	lt tn	m-cr	m	a								N			abund chert grains
57.5						chert ss, cgl	orgy	vf-peb	p	a								N			very abund chert grains
00						chert ss, cgl	orgy	vcr-peb										N			chert grains & frag. & pebbles dominate.
2.5						sh	tn											N			
5.0						qtz ss	lt tn	m-peb	P	a								N			
7.5						qtz ss	lt tn	m-vcr	P	a								N			
0.0						qtz ss-cgl	orgy	m-peb	P	a								N			
72.5						qtz ss cgl	gytn	m-peb	P	a								N			dominant chert & qtzite pebble & fragments
75.0						sltst, sh	gy tn											N			
77.5						sndy sh	gy	f-m	P	a								N			
80.0						qtz ss, sh	gy	f-m	P	a								N			
2.5						qtz ss	wh	m	w	r								N			
5.0						qtz ss, sh	wh-ywgy	f-m	m	a								W			
7.5						sh	ppbn-gy											N			
0.0						sh-qtz ss	gyrdbn-wh	f-m	m	a								S			
2.5						qtz ss-sh	wh-gyrdbn	f-m	m	a								S			
5.0						sh	rdbn-gy											W			
7.5						qtz ss	vlttn	f-m	m	a								m			Moisture first noted
00.0						qtz ss	vlttn	f-m	m	a								S			H2O injection
02.5						qtz ss-sh	wh-ppbngy					L	TR	C				N			shale frag may be transient
05.0						qtz ss	wh	m-cr	m	a			TR	C				N			light colored chert frags & grains
07.5						qtz ss	wh	f-cr	P	a								N			
10.0						qtz ss	wh	m-cr	m	a			TR	C				N			
12.5						qtz ss	wh	m-vcr	m	a			TR	C				N			some multicolored chert grains
15.0						sh	ltgy						TR	C				N			some vcr chert grains
17.5						qtz ss sh	vltgy	f-cr	p	a								N			some cr chert grains
20.0						sndy sh	ltgy-ltgn	f-cr	p	a								N			〃 〃 〃 〃
22.5						sndy slt-sh	gy-rdbn	f-cr	p	a								N			
25.0						sndy sh	gy-rdbn	f-cr	p	a								N			

PERCENTAGE COMPOSITION IMAGE



Date 8-19-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-5
Property White Mesa Mill Project Nitrate Study Unit No. ___ Sec. ___ Twp. ___ Rge. ___
County San Juan State Utah Location ___ Elev. ___

PAGE 2 OF 2
T.D. PROBE ___
T.D. DRILL 155.0
FLUID LEVEL ___

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
125.0																					
127.5						qtz ss, sh	wh-ppbn	vf-m	m	a								N			
130.0						qtz ss	wh	vf-m	m	a								N			
132.5						qtz ss	wh-ltgn	vf-m	m	a								N			
135.0						qtz ss	wh-ltgy	vf-m	m	a								N			
137.5						qtz ss	vltgy	vf-f	m	a								N			
140.0						qtz ss	vltgn	vf-f	m	a								N			
142.5						qtz ss	vltgy	vf-f	m	a								N			
145.0						qtz ss	vltgy	vf-f	m	a			TR	c				N			
147.5						qtz ss, sh	vltgy-ltgn	vf-f	m	a								N			Upper Brushy Basin fm contact @ 147.0
150.0						qtz ss, sltst	ltgy-dkgygn	vf-f	m	a								N			
152.5						sh	gy-ppbn											N			
155.0						sh	gy-ppbn											N			
TD.																					

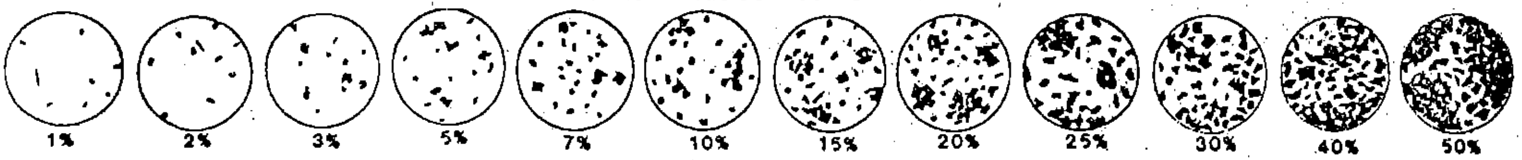
PERCENTAGE COMPOSITION IMAGE

Date 8-18-09 Geologist L. Casebolt Drilling Co. Baylas Exploration, Inc Hole No. TWN-6
Property White Mess Mill Project ~~[illegible]~~RATE STUDY Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 2
T.D. PROBE ____
T.D. DRILL 135.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst, mdst	rd br											S			Surface Soil.
5.0						Sh	ywbn											VS			Upper ct w/ Mancos Sh. Fm. Some selenite xls
7.5						Sh	ywbn											S			Selenite
10.0						sh	ywbn-gy											S			"
12.5						sh	ywbn-gy											S			"
15.0						sh	ywbn-gy											S			"
17.5						Sh	ywbn-gy											S			"
20.0						sh	ywbn-gy											S			"
22.5						sndy sh	orbn	f-m	m	a								N			
25.0						sh	dk ywbn											N			
27.5						sh	dk ywbn											N			
30.0						qtz ss	dk tn	f-m	m	a		L						N			Upper Dakota Ct @ 27.5'
32.5						qtz ss	tn	f-m	m	a		L						N			
35.0						qtz ss	tn bn	vf-f	p	a		L						N			
37.5						qtz ss	tn bn	f-m	m	a		L						N			
40.0						qtz ss	tn	m	m	a								N			
42.5						qtz ss	tn	m	m	a								N			
45.0						qtz ss	tn	m	m	a								N			
47.5						qtz ss	tn	m	m	a								N			
50.0						qtz ss	tn	m	m	a								N			
52.5						qtz ss	tn	f-m	m	a		L						N			
55.0						qtz ss	tn	m	m	a		L						N			
57.5						qtz ss	tn bn	m	m	a								N			
60.0						qtz ss	tn	m-cr	m	r								N			
62.5						qtz ss	tn	m-vcr	m	r								N			
65.0						qtz ss, cgl	tn bn	m-peb	p	a								N			abund. multi colored chert frags + pebbles
67.5						qtz ss	tn bn	m-vcr	m	a								N			
70.0						qtz ss	tn bn	m-vcr	m	r								N			Moisture first noted @ 67.5
72.5						qtz ss	tn bn											N			H2O injection begins @ 70.0'
75.0						qtz ss, cgl	ywtn-gy	m-peb	p	a								N			some chert pebbles + frags.
77.5						qtz ss	ywgyTn	m-vcr	p	a								N			" " frags + grains.
80.0						sh	gygn-ppbn											N			
82.5						sh	ppbn											N			
85.0						sh	ppbn											N			
87.5						sh	gn ppbn											N			
90.0						sh-qtz ss	gn-wh											N			
92.5						qtz ss	wh											N			
95.0						qtz ss	wh											N			
97.5						qtz ss	wh											N			
100.0						qtz ss	wh											N			
102.5						qtz ss	wh	f-m	m	a								N			
105.0						qtz ss	ltgy	m-vcr	m	a								N			
107.5						qtz ss	ltgy	m-vcr	m	a								N			
110.0						qtz ss	ltgy	m-vcr	m	r								N			
112.5						qtz ss -	wh —	m	m	r								N			
115.0						qtz ss, cgl	wh-gy	m-peb	p	a								N			Some chert frag + pebbles
117.5						qtz ss, cgl	wh-gygn	m-peb	p	a								N			abund chert frags + pebbles.
120.0						qtz ss	wh	m-cr	w	R								N			
122.5						qtz ss	wh	m	w	R								N			
125.0						qtz ss	wh	m	w	R								N			

PERCENTAGE COMPOSITION IMAGE



Date 8-18-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-6
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 2 OF 2
T.D. PROBE ______
T.D. DRILL 135.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						qtz ss, sh	vltn, gn	f-m	m	r			TR	C				N			Upper Brushy Basin Fm contact @ 127.0
130.0						qtz ss, sh	gn-rdbn	f-m	m	r								N			
132.5						sh	rdbn-gy											N			
135.0						sh	rdbn-gy											N			
T.D.																					

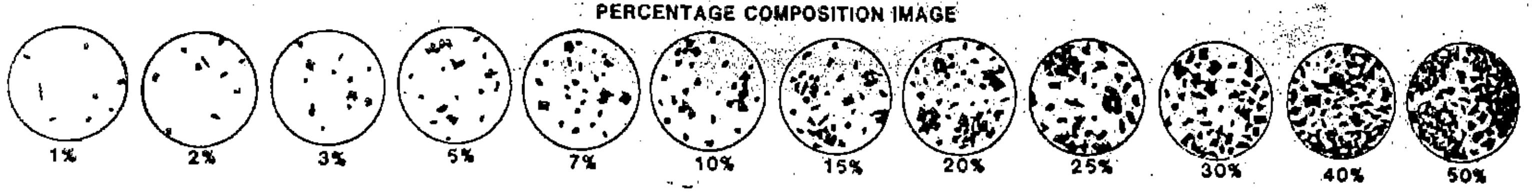
PERCENTAGE COMPOSITION IMAGE

Date 8-20-09 Geologist G. CASEBOLT Drilling Co. Bayles Exploration Inc Hole No. TWN-7
Property White Mesa Mill Project NITRATE STUDY Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State utah Location ______ Elev. ______

PAGE 1 OF ______
T.D. PROBE ______
T.D. DRILL 120.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst, mdst	rd bn											S			Surface Soil.
5.0						sltst, mdst	rdbn											S			Surface Soil
7.5						siltst, mdst	rdbn											VS			
10.0						siltst, mdst	rdbn											VS			
12.5						sh	ywbn											VS			Mancos sh contact at 10.0 ft.
15.0						sh	dkgybn											VS			
17.5						sh	dkgybn											S			
20.0						sh	dk-ltgybn											W			
22.5						sh, qtz ss	orbn	f-m	P	a								N			Dakota Fm. ct @ 22.0'
25.0						qtz ss	ltgy	f-m	P	a								N			
27.5						qtz ss	vltgy	f-m	P	a		L						N			
30.0						qtz ss	lt tn	f-m	P	a		L						N			
32.5						qtz ss	wh	m	m	r								N			
35.0						qtz ss	wh	m-cr	m	r								N			Some chert grains as the coarser fraction.
37.5						qtz ss	wh	m	w	r								N			
40.0						qtz ss	wh	m-cr	m	a		L						N			
42.5						qtz ss	wh	m	w	r								N			
45.0						qtz ss	wh	m	w	r								N			
47.5						qtz ss	wh	m	m	a								N			
50.0						qtz ss	wh	m	m	a								N			
52.5						qtz ss	lttn	m-vcr	P	a								N			
55.0						qtz ss	ltgytn	m-vcr	P	a								N			
57.5						sh	tn-ltgy											N			
60.0						sh-qtz ss cgl	lttn-dkbn	peb	P	a								N			dk bn chert pebble frags.
62.5						qtz ss, cgl	ortn	m-peb	P	a		L						N			abund chert frag, grains and pebbles
65.0						qtz ss, cgl	ywtn	m-peb	P	a		L						N			" " " " " "
67.5						qtz ss, cgl	ywtn	m-peb	P	a		L						N			" " " " " "
70.0						qtz ss cgl	dktn	m-peb	P	a		L						N			" " " " " "
72.5						qtz ss cgl, sh	ltgntn	f-peb	P	a								N			" " " " " "
75.0						sh-qtz ss	ltgn	f-m	m	a								N			
77.5						qtz ss	lt tn	f-m	m	a		L						m			
80.0						sh	ltgygn											N			
82.5						sh	ltgygn-rdbn											N			
85.0						sh	gygn-rdbn											N			
87.5						sh	rdbn-gygn											N			
90.0						sh	rdppbn											N			
92.5						sh	rdppbn											N			
95.0						sh	gygn-ppbn											N			
97.5						sh, qtz ss	ltgn-ppbn-wh	vf-m	P	a		L						N			
00.0						qtz ss	wh	f-m	P	a								M			
02.5						qtz ss, sh	wh-gn-ppbn	f-m	P	a		L						N			
05.0						sh	ppbn-gn											N			Brushy Basin ct @ 102.5
07.5						sh	gnppbn											N			
10.0						sndy sh	ltgygn	f-m	P	a								N			
12.5						sndy sh	ltgygn	f-cr	P	a								N			
15.0						qtz ss	ltgy-ltgn	f-m	P	a								N			
17.5						qtz ss, sh	lttn	f-m	P	a								N			
20.0						sndy sh	gytn	f-m	P	a								N			T.D.
D																					

PERCENTAGE COMPOSITION IMAGE



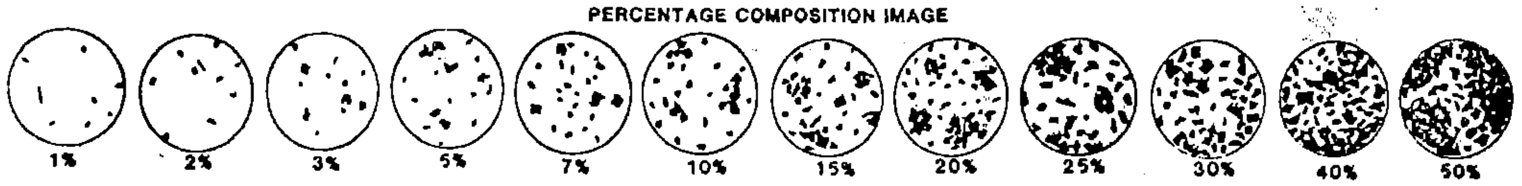
Date 8-19-09 Geologist L. CASEBOLT Drilling Co. Bayles Exploration, Inc. Hole No. TWN-8
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 2
T.D. PROBE 150.0
T.D. DRILL 150.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst mdst	rd bn											VS			Surface Soil.
5.0						qtz ss	or tn	vf-f	m	a								S			Surface Soil.
7.5						qtz ss	lt tn	vf-f	m	a		L						W			Dakota Fm @ 5.0'
10.0						qtz ss	lt tn	vf-f	m	a								N			
12.5						qtz ss	tn	f-m	m	a								N			
15.0						qtz ss	tn	f-m	m	a		L						N			
17.5						qtz ss	tn	f-m	m	a								N			
20.0						qtz ss, sh	tn-gy	m-cr	p	a								N			
22.5						qtz ss	tn	m	w	r								N			
25.0						qtz ss	tn	f	w	r								N			
27.5						qtz ss, sh	tn-dk gy	m	w	r								N			
30.0						qtz ss, sh	tn-dk gy	f-m	w	a								N			
32.5						qtz ss	tn gy	m-vcr	p	a								N			light colored chert frags.
35.0						qtz ss-sh	tn-dk gy	m-cr	p	a								N			
37.5						qtz ss, cgl	tn gy	m-peb	p	a								N			abund. multicolored chert frag, grains and pebbles.
40.0						qtz ss, cgl	tn gy	m-peb	p	a								N			" " " " " " "
42.5						qtz ss cgl	tn gy	m-peb	p	a								N			" " " " " " "
45.0						qtz ss	tn	m	w	R								N			
47.5						qtz ss	tn	m	w	R								N			
50.0						qtz ss, cgl	tn	m-peb	p	a								N			
52.5						qtz ss	tn	f-m	m	a		L						N			
55.0						qtz ss	lt gy	f-m	m	a								N			
57.5						qtz ss	wh	f-m	m	a								N			
60.0						qtz ss	lt gy	f	w	r								N			
62.5						qtz ss	lt gy	f	w	r								N			
65.0						qtz ss	lt gy	f	w	r								N			
67.5						qtz ss	lt gy	f	w	r								N			
70.0						qtz ss, sh	lt gn-wh	f	w	r								W			
72.5						qtz ss	wh	f	w	r								W			
75.0						qtz ss	wh	f-m	p	a			Tr	C				W			
77.5						qtz ss	wh	m-cr	m	a								N			Moisture first noted
80.0						qtz ss	wh	m-cr	m	a								N			H_2O inject begin
82.5						qtz ss	wh	m-peb	p	a			<1%	c				N			some chert frags & grains
85.0						qtz ss	wh	m-vcr	p	a			Tr	c				N			
87.5						qtz ss	wh	f-vcr	p	a		L	1%	C				N			
90.0						qtz ss, cgl	wh-dk gy	m-peb	p	a			1%	c				N			abund. dark chert pebs & grains
92.5						qtz ss, cgl	dk gy	f-peb	p	a								N			some " " " "
95.0						qtz ss, cgl	dk bn	m-peb	p	a								N			abund " " " "
97.5						qtz ss, cgl	lt gy	f-peb	p	a								N			some " " " "
100.0						qtz ss, sh	wh-gy	f-vcr	p	a			1%	C				N			
102.5						sh	gn											N			
105.0						sltst-sh	gn-lt pk											N			
107.5						qtz ss	wh	f-m	p	a								N			
110.0						qtz ss	wh	f-m	p	a			Tr	c				N			
112.5						qtz ss.	wh	f-cr	p	a			1%	c				N			
115.0						qtz ss, cgl	wh	f-peb	p	a			Tr	C				N			chert frags.
117.5						qtz ss	wh	f-peb	p	a								N			
120.0						qtz ss, cgl	wh	m-peb	p	a			3%	C				N			noteable pyrite occurrance, chert frags.
122.5						qtz ss	wh	f-m	m	r			Tr	C				N			
125.0						qtz ss	wh	f-m	m	r								N			

32
24

PERCENTAGE COMPOSITION IMAGE



Date 8-19-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-8
Property White Mesa Mill Project Nitrate study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE 150.0
T.D. DRILL 150.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0																					
127.5						qtz ss	wh	f-m	m	a								N			
130.0						qtz ss	wh	f	m	a								N			
132.5						qtz ss	wh	vf-f	m	a								N			
135.0						qtz ss	wh	vf-f	m	a								N			
137.5						qtz ss	vltgy	vf	m	a								N			
140.0						qtz ss	vltgy	vf f	m	a								N			
142.5						qtz ss, sh	vltgy	vf f	m	a								N			
145.0						sh	gy-rdbn											N			Upper Brushy Basin Fm contact @ 142.5'
147.5						sh	rdbn-ppbn											N			
150.0						sh	gy											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE

Date 8-17-09 Geologist L. Casebolt Drilling Co. Boyles Exploration Hole No. TWN-9
Property White Mesa Project Nitrate Study Unit No. Sec. Twp. Rge.
County San Juan State Utah Location Elev.

PAGE 1 OF 1
T.D. PROBE
T.D. DRILL 162.5
FLUID LEVEL

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sh	lt pk tn											VS			
5.0						sndy sh	lt pk tn	f- m	p	a								VS			
7.5						qtz ss	tn	f- m	p	a		L						S			Top of Dakota Fm @ 5.0 ft.
10.0						qtz ss	tn	f- cr	p	a								N			
12.5						qtz ss	tn	m- cr	p	a								N			
15.0						qtz ss	dk tn	m- cr	p	a								N			
17.5						qtz ss	dk tn	m-vcr	p	a								N			
20.0						qtz ss	dk tn	m- cr	p	a								N			
22.5						qtz ss, sh	tn-dk gy	m-vcr	p	a								N			
25.0						qtz ss	tn	m	w	r								N			
27.5						qtz ss	tn	f- m	m	r								N			
30.0						sh	dk gy											N			
32.5						sh, qtz ss	dk gy-gy	f- m	m	a								N			
35.0						qtz ss	tn	m- cr	m	r								N			
37.5						qtz ss, sh	gy tn	f- cr	p	a								N			
40.0						qtz ss	lt tn	m- cr	m	r								N			Some chert grains
42.5						qtz ss, sh, cgl	dk gy	f- peb	p	a		L						N			
45.0						qtz ss, cgl	gy bn	m-peb	p	a								N			very abund. chert frags. + pebbles.
47.5						qtz ss, cgl	gy bn	m-peb	p	a								N			" " " " "
50.0						qtz ss, cgl	tn	m-peb	p	a								N			some chert frags + pebbles.
52.5						qtz ss	or tn	m- cr	p	a								N			
55.0						qtz ss, cgl	gy tn	m- cr	p	a								N			abund chert pebbles + fragments.
57.5						qtz ss, cgl	gy tn	m-peb	p	a								N			" " " " "
60.0						qtz ss, cgl	gy tn	m-peb	p	a								N			" " " " "
62.5						qtz ss	tn	f- m	m	r								N			
65.0						qtz ss	tn	m- cr	m	r								N			
67.5						qtz ss	lt tn	m	w	r								N			
70.0						qtz ss, cgl	tn-dk bn	f-peb	p	a								N			
72.5						qtz ss, cgl	tn	f- peb	p	a								N			
75.0						qtz ss		m	w	r								N			
77.5						qtz ss, cgl	tn	f- peb	p	a								N			abund chert frags + pebbles.
80.0						qtz ss, cgl	tn	m-peb	p	a								N			"
82.5						qtz ss, cgl	gy tn	m-peb	p	a								N			"
85.0						qtz ss, cgl	gy tn	m-peb	p									N			
87.5						qtz ss, cgl	gy tn	m-peb										N			
90.0						qtz ss, cgl	gy tn	m- peb										N			
92.5						qtz ss, cgl	gy tn	m- peb										W			
95.0						qtz ss, cgl, sh	gy tn-gn	f-peb										S			Brushy Basin Ct @ 94.0'
97.5						sh	gn											S			
100.0						sh	gn											VW			
102.5						sh	gn-pp bn											VW			
T.D.																					

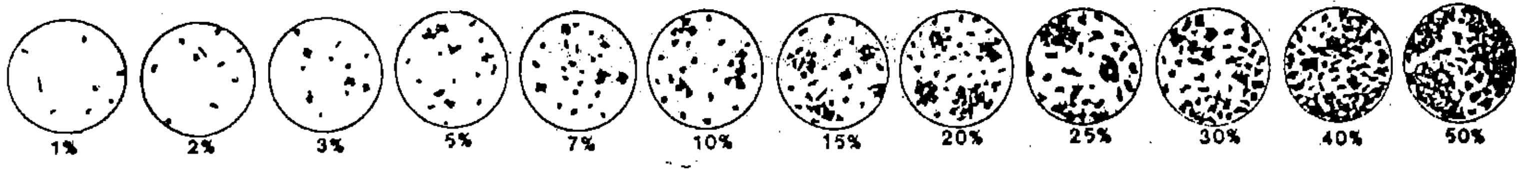
PERCENTAGE COMPOSITION IMAGE

Date 8-17-09 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. TWN-10
Property White Mesa Mill Project NITRATE Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE 107.5
T.D. DRILL 107.5
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst, mdst	rdbn											S			Surface soil
5.0						sltst, mdst	rd bn											S			Surface Soil
7.5						sndy sh	tn	f-m	p	a								VS			Mancos sh contact at 5.0'
10.0						sh	ywbn											VS			
12.5						sh	ywbn											VS			
15.0						sh	ywbn											S			
17.5						sh	ywbn											m			
20.0						sh	ywbn											w			
22.5						sh	ywbn											W			
25.0						sh	ywbn-gy											W			
27.5						sh	ywbn-gy											N			
30.0						sh	ywbn-gy											N			
32.5						qtz ss	tn	f-cr	m	r								N			Upper Dakota fm contact @ 30.0'
35.0						qtz ss	tn	f-cr	m	r		L						N			
37.5						qtz ss, sh	tn-blk	m-cr	m	r								N			
40.0						sh	dkgy											N			
42.5						sh, qtz ss	dkgy-tn	f-m	M	a		L						N			
45.0						qtz ss cgl, sh	tn-dkgy	m-peb	p	a								N			Some chert pebbles + frags.
47.5						qtz ss, cgl	tn	f-peb	p	r								N			" " " "
50.0						qtz ss, cgl	tn	m-peb	p	r								N			abund " " "
52.5						qtz ss, cgl	tn-gy	m-peb	p	a								N			" " " "
55.0						qtz ss, cgl	tn	m-peb	p	r								N			" " " "
57.5						qtz ss, cgl	tn	m-peb	p	r								N			" " " "
60.0						qtz ss	tn	f-cr	M	r								N			
62.5						qtz ss	tn	f-m	m	a								N			
65.0						qtz ss, sh	tn-gn	f-vcr	p	a								N			
67.5						sh	gy											N			
70.0						sh	gy-pprdbn											N			
72.5						sh	gy-pprdbn											N			
75.0						sh, qtz ss cgl	gy gn-bn	m-peb	p	a								N			
77.5						qtz ss, sh	tn	m-cr	m	a								N			
80.0						qtz ss	tn	f-cr	M	a								N			
82.5						qtz ss	tn	m-vcr	M	a								N			abound chert grains and frags.
85.0						qtz ss	tn	m-vcr	M	a								N			
87.5						qtz ss	tn	f-m	m	r								N			
90.0						qtz ss	tn	f-m	m	r								N			
92.5						qtz ss	tn	f-m	m	r								N			Moisture @ 92.5
95.0						qtz ss	tn	m-vcr	M	r								N			Begin H_2O injection
97.5						qtz ss, sh	vltgygn	f-cr	p	a								N			
100.0						qtz ss	wh-vltgy	f-m	m	a								N			
102.5						qtz ss	vltgy	vf-f	m	a								N			Brushy Basin Cf @ 102.5
105.0						sh	gn-rdbn											N			
107.5						sh	gn											N			T.D.
T.D.																					

PERCENTAGE COMPOSITION IMAGE



Date 9-29-2009 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. TWN-11
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 2
T.D. PROBE ______
T.D. DRILL 147.5
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst, mdst	rdbn											W			Surface Soil.
5.0						sltst, mdst	rdbn											S			Surface soil
7.5						sltst, sh	rd bn-ywbn											VS			Color change, Mancos Sh @ approx 6'
10.0						Sh/qtz ss	lt ywtn	f-m	P	a		L						VS			-
12.5						qtz ss, sh	lt bn	f-m	P	a		L						S			
15.0						sh	dkgybn											S	Tr	I	trace carbonaceous frags.
17.5						sh	dkgybn											N	A	I	abund. " "
20.0						sh	dkgybn											N	Tr	I	trace " "
22.5						qtz ss, sh	gybn	f-m	P	r								N			Top Dakota Fm @ approx 21.0'
25.0						qtz ss	gytn	f-m	P	a								N			
27.5						qtz ss	tn	f-m	P	a								N			
30.0						qtz ss	tn	f-m	P	r								N			
32.5						qtz ss, sh	tn	f-m	P	a								N			
35.0						qtz ss, sh	tn/gy	f-m	P	a								N			
37.5						qtz ss	tn	f-m	m	a								N			
40.0						qtz ss	lttn	f	m	a								N			
42.5						qtz ss	ortn	f	m	a		L						N			
45.0						qtz ss	lt bn	f	m	a		L						N	Tr	I	
47.5						qtz ss	lt bn	f	m	a								N	Tr	I	moisture first noted @ 47'
50.0						cgl/qtz ss	ltgybn	m-peb	P	a		L						N	<Tr	I	Begin H2O inject at 47.5' tr. carbonaceous frags.
52.5						cgl, qtz ss	ltgy bn	m-peb	P	a								N			abund. chert frags + pebbles.
55.0						qtz ss, cgl	lttn	m-peb	P	a								N			some chert frags & pebbles.
57.5						qtz ss, sltst	lttn	vf-m	P	a								N			
60.0						qtz ss, sh	lt tn	vf-m	P	a								N			
62.5						qtz ss, cgl	tn bn	m-peb	P	r								N			some multi colored chert frags. + grains
65.0						qtz ss	tn	m-vcr	P	r								N			" " " " grains
67.5						qtz ss	tn	m-vcr	P	r								N			" " " " "
70.0						qtz ss	tn	m-vcr	P	r								N			" " " " "
72.5						qtz ss cgl	tn	m-peb	P	r								N			" " " " "
75.0						cgl, qtz ss	lt ortn	m-peb	P	a								N			abund. " " " frags, pebbles.
77.5						qtz ss, cgl	wh-lttn	m-vcr	P	a								N			" " " " "
80.0						qtz ss	tn	m-cr	P	r								N			" " " " grains
82.5						qtz ss	tn	m-cr	P	r								N			" " " " "
85.0						qtz ss	ltgy	vf-f	m	a								N			sparse chert grains
87.5						qtz ss	ltgy	vf-f	m	a								N			
90.0						qtz ss	ltgy	vf-f	m	a								N			
92.5						qtz ss, sh	ltgy	vf-f	m	a								N			
95.0						qtz ss	ltgy	vf-f	m	a								N			
97.5						qtz ss	wh	vf-f	m	a								N			
100.0						qtz ss	wh	vf-f	m	a								N			
102.5						qtz ss	wh	vf-f	P	a			Tr	C				N			Trace of pyrite grains
105.0						qtz ss	wh	vf-f	P	a								N			
107.5						qtz ss	wh	vf-f	P	a								N			
110.0						qtz ss	wh	f-m	P	a			Tr	C				N			some aggregates of pyrite
112.5						qtz ss	wh	f-m	m	a								N			
115.0						qtz ss	wh	f-m	m	a								N			
117.5						qtz ss	wh	f-m	m	a								N			
120.0						qtz ss	wh	f-m	m	a								N			
122.5						qtz ss	wh	f-m	m	a			Tr	C				N			Tr of pyrite aggregate
125.0						qtz ss	wh											N			

PERCENTAGE COMPOSITION IMAGE

Date 9-29-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-11
Property White Mesa Mill Project Nitrate Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 147.5
FLUID LEVEL 68'

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
127.5						qtz ss	wh	f-m	m	a								N			
130.0						qtz ss	wh	f-m	m	a								N			
132.5						qtz ss cgl	ltgy	m-peb	p	a								VW			abund. chert fragments and pebbles
135.0						qtz ss sh	ltgy	f-cr	p	a								N			
137.5						qtz ss	ltgy	vf-f				L						N			
140.0						qtz ss	ltgy	vf-f				L						N			
142.5						sh	gy-rdbn											N			Brushy Basin Mb. @ 140.0'
145.0						sh	gy-rdbn											N			
147.5						sh	rdbn											N			T.D.

PERCENTAGE COMPOSITION IMAGE

Date 9-29-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-12
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 115.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS Well by Highway
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						sltst-mdst	rdbn											S			Surface Soil
5.0						sltst-mdst	rd bn											VS			Surface soil
7.5						qtz ss	ortn	f-m	m	a		L						S			Top of Dakota Fm @ 5.0'
10.0						qtz ss	tn	f-m	m	a								N			
12.5						qtz ss	tn	f-m	m	a								N			
15.0						qtz ss	tn	f	m	a								N			
17.5						qtz ss	tn	f	m	a								N			
20.0						qtz ss, sh	tn	f	m	a								N	Tr	I	
22.5						qtz ss, sh	gytn	f	m	a								N	Tr	I	
25.0						qtz ss	tn	m	m	a								N			
27.5						qtz ss	ortn	m	m	a		L						N			
30.0						qtz ss	tn	m cr	p	a		L						N			some chert frag, and grains
32.5						qtz ss	ywtn	f m	p	a								N			
35.0						qtz ss	ywtn	f m	p	a								N			
37.5						qtz ss	ywtn	f m	p	a								N			
40.0						qtz ss	ywtn	m-vcr	p	a								N			abund chert frag, & grains
42.5						qtz ss	ywtn	vf-f	p	a								N			
45.0						qtz ss	tn	m-peb	p	a								N			Begin H_2O injection @ 42.5 abund chert frags
47.5						cgl, qtz ss	ywtn	m-peb	p	a								N			abund multicolored chert frags
50.0						cgl, qtz ss	tn	m-peb	p	a								N			" " " " "
52.5						qtz ss, cgl	vlttn	vf f	p	a								N			some chert frags
55.0						qtz ss, cgl	vlttngy	vf f	p	a								N			
57.5						qtz ss	wh	vf-f	p	a								N			
60.0						qtz ss	wh	vf f	p	a			Tr	C				N			
62.5						qtz ss	wh-tn	vf-cr	p	a								N			some chert frags.
65.0						qtz ss	wh	m-vcr	p	a			Tr	C				N			
67.5						qtz ss	wh	m-vcr	p	a			1%	C				N			
70.0						qtz ss	wh	m-vcr	p	a			Tr	C				N			
72.5						qtz ss	wh	m	m	a								N			
75.0						qtz ss	wh	m	m	a								N			
77.5						qtz ss	ltgy	m-cr	m	a								N			
80.0						qtz ss	ltgy	f-m	p	a			Tr	C				W			
82.5						qtz ss	tn	f-m	p	a								W			
85.0						qtz ss	wh	f-m	p	a								N			
87.5						qtz ss	wh	m	p	a								N			
90.0						qtz ss	ltgn	f-m	p	a								N			
92.5						qtz ss	wh	f-cr	p	a			Tr	C				N			
95.0						qtz ss	wh	f-m	p	a			Tr	C				W			
97.5						qtz ss	wh	f m	p	a			Tr	C				N			
100.0						qtz ss	wh	f-m	p	a								N			
102.5						cgl, qtz ss	tn	f-peb	p	a								N			abund. chert frags & pebbles
105.0						cgl, qtz ss	gy	f-peb	p	a								N			" " " "
107.5						cgl, qtz ss	gytn	f-peb	p	a								N			" " " "
110.0						sh	gy rdbn											N			Upper Brushy Basin Cl @ 107.5'
112.5						Sh	gy rdbn											N			
115.0						sh	gy rdbn											N			
TD.																					

PERCENTAGE COMPOSITION IMAGE

Date 9-30-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-13
Property White Mesa Mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 120.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sltst mdst	lt rdbn											S			Surface soil
5.0						sltst mdst	rd bn											VS			Surface Soil
7.5						qtz ss	rd bn	f	m	a								VS			Top of Dakota @ 5.0'
10.0						qtz ss	lt tn	f	M	a								N			
12.5						qtz ss, sh	dk ywgy	f-m	M	a								N			
15.0						sh, qtz ss	dk ywgy	f-m	m	a								N			
17.5						qtz ss	tn	vf-m	P	a								N			
20.0						qtz ss	tn	f	m	a		L						N			
22.5						qtz ss	tn	f	m	r								N			
25.0						qtz ss	lt tn-tn	f-vcr	P	a								N			some chert grains
27.5						qtz ss	tn	f-vcr	P	a								N			" " "
30.0						qtz ss, cgl	vlttn-tngy	m-peb	P	a								N			abund. chert frags & pebbles.
32.5						qtz ss	vlttn	m-cr	m	r								N			
35.0						qtz ss, cgl	tn-gy	m-peb	P	a								N			some chert frags & pebbles.
37.5						qtz ss	tn	f-m	m	a								N			abund dk gray chert frags & grains
40.0						qtz ss	tn	M	m	r								N			
42.5						qtz ss	tn	f-m	m	r								N			
45.0						qtz ss	tn	f-m	m	r								N			
47.5						qtz ss	tn	f-vcr	P	a								N			abund. chert frags & grains
50.0						qtz ss	tn	f-vcr	P	a								N			" " " "
52.5						qtz ss	tn	m-vcr	P	a								N			
55.0						qtz ss	tn	f-m	M	r								N			
57.5						qtz ss, cgl	tn	f-peb	P	a								N			some chert frags.
60.0						qtz ss, cgl	tn	f-peb	P	a								N			" " "
62.5						qtz ss cgl	dk tn	m-peb	P	a								N			abund. chert frags & pebbles.
65.0						qtz ss cgl.	wh	f-peb	P	a								N			
67.5						qtz ss	wh	m-cr	P	a								N			
70.0						qtz ss	vlttn	m-vcr	P	a								N			
72.5						qtz ss, cgl	or tn	m-peb	P	a								N			abund chert frags & pebbles.
75.0						sndy sh, cgl	ltgygn	f-peb	P	a								N			
77.5						qtz ss, sltst	ltgygn	f-cr	P	a								N			
80.0						qtz ss-sltst	wh-gy	vf-cr	P	a								N			
82.5						qtz ss, sltst	wh-ltgn	m-peb	P	a								W			
85.0						qtz ss, sltst	wh-ltgy	f-m	P	a								N			
87.5						sltst, qtz ss	gy-rdbn	vf-m	P	a								N			
90.0						sndy sltst	gy-rdbn	vf-m	P	a								N			
92.5						sndy sh	wh, gy-rdbn	vf-peb	P	a								N			some chert frags & pebbles.
95.0						sh, qtz ss	wh, rdbn	m-cr	P	a								N			
97.5						sh, qtz ss	rdbn-gy	m-vcr	P	a								N			
100.0						qtz ss-sh	rdbn-wh	f-peb	P	a								N			
102.5						qtz ss, cgl	wh	f-peb	P	a			Tr	c				N			very abund. chert frags & pebbles
105.0						cgl	wh-lttn	m-peb	P	a			Tr	c				N			" " " " "
107.5						cgl	tn	f-peb	P	a			Tr	c				N			" " " " "
110.0						cgl	tn-gn	m-peb	P	a			Tr	c				N			" " " " "
112.5						qtz ss, cgl	wh-gyrd	f-peb	P	a			Tr	c				N			" " " " "
115.0						qtzs, sltst	wh-ltgy	vf-f	P	a								N			
117.5						sh	gy-rdbn											N			Upper Brushy Basin contact @ 115.0 ft.
120.0						sh	gy-rdbn											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE

Date *Sept. 28, 2009* Geologist *L. Casebolt* Drilling Co. *Bayles Exploration, Inc.* Hole No. *TWN-14*
Property *White Mesa Mill* Project *Nitrate Study* Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County *San Juan* State *Utah* Location ______ Elev. ______

PAGE *1* OF *2*
T.D. PROBE ______
T.D. DRILL *135.0*
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sndysltst	rdbn											N			Surface soil
5.0						Sndysltst	rdbn											S			Surface soil
7.5						qtz ss	tnbn	cr	P	a		L						S			Color Change at 5.0' qtz ss, tnbn Top of Dakota Fm.
10.0						sh	vdk gy	-	-	-	-							N			
12.5						sh-qtz ss	vdkgy-tn	f-cr	P	a		L						N			
15.0						qtz ss	lt tn	f-m	M	r		L						N			
17.5						qtz ss	lt tn	f-m	M	R		L						N			
20.0						qtz ss	ltgytn	f-m	M	R								N			
22.5						qtz ss-sh	tn-ltgy	f-m	M	r		L						N			
25.0						qtz ss-sh	tn-gy	f-m	M	r		L						N			carbonaceous fragments
27.5						qtz ss-sh	tn-gy	f-m	M	r		L						N			sparce carbonaceous fragments
30.0						qtz ss-sh	tn-gy	vf-m	M	r		L						N			
32.5						qtz ss	vltgytn	m-cr	M	r		L						N			sparce gy chert frags.
35.0						qtz ss	ywtn	m-vcr	M	r		L						N			abund. chert frags.
37.5						qtz ss	ywtn	m-vcr	W	R		L						N			" " "
40.0						qtz ss	tn	f-vcr	M	R								N			" " "
42.5						qtz ss	tn	f-m	M	r								N			" " "
45.0						qtz ss-sltst	wh-lttn	vf-f	M	R		L						N			some gray chert frags
47.5						qtz ss	vlttn	m	W	R								N			some multicolored chert frags. & grains
50.0						qtz ss	vlttn	m	W	R								N			abunt " " " " "
52.5						qtz ss	vlttn	f-m	M	r								N			some " " " grains
55.0						qtz ss	vlttn	f-m	M	r								N			" " " " "
57.5						qtz ss	vlttn	f-m	M	r								N			some angular chert frags.
60.0						sh	ltgy-gy											N			
62.5						sh-sltst	gy-dkgy											N			
65.0						sh-sltst, ss	gy	f-m	P	r								N			
67.5						qtz ss	wh-vltgy	vf-m	P	r								N			abund multicolored chert grains
70.0						qtz ss	lt tn	vf-m	P	r								N			
72.5						qtz ss	ltgytn	f-m	P									N			abund dkgy chert grains
75.0						qtz ss	tn	f-vcr	P	a								N			" multi colored chert grains
77.5						qtz ss-cgl	tn-ltgy	f-vcr	P	a								N			" " " " " and frags
80.0						qtz ss-cgl	lt tngy	f-vcr	P	a								N			" " " " " " "
82.5						cgl-qtz ss	gytn	f-peb	P	a								N			abund dkgy chert pebbles & frag.
85.0						cgl-ss-sh	tngygn	f-peb	P	a								N			" " " " "
87.5						qtz ss-sh	wh-ltgn	f-m	M	r								N			Some chert grains,
90.0						qtz ss	wh-ltgn	vf-f	M	a			sp	c				N			some chert grains, sparse disseminated pyrite
92.5						qtz ss	wh	vf-f	M	a			S	c				N			some disseminated pyrite
95.0						sltst-sh-ss	gnrdbn-wh	vf-f	M	a								N			
97.5						sltst-sh	gnrdbn											N			
100.0						sltst-ss	wh-ltgn	vf-f	M	a								N			
102.5						qtz ss-sh	wh-ltgn	vf-f	M	a								N			
105.0						qtz ss-sh	wh-vltgn	vf-f	M	a								N			
107.5						qtz ss-sltst	wh-gn-rdbn	vf	M	a								N			
110.0						sltst-sh	gygn-rdbn											N			some apparent slickenside surfaces
112.5						sltst-sh	tn-rdbn	peb		P								N			chert pebble
115.0						sh	rdbn											N			
117.5						sh cgl ss	ltgn	peb		P								N			chert pebbles.
120.0						Cgl, ss	dktn	f-peb					S	C				N			abund chert pebbles & frag. some dissem. pyrite
122.5						sltst ss	ltgn-rdbn	vf-f	M	P								N			Upper Brushy Basin Ct @ 120.0
125.0						sltst	ltgn-rdbn											N			

PERCENTAGE COMPOSITION IMAGE

Date Sept 28, 2009 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-14
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 135.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
125.0						sltst	ltgy-rdbn											N			
127.5						sltst	gy gn-rdbn											N			
130.0						Sh	rdbn-gygn											N			
132.5						Sh, qtzss	rdbn-wh											N			T.D.
135.0																					

PERCENTAGE COMPOSITION IMAGE

Date 12-1-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-15
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 2
T.D. PROBE ____
T.D. DRILL 155
FLUID LEVEL 89

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst, mdst	rdbn											W			Surface soil.
5.0						sltst, mdst	rdbn											VS			Surface soil
7.5						sltst, mdst	rdbn											VS			Surface soil
10.0						sltst, mdst	rdbn											VS			Surface soil
12.5						sltst, sh	rdbn ywbn											VS			color change ywgn Mancos Sh. @ 12.0'
15.0						sh	ywbn											S			
17.5						sh	ywbn											S			
20.0						sh	ywbn											S			
22.5						sh	ywbn											S			
25.0						sh	ywbn											W			
27.5						sh	ywbn-gy											N			
30.0						sh	ywbn-gy											N			
32.5						sh	vdkgy											N			
35.0						sh	ywbn-gy											N			
37.5						sh	vdkgybn											N			
40.0						qtz ss, sh	tn-dkgy	m	m	a		L						N			Upper Dakota Ct. @ 38.0'
42.5						qtz ss	tn	m	m	a		L						N			
45.0						qtz ss, sh	tn-gy	m	m	a		L						N			
47.5						sh	vdkgy											N			
50.0						sh, qtz ss	bn-vdkgy	m	m	a		L						N	Tr	F	
52.5						qtz ss	gybn	m-cr	P	a								N	Tr	F	
55.0						qtz ss	ywtn	m-cr	P	a								N			
57.5						qtz ss	ywtn	m-cr	P	a								N			
60.0						qtz ss	ywtn	m-cr	P	a								N			
62.5						qtz ss/cgl	ywgy	m-peb	P	a								N			
65.0						qtz ss/cgl	ywortn	m-peb	P	a								N			H_2O injection beg. @ 62.5
67.5						sndy sh	ltblgy	vf-f	P	a								N			
70.0						sh	ltblgy	vf-f	P	a								N			
72.5						qtz ss	wh-gy	vf-f	P	a								N			
75.0						qtz ss	wh-rd	vf-f	P	a		H						N			
77.5						qtz ss	ortn	f	m	a		L						N			
80.0						qtz ss	tn	f-peb	P	a								N			
82.5						qtz ss	tn	f-peb	P	a								N			
85.0						qtz ss	tn	f-peb	P	a		L						N			
87.5						qtz ss	tn	m	m	a								N			
90.0						qtz ss	tn	m	m	a								N			
92.5						qtz ss	tn	f-m	m	a								N			
95.0						qtz ss, cgl	tn-orbn	f-peb	P	a		L						N			some chert frag. & grains
97.5						qtz ss, cgl	tn	m-peb	P	a								N			abund chert frags & pebbles.
100.0						qtz ss, cgl	wh-ltgy	m-peb	P	a								N			" " " "
102.5						qtz ss	lttn	m-vcr	P	a								S			
105.0						qtz ss, sh	lttn-gy	m-cr	P	a								S			
107.5						sndy sh	ltgygn	f-m	P	a								N			
110.0						qtz ss	vltgygn	vf-f	P	a								N			
112.5						qtz ss, sh	wh-ltgn	vf-f	P	a								N			
115.0						sndy sh	ltgn	f-m	P	a								N			
117.5						sh, qtz ss	ltgn	f-m	P	a								N			
120.0						qtz ss	ltgn	f-m	P	a								N			
122.5						qtz ss	ltgy	f-m	P	a								N			
125.0						qtz ss	ltgy-tn	m-peb	P	a								N			abund chert pebbles & frags

PERCENTAGE COMPOSITION IMAGE

Date 10-1-09 Geologist L. Casebolt Drilling Co. Boyles Exploration, Inc. Hole No. TWN-15
Property White Mesa Mill Project Nitrate study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 155.0
FLUID LEVEL 89'

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
127.5						Chert cgl.	orgytn	cr- peb	p	a								N			very abund chert pebbles + frags
130.0						Chert Cgl	orgytn	cr- peb	p	a			Tr	C				N			" " " " "
132.5						cgl, sh	gyrdbn	m- peb	p	a								N			" " "
135.0						Sh, cgl	gy rdbn	peb	p	a								N			
137.5						Sh	gy rdbn											N			
140.0						sltst	ltgy											N			
142.5						sltst	ltgyrdbn											N			
145.0						sltst, sh	gn-rdbn											N			
147.5						qtz ss, sltst	wh-rdbn-gy	f	m	a								N			
150.0						qtz ss	wh-ltgy	vf-f	p	a								N			
152.5						sh	gy-ppbn											N			Upper Brushy Basin Ct @ 150.0'
155.0						sh	ppbn-gy											N			
T.D.																					

PERCENTAGE COMPOSITION IMAGE

Date 9-30-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-16
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF ____
T.D. PROBE ____
T.D. DRILL 100.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
2.5						sltst, mdst	rdbn											VS			Surface soil
5.0						qtz ss	tn	m	m	a								N			Top of Dakota @ 2.5'
7.5						qtz ss	tn	f-m	P	a								N			
10.0						qtz ss	tnbn	m-cr	P	a								N			
12.5						qtz ss	tn	f-m	m	a								N			
15.0						qtz ss	tn	f-m	m	a								N			
17.5						qtz ss	tn	m	m	a								N			moisture 12.5'
20.0						qtz ss	tn	f-m										N			
22.5						sndy sh	tn	f-m	P	a								N			H2O injected 20'
25.0						qtz ss	wh-tn	f-m	P	a		L						N			
27.5						qtz ss	wh	f-m	P	a								N			
30.0						qtz ss	lttn	f	m	a								N			
32.5						qtz ss	rd-ltgy	vf-f	m	a		H						N			
35.0						qtz ss	rd-lttn	f-m	m	a		L/H						N			
37.5						qtz ss	ywtn	vf-f	m	a								N			
40.0						qtz ss	lttn	f-cr	P	a								N			some chert frags.
42.5						qtz ss	tn	f-cr	P	r		L						N			
45.0						qtz ss, cgl	lttn	m-peb	P									N			some chert fragments + pebbles.
47.5						qtz ss	vlttn	m	m	R								N			
50.0						qtz ss	vlttn	m	m	R								N			
52.5						qtz ss	vlttn	m	m	r								N			
55.0						qtz ss, cgl	ortn	m-peb	P	a								N			chert frags + pebbles.
57.5						sh, cgl	or-gygn	peb	P	a								N			" " "
60.0						qtz ss, sh, cgl		m-peb	P	a								N			
62.5						qtz ss, sh	vlttn-gy	m-cr	P	a		L						N			
65.0						qtz ss, sh	tn-ltgy	m	m	a		L						N			
67.5						qtz ss, cgl	ltgytn	peb	P	a								N			
70.0						qtz ss, cgl	tn	m-peb	P	a								N			
72.5						qtz ss	tn	f-m	P	a								N			
75.0						qtz ss	tn	f-m	P	a								N			
77.5						qtz ss	tn	f-m	m	a								N			
80.0						qtz ss	tn	m-vcr	P	a								N			
82.5						qtz ss	tn	f-m	m	a								N			
85.0						qtz ss cgl	ortn-gy	m-peb	P	a								N			
87.5						qtz ss	Tn	m-cr	P	a								N			
90.0						qtz ss	gy	m-cr	P	a			Tr	C				N			
92.5						sh,	gy ppbn											N			Upper Brushy Basin Ct. @ 90.0'
95.0						sh, cgl.	pprdbn	peb										N			
97.5						sh	lt gy											N			
100.0						sh	ppbn-gy											N			

PERCENTAGE COMPOSITION IMAGE

Date 10-2-09 Geologist L. Casebolt Drilling Co. Bayles Exploration Inc. Hole No. TWN-17
Property White Mesa mill Project Nitrate Study Unit No. ______ Sec. ______ Twp. ______ Rge. ______
County San Juan State Utah Location ______ Elev. ______

PAGE 1 OF 1
T.D. PROBE ______
T.D. DRILL 110.0
FLUID LEVEL ______

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						sltst, mdst	rdbn											S			Surface soil
5.0						sltst, mdst	rdbn											S			Surface soil
7.5						qtz ss	tn	f-m	P	a		L						N			Color change top of Dakota @ 5.0'
10.0						qtz ss, sh	tn bn	f-cr	P	a								N			white chert frags + grains.
12.5						qtz ss	tn	f-vcr	P	a								N			
15.0						qtz ss	tn	m	m	a								N			
17.5						qtz ss	tn	m-cr	m	r								N			
20.0						qtz ss	tn	m	m	r								N			
22.5						qtz ss	tn	m-cr	P	r								N			
25.0						qtz ss-qtzite	wh	m-vcr	P	a								N			fragments of orthoquartzite
27.5						qtz ss	wh-tn	m-cr	P	a								N			
30.0						qtz ss	tn	m-cr	P	a								N			
32.5						qtz ss	tn	f-m	P	a								N			
35.0						qtz ss, sh	ltgytn	f-m	P	a		L						N			
37.5						qtz ss	tn	m-cr	m	a								N			
40.0						qtz ss	tn	f-m	m	a								N			
42.5						qtz ss	lt tn	f-m	m	a								N			
45.0						qtz ss	wh	m-vcr	P	a								N			
47.5						qtz ss	lt or tn	m-vcr	P	a								N			
50.0						qtz ss, cgl	or tn	m-peb	P	a								N			some small chert pebbles.
52.5						qtz ss	wh	m-cr	P	a								N			
55.0						qtz ss, cgl	tngy	f-peb	P	a								N			some small chert pebbles + frags.
57.5						qtz ss	tn	f-vcr	P	a								N			
60.0						qtz ss	tn	f-cr	P	a								N			
62.5						qtz ss, cgl	tn	f-peb	P	a								N			some small chert frags.
65.0						qtz ss, cgl	tn	f-vcr	P	a								N			some chert frags.
67.5						qtz ss	vlttn	f-vcr	P	a								N			
70.0						qtz ss	tn	f-cr	P	a								N			
72.5						sh	ltgygn											N			
75.0						sh	ltgygn											N			
77.5						qtz ss, sh	wh-ltgn	vf-f	P	a								N			
80.0						qtz ss	wh-ltgn	vf-f	P	a		L						N			
82.5						qtz ss	wh-tn	f-cr	P	a								N			
85.0						qtz ss	wh-tn	f-m	P	a								N			
87.5						qtz ss	tn	f-m	P	a								N			
90.0						qtz ss	tn-gy	f-m	P	a								N			
92.5						sh	dkgybn											N			
95.0						qtz ss, cgl	gy	f-peb	P	a								N			
97.5						qtz ss, cgl	gy-rdbn	m-peb	P	a								N			
100.0						cgl	bn-rdbn	peb	P	a								N			abund. multicolored chert pebbles + frags.
102.5						cgl	gy bn	peb	P	a								W			" " " " "
105.0						qtz ss, cgl, sh	tn-rdbn	f-peb	P	a								S			Upper 00 et @ 104 ft'
107.5						Sh, sltst	ltgy-rdbn	vf-f	P	a								N			
110.0						sh	pprdbn											N			T.D.

PERCENTAGE COMPOSITION IMAGE

Date 10-9-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-18
Property White Mesa mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 1 OF 1
T.D. PROBE ____
T.D. DRILL 145.0
FLUID LEVEL ____

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE			METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON		REMARKS
													AMOUNT	HABIT	ALTER.				AMOUNT	TYPE	
0																					
2.5						sndy sltst	rdbn	vf-cr	P	a								S			surface soil.
5.0						sndy sltst	rdbn	vf-m	P	a								W			Surface soil
7.5						sltst-sndy	rdbn	vf-cr	P	a								W			surface soil
10.0						sltst-sndy	rdbn	vf-m	P	a								S			
12.5						qtz ss	tn	m	m	a		L						N			Upper contact Dakota fm @ 10.0'
15.0						qtz ss	tn	f-m	m	a								N			
17.5						qtz ss	tn	m	m	a								N			
20.0						qtz ss	tn	m	m	a								N			
22.5						qtz ss	tn	m	m	a		L						N			
25.0						qtz ss	tn	f-m	m	a								N			
27.5						qtz ss, sh	tn	m-cr	m	a								N			
30.0						qtz ss	tn	m-cr	m	r								N			
32.5						qtz ss	tn	m-peb	P	a								N			some light colored chert pebbles & frags.
35.0						qtz ss	tn	m-cr	P	a								N			" " " " " "
37.5						sh, qtz ss	gy	m-peb	P	a								N			" " " " " "
40.0						sh	gy											N			
42.5						sh, qtz ss	gy	m-cr	P	a								N			
45.0						sh, qtz ss	tn	m-peb	P	a								N			" " " " " "
47.5						sh	gytn											N			
50.0						sh	gytn											N			
52.5						sltst	gy											N			
55.0						sndy sh	gy	f-m	P	a								N			
57.5						sltst, sh	gy											N			
60.0						sndy sltst	gy	f-m	P	a								N			
62.5						qtz ss	gy	vf-f	P	a								N			
65.0						qtz ss, sh	gy	vf-f	P	a								N			
67.5						qtz ss, sh	tn-gy	vf-f	P	a								N			
70.0						sh	gy											N			
72.5						sh, qtz ss	gy-ortn	f-m	P	a		L						N			
75.0						qtz ss	lt tn	m	m	a		L						N			
77.5						qtz ss	lt tn	m-cr	m	a								N			
80.0						qtz ss	lt tn	m-peb	m	a		L						N			
82.5						qtz ss	wh	m	m	a								N			
85.0						qtz ss	wh	m-cr	m	a								N			
87.5						qtz ss	wh	m-cr	m	a								S			
90.0						qtz ss, sh	lt tn	m-cr	m	r								W			
92.5						qtz ss, sh	ltgn-tn	m-cr	m	r								N			
95.0						sh	gn-ppbn											N			
97.5						Sh	gn-ppbn											N			
100.0						sh, qtz ss	gn-ppbn											N			
102.5						qtz ss, sh	gn-tn	m	m	r		L						N			
105.0						qtz ss	gy gn	f-m	m	r			<½	C				N			
107.5						qtz ss	gy gn	f-m	m	r								N			
110.0						qtz ss	gy gn	f-m	m	r								N			
112.5						qtz ss	ltgy	f-m	P	r			1%	c				N			pyrite noted.
115.0						qtz ss	ltgy	f-m	P	a								N			
117.5						qtz ss	vltgy	f-m	m	a								N			
120.0						qtz ss, sh	ltgy	f-m	m	a								N			
122.5						qtz ss	ltgy	f-vcr	P	a		L						N			chert frags.
125.0						qtz ss	ltgy	f-m	m	a								N			

PERCENTAGE COMPOSITION IMAGE

Date 10-9-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-18
Property White Mesa Mill Project Nitrate Study Unit No. ____ Sec. ____ Twp. ____ Rge. ____
County San Juan State Utah Location ____ Elev. ____

PAGE 2 OF 2
T.D. PROBE ____
T.D. DRILL 145.0
FLUID LEVEL 57

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
127.5						qtz ss	ltgy	f-cr	p	a								N			
130.0						qtz ss	ltgy	f-cr	p	a		L						N			chert frags.
132.5						qtz ss, sh	ltgy	f-m	m	a		L						N			
135.0						qtz ss	ltgy	f-m	m	a								N			
137.5						qtz ss	gy	f-m	m	a								N			
140.0						sltst	gy											N			
142.5						sltst: sh	gy-rdbn											W			
145.0						sh	rdbn											N			Upper Brushy Brushy Basin fm ct@ 142.0
TD																					

PERCENTAGE COMPOSITION IMAGE

Date 10-12-09 Geologist L. Casebolt Drilling Co. Bayles Exploration, Inc. Hole No. TWN-19
Property White Mesa Mill Project Nitrate Study Unit No. ___ Sec. ___ Twp. ___ Rge. ___
County San Juan State Utah Location ___ Elev. ___

PAGE 1 OF 1
T.D. PROBE ___
T.D. DRILL 110.0 TD
FLUID LEVEL ___

DEPTH	SAMPLE TAKEN	GRAPHIC LOG	ALTERATION	GAMMA ANOMALY	BRECCIA PIPE	LITHOLOGY	COLOR OF WET SAMPLE	GRAIN SIZE	SORTING	ANGULARITY	CEMENT MATRIX	IRON OXIDE	PYRITE AMOUNT	PYRITE HABIT	PYRITE ALTER.	METALLIC	NON-METALLIC	REACT.-10% HCL	CARBON AMOUNT	CARBON TYPE	REMARKS
0																					
2.5						mdst sltst	rdbn											W			Surface soil
5.0						mdst, sltst	rdbn											S			
7.5						qtz ss	dk tn	m	M	r		L						N			Upper Dakota Ct @ 5.0'
10.0						qtz ss	tn	m-cr	P	a								N			some wh chert grains
12.5						qtz ss	dktn	m-cr	P	a								N			" " " "
15.0						qtz ss	tn	m cr	P	a								N			abund multi colored chert frags.
17.5						qtz ss	tn	m-cr	P	a		L						N			" " " " "
20.0						qtz ss	tn	m-cr	P	a								N			
22.5						qtz ss, cgl	tn	m-peb	P	a								N			moisture first noted from 20.0
25.0						cgl, qtz ss	bn	m peb	P	a								N			abund. multi colored chert pebbles
27.5						cgl, qtz ss	bn	m peb	P	a								N			" " " " "
30.0						qtz ss	tn	m vcr	P	o								N			
32.5						qtz ss	tn	f-m	P	a								N			
35.0						qtz ss	tn	m-cr	P	a								N			begin H2O from inject @ 35'
37.5						qtz ss	tn	m	m	r								N			
40.0						qtz ss, cgl	ltgy	m-peb	m	a								N			
42.5						qtz ss	ltgytn	f-m	P	o								N			
45.0						qtz ss	ltgytn	f-m	P	a								N			
47.5						qtz ss	lttn	f-m	P	a								N			
50.0						cgl, qtz ss	ltgytn	f-peb	P	a								N			
52.5						qtz ss, cgl	ltgytn	f-peb	P	a								N			
55.0						qtz ss	tn	f-vcr	P	o								N			
57.5						qtz ss cgl	ortn	f-peb	P	a								N			
60.0						sh, qtz ss	gytn											N			
62.5						sltst	ltgy											N			
65.0						sltst, sh	ltgy											N			
67.5						qtz ss sltst	ltgy	vf-f	P	a								N			
70.0						qtz ss	ltgy	vf-f	P	a								N			
72.5						qtz ss	ltgy-lt bn	vf-m	P	a		L						N			
75.0						qtz ss	ltgy-tn	vf-m	P	a		L						N			
77.5						qtz ss - sltst	ltgy-tn	vf-m	P	a								N			
80.0						qtz ss	ltgy-tn	f-vcr	P	r								N			
82.5						qtz ss, sltst	ltgy-tn	vf-m	P	a		L	<1%	C				N			
85.0						qtz ss	wh	f-m	P	a			<1%	C				N			
87.5						qtz ss	wh	f-m	P	a								N			
90.0						qtz ss	wh	f-m	P	a								N			
92.5						qtz ss, cgl	wh-gy	m-peb	P	o			Tr	C				N			some chert pebbles and frags.
95.0						qtz ss, cgl	gy-wh	m-peb	P	a								N			
97.5						sh, cgl, qtz ss	gy-bn	m-peb	P	a								N			
100.0						sh	gy											N			
102.5						qtz ss cgl	gy-rdbn	m-peb	P	a								N			
105.0						sh, qtz ss	gy	f-m	P	o								N			Brushy Bsn, Ct @ 105.0'
107.5						sh	rdbn											N			
110.0						sh	ppbn-gn											N			
TD.																					

PERCENTAGE COMPOSITION IMAGE

SAMPLE DESCRIPTION KEY

DEPTH SCALE
Scale is 1"-50' for drill samples and 1"-5' for core.

SAMPLE TAKEN
☒ ■ ☐ Mark through interval which special chip sample is saved, with an "X" mark through core interval with shading.

GRAPHIC LOG
Standard rock symbol for interval.

ALTERATION
|	Reduction
+ +	Dissolution
o o	Oxidation

GAMMA ANOMALY (Probe)
T	3xBG - .009	Trace
1	.010 - .049	Low Mineral
2	.050 - .199	High Mineral
3	.200 >	Ore

BRECCIA PIPE
|	Definate
|	Unsure

LITHOLOGY
Standard abbreviation for rock type.

COLOR
GSA Rock-Color Chart of wet samples.

GRAIN SIZE
Sandstone		Carbonates
Peb	Pebble	
vc	Very Coarse	vc
c	Coarse	c
m	Medium	m
f	Fine	f
vf	Very Fine	vf

SORTING
W	Well-sorted
M	Moderately-sorted
P	Poorly-sorted
U	Un-sorted

ANGULARITY
VA	Very Angular
A	Angular
a	subangular
r	Subrounded
R	Rounded
WR	Well Rounded

CEMENT-MATRIX
A	Argillaceous
C	Carbonate
D	Dolomite
S	Silica
F	Ferruginous

IRON OXIDE
H	Hematite	A	Abundant
L	Limonite	M	Moderate
G	Geothite	T	Trace

PYRITE-MARCASITE
Amount - In percent.

Habit
A	Aggregate
C	Interangular cement
G	Globules
I	Individual
M	Massive
MT	Marcasitic texture
O	Organic replacement

Alteration
F	Fresh
T	Tarnished
P	Pseudomorphs after pyrite

METALLIC MINERALS
Mark with an "X" and clarify in remarks and metallic minerals observed.
(MoS_2,NiS,PbS,UO_2,CU_2O,etc.)

NON-METALLIC MINERALS
Mark with an "X" and clarify in remarks any non-metallic minerals observed. (Barite, Anhydrite, Gypsum, Calcite, etc.)

REACTION -10% HCL
VS	Very Strong
S	Strong
M	Moderate
W	Weak
VW	Very Weak
N	None

CARBON MATERIAL
Amount - In percent

Type
C	Coal
F	Distinct woody fragments
H	Humic
HY	Hydrocarbon
I	Interbedded trash
L	Lignitic

BRECCIA NOMENCLATURE
See sample manual - use grain size, sorting and angularity columns for classification and description.

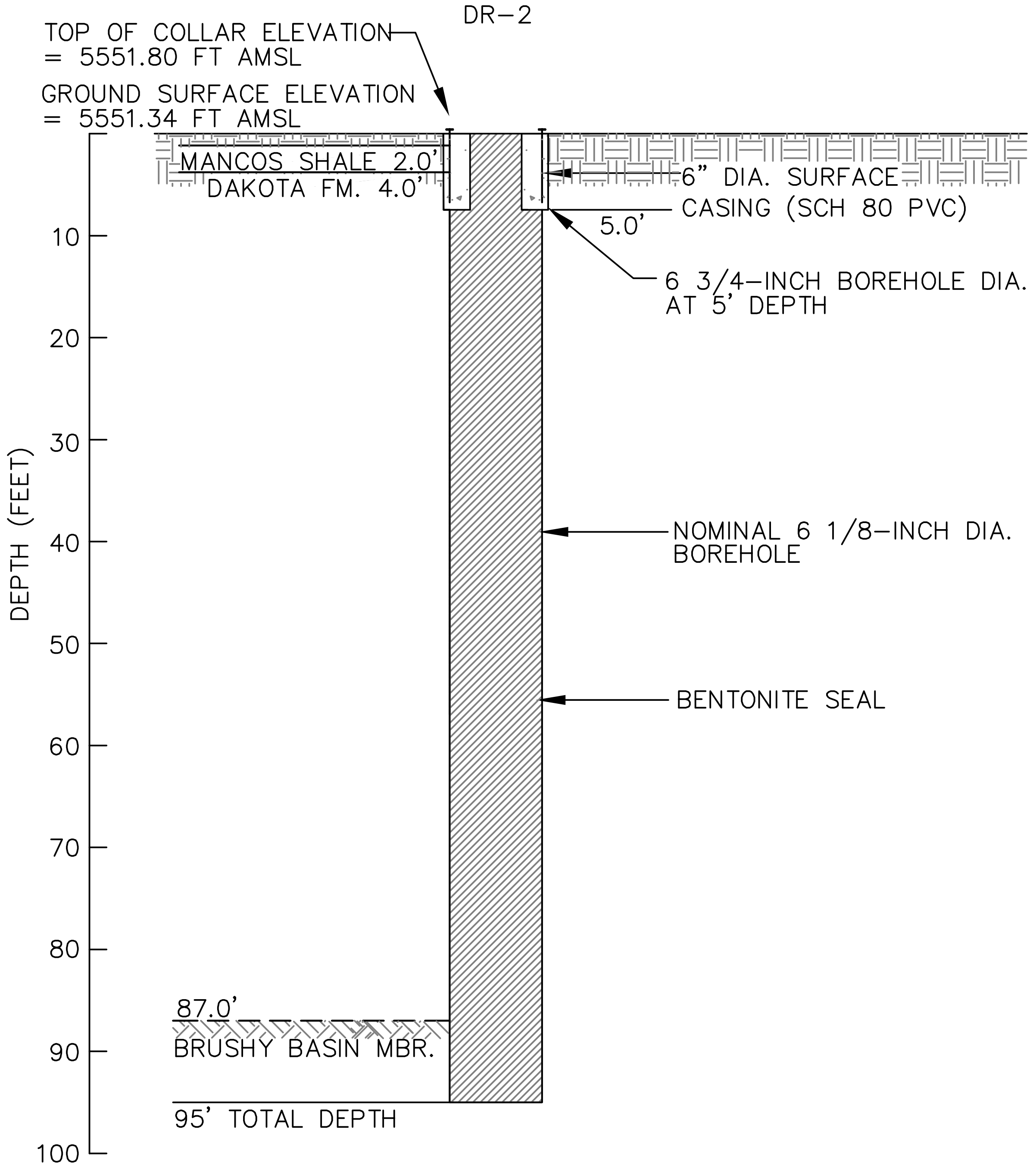
REMARKS
Use to clarify and expand on the columnar data. Explain anything not evident or any special characteristics such as: heavy minerals, tuffaceouness, cyclic sedimentation, fossils, sedimentary structures, formation picks, etc.

APPENDIX B

WELL CONSTRUCTION SCHEMATICS

APPENDIX B.1

DR - SERIES

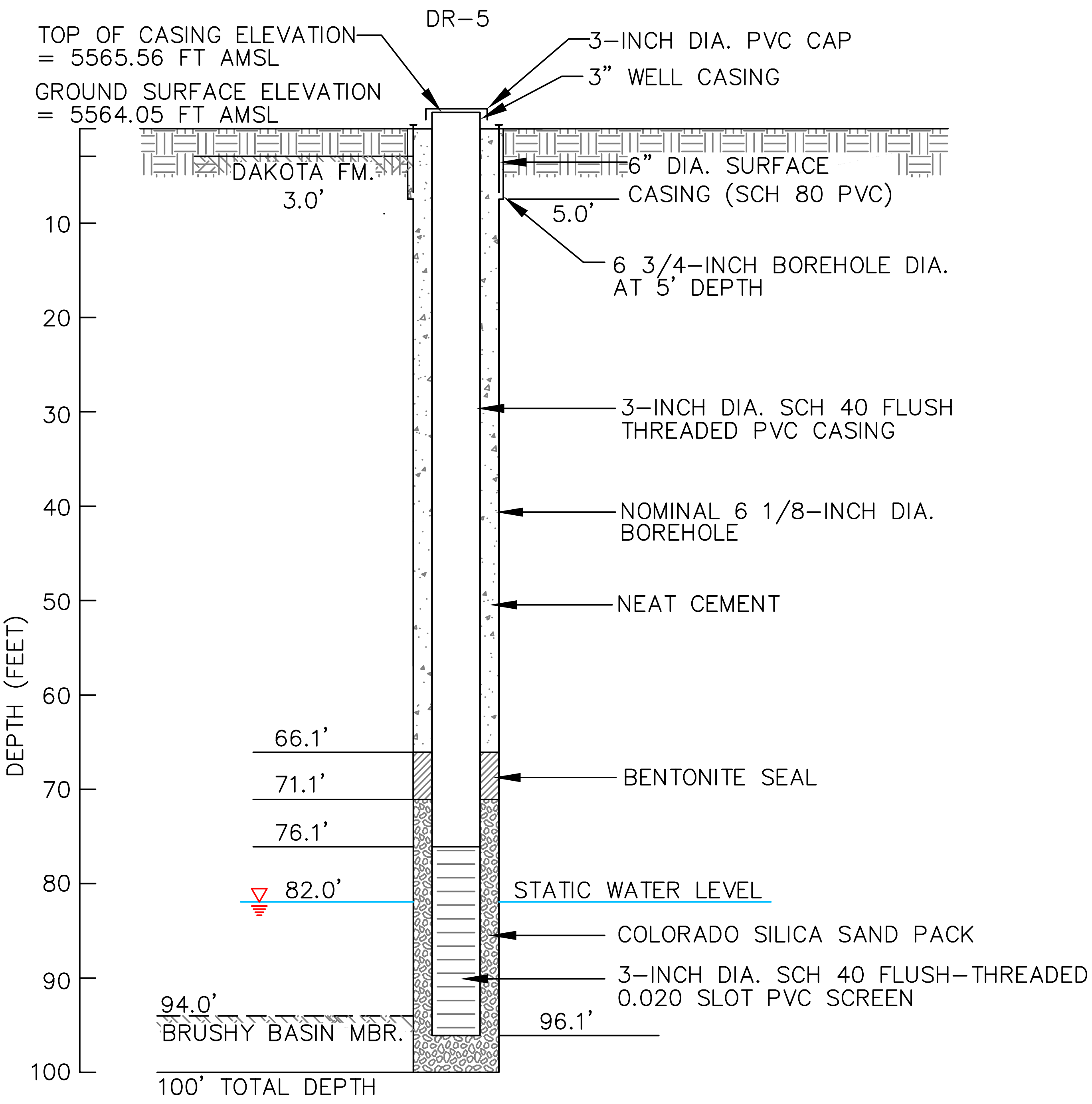


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

DR-2
WELL ABANDONMENT SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180271A Well Construction Diagram	

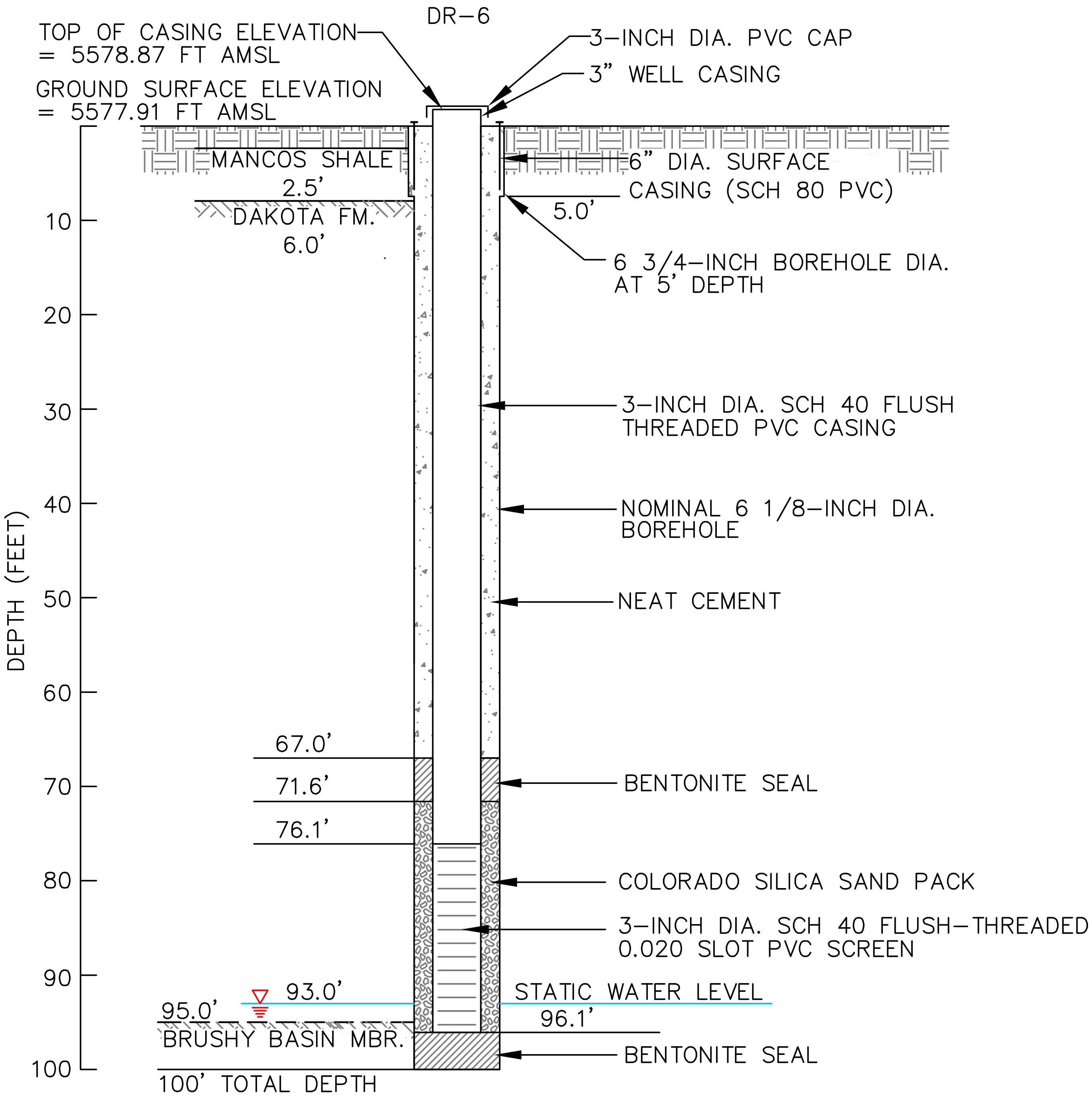


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-5
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180250A Well Construction Diagram	

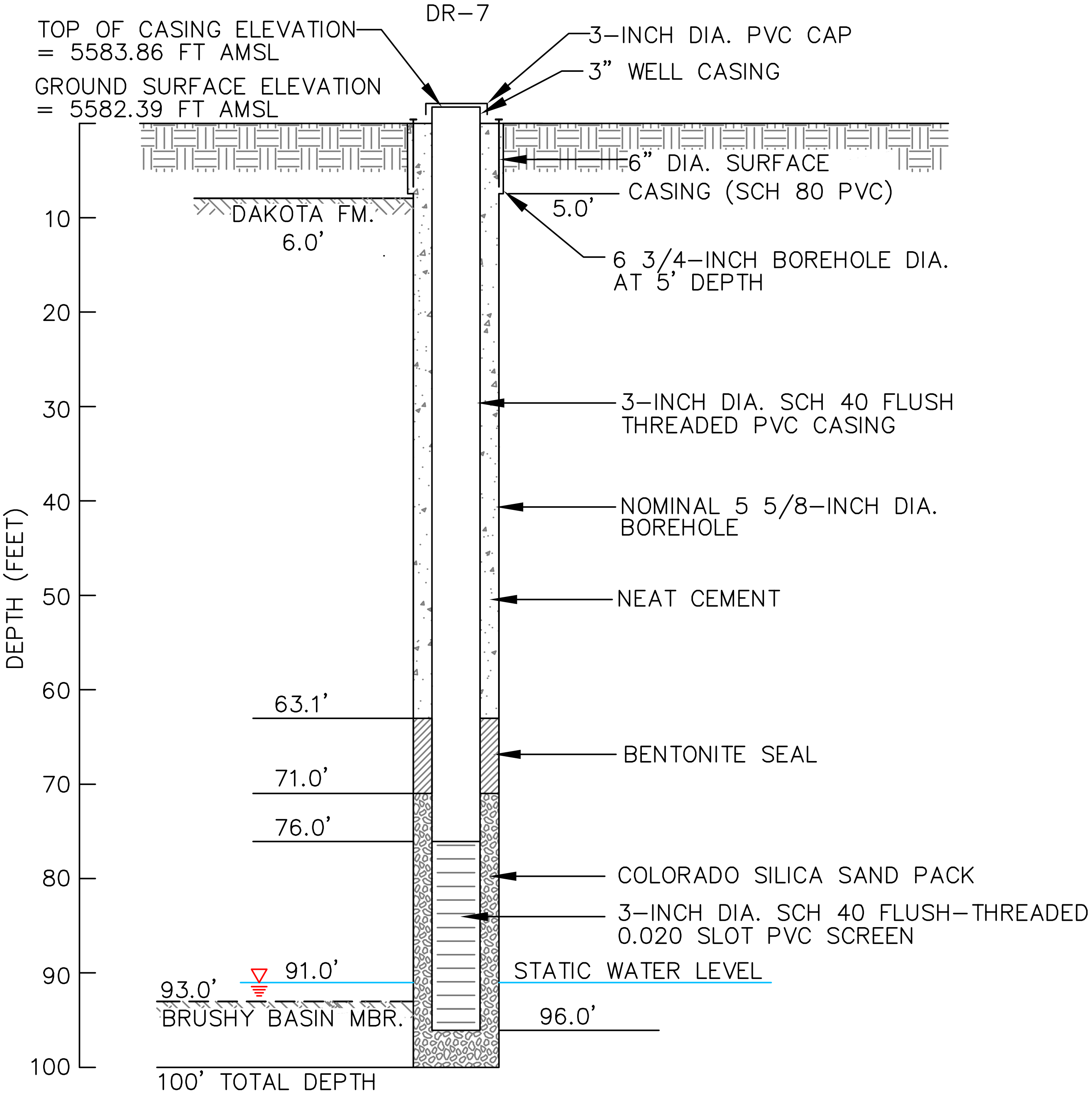


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-6
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180251A Well Construction Diagram	

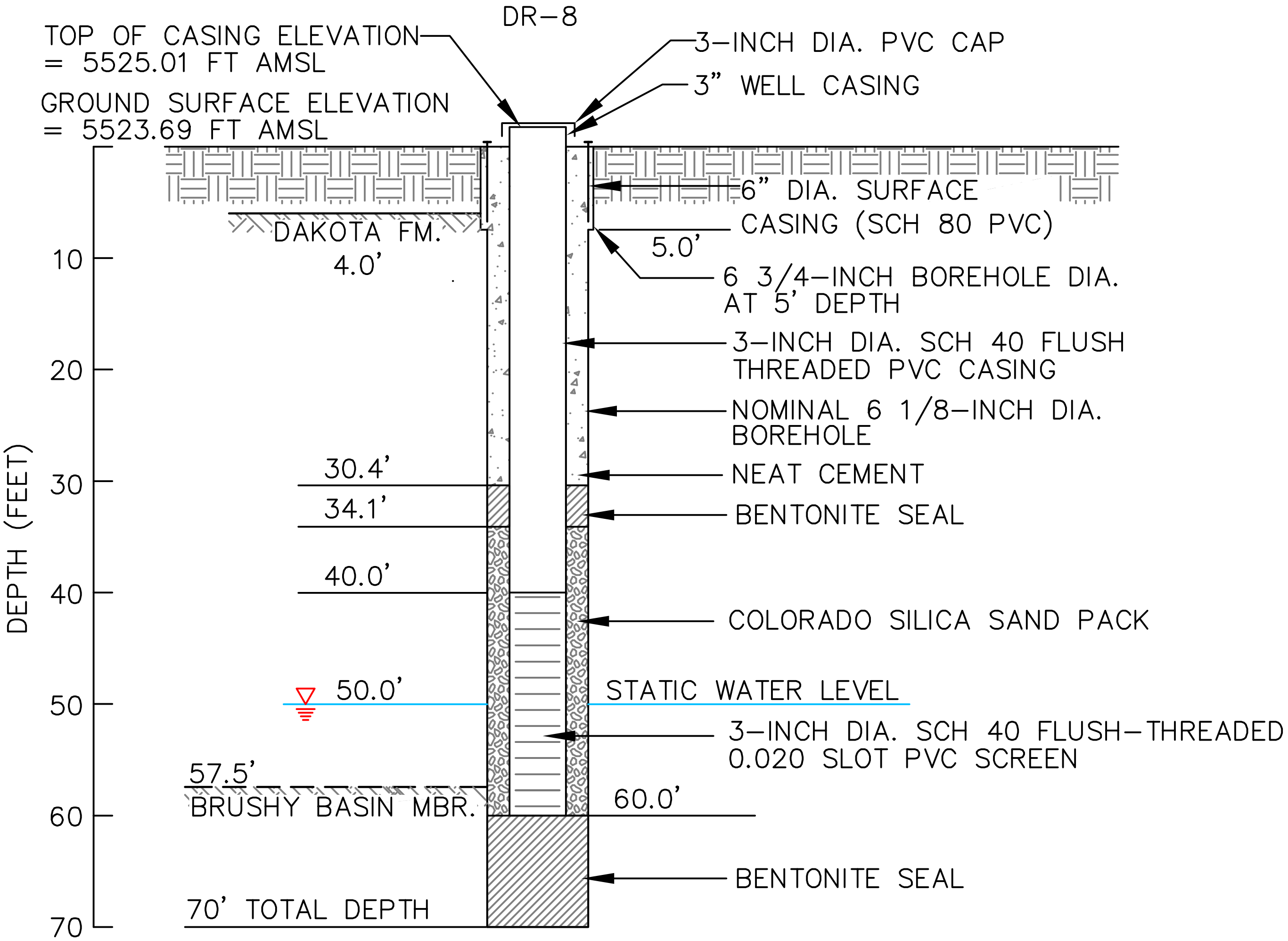


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-7
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180252A Well Construction Diagram	

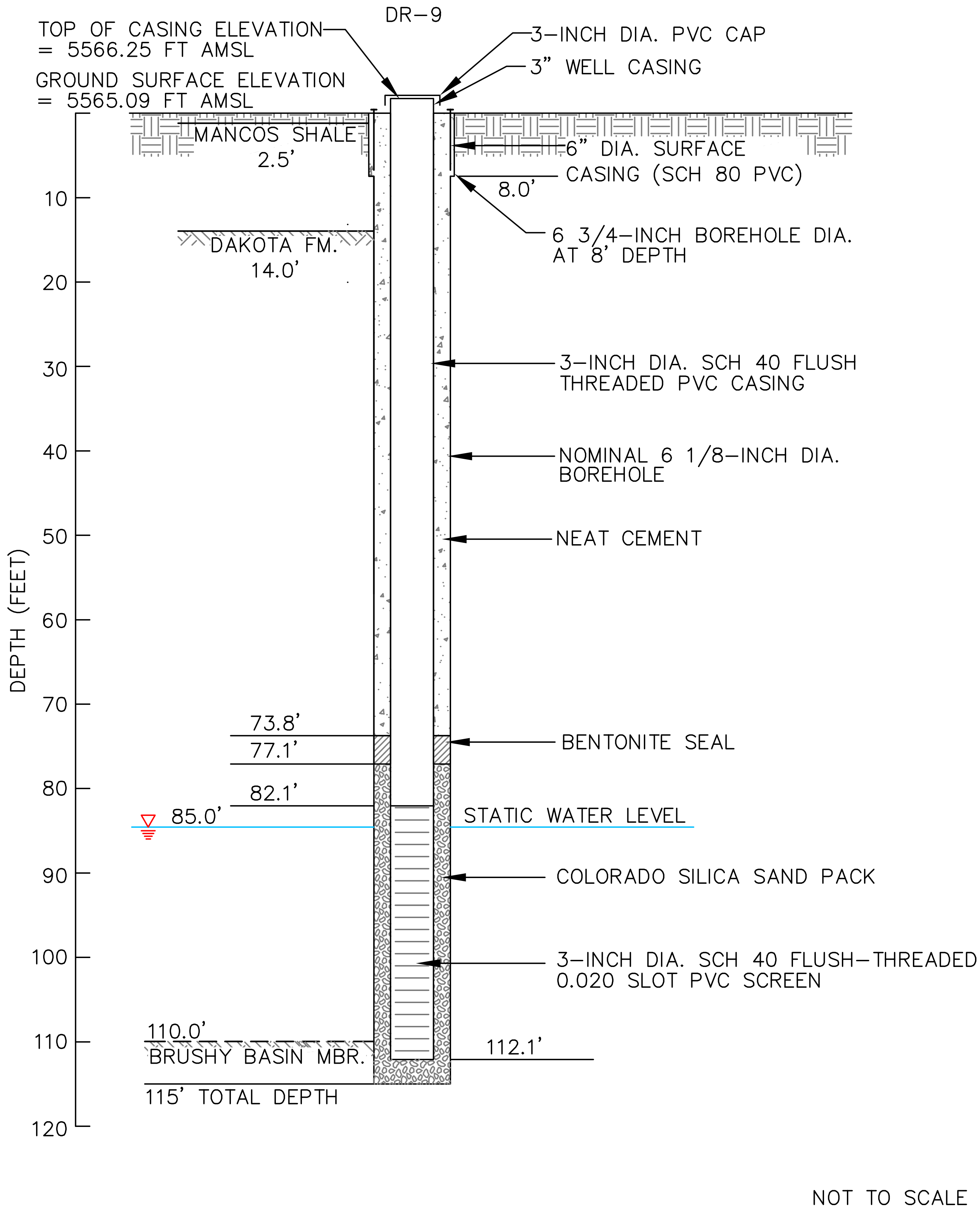


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

DR-8
AS-BUILT WELL CONSTRUCTION SCHEMATIC

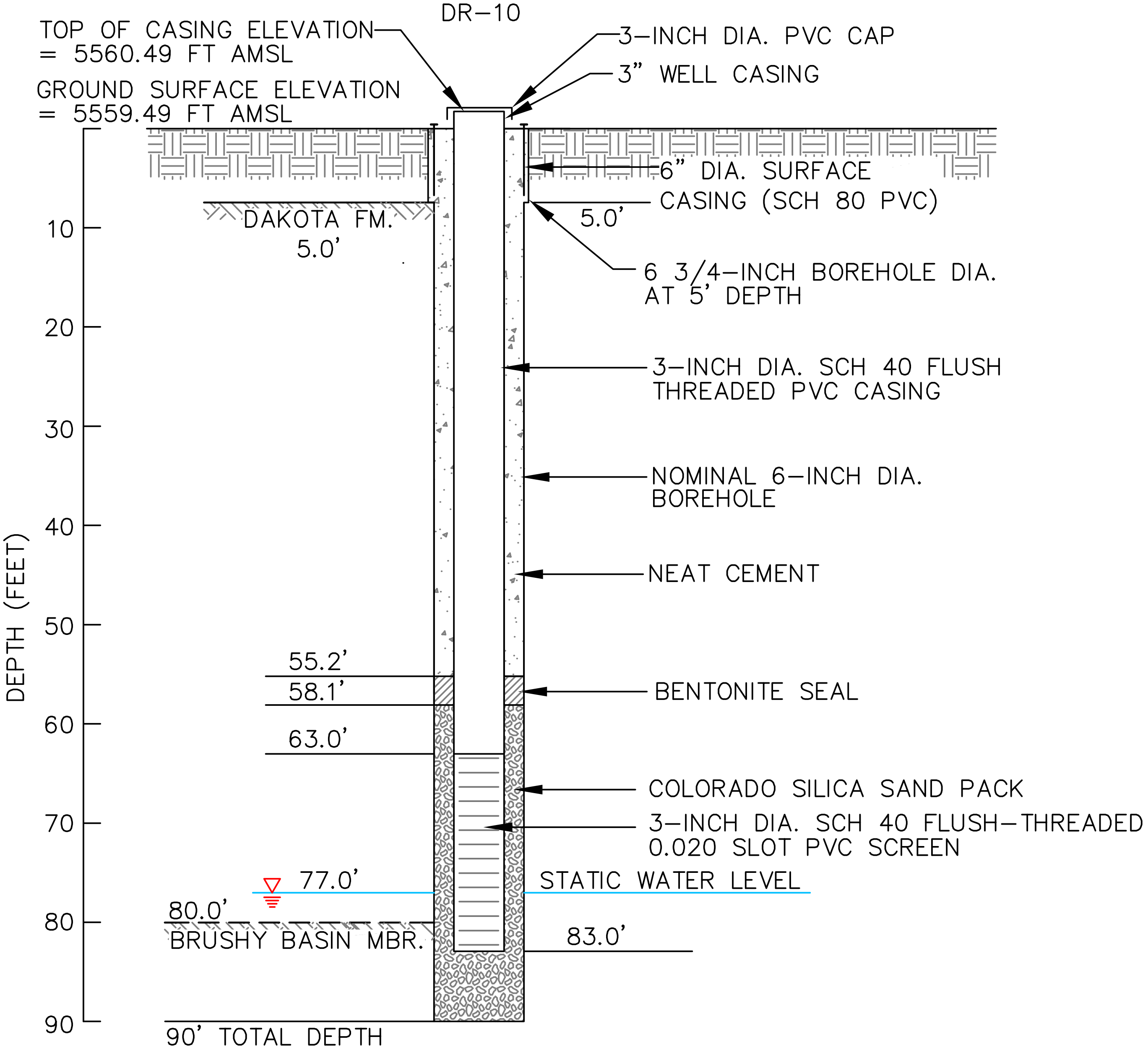
Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180253A Well Construction Diagram	



HYDRO GEO CHEM, INC.

DR-9
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180254A Well Construction Diagram	

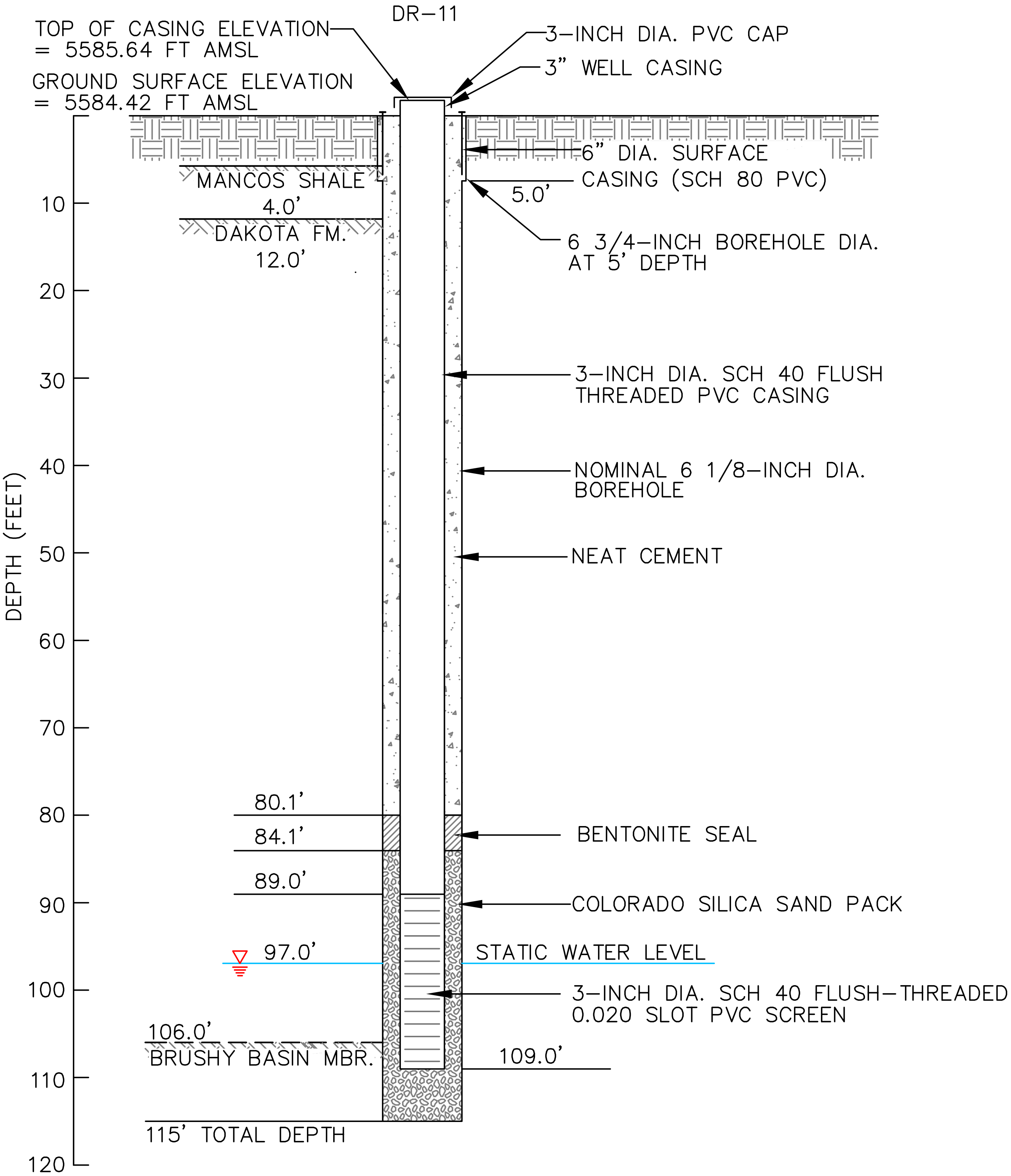


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-10
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180255A Well Construction Diagram	7

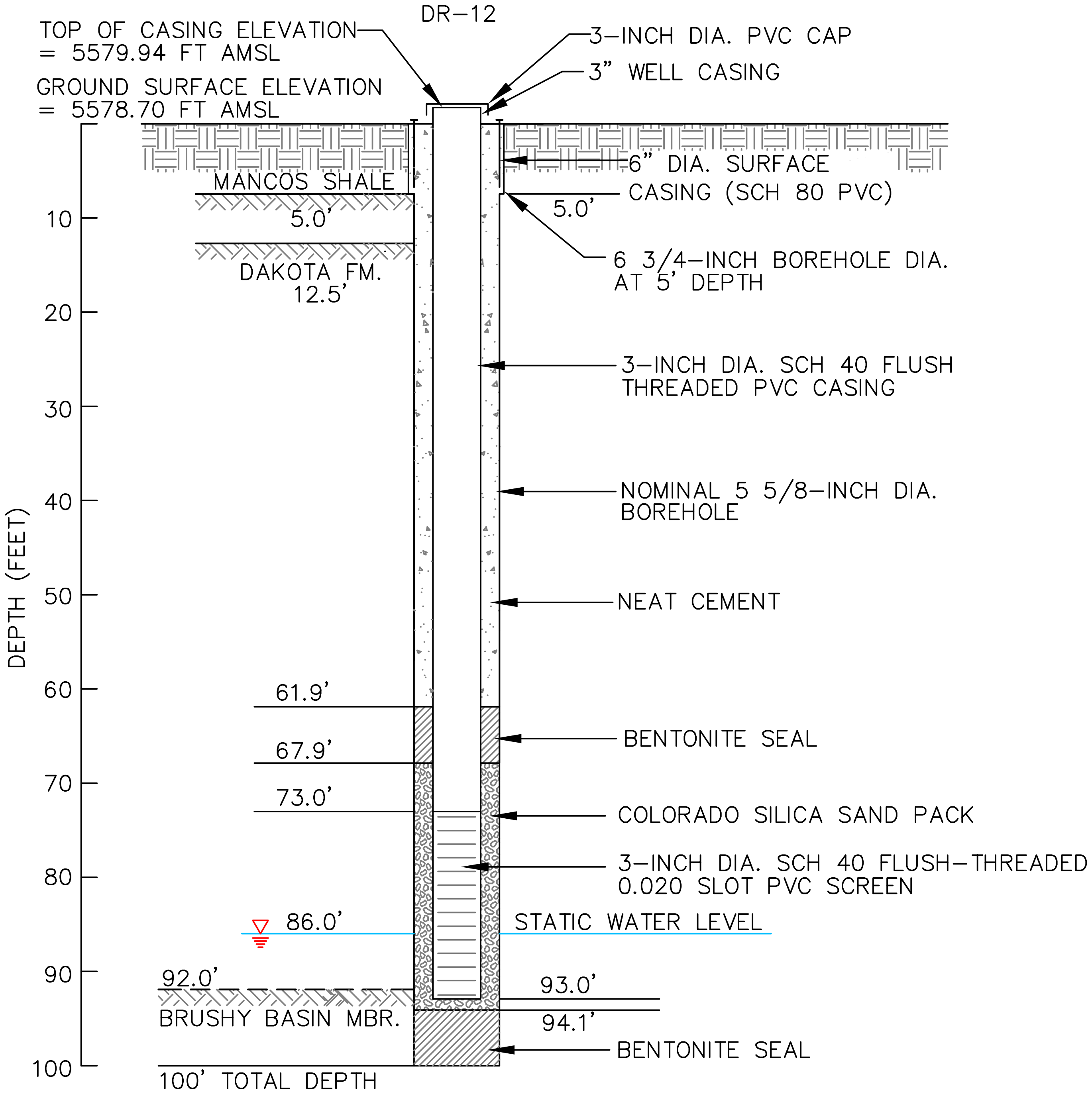


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-11
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180256A Well Construction Diagram	8

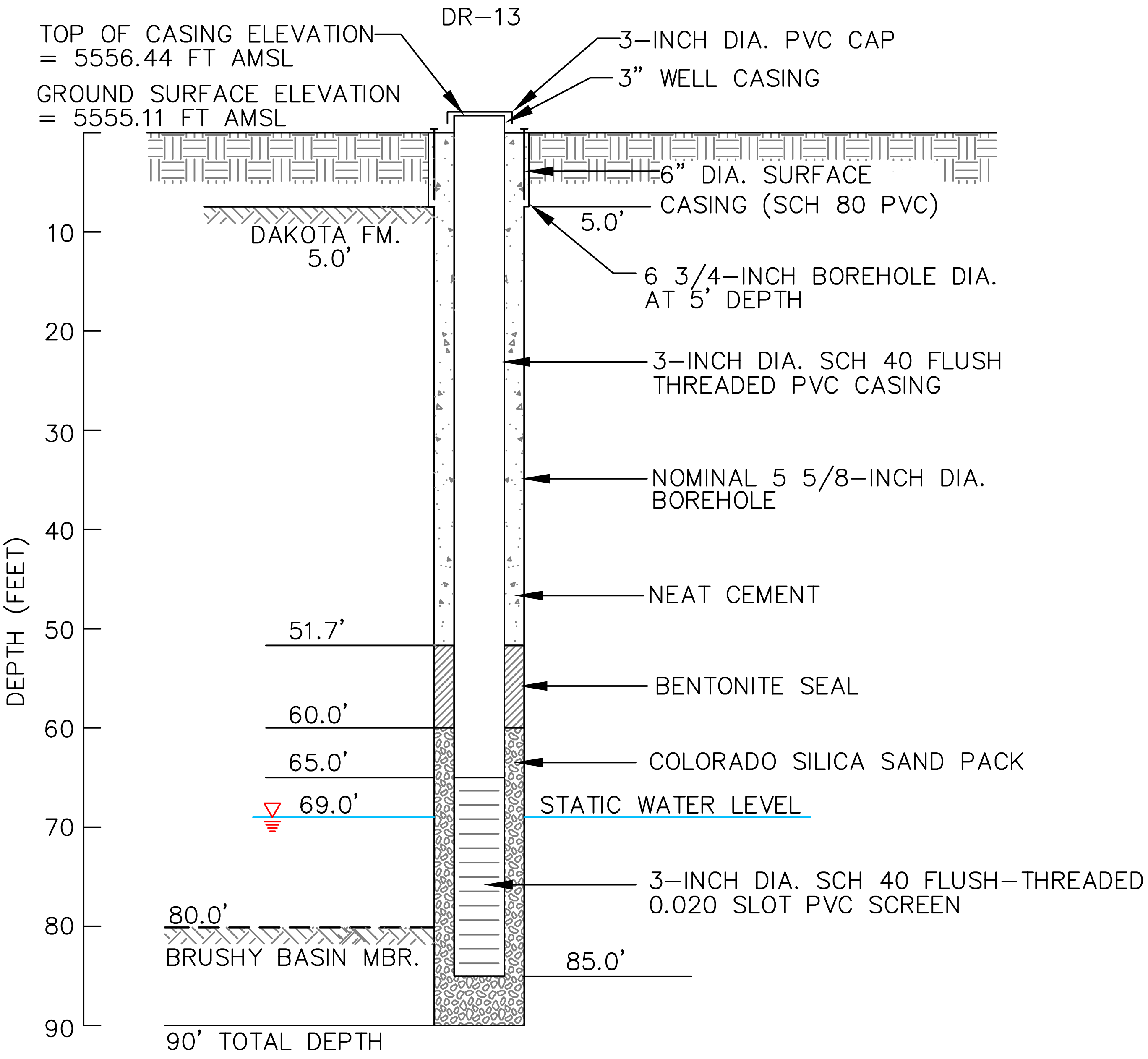


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-12
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180257A Well Construction Diagram	

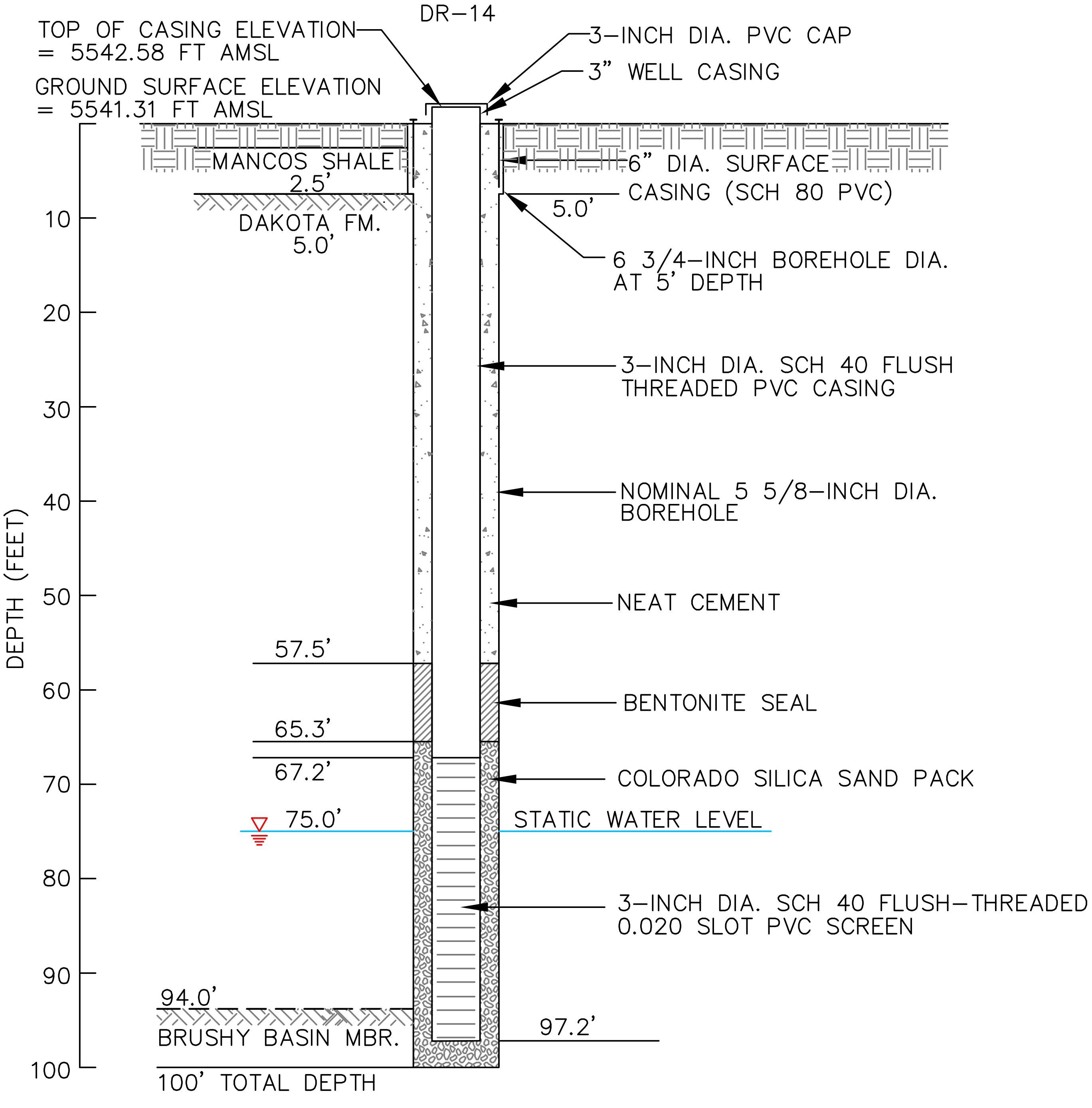


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-13
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180258A Well Construction Diagram	

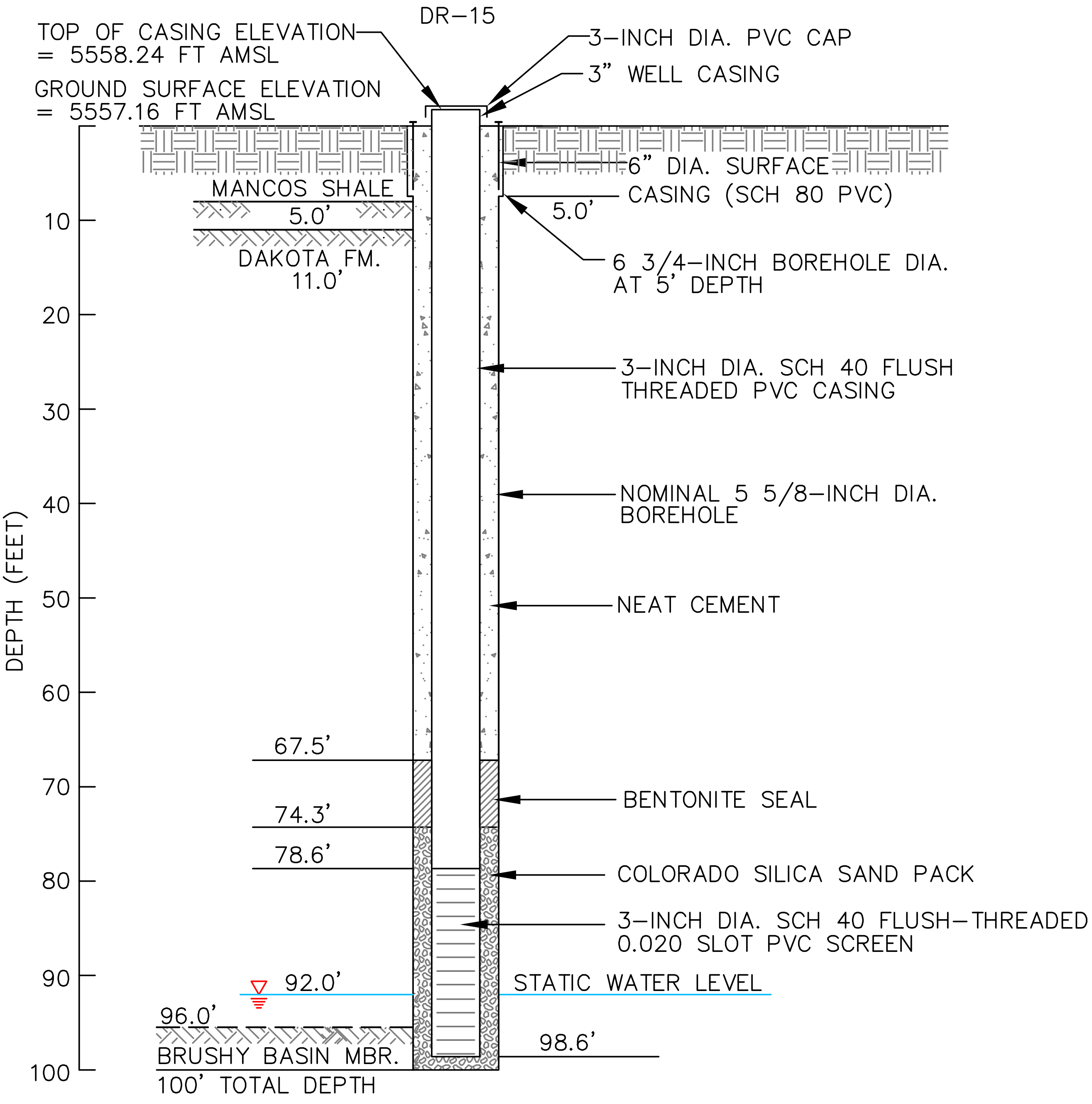


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-14
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180259A Well Construction Diagram	

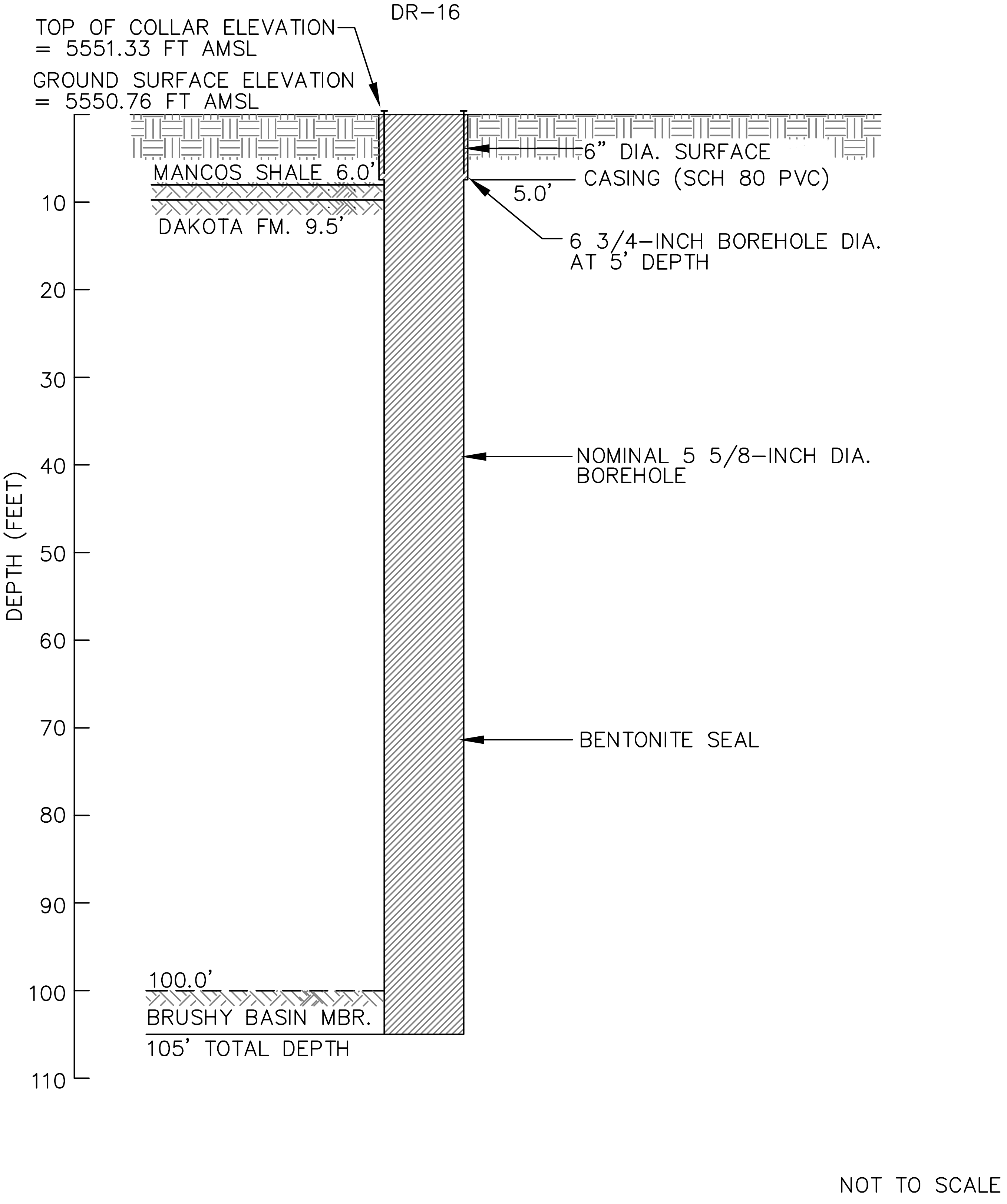


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-15
AS-BUILT WELL CONSTRUCTION SCHEMATIC

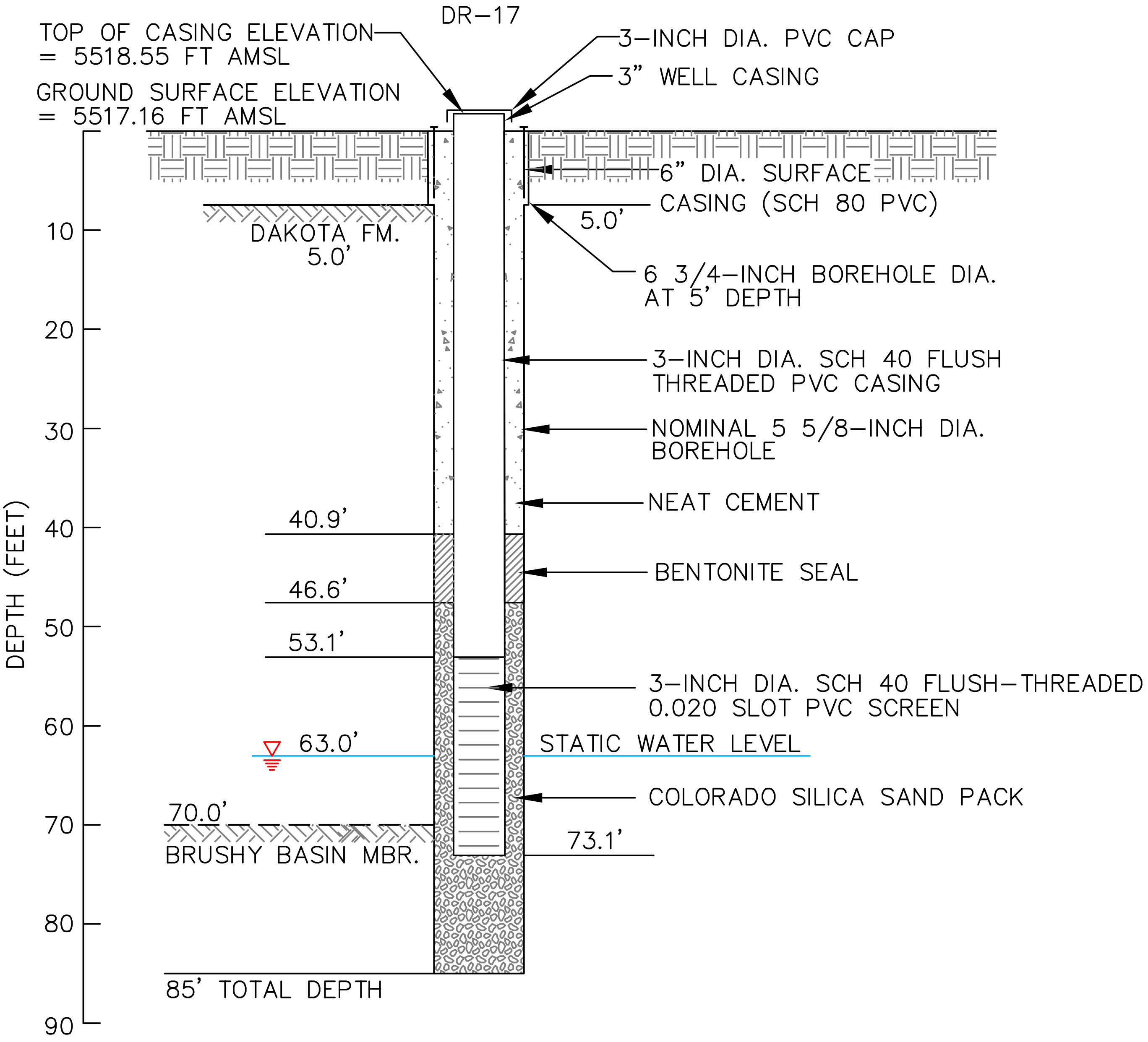
Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180260A Well Construction Diagram	



HYDRO GEO CHEM, INC.

DR-16
WELL ABANDONMENT SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180261A Well Construction Diagram	

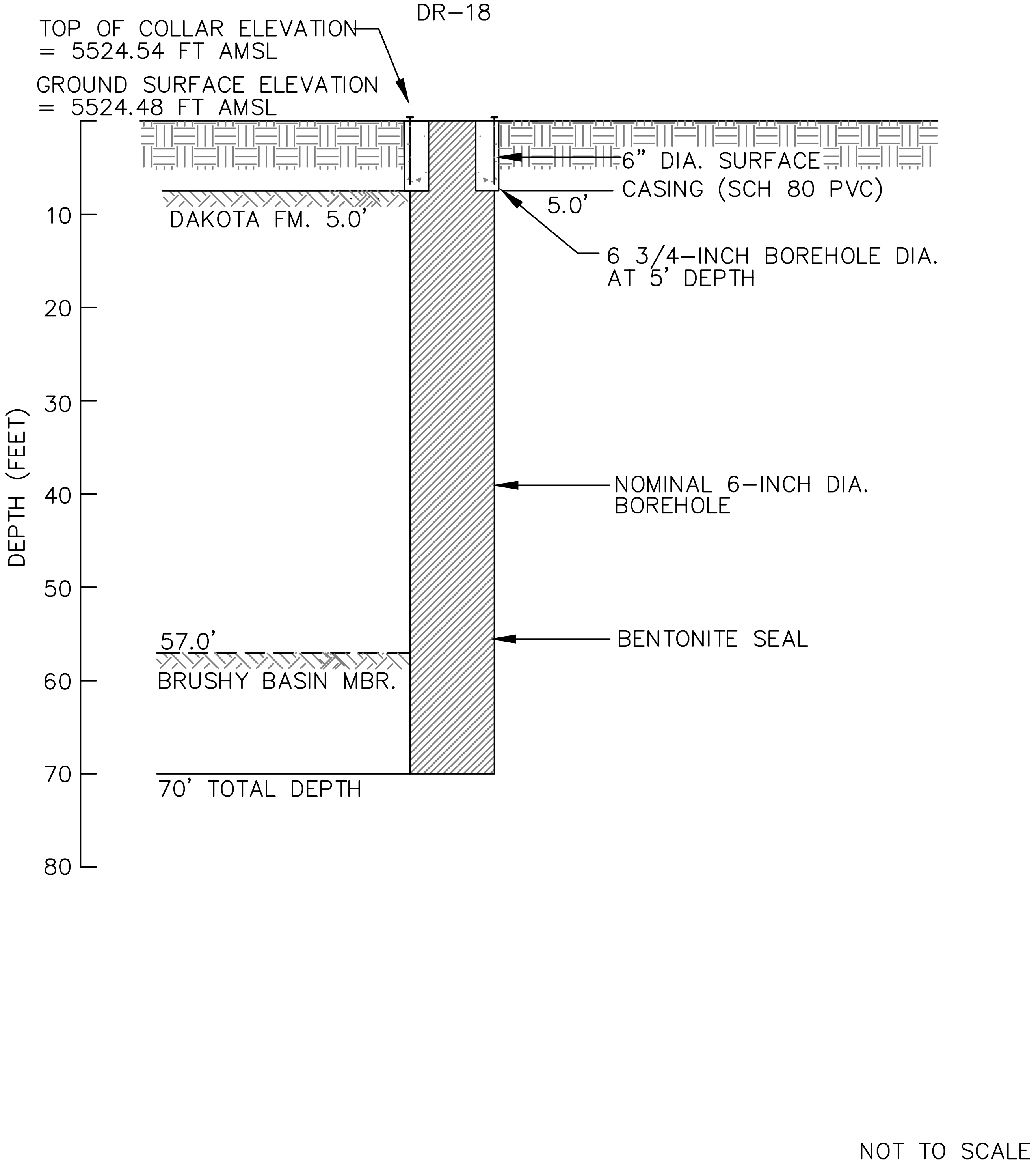


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-17
AS-BUILT WELL CONSTRUCTION SCHEMATIC

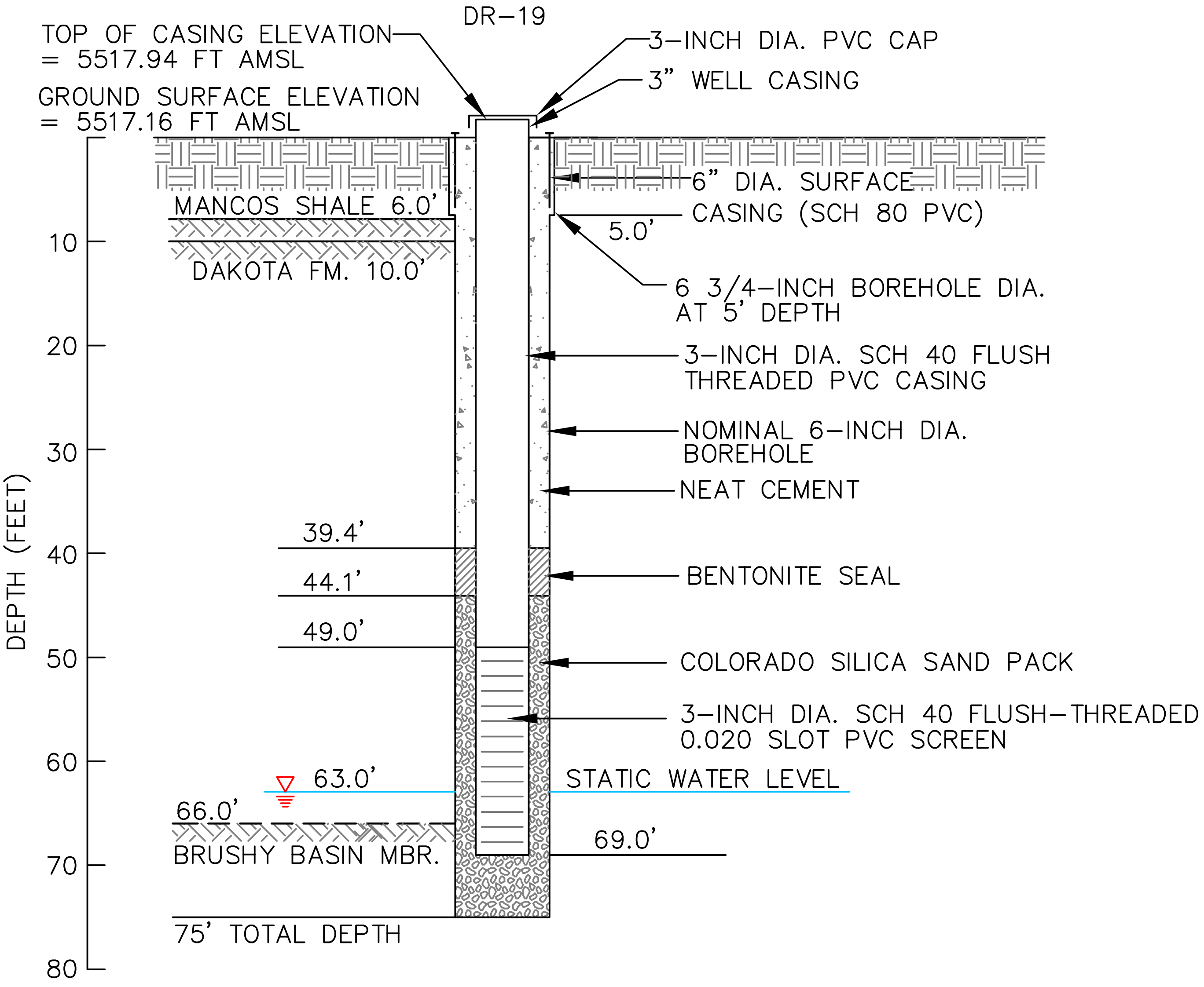
Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180262A Well Construction Diagram	



HYDRO GEO CHEM, INC.

DR-18
WELL ABANDONMENT SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180263A Well Construction Diagram	

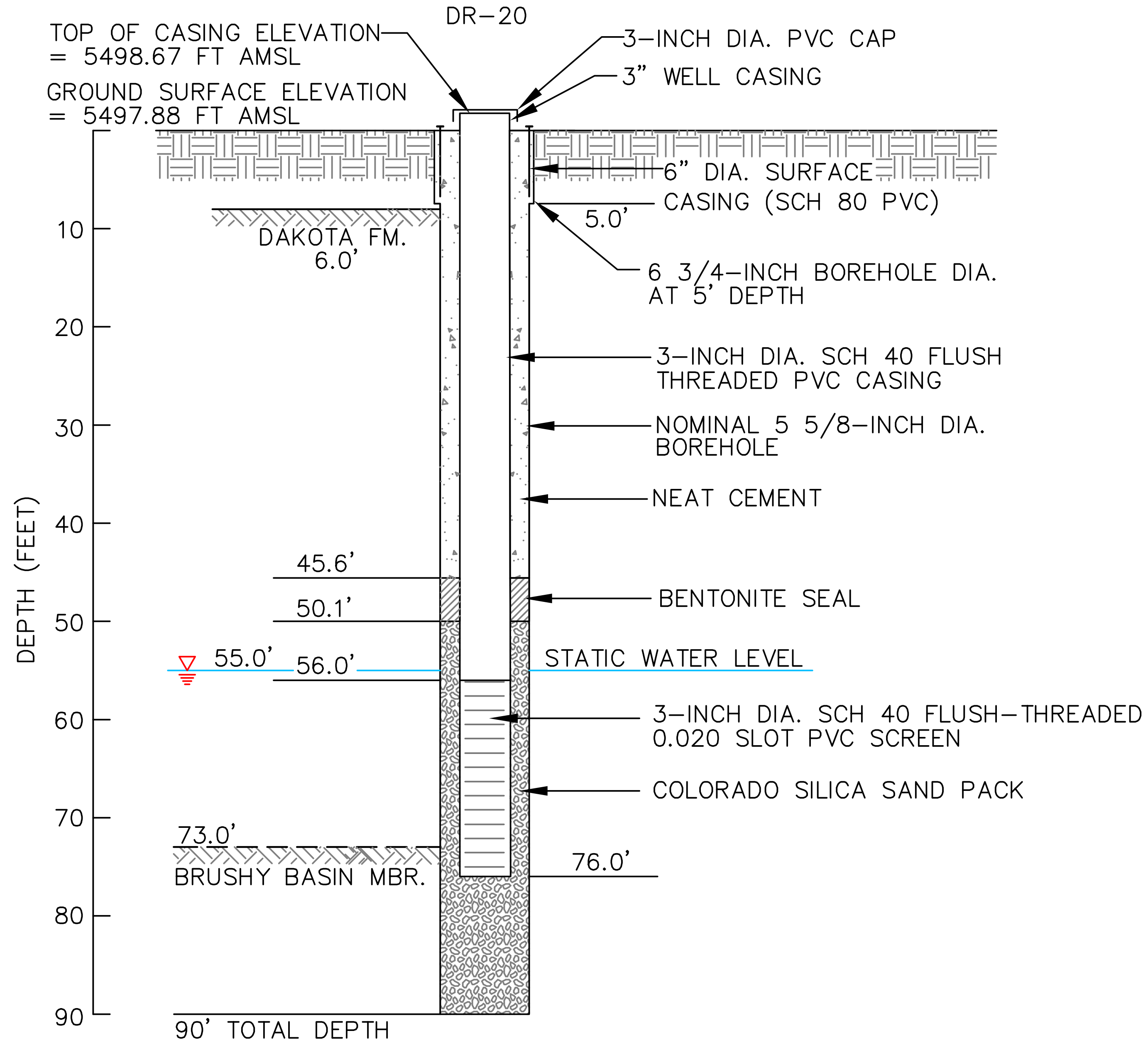


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-19
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180264A Well Construction Diagram	

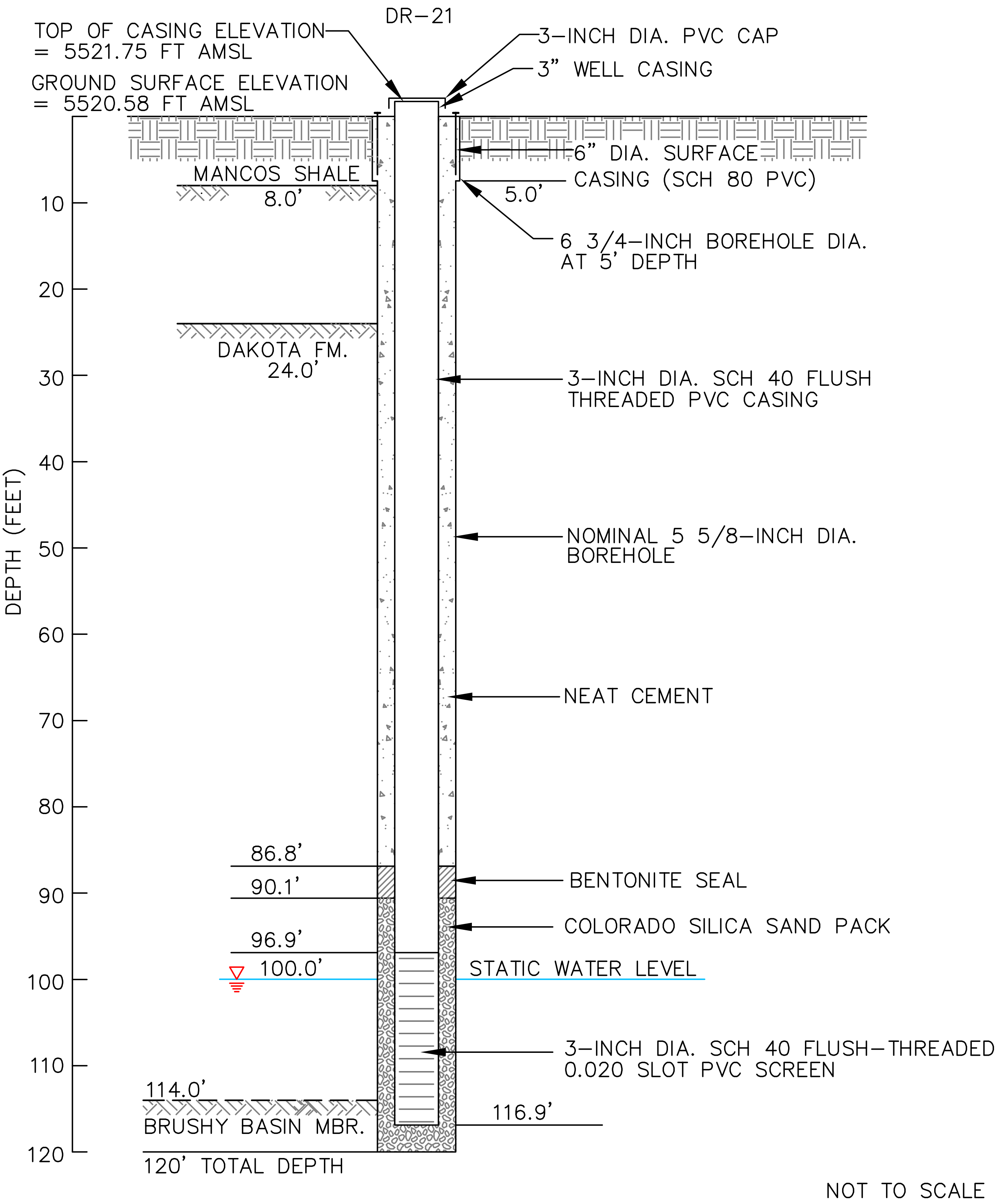


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-20
AS-BUILT WELL CONSTRUCTION SCHEMATIC

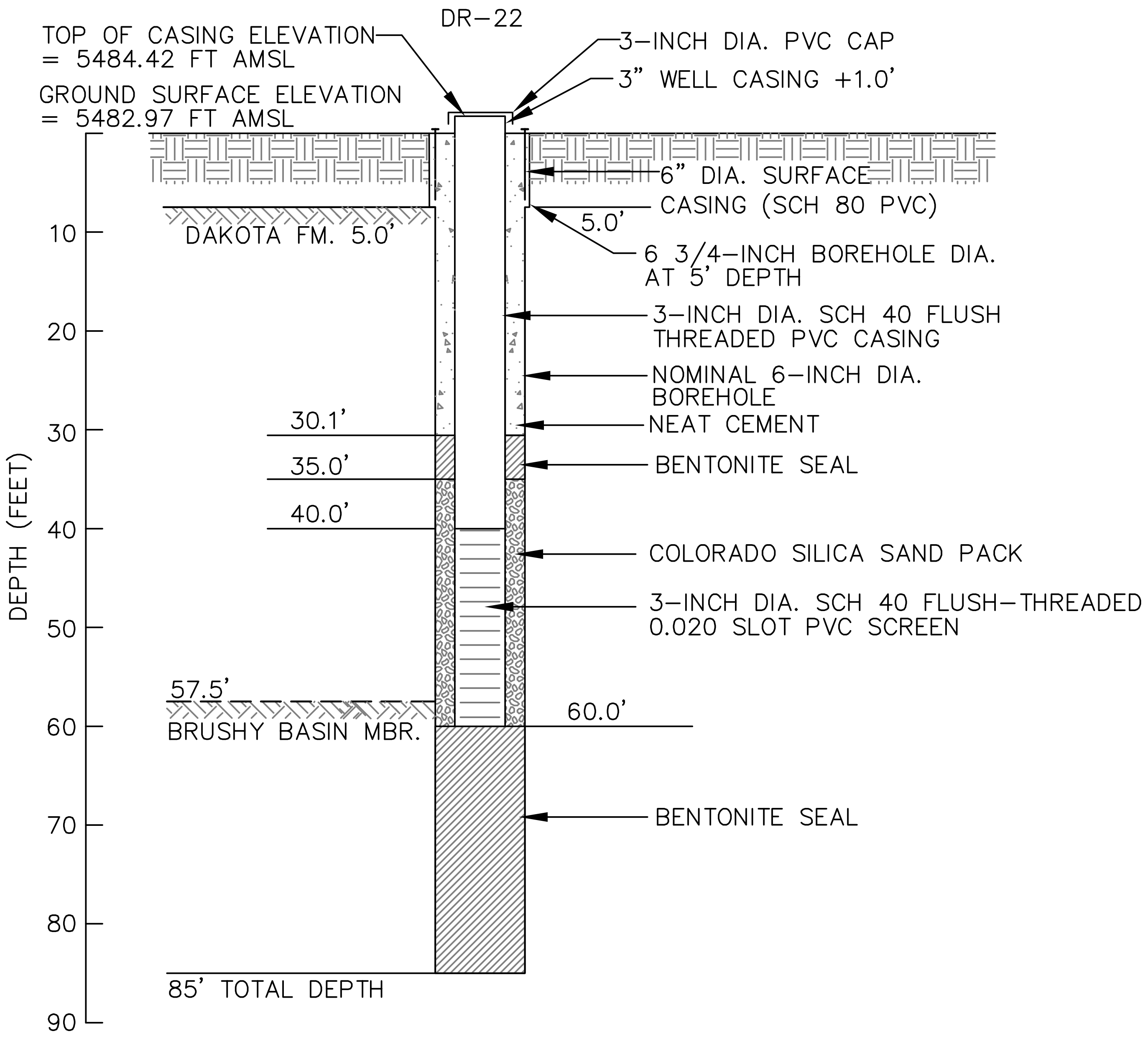
Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180265A Well Construction Diagram	



HYDRO GEO CHEM, INC.

DR-21
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180266A Well Construction Diagram	

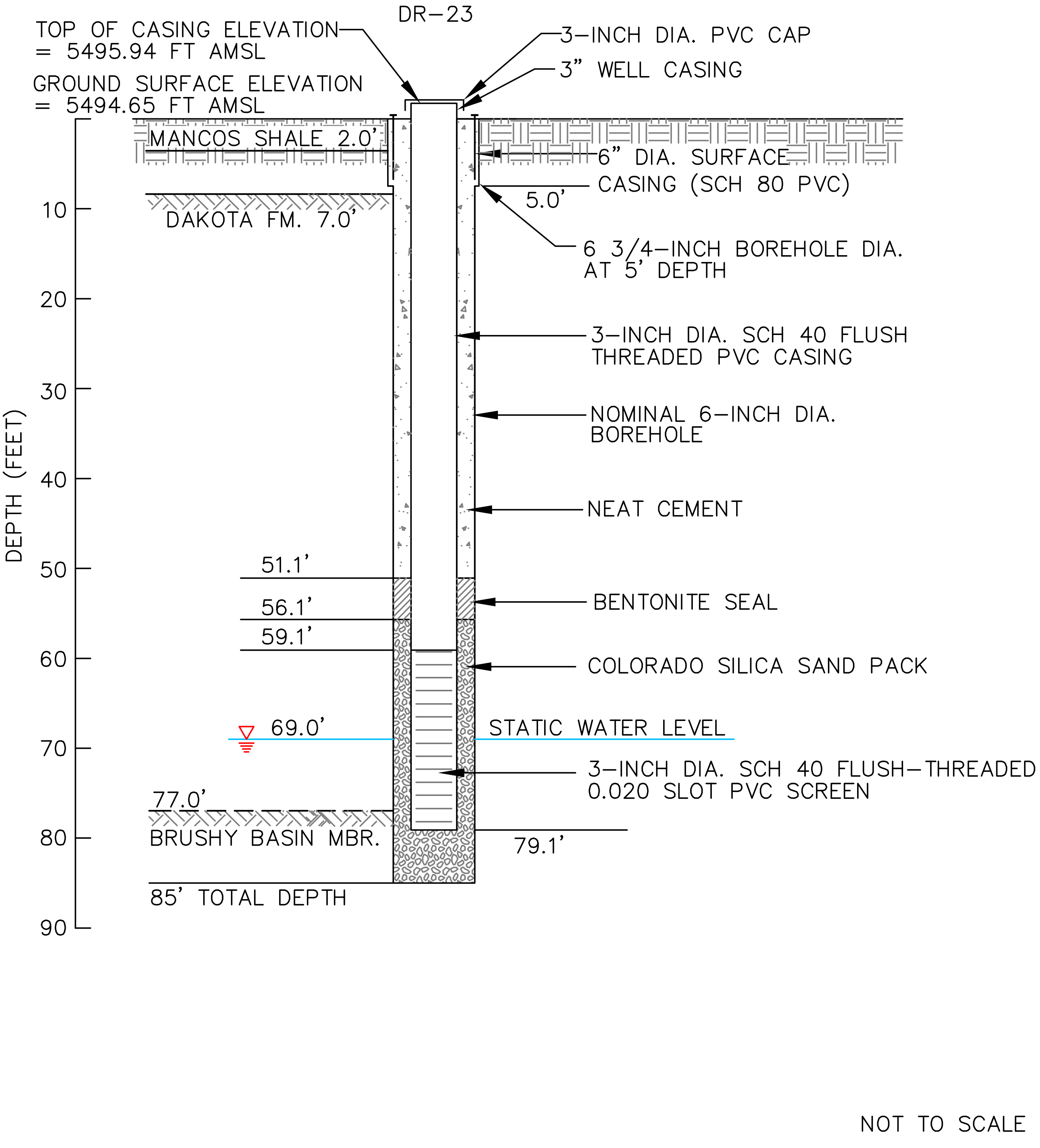


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-22
AS-BUILT WELL CONSTRUCTION SCHEMATIC

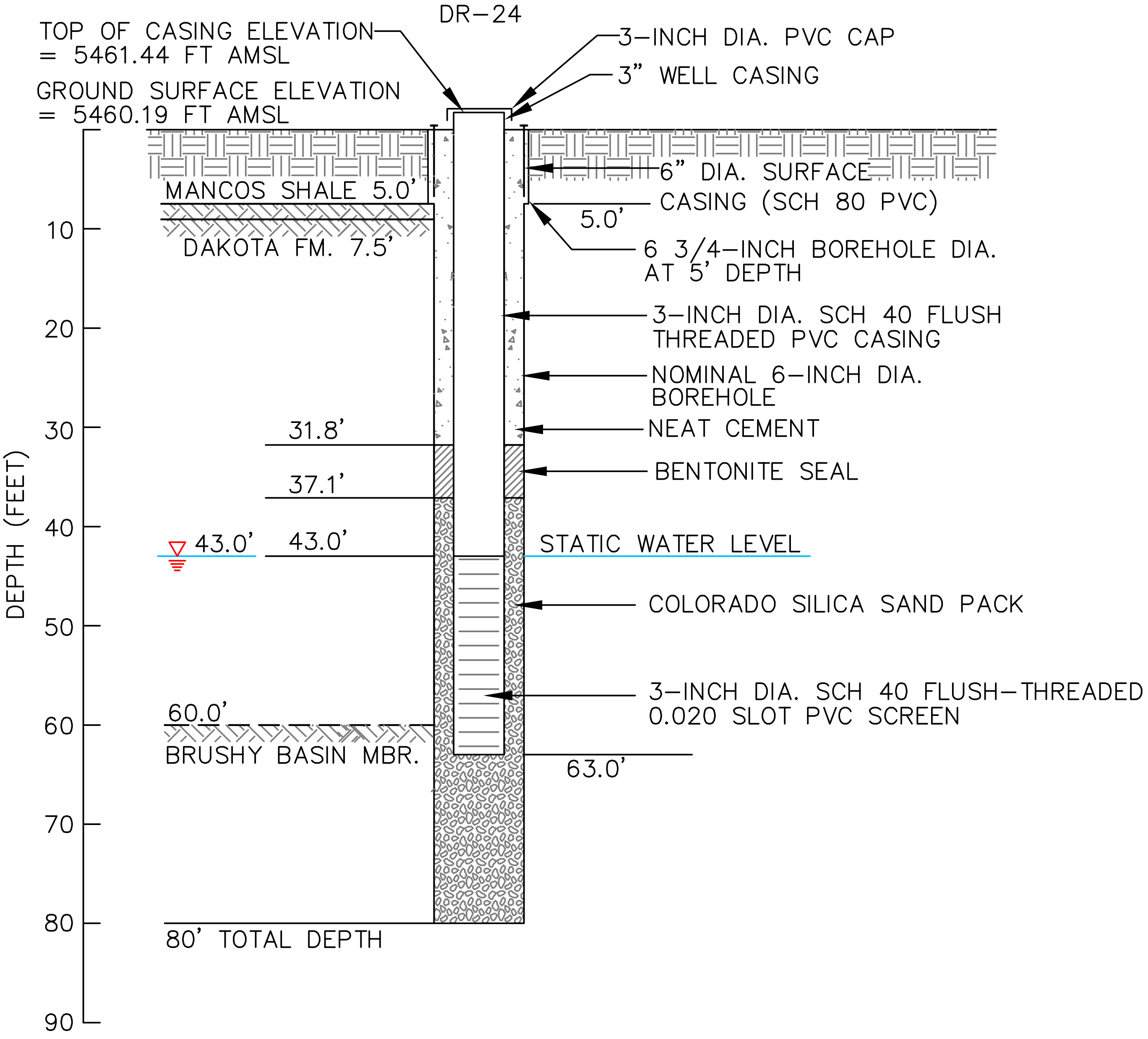
Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180267A Well Construction Diagram	



HYDRO GEO CHEM, INC.

DR-23
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180268A Well Construction Diagram	

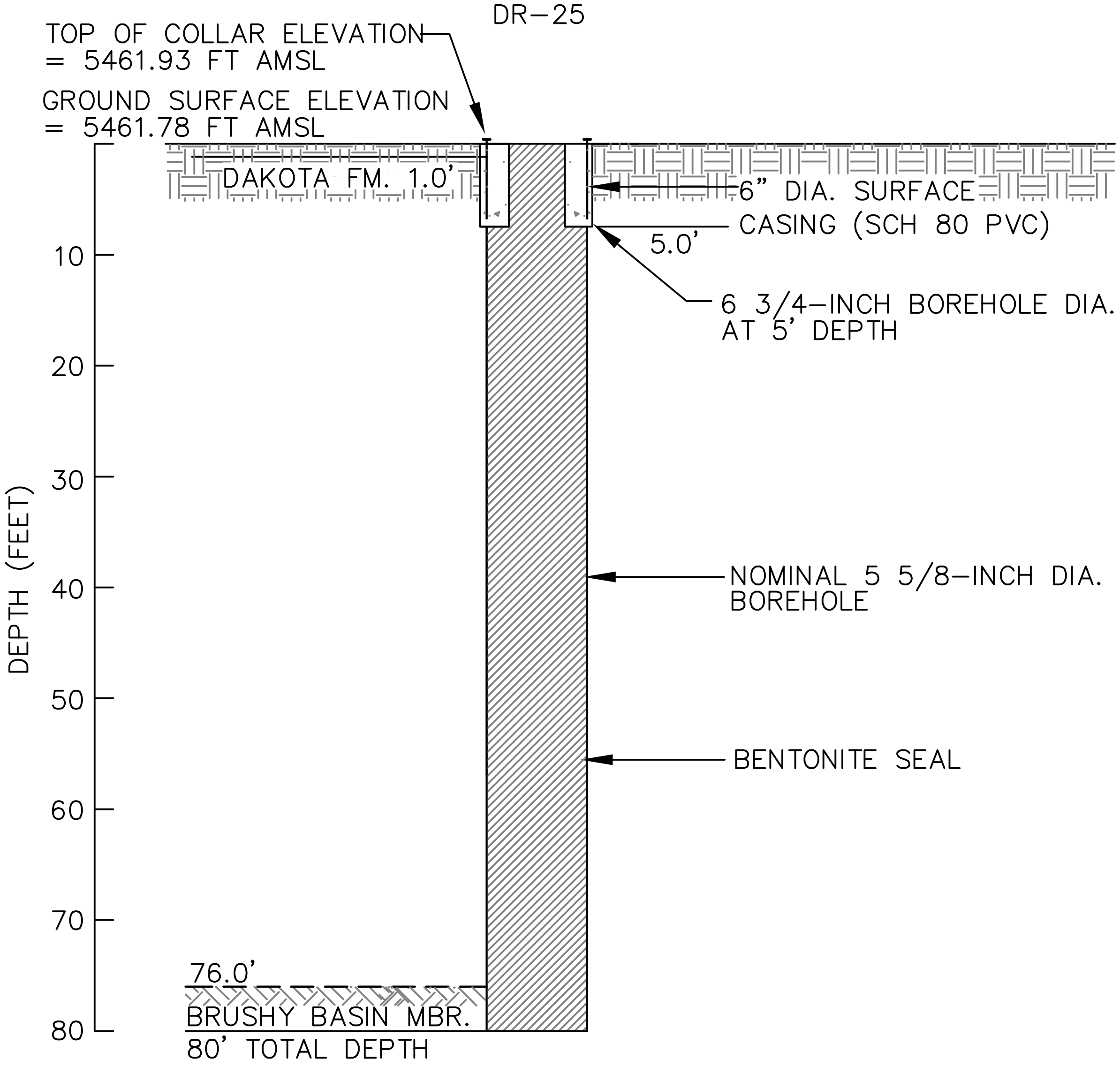


NOT TO SCALE

HYDRO GEO CHEM, INC.

DR-24
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180269A Well Construction Diagram	



NOT TO SCALE

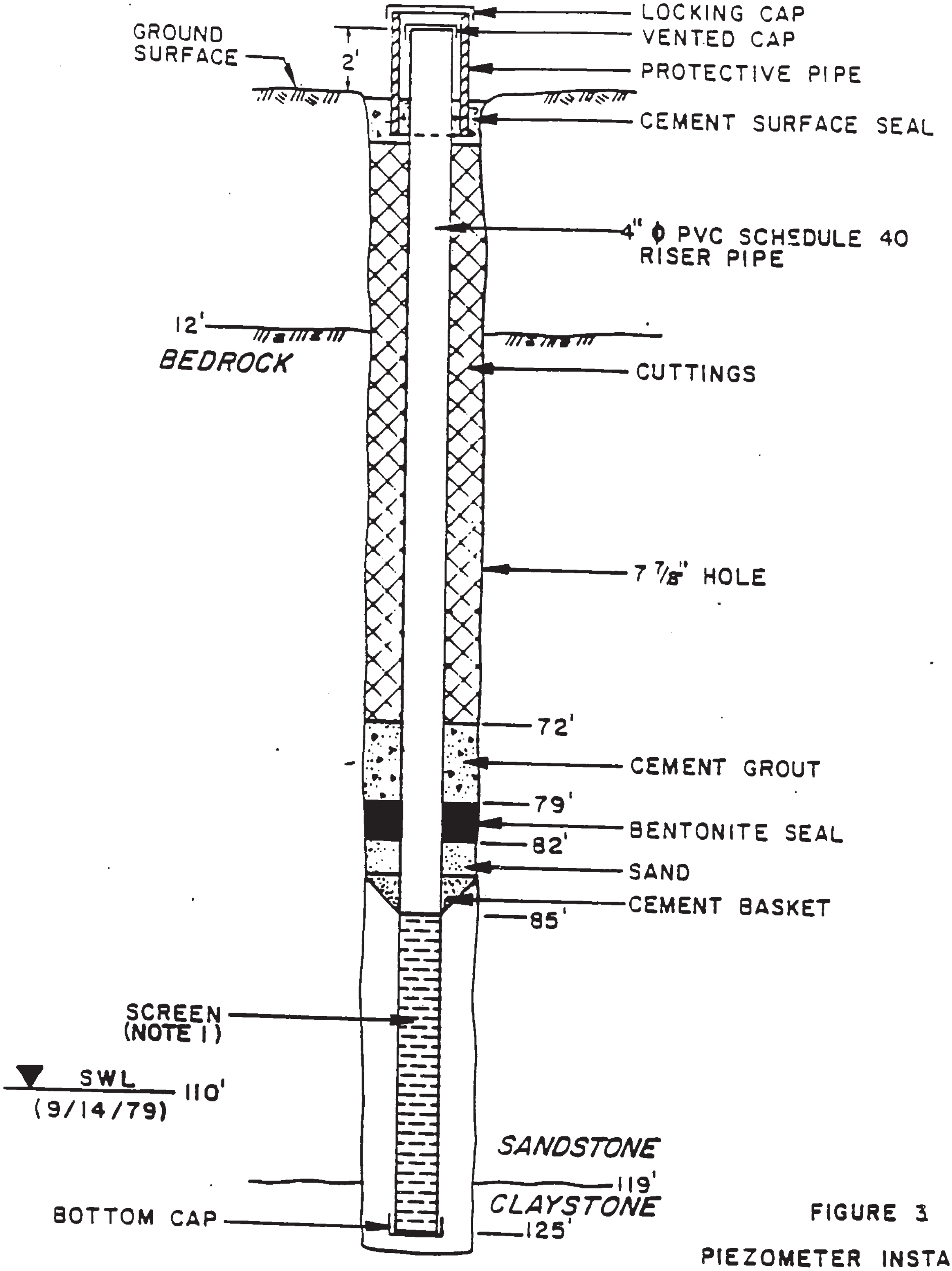
HYDRO GEO CHEM, INC.

DR-25
WELL ABANDONMENT SCHEMATIC

Approved	Date	Reference	Figure
SJS	1/9/12	K:\7180270A Well Construction Diagram	

APPENDIX B.2

MW - SERIES



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

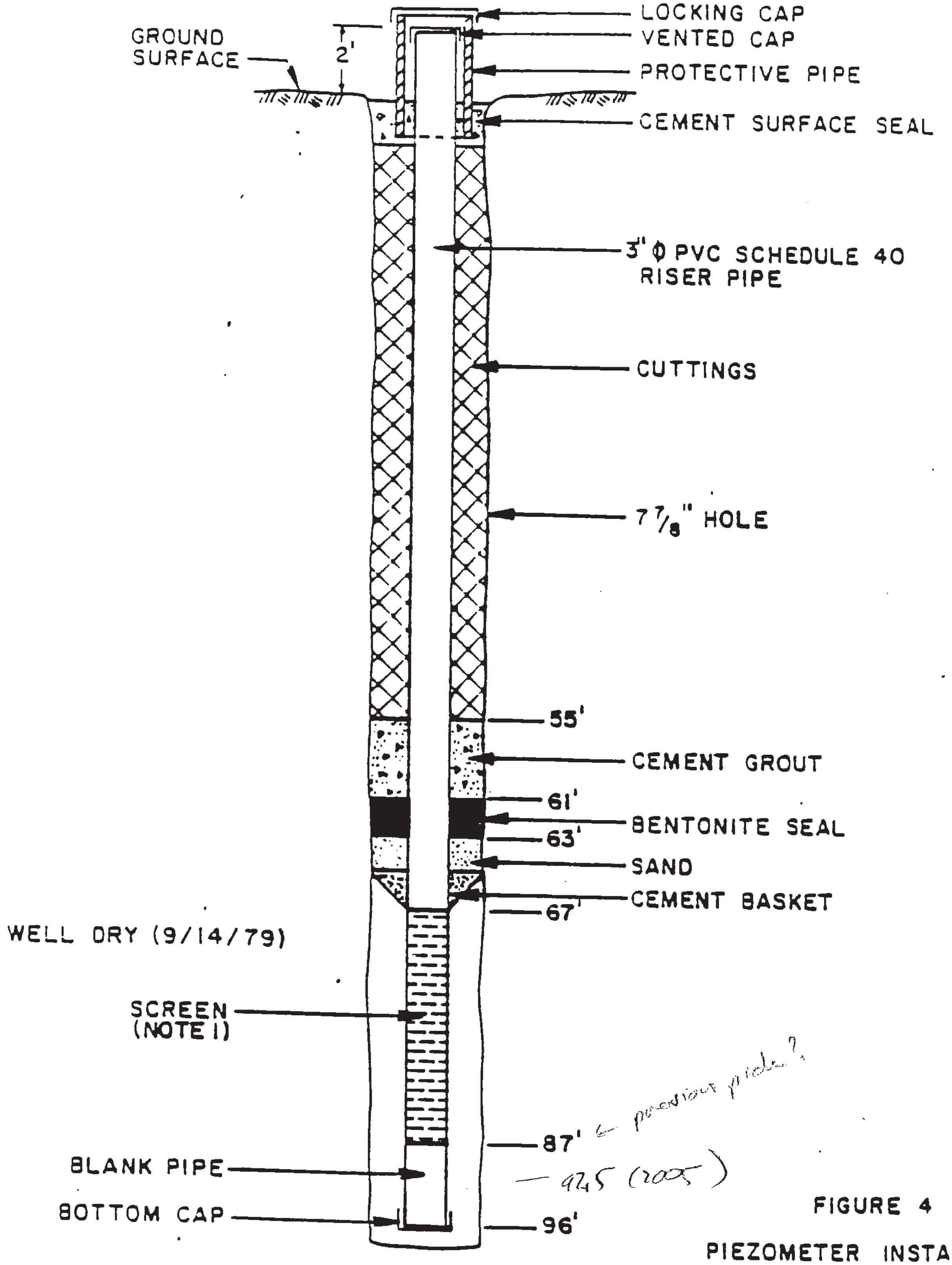
FIGURE 3

PIEZOMETER INSTALLATION
WELL NO. 2
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

BY
9-27-79
APPROVED BY
11/16/79
NUMBER
EVISED
20-82
2/23/82



WELL DRY (9/14/79)

87' ← previous probe?

— 945 (2005)

NOT TO SCALE

NOTE I : SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ROW/FT. PIPE.

FIGURE 4

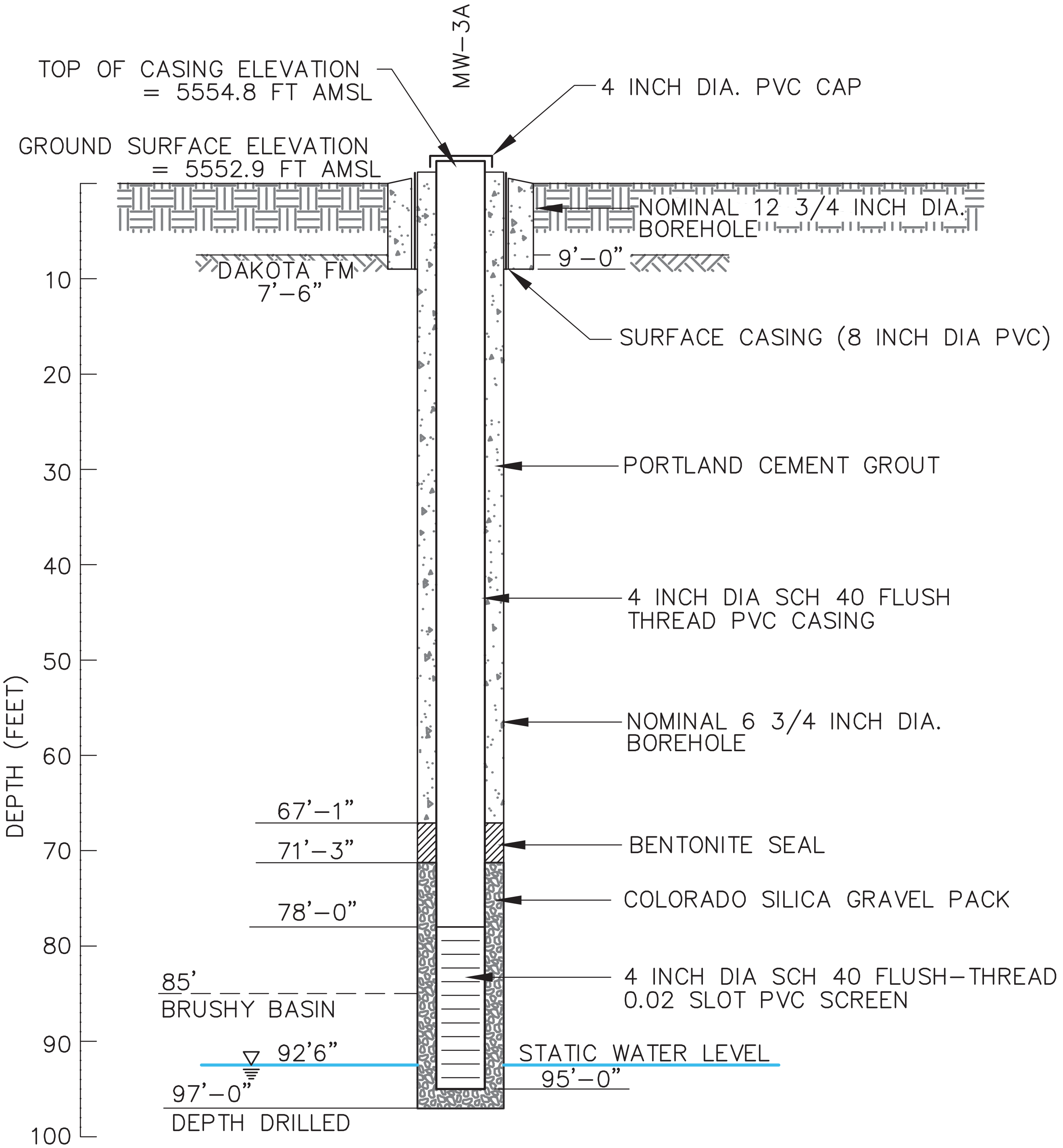
PIEZOMETER INSTALLATION
WELL NO. 3
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

BY B.K. 9-28-79
APPROVED BY WJS 11/?/79
ES 10/2/79
DRAWING NUMBER RM .82

REVISED 2-20-82

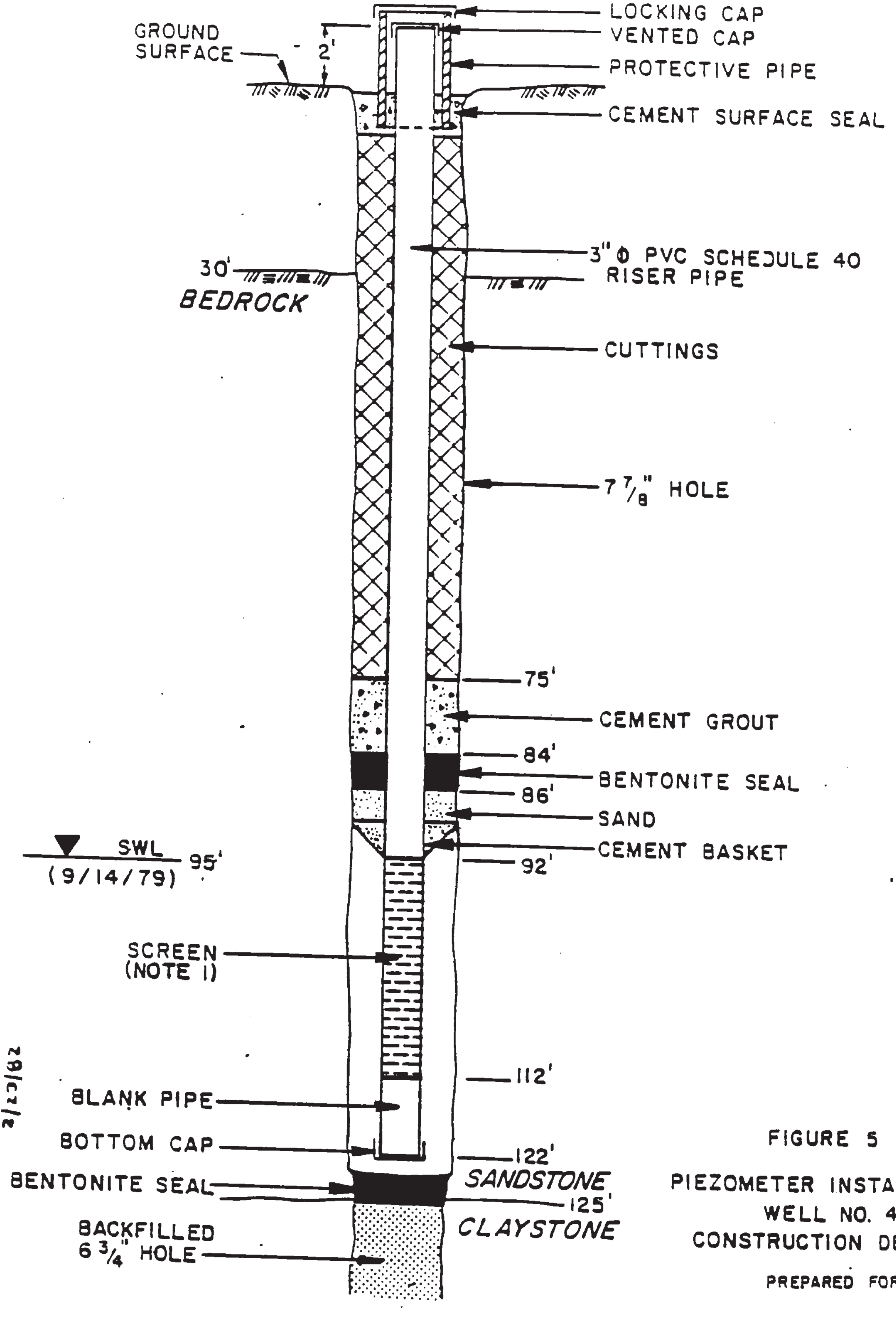


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

MW-3A
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	8/01/05			7180210A	2



NOT TO SCALE

NOTE 1: SCREEN CONSISTS OF COMMERCIALLY SLOTTED PIPE WITH 0.045 IN. WIDE SLOTS, 3 ROWS AND 40-42/SLOTS/ ROW/FT. PIPE

FIGURE 5

PIEZOMETER INSTALLATION
WELL NO. 4
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

REVISION:
△ REVISED 2-20-82 CEO 2/23/82

DRAWN BY B.K.H. 9-28-79
CHECKED BY CEO 10/29/79
APPROVED BY
DRAWING NUMBER
682

DRAWN BY	SL.T.	CHECKED BY	CEO	2/23/83	DRAWING NUMBER RM78-682-A44
	11-20-80	APPROVED BY		3/23/83	

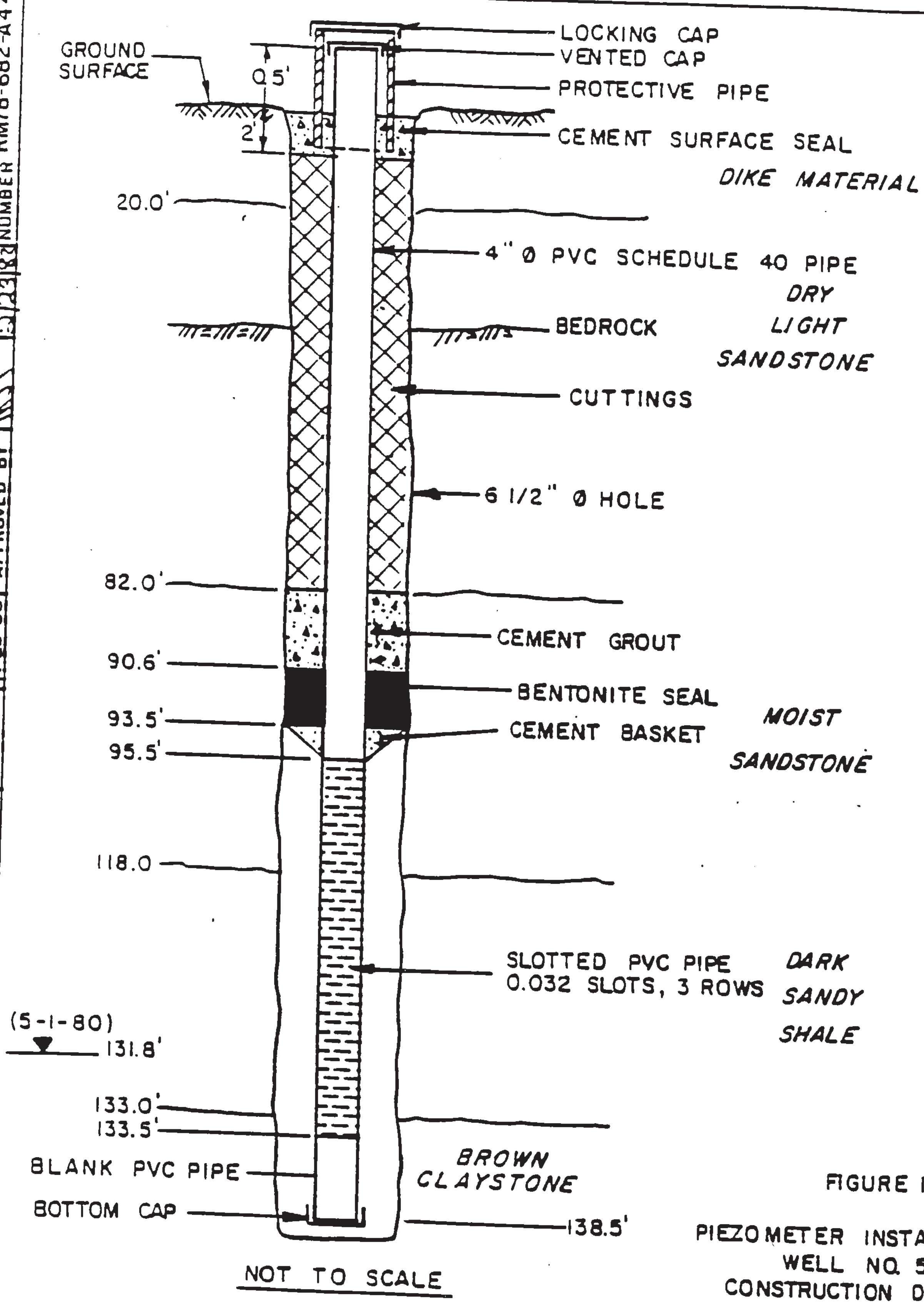


FIGURE 11

PIEZOMETER INSTALLATION
WELL NO. 5
CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

D'APPOLONIA

DRAWING NUMBER .2-2039-A1

CHECKED BY

APPROVED BY

10-28-82

11-1-82

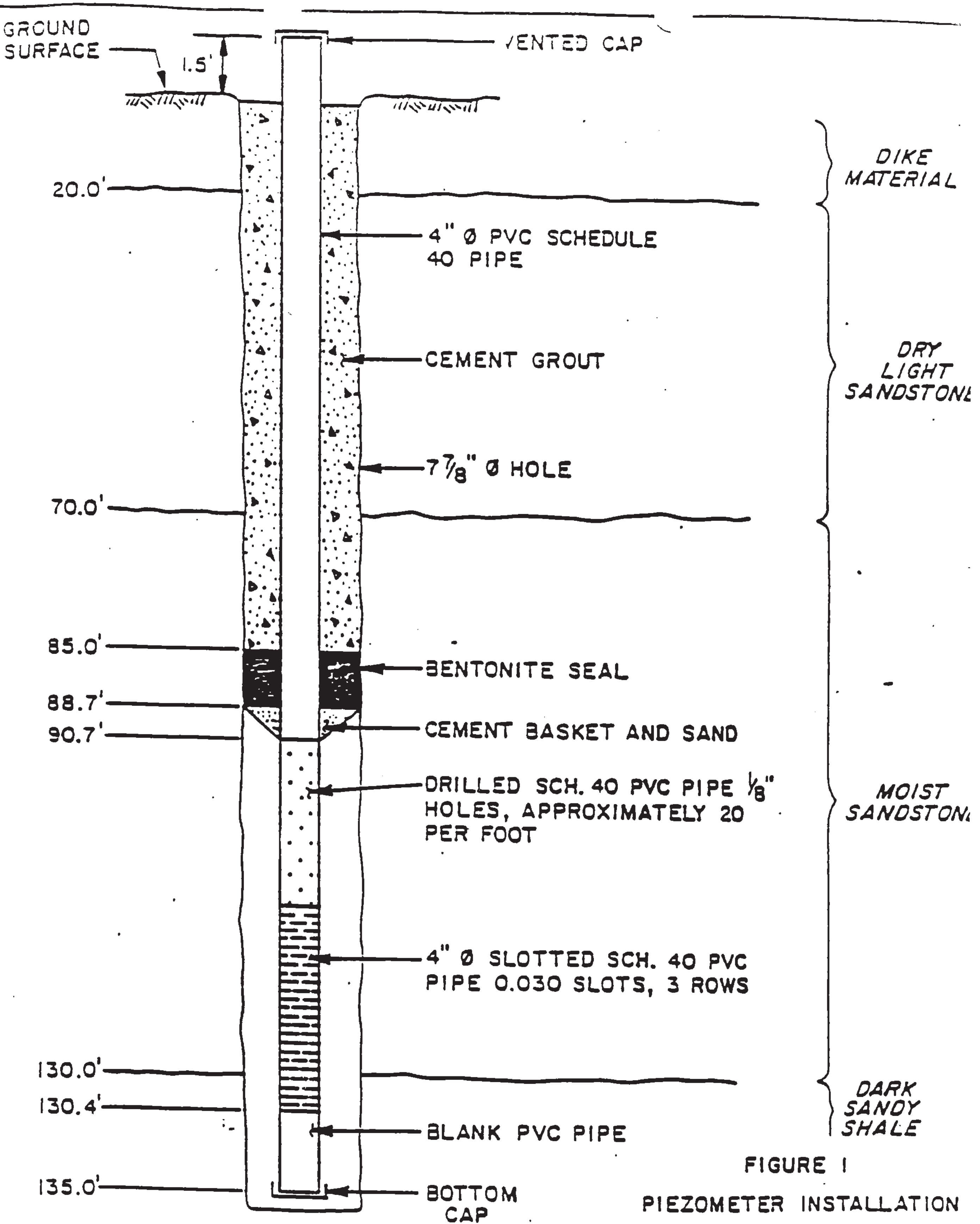


FIGURE I

PIEZOMETER INSTALLATION

WELL NO. 11

CONSTRUCTION DETAILS

PREPARED FOR

ENERGY FUELS NUCLEAR, I

DENVER, COLORADO

10-28-82 APPROVED BY AN 11-1-82 NUMBER 1A

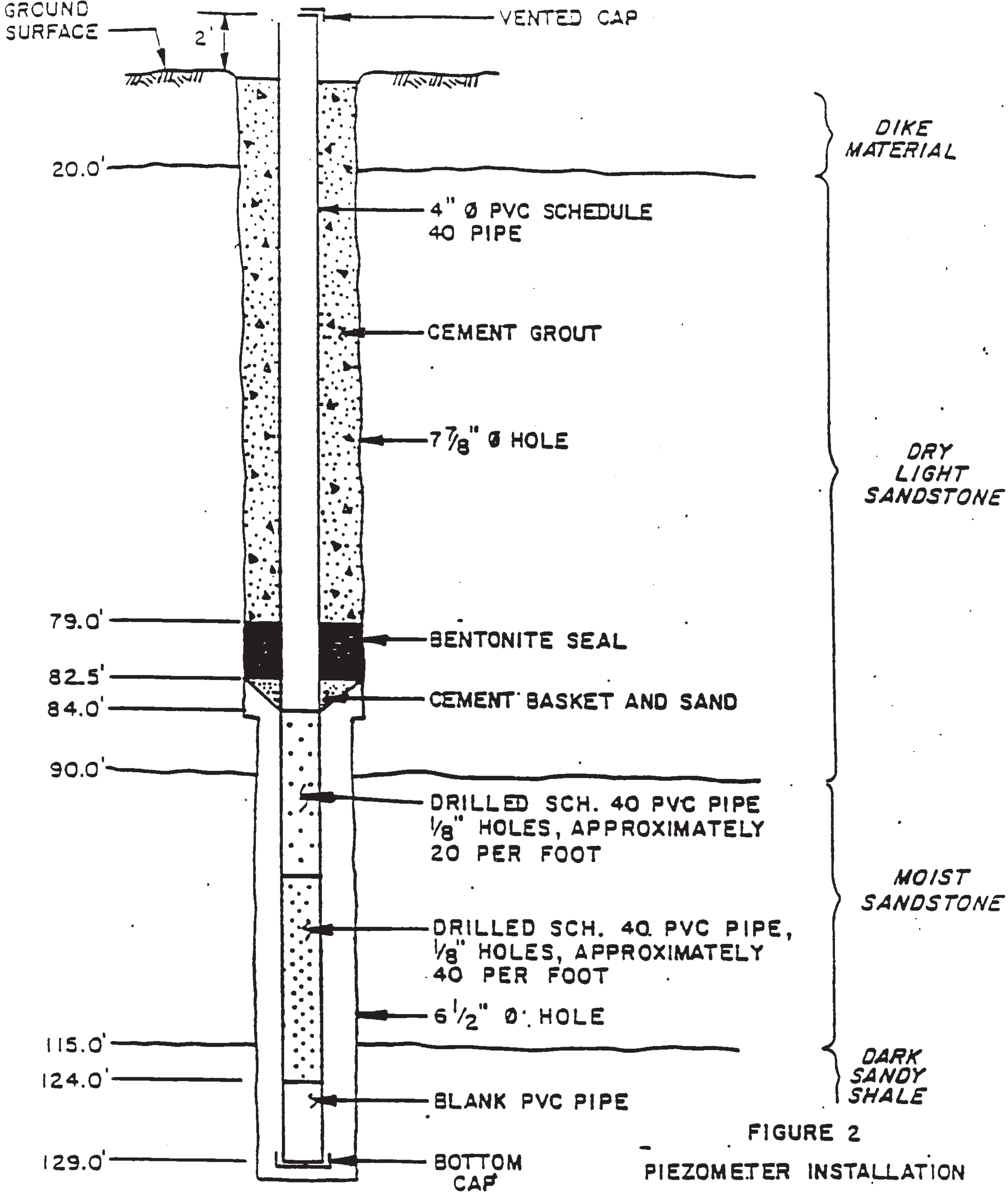


FIGURE 2

PIEZOMETER INSTALLATION
WELL NO. 12
CONSTRUCTION DETAILS
PREPARED FOR

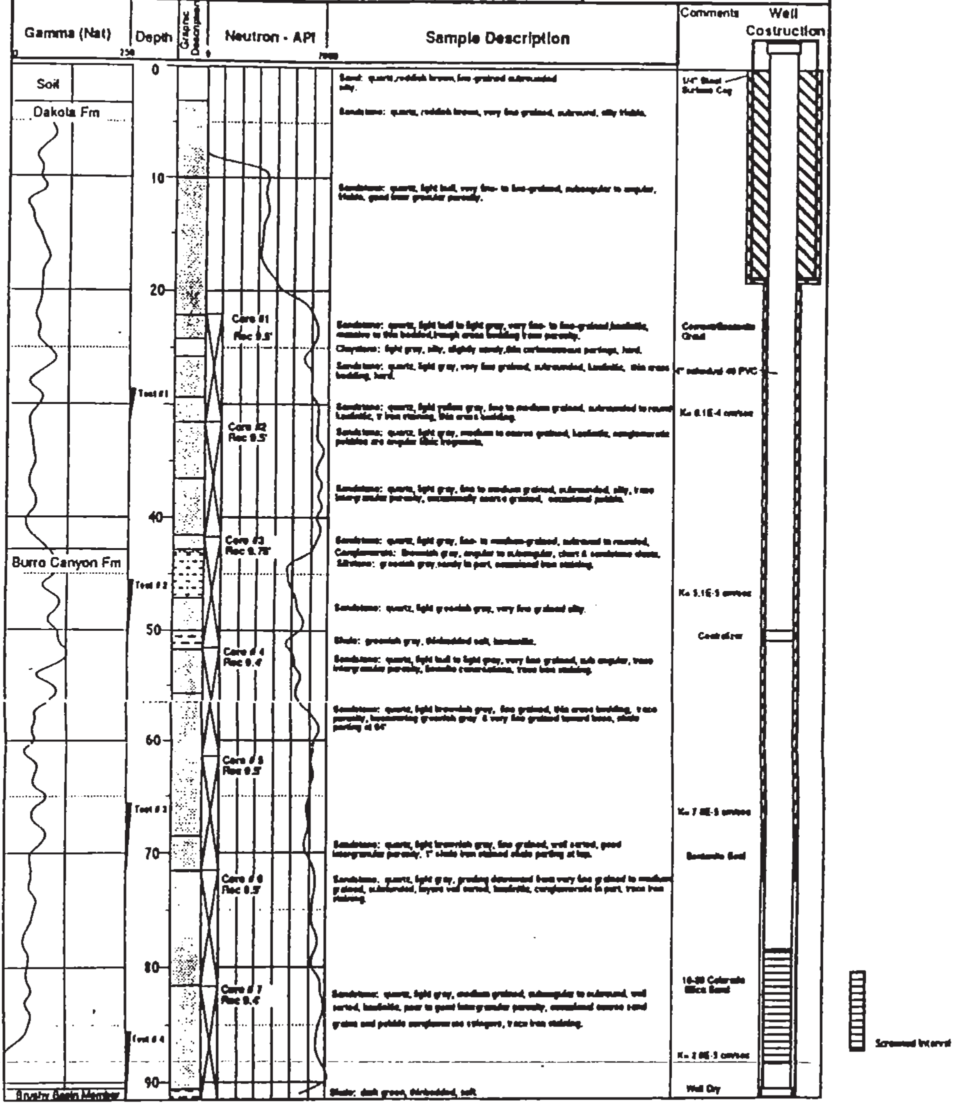
ENERGY FUELS NUCLEAR, INC.
DENVER, COLORADO

PEEL Environmental Services
Arvada, CO (303)422-8116

Bore Hole No. :
WMMW-16

UMETCO Minerals Corporation

Project: White Mesa
Surface Elev. 5588.18
T. D. = 91.5
Date: 12/07/92
Depth to Water: Dry
Geologist: F. A. Peel



Sand: quartz, reddish brown, fine grained subrounded silty.

Sandstone: quartz, reddish brown, very fine grained, subround, silty friable.

Sandstone: quartz, light buff, very fine- to fine-grained, subangular to angular, friable, good inter granular porosity.

Sandstone: quartz, light buff to light gray, very fine- to fine-grained, kaolinitic, massive to thin bedded, trough cross bedding, fair porosity.

Claystone: light gray, silty, slightly sandy, thin carbonaceous partings, hard.

Sandstone: quartz, light gray, very fine grained, subrounded, kaolinitic, thin cross bedding, hard.

Sandstone: quartz, light yellow gray, fine to medium grained, subrounded to round, kaolinitic, tr iron staining, thin cross bedding.

Sandstone: quartz, light gray, medium to coarse grained, kaolinitic, conglomeratic, pebbles are angular lithic fragments.

Sandstone: quartz, light gray, fine to medium grained, subrounded, silty, trace intergranular porosity, occasionally coarse grained, occasional pebble.

Sandstone: quartz, light gray, fine- to medium-grained, subround to rounded,
Conglomerate: Brownish gray, angular to subangular, chert & sandstone clasts,
Siltstone: greenish gray, sandy in part, occasional iron staining.

Sandstone: quartz, light greenish gray, very fine grained silty.

Shale: greenish gray, thinbedded soft, bentonitic.

Sandstone: quartz, light buff to light gray, very fine grained, sub angular, trace intergranular porosity, limonite concretions, trace iron staining.

Sandstone: quartz, light brownish gray, fine grained, thin cross bedding, trace porosity, becoming greenish gray & very fine grained toward base, shale parting at 64'

Sandstone: quartz, light brownish gray, fine grained, well sorted, good intergranular porosity, 1" shale iron stained shale parting at top.

Sandstone, quartz, light gray, grading downward from very fine grained to medium grained, subrounded, layers well sorted, kaolinitic, conglomeratic in part, trace iron staining.

Sandstone: quartz, light gray, medium grained, subangular to subround, well sorted, kaolinitic, poor to good intergranular porosity, occasional coarse sand grains and pebble conglomerate stringers, trace iron staining.

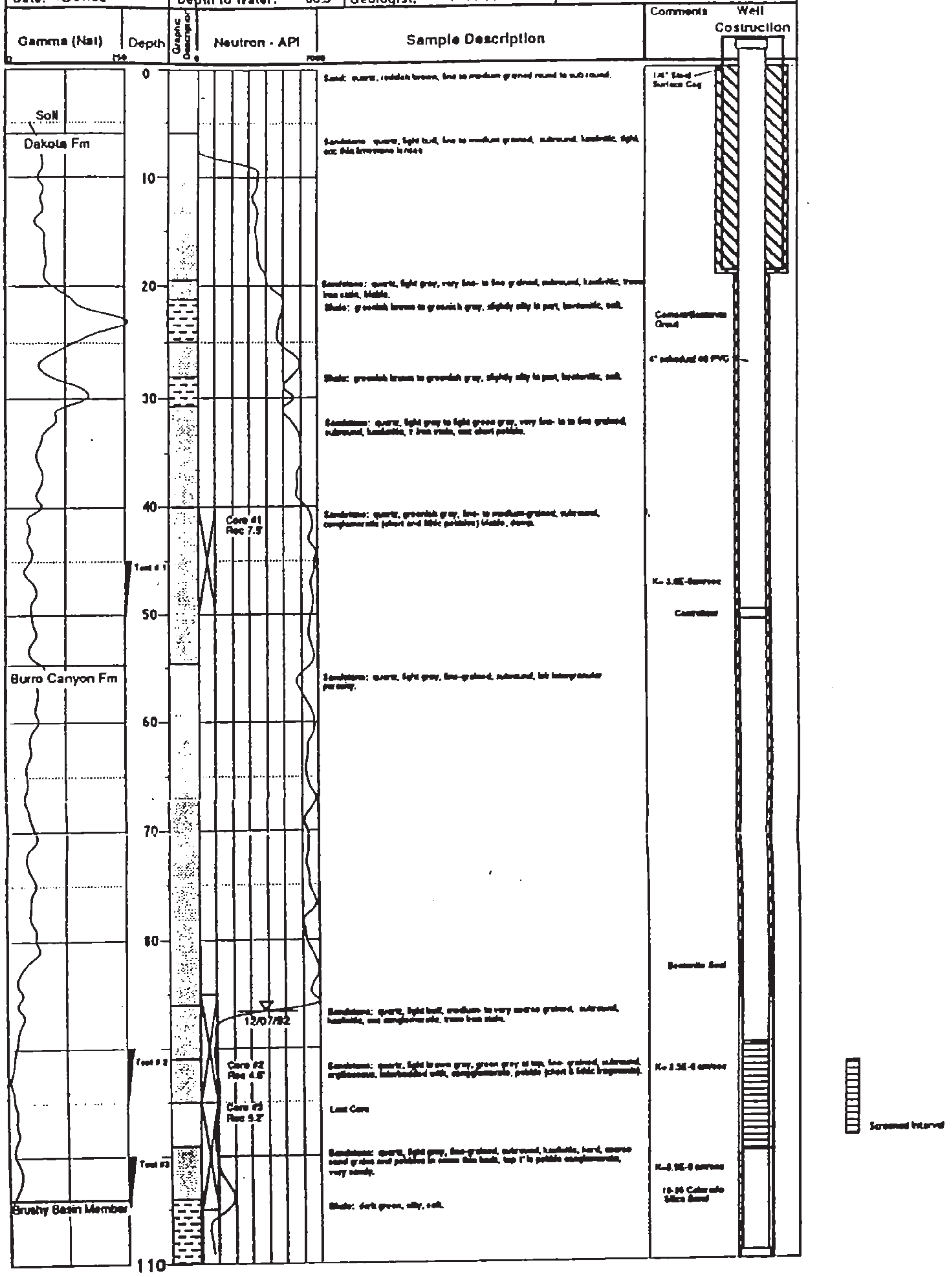
Shale: dark green, thinbedded, soft

PEEL Environmental Services
Arvada CO (303)472 4116

Bore Hole No. : WMMW-17

UMETCO Minerals Corporation

Project: White Mesa	Surface Elev. 5575 06	T. D. = 110'
Date: 12/07/92	Depth to Water: 86.5'	Geologist: F. A. Peel



Sand: quartz, reddish brown, fine to medium grained round to sub round.

Sandstone: quartz, light buff, fine to medium grained, subround, kaolinitic, tight, occ thin limestone lenses

Sandstone: quartz, light gray, very fine- to fine grained, subround, kaolinitic, trace iron stain, friable.

Shale: greenish brown to greenish gray, slightly silty in part, bentonitic, soft.

Shale: greenish brown to greenish gray, slightly silty in part, bentonitic, soft.

Sandstone: quartz, light gray to light green gray, very fine- to to fine grained, subround, kaolinitic, [illegible] iron stain, occ chert pebble.

Sandstone: quartz, greenish gray, fine- to medium-grained, subround, conglomeratic (chert and lithic pebbles) friable, damp.

Sandstone: quartz, light gray, fine-grained, subround, fair intergranular porosity.

Sandstone: quartz, light buff, medium- to very coarse grained, subround, kaolinitic, occ conglomeratic, trace iron stain.

Sandstone: quartz, light brown gray, green gray at top, fine- grained, subround, argillaceous, interbedded with, conglomeratic, pebble (chert & lithic fragments).

Lost Core

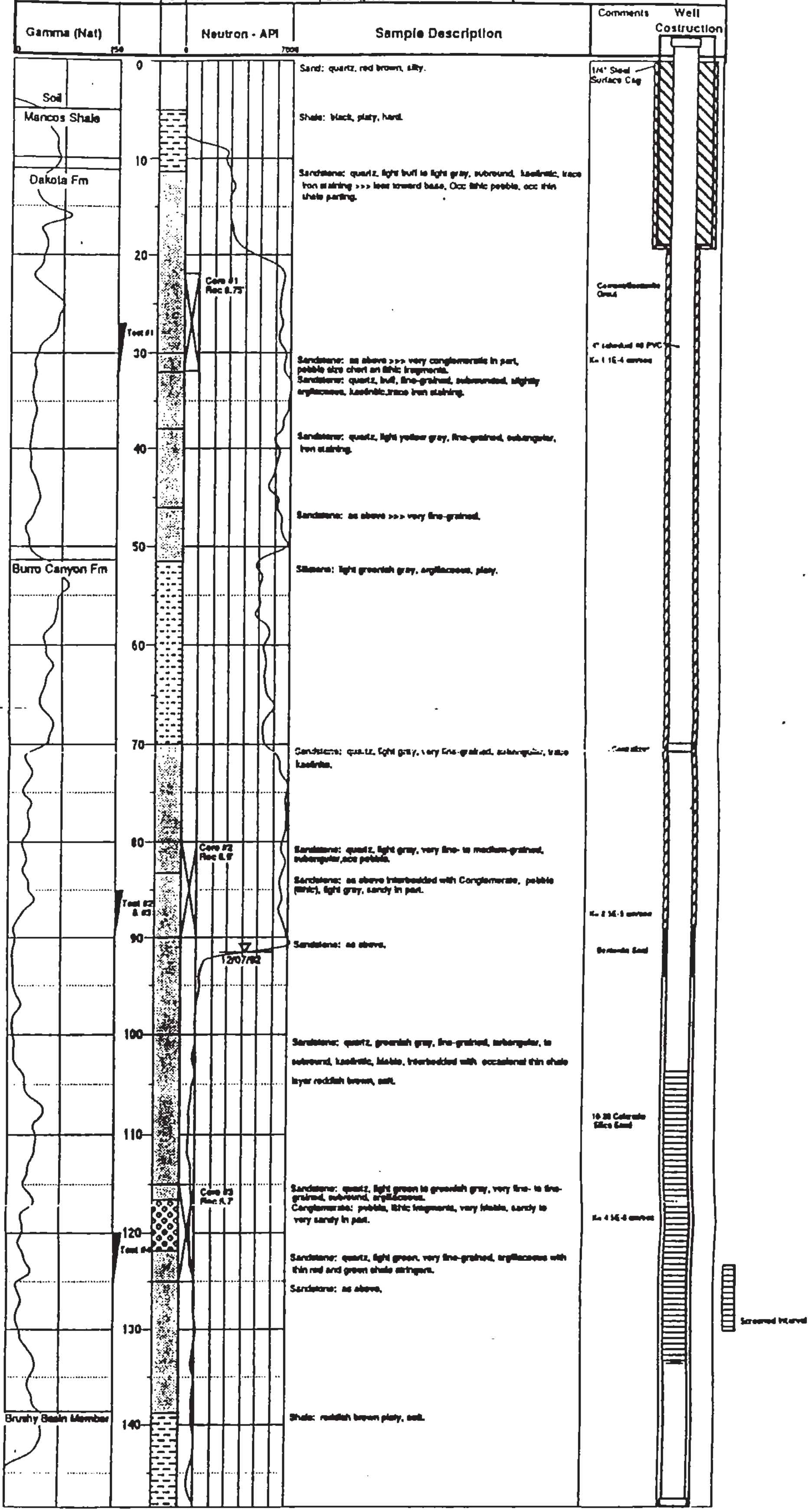
Sandstone: quartz, light gray, fine-grained, subround, kaolinitic, hard, coarse sand grains and pebbles in some thin beds, top 1' is pebble conglomeratic, very sandy.

Shale: dark green, silty, soft.

PEEL Environmental Services
Arvada, CO (303)422-4116

Bore Hole No. : WMMW-18

Project: White Mesa
Surface Elev. 5657.58
T. D. = 148.5'
UMETCO Minerals Corporation
Date: 12/07/92
Depth to Water: 92'
Geologist: F. A. Peel



Sand: quartz, red brown, silty.

Shale: black, platy, hard.

Sandstone: quartz, light buff to light gray, subround, kaolinitic, trace iron staining >>> less toward base. Occ lithic pebble, occ thin shale parting.

Sandstone: as above >>> very conglomeratic in part, pebble size chert an lithic fragments.

Sandstone: quartz, buff, fine-grained, subrounded, slightly argillaceous, kaolinitic,trace iron staining.

Sandstone: quartz, light yellow gray, fine-grained, subangular, iron staining.

Sandstone: as above >>> very fine-grained.

Siltstone: light greenish gray, argillaceous, platy.

Sandstone: quartz, light gray, very fine-grained, subangular, trace kaolinite.

Sandstone: quartz, light gray, very fine- to medium-grained, subangular,occ pebble.

Sandstone: as above interbedded with Conglomerate, pebble (lithic), light gray, sandy in part.

Sandstone: as above.

Sandstone: quartz, greenish gray, fine-grained, subangular, to subround, kaolinitic, friable, interbedded with occasional thin shale layer reddish brown, soft.

Sandstone: quartz, light green to greenish gray, very fine- to fine-grained, subround, argillaceous.

Conglomerate: pebble, lithic fragments, very friable, sandy to very sandy in part.

Sandstone: quartz, light green, very fine-grained, argillaceous with thin red and green shale stringers.

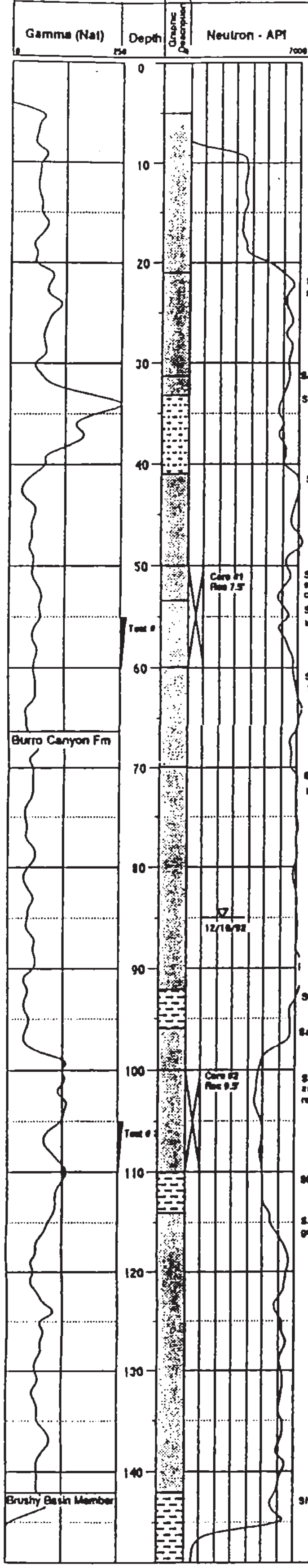
Sandstone: as above.

Shale: reddish brown platy, soft.

PEEL Environmental Services
Arvada, CO (303)432-5116

Bore Hole No. :
WMMW-19

Project: White Mesa
Surface Elev. 5655.05
T. D. = 149
UMETCO Minerals Corporation
Date: 12/07/92
Depth to Water: 150
Geologist: F. A. Peel



Sample Description

Sand: quartz, reddish brown/fine-grained, silty.

Sandstone: quartz, light gray, fine-grained, subround, kaolinitic.

Sandstone: quartz, light buff, very fine- to medium-grained, subangular to subround, kaolinitic, iron staining.

Sandstone: as above >>> less iron stained.

Siltstone: quartz, medium gray, sandy hard.

Sandstone: quartz, light buff, very fine- to medium-grained, subangular to subround, kaolinitic, iron staining.

Sandstone: quartz, light gray to buff, coarse-grained, subangular to subround, poorly sorted, kaolinitic, red iron staining, conglomeratic (chert & lithic pebbles).

Sandstone: quartz, very fine- to fine-grained, subround, very kaolinitic trace iron staining, occ shale parting. >>> very hard at base.

Sandstone: quartz, light buff, very fine- to medium-grained, subround, kaolinitic, red and brown iron staining.

Sandstone: quartz, light gray, very fine- to fine-grained, subround, Kaolinitic.

Shale: reddish brown, platy, waxy, soft.

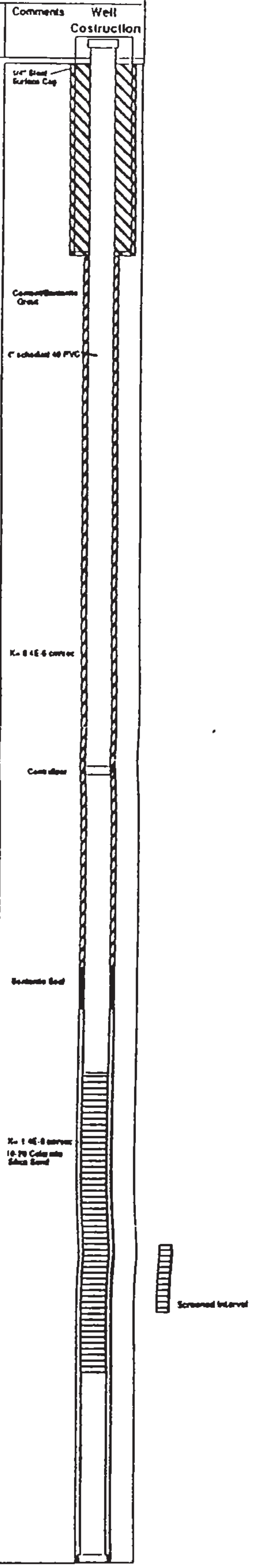
Sandstone: quartz, light gray, fine- to medium-grained, conglomeratic.

Sandstone: quartz, light greenish gray, very fine-grained, subround, argillaceous to very argillaceous, thin green shale partings, waxy, reddish brown shale parting at base.

Shale: as above.

Sandstone: quartz, light greenish gray, fine-grained, occ medium-grained, subround, Kaolinitic.

Shale: dark reddish brown, soft.



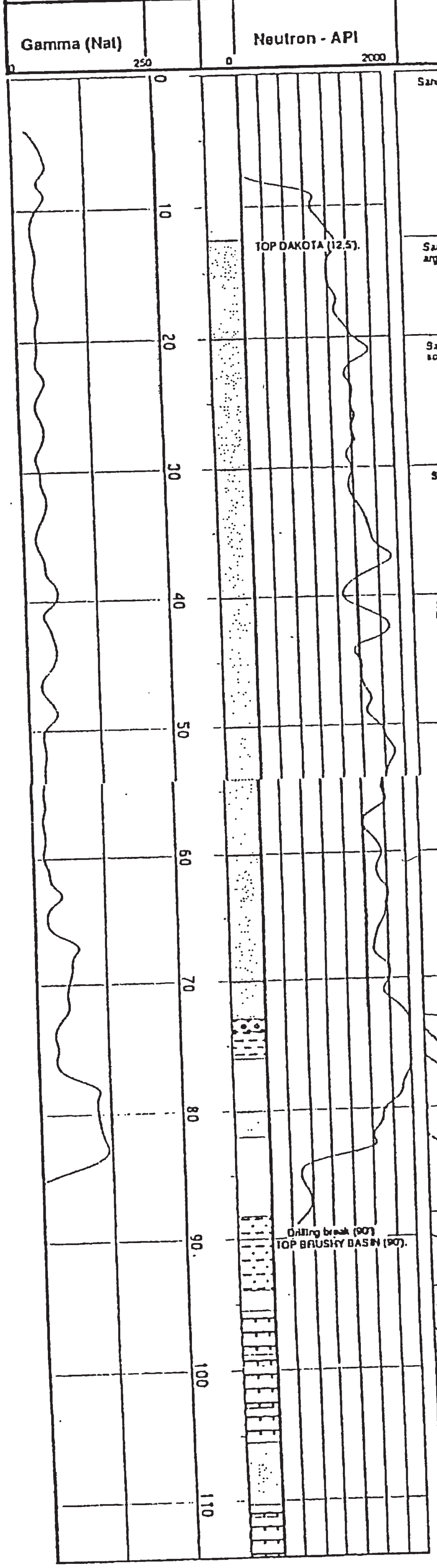
Note: well was logged before the well recharged

PEEL *Environmental Services*
Arvada, CO (303)422-5116

Bore Hole No. :
WMMW-20

Project: White Mesa
Surface Elev. 5538 Est.
T. D. = 114.5
PBTD = 90'

Date: 8/4/94
Depth to Water: 86.4
Geologist: C. Bilgood



Sample Description

Sand: quartz, reddish brown, silty, argillaceous, aeolian.

Sandstone: quartz, light gray to buff, very fine to fine grained, argillaceous, subangular, soft.

Sandstone: quartz, light gray, fine- to medium-grained, argillaceous, soft, trace iron staining, trace pinpoint porosity.

Sandstone: as above, conglomeratic in part with dark gray chert clasts.

Sandstone: quartz, light gray, argillaceous, fine- to medium grained, firm.

Sandstone: as above, conglomeratic in part, dark gray and white chert clasts.

Sandstone: as above, becoming less argillaceous, light brown gray, medium-grained, well sorted, fair intergranular porosity.

Sandstone: quartz, light gray, medium-grained, occasionally coarse-grained, subangular to subrounded becoming very argillaceous, shale clasts from 72.0 to 72.9'.

Conglomerate: lithic, pebble, shale and chert clasts, very sandy, poorly sorted, subrounded.

Shale: olive green, waxy, soft, top 0.2' blocky, sandy.

Missing Core

Sandstone: quartz, dark reddish green to gray, fine-grained, very argillaceous, subrounded, scattered iron staining, massive, hard, tight, becoming dark reddish gray, thin bedded and platy at base

Missing Core

Siltstone: dark reddish brown, sandy in part, argillaceous, thin stringers of dark red brown silty shale at top.

Siltstone: green, waxy, brittle, occasional vertical tension joints, silty in part, iron staining along 2" near vertical fractures.

Missing Core

Claystone: dark greenish gray with reddish cast, poorly developed horizontal plating, waxy, filled vertical joints, becoming lighter in color at base.

Claystone: light green gray, silty to sandy, hard to very hard.

Claystone: red, silty to sandy, hard, mottled green top and bottom, poorly developed horizontal plating.

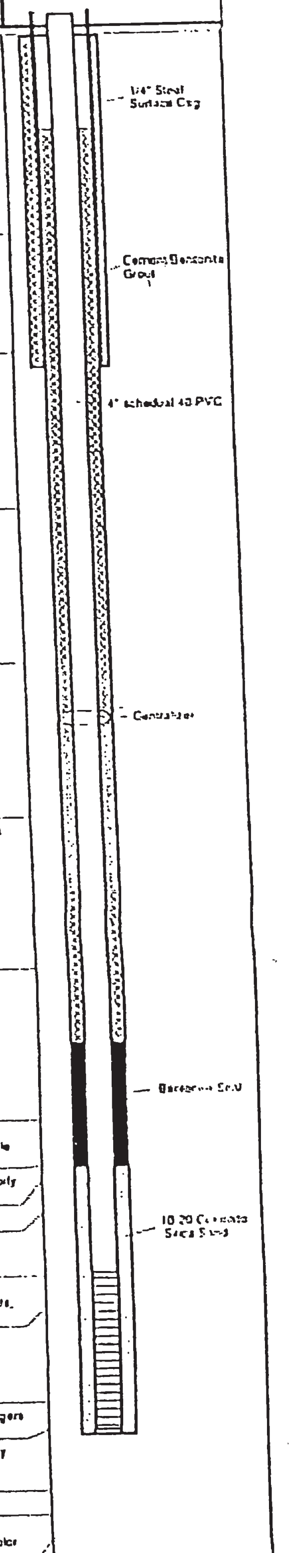
Claystone: dark reddish purple with occasional green tinge, blocky, 2" vertical fracture at base filled with white clay.

Claystone: earthy red, poorly developed horizontal plating, some thin vertical 2" to 4" hairline fractures filled and altered to light green in color

Sandstone: quartz, light gray green, very fine- to medium grained, very argillaceous, subangular, silty, poorly sorted in part grading downward into light green gray siltstone and light green gray shale, very hard and tight, very argillaceous and sandy.

Claystone: dark red brown, massive, hard.

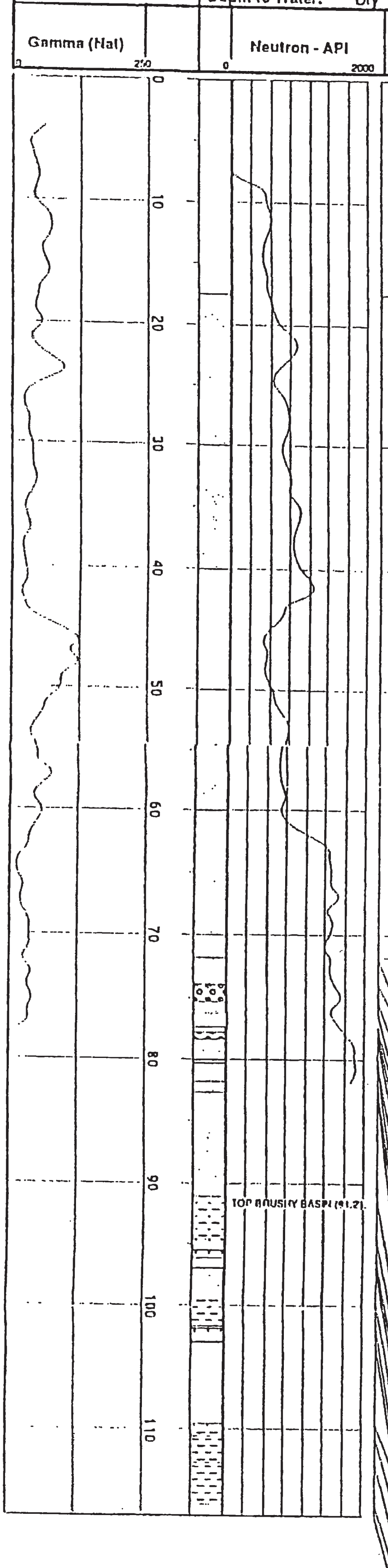
Claystone: light gray green, poorly developed horizontal plating, hard, sharp contact with overlying red shale.



PEEL Environmental Services
Arvada, CO (303)422-5116

Bore Hole No. : WMMW-21

Project: White Mesa
Surface Elev. 5558 Est.
T. D. = 117.0'
PBTD = 90.0'
Date: 8/12/94
Depth to Water: Dry
Geologist: C. Bilgood



Sample Description

Sand: aeolian sand, quartz, reddish brown.

Sandstone: quartz, light gray, fine- grained, angular to subangular to rounded, well sorted, argillaceous, some light tan to gray poorly sorted fine- to medium-grained sandstone.

Sandstone: quartz, light tan, fine- to medium-grained, argillaceous, limonitic staining, abundant chert fragments (probable conglomerate).

Sandstone: quartz, light tan, fine- to medium-grained, friable, well sorted, olive green soft claystone clasts.

Sandstone: quartz, light gray to greenish gray, fine- to medium grained, sub angular to subrounded, poorly sorted, argillaceous, abundant varicolored chert fragments, conglomeratic in part, pyritic.

Sandstone: quartz, gray to light gray, fine- to medium-grained, subrounded, argillaceous, well sorted, abundant pyrite and pyrite crystals probably developed along fractures.

Missing Core

Sandstone: quartz, light grey, medium-grained, subrounded, very argillaceous, conglomeratic,chert fragments, angular to subangular, occasional subrounded pebble, black chert fragments.

Missing Core

Conglomerate: black pebble, chert, very sandy, quartz, medium-grained, subrounded, very argillaceous.

Sandstone: quartz, conglomeratic grading downward to sandy conglomerate.

Missing core

Conglomerate: chert pebble, argillaceous, sandy, hard, tight.

Sandstone: quartz, light gray, fine- to medium grained, subangular to subrounded,conglomeratic, argillaceous, hard, tight.

Sandstone: quartz, light gray, fine- to medium grained, rounded to subrounded,slightly conglomeratic, very hard and tight, well sorted, siliceous cement, no visible porosity.

Sandstone: as above with large vertical fractures filled with pyrite.

Sandstone: quartz, light gray, fine- to medium-grained, subrounded to rounded, very hard and tight, siliceous cement, no visible porosity.

Sandstone: quartz, light gray, very fine- to medium-grained, poorly sorted, conglomeratic, siliceous cement, parting along bedding planes, numerous vertical or near vertical fractures filled with pyrite, very hard and tight, no visible porosity.

Siltstone: very light gray green, pyritic, near vertical fractures, some horizontal bedding parting, hard, becoming more Shaley at base.

Claystone: light gray green, sandy, near vertical fractures, pyritic, blocky in part.

Missing Core

Sandstone: quartz, light gray green, very fine-grained, vertical fractures,occasional small chert pebbles, some horizontal parting.

Shale: grey-green, slightly sandy, bedding plane and vertical tension fractures

Claystone: gray green, waxy, soft.

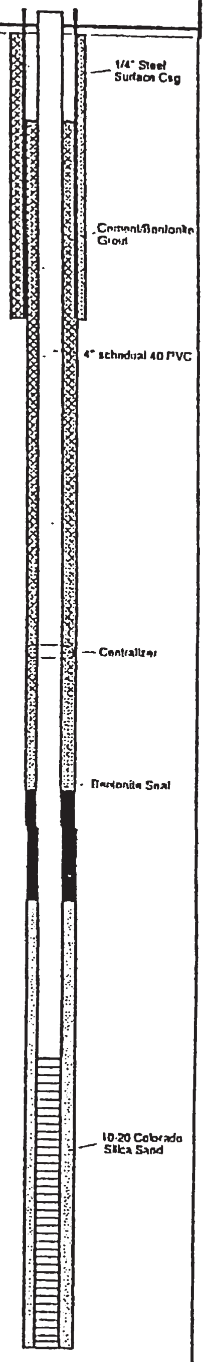
Missing Core

Siltstone: Light gray green with very fine-grained sandstone stringers, chert fragments, argillaceous, very sandy.

Shale: brownish-grey, becoming grey-green, soft very platy, random tension fracturing.

Shale: light greenish gray to green-grey, very sandy, very silty, tension fracturing, trace soft, red shale at base.

Missing Core



PEEL Environmental Services
Arvada, CO (303)422-3116

Bore Hole No. :
WMMW-22

Project: White Mesa
Surface Elev. 5516 Est
T. D. = 140'
PBTD = 120'
Date: 8/4/94
Depth to Water: 76
Geologist: C. Bilgood

Sample Description

Sandstone: aeolian sand, quartz, reddish brown.

Conglomerate: chert, light gray to dark gray, occasional translucent, interbedded with light gray quartz sandstone, rounded, thin bedded.

Conglomerate: sandstone and conglomerate as above.

Sandstone: quartz, white to very light gray, fine- to medium-grained, argillaceous

Sandstone: quartz, white to very light tan, fine-grained, well cemented, hard, tight

Sandstone as above, very hard, siliceous cement

Sandstone as above with trace light gray chert fragments, trace iron staining

Sandstone. quartz, light gray to light tan, very fine-grained, subangular, chert clasts to 1/2", siliceous cement, well cemented, hard, iron staining, occasionally light green in color.

Sandstone: as above with increase in chert clasts.

Missing Core

Sandstone: quartz, light tan to light gray, fine- to medium-grained, subangular to subrounded, siliceous cement, tight, becoming very conglomeratic at base, hard, well cemented.

Sandstone: as above becoming conglomeratic at base. Conglomerate pebbles sub angular to subround, varicolored

Missing Core

Conglomerate: varicolored as above, chert and claystone fragments.

Sandstone: quartz, very light gray, very fine-grained, argillaceous, subrounded, occasional rock clasts, trace intergranular porosity, some horizontal bedding parting, some cross bedding

Missing Core

Sandstone: quartz, light gray to light green gray, fine- to very coarse-grained, subangular to rounded, poorly sorted, large 1" green gray claystone clasts, fair to good intergranular porosity, very friable.

Sandstone: quartz, very light gray, fine- to medium-grained, subangular to subrounded, very friable, good intergranular porosity, massive, well sorted.

Sandstone quartz, light green gray, fine grained, argillaceous, rounded, fair intergranular porosity, friable

Missing Core

Sandstone quartz, light green gray, fine- to coarse-grained, argillaceous at base, conglomeratic, varicolored, with green claystone, chert and other lithic fragments

Claystone green, waxy

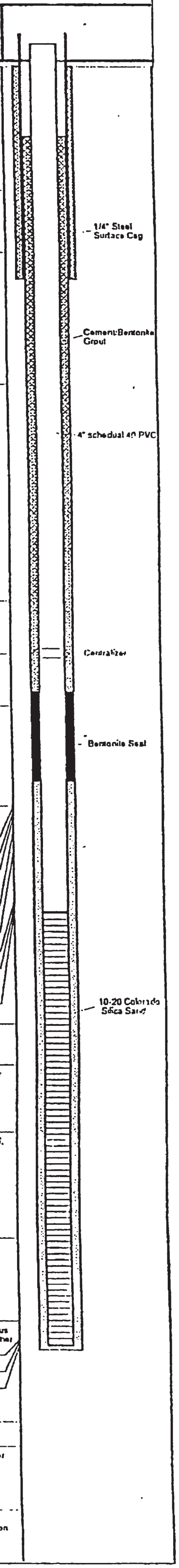
Missing Core

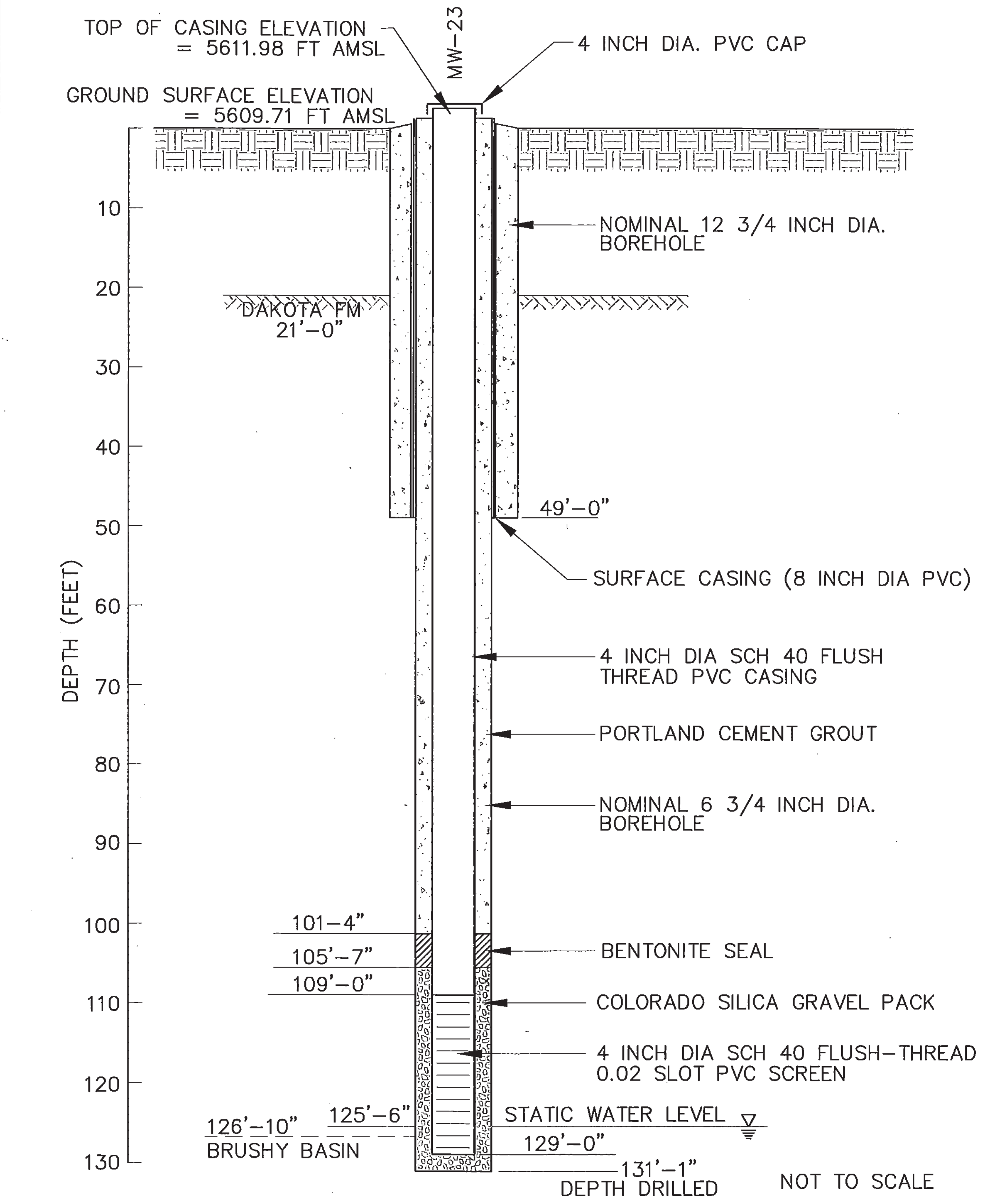
Claystone red brown, mottled green, some horizontal parting

Claystone gray green to bright green, some red mottling and banding

Siltstone. light gray green, hard, very argillaceous, slightly sandy, lower 1' grading into light green claystone.

Claystone light gray mottled, with red brown claystone, hard, some platyness, some 3" to 10" vertical fractures, some sealed, some iron staining





HYDRO
GEO
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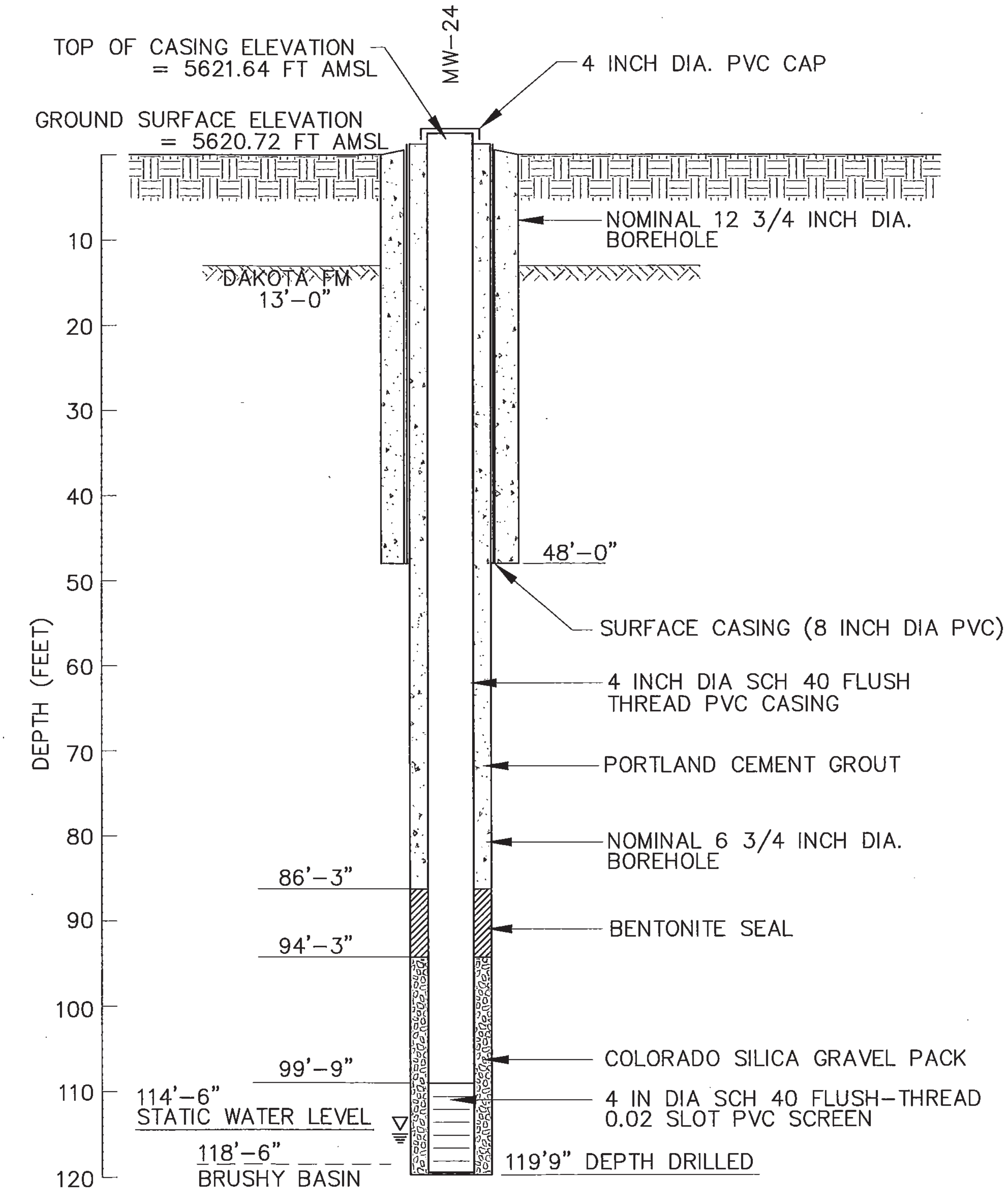
MW-23
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180211A	3



NOT TO SCALE

HYDRO
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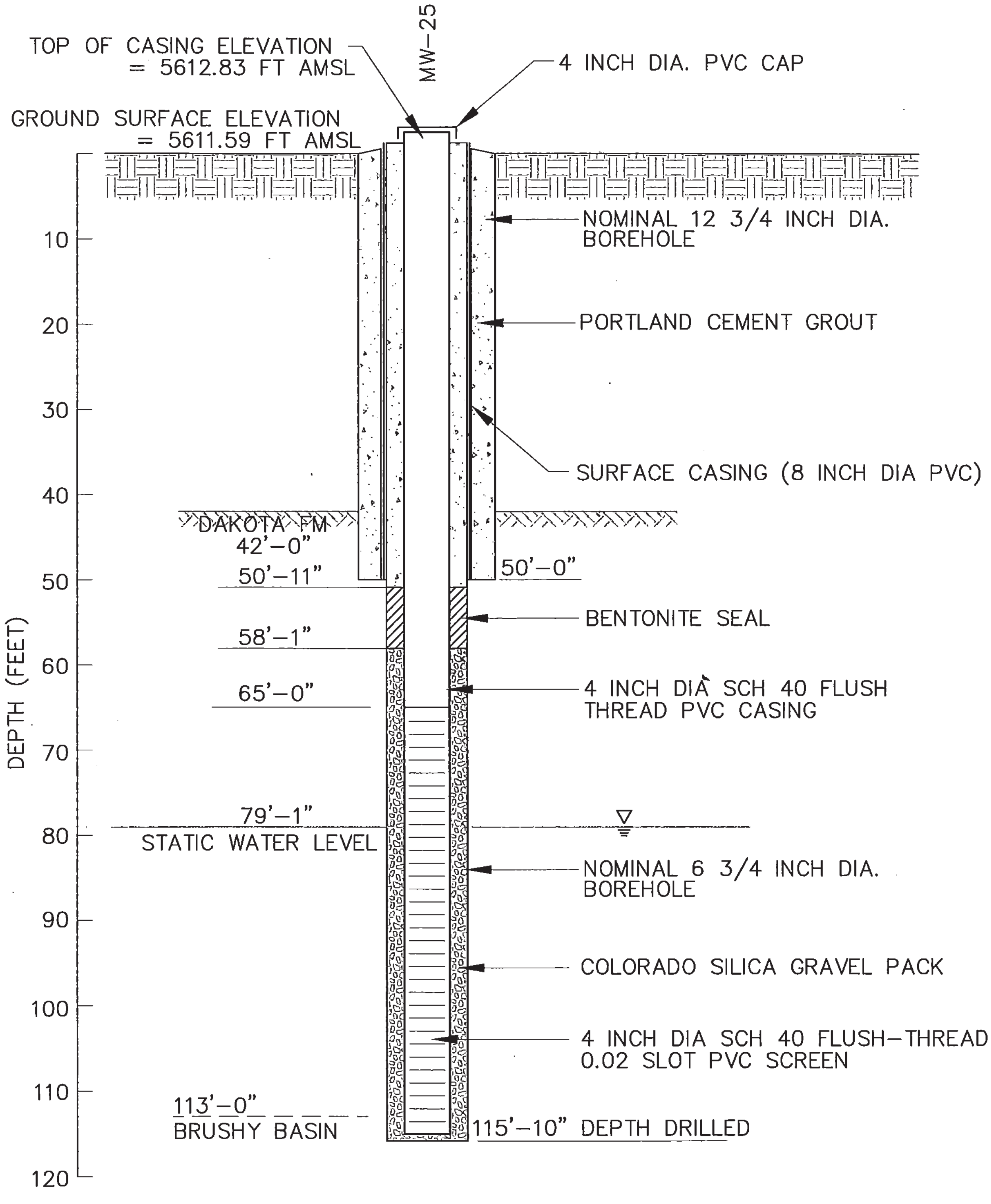
MW-24
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180212A	4



NOT TO SCALE

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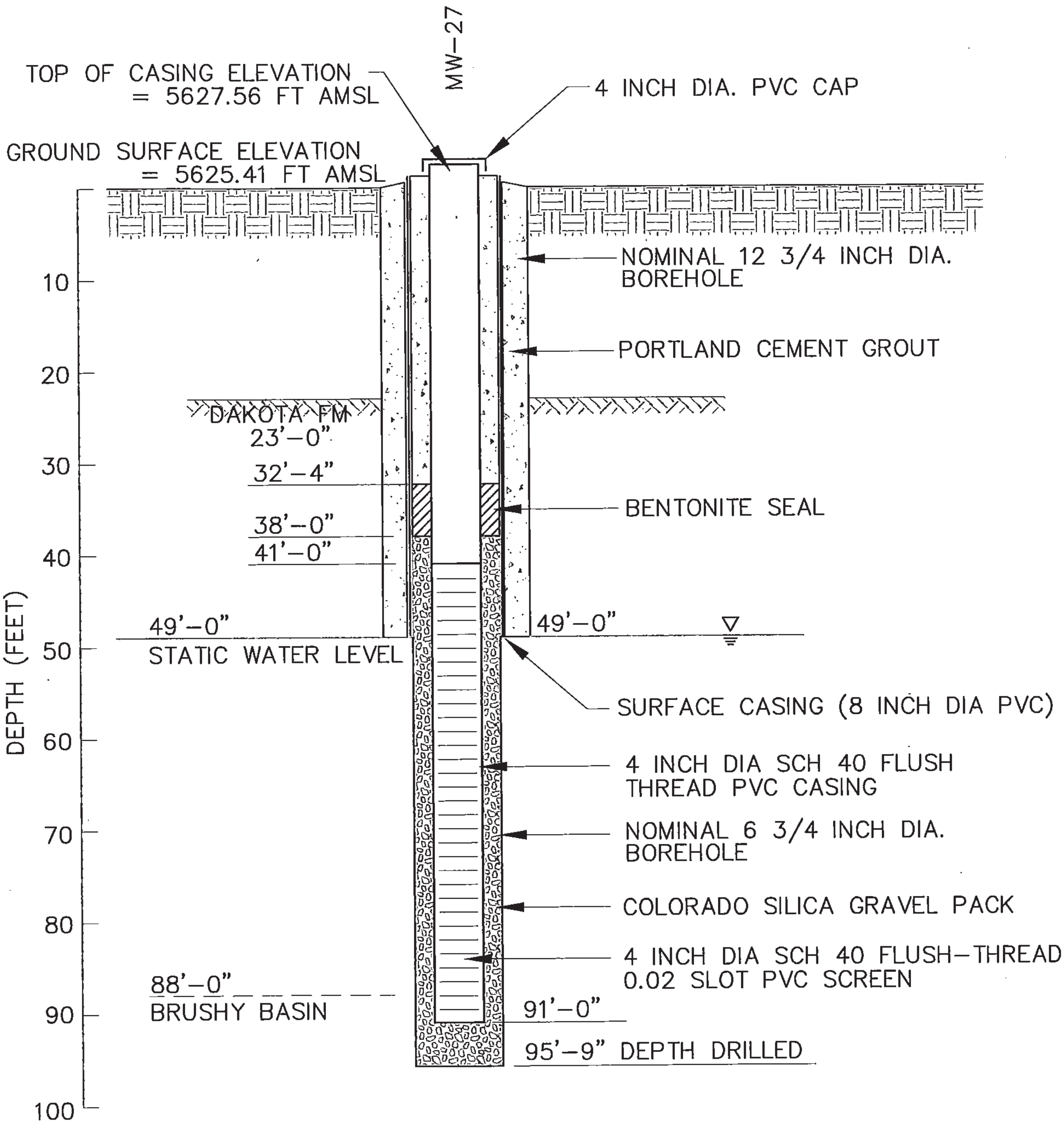
MW-25
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180213A	5



NOT TO SCALE

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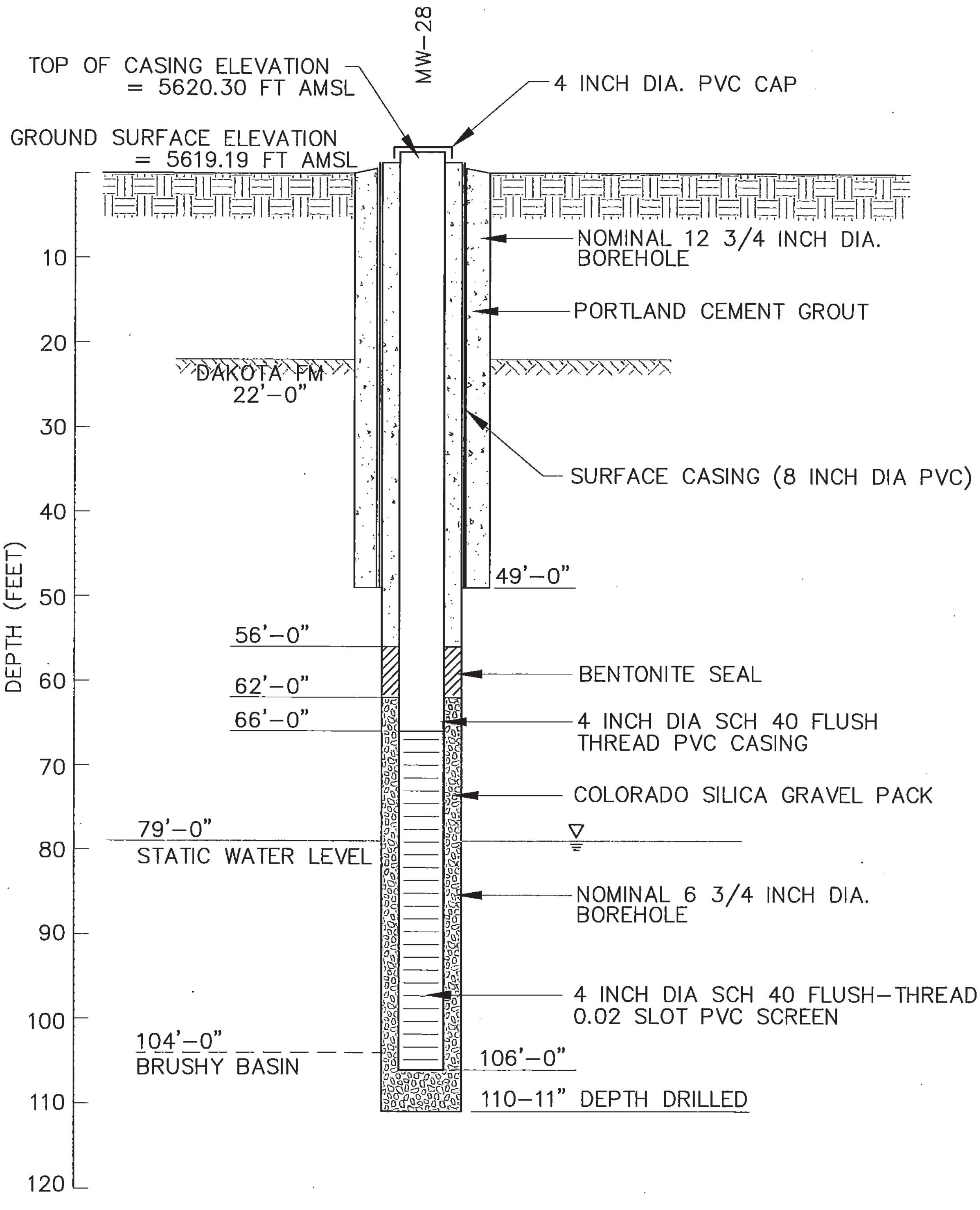
MW-27
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180214A	6



NOT TO SCALE

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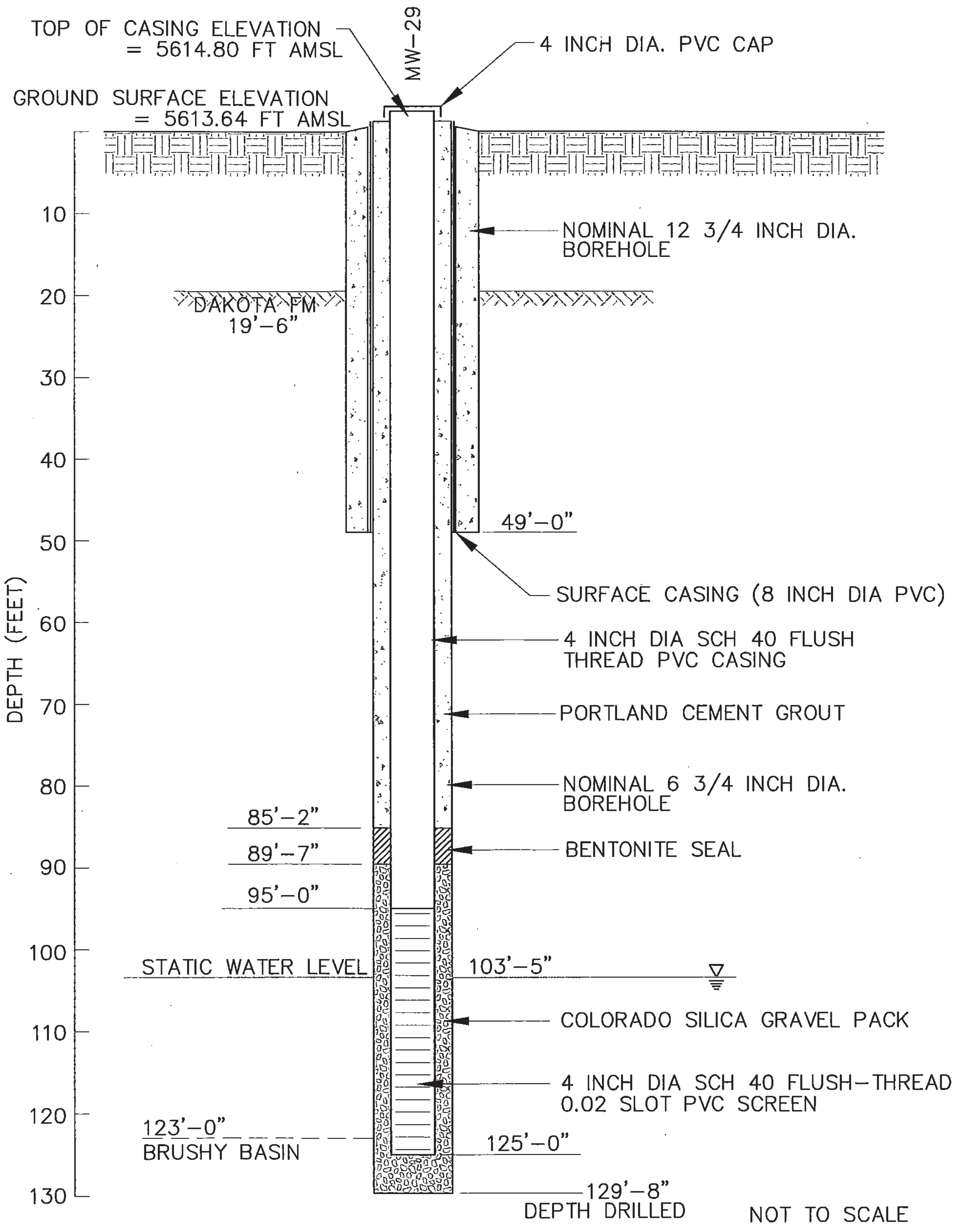
MW-28
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved SS	Date 8/01/05	Revised	Date	Reference: 7180215A	FIG. 7



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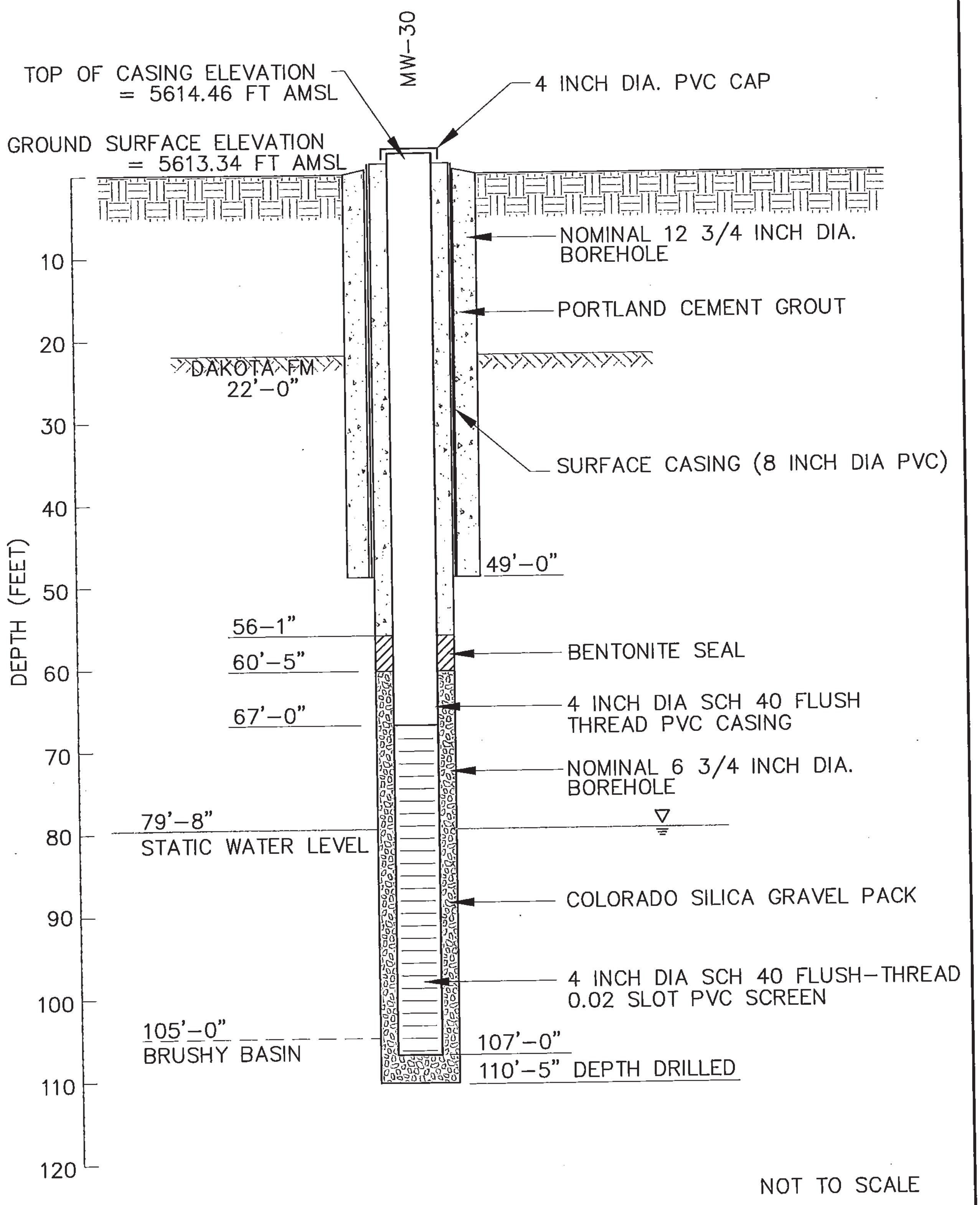
MW-29
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180216A	8



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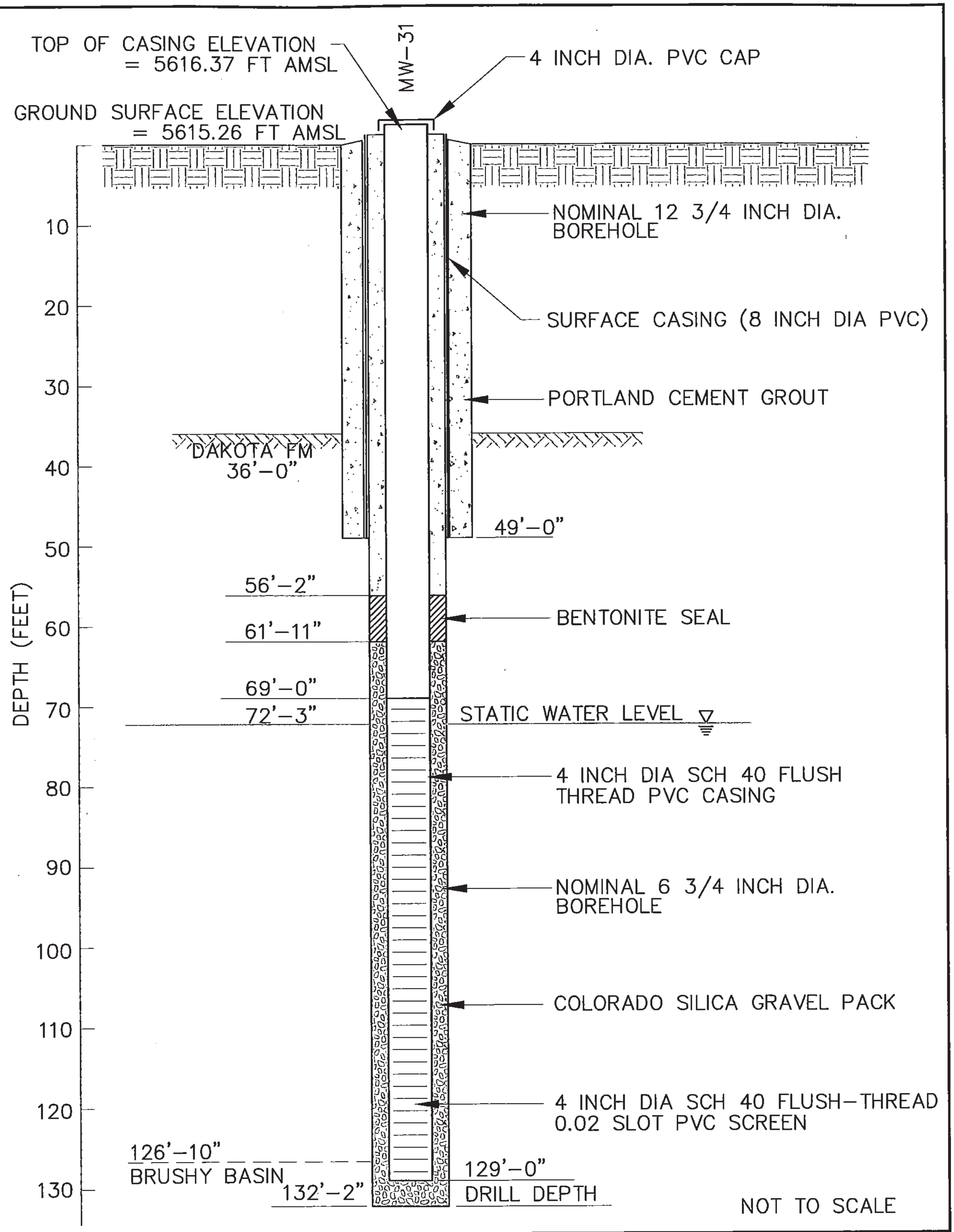
MW-30
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180217A	9



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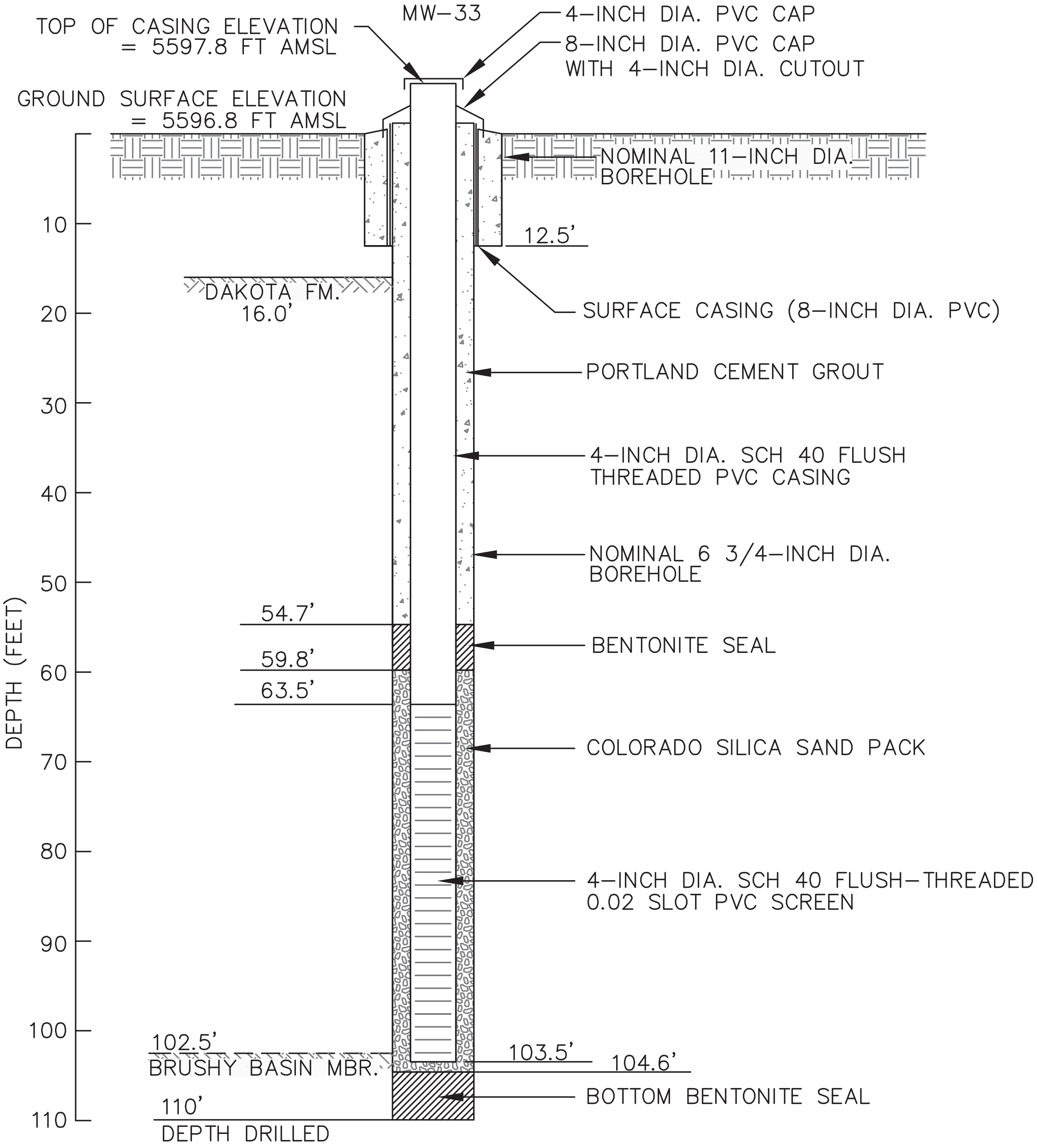
MW-31
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/01/05			7180218A	10



NOTE: WELL IS DRY

NOT TO SCALE

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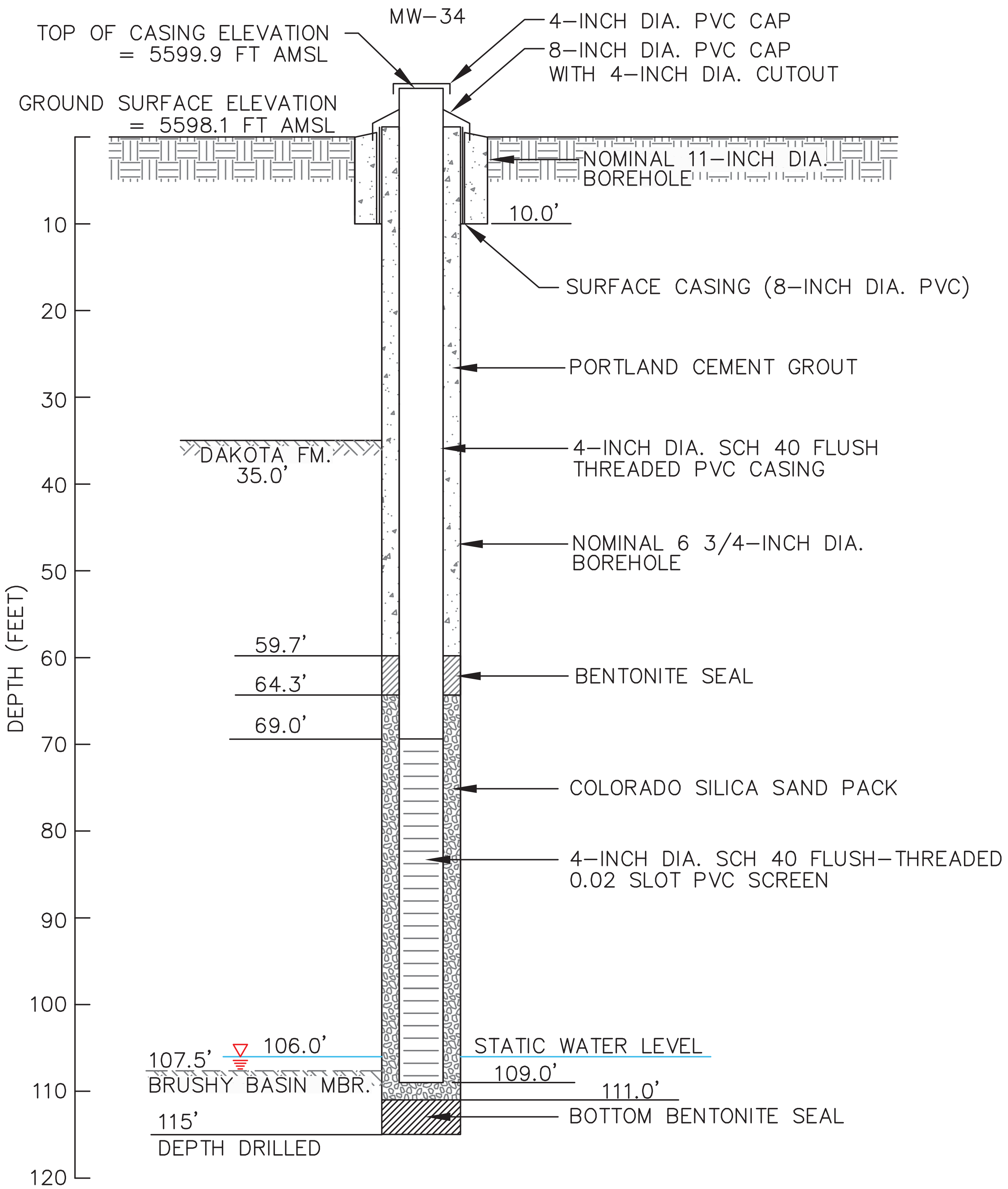
MW-33
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
RKZ	9/21/10	JAA	9/21/10	7180248A	2

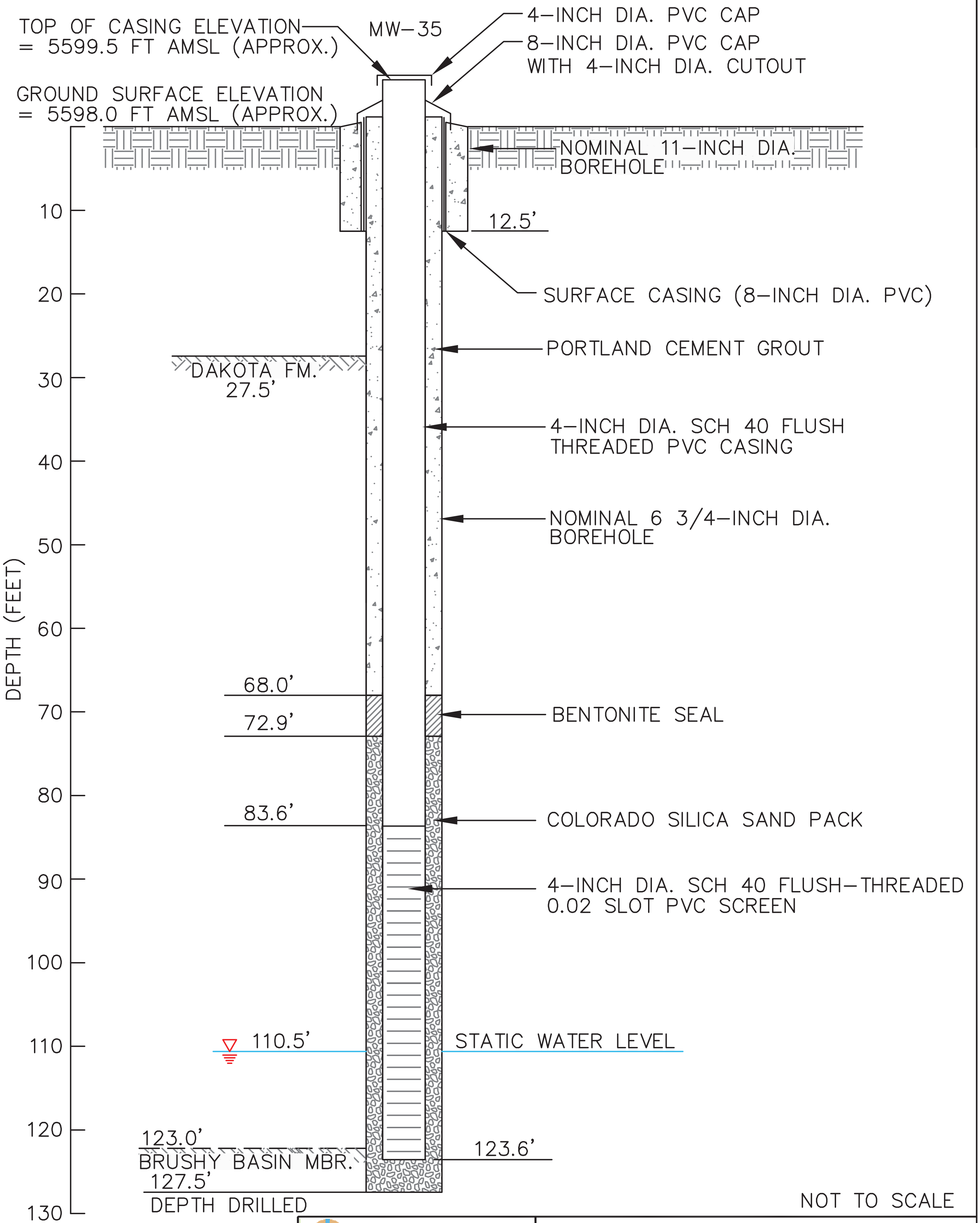


NOT TO SCALE

HYDRO GEO CHEM, INC.

MW-34
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
RKZ	9/21/10	JAA	9/21/10	7180248A	3



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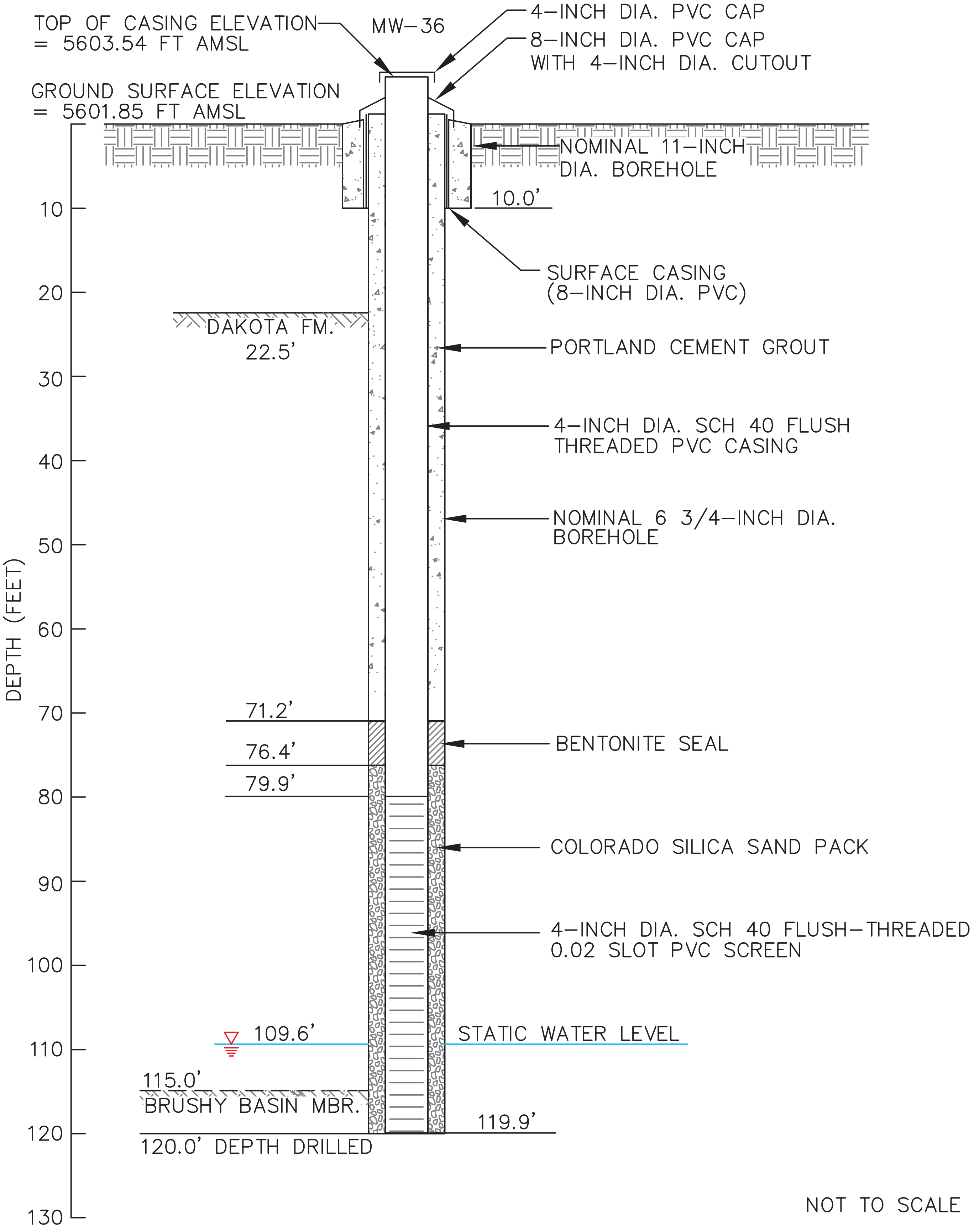
CHEM, INC.

MW-35
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
RKZ	9/21/10	JAA	9/21/10	7180248A	4



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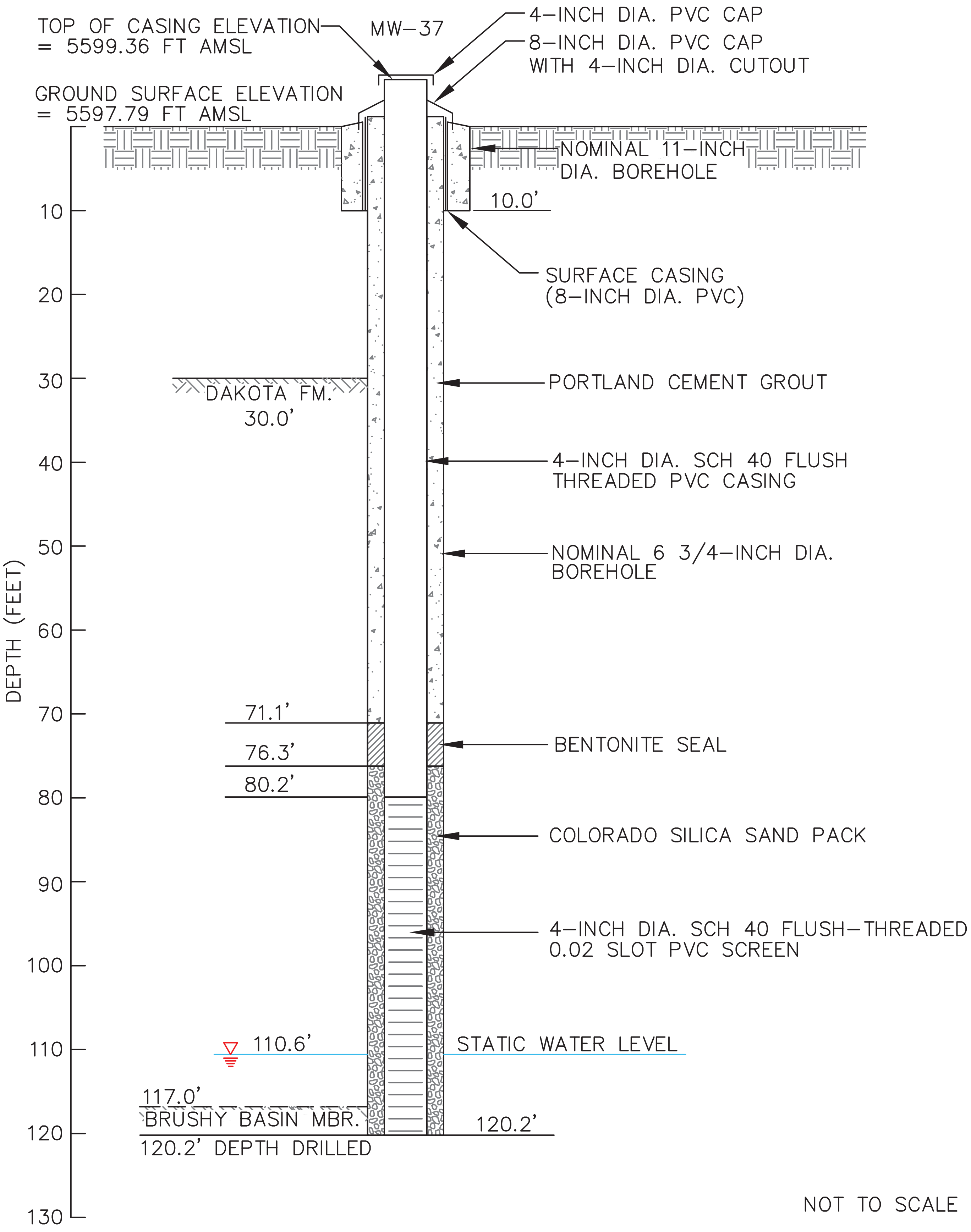
GEO
CHEM, INC.

MW-36
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	6/21/11	JAA	6/21/11	7180249A	2



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MW-37
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	6/21/11	JAA	6/21/11	7180249A	3

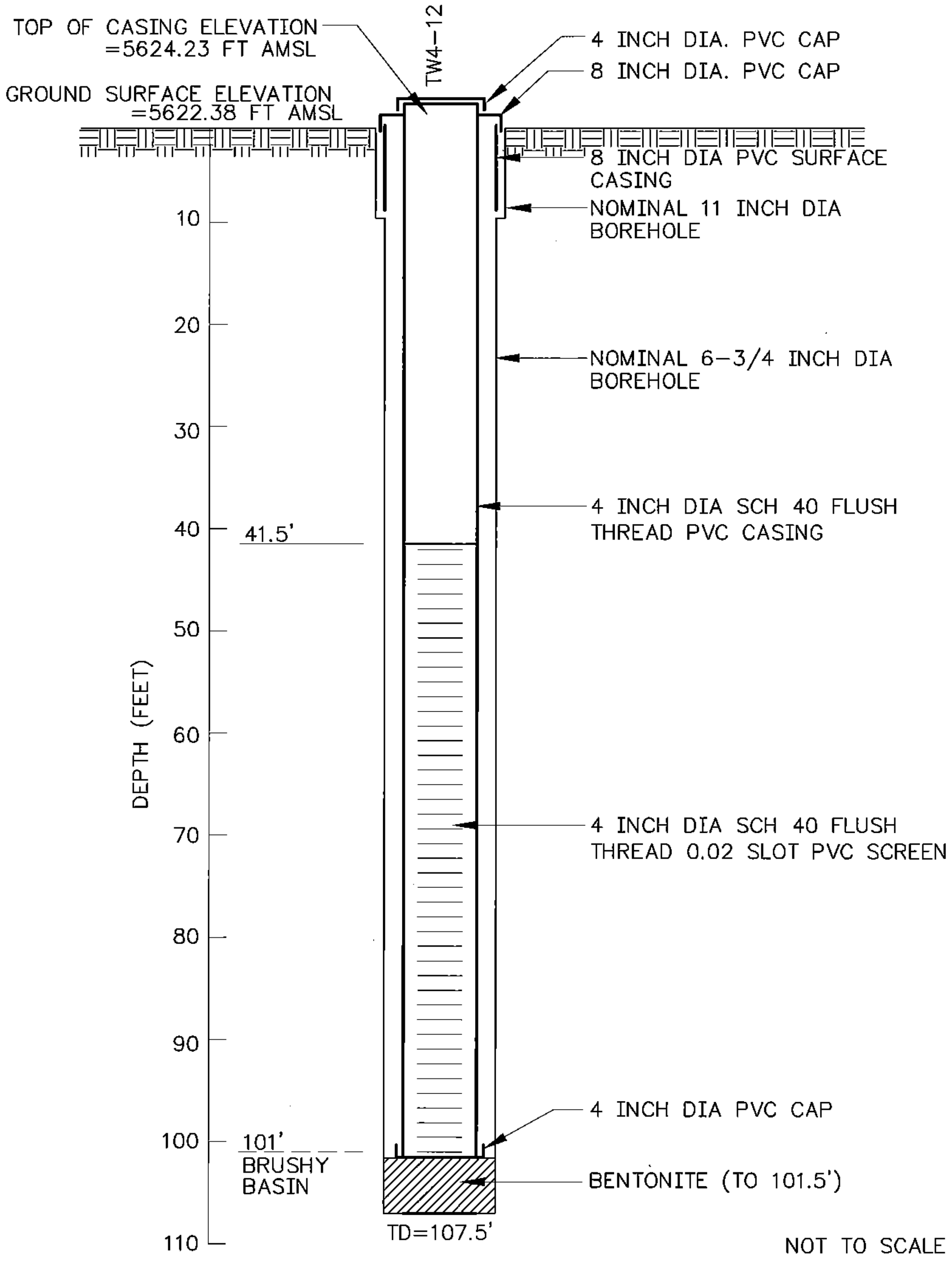
APPENDIX B.3

TW4 - SERIES

TABLE 3
Temporary Perched Well Completion and Analytical Parameters

	TW 4-1	TW 4-2	TW 4-3	TW 4-4	TW 4-5	TW 4-6	TW 4-7	TW 4-8	TW 4-9
Approximate screened interval (feet bls)	70-110	80-120	67-97	72-112	80-120	57.5-97.5	80-120	85-125	80-120
Depth to water[1] (feet below measuring point)	81.1	76.4	65.3	90.5[2]	61.4	86.5[2]	67.5	75.2	60.5
pH	6.80	7.06	6.72	NS	6.24	NS	6.87	6.97	6.26
Electrical conductivity (mS/cm)	4,063	3,581	3,655	2,100	1,787	3,487	4,056	3,402	3,049
Temperature (°C)	13.1	14.4	13.4	14.8	14.5	15.0	14.4	14.2	13.3
Chloroform (µg/L) (1st sampling)	5.8	2,510	702	NS	29.5	NS	256	<1	4.2
Chloroform (µg/L) (2nd sampling)	1,100	5,520	834	NS	49	NS	616	21.8	1.88
Chloroform (µg/L) (3rd sampling)	1,490	NS	NS	NS	NS	NS	NS	NS	NS
Chloroform (µg/L) (initial sampling of TW 4-4 and TW 4-6)	NS	NS	NS	<0.5	NS	<0.5	NS	NS	NS
Chloroform (µg/L) (4th sampling) (2nd sampling of TW 4-4 and TW 4-6)	2,320	5,220	836	<1	124	<1	698	102	14.2

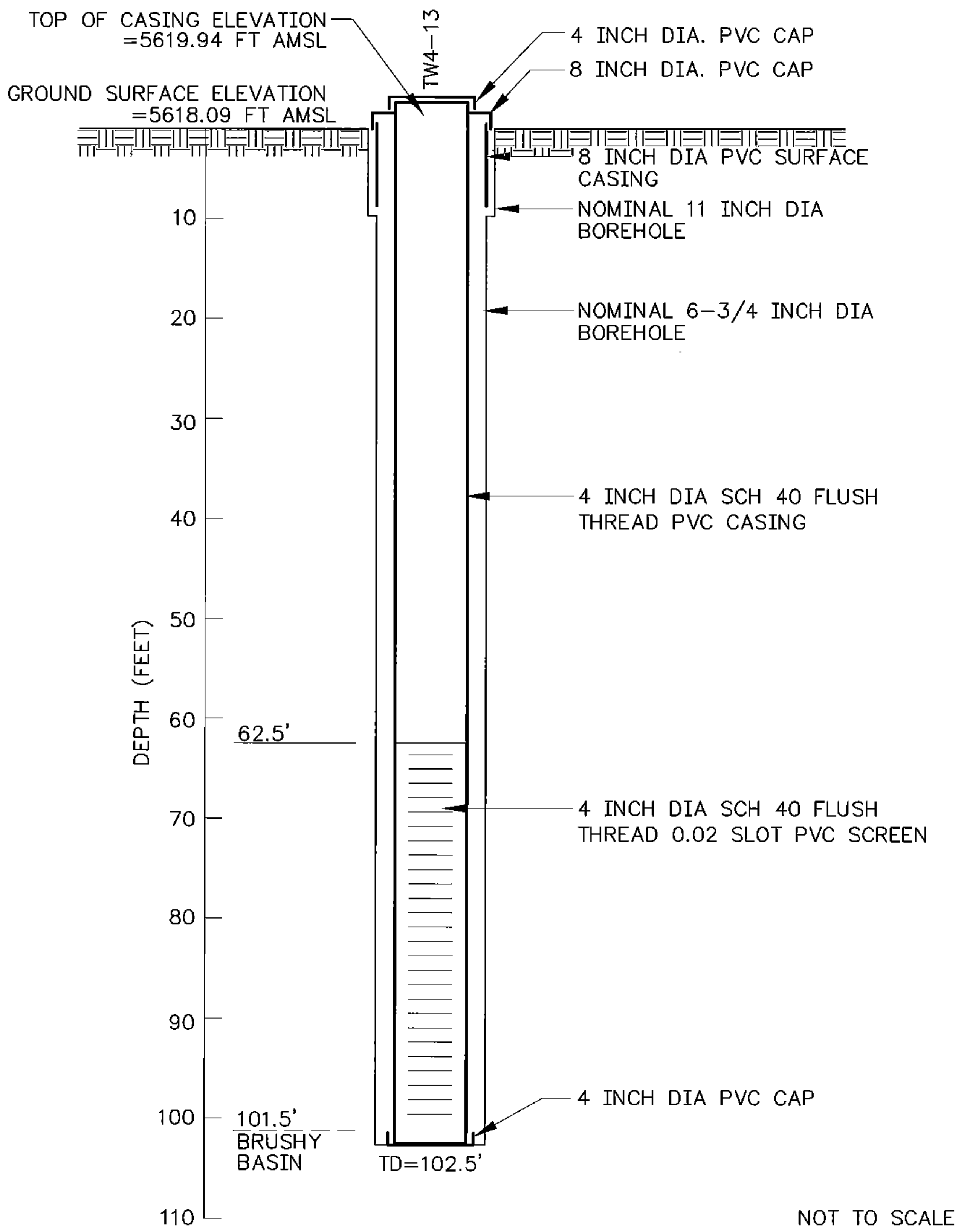
Note: *1 = Depth to water measured on January 3, 2000*
2 = Depth to water measured on July 27, 2000
NS = not sampled



HYDRO GEO CHEM, INC.

TW4-12
WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/30/02			7180203A	2



HYDRO
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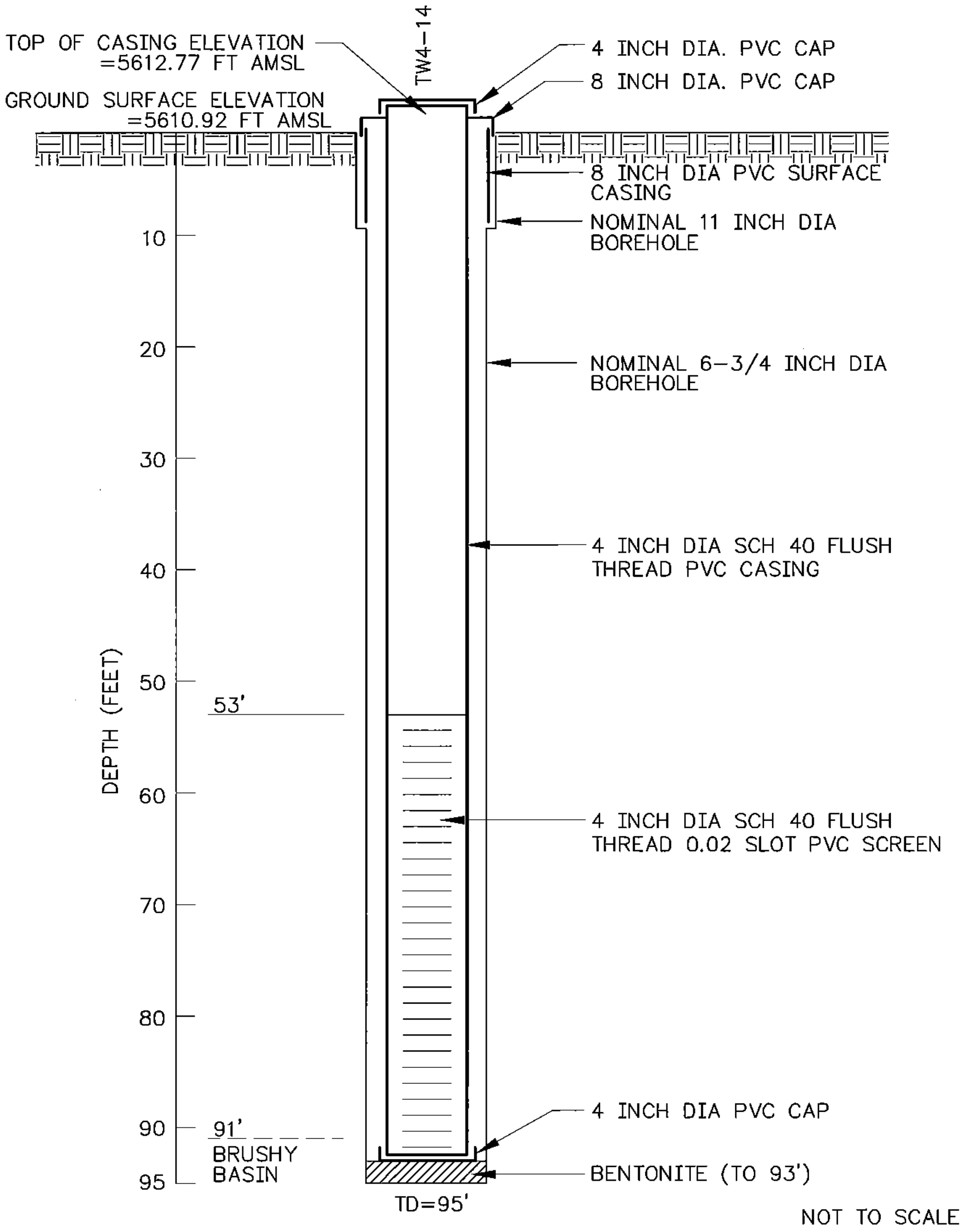
TW4-13
WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/30/02			7180202A	3



HYDRO
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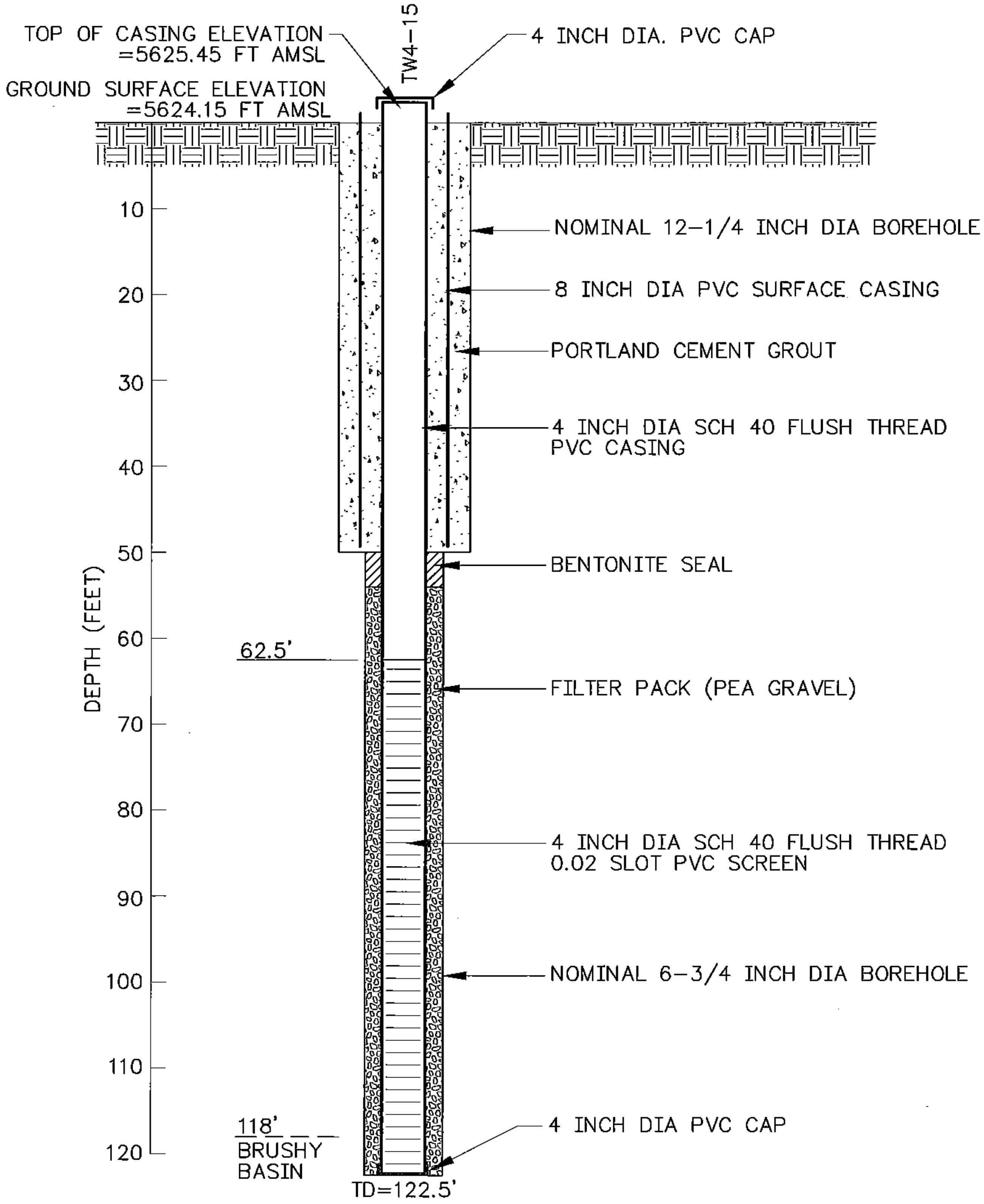
CHEM, INC.

TW4-14
WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/30/02			7180201A	4



NOT TO SCALE

HYDRO
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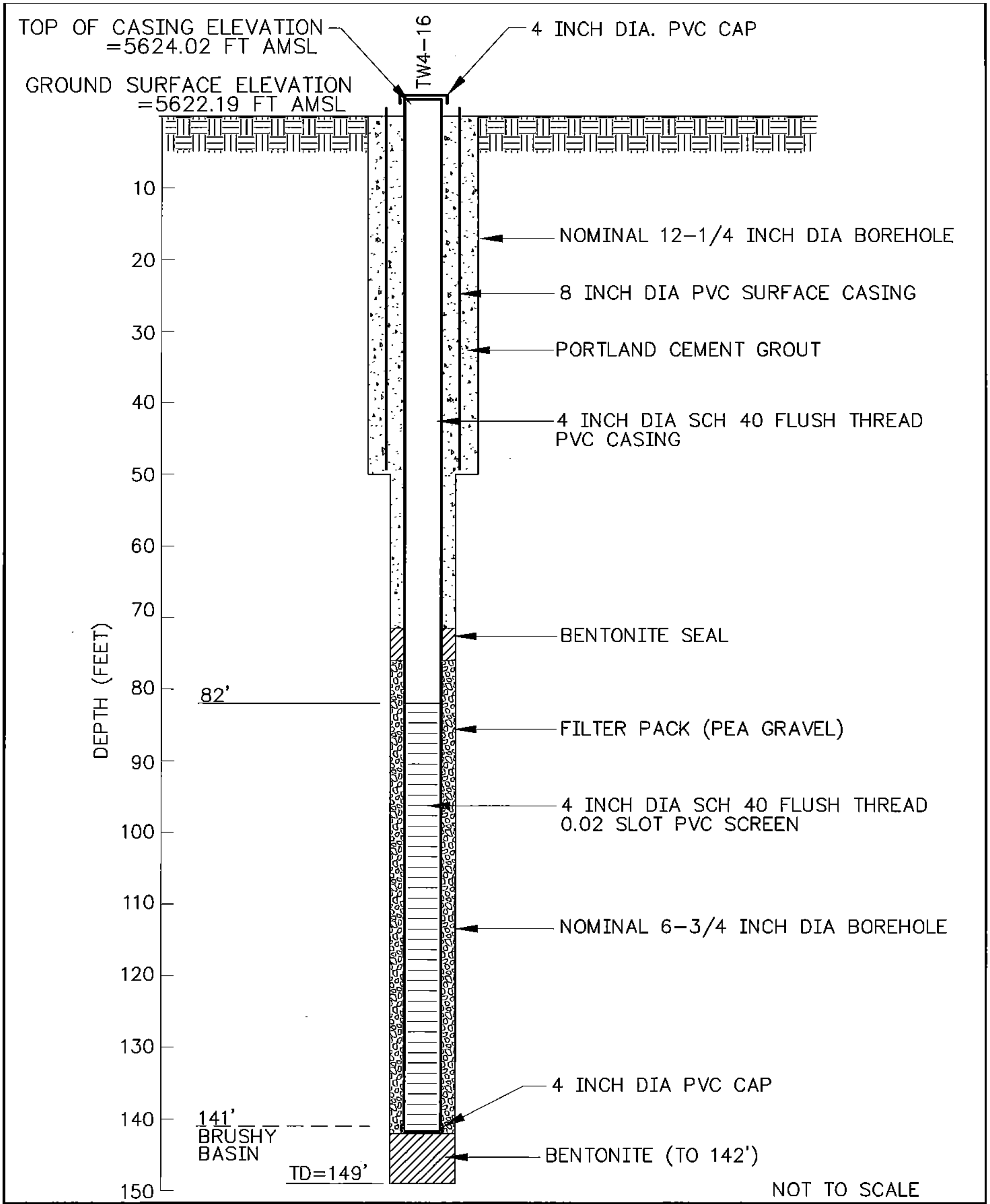
TW4-15
WELL CONSTRUCTION SCHEMATIC

Approved	Date	Revised	Date	Reference:	FIG.
SS	8/30/02			7180204A	5



HYDRO
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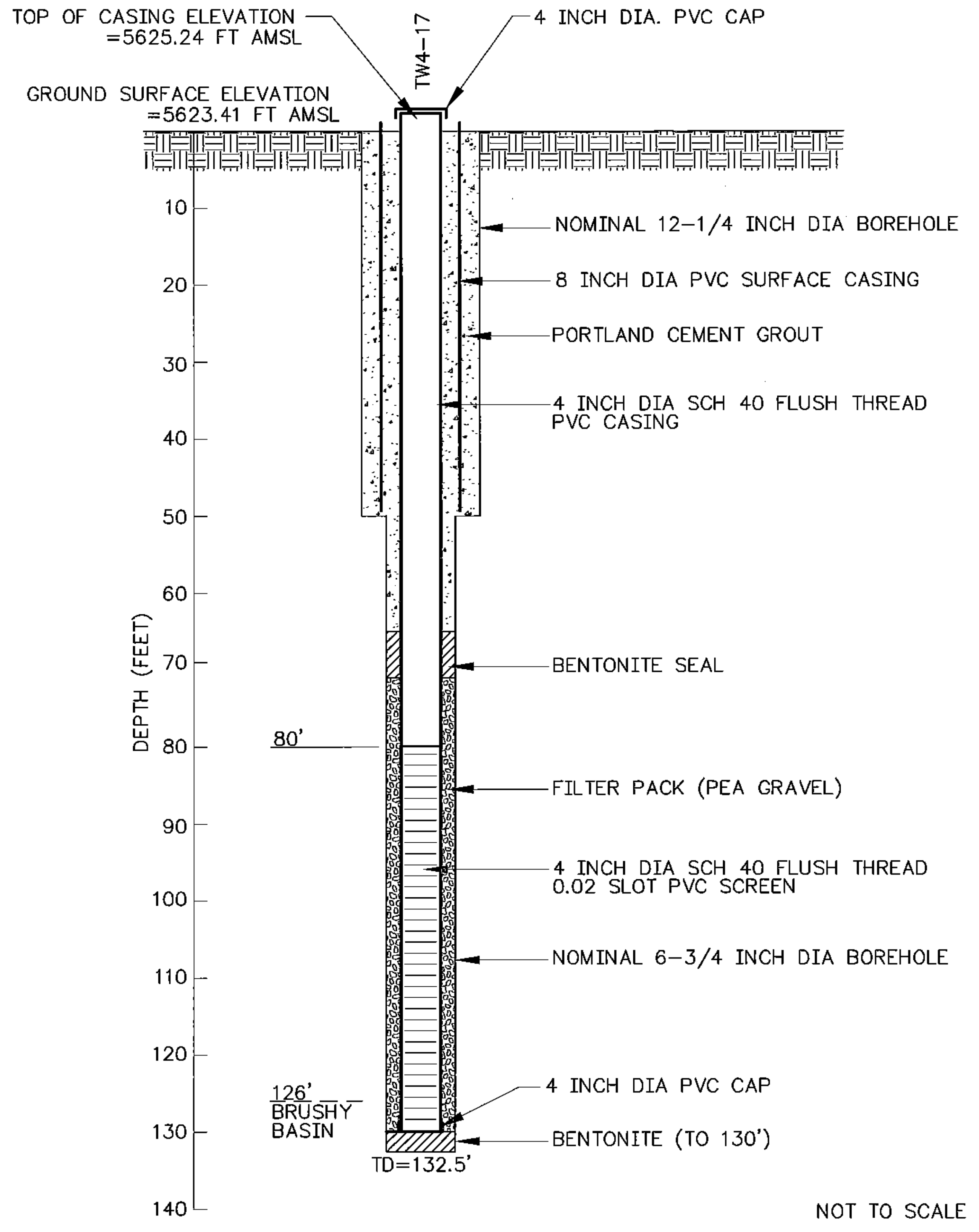
TW4-16
WELL CONSTRUCTION SCHEMATIC

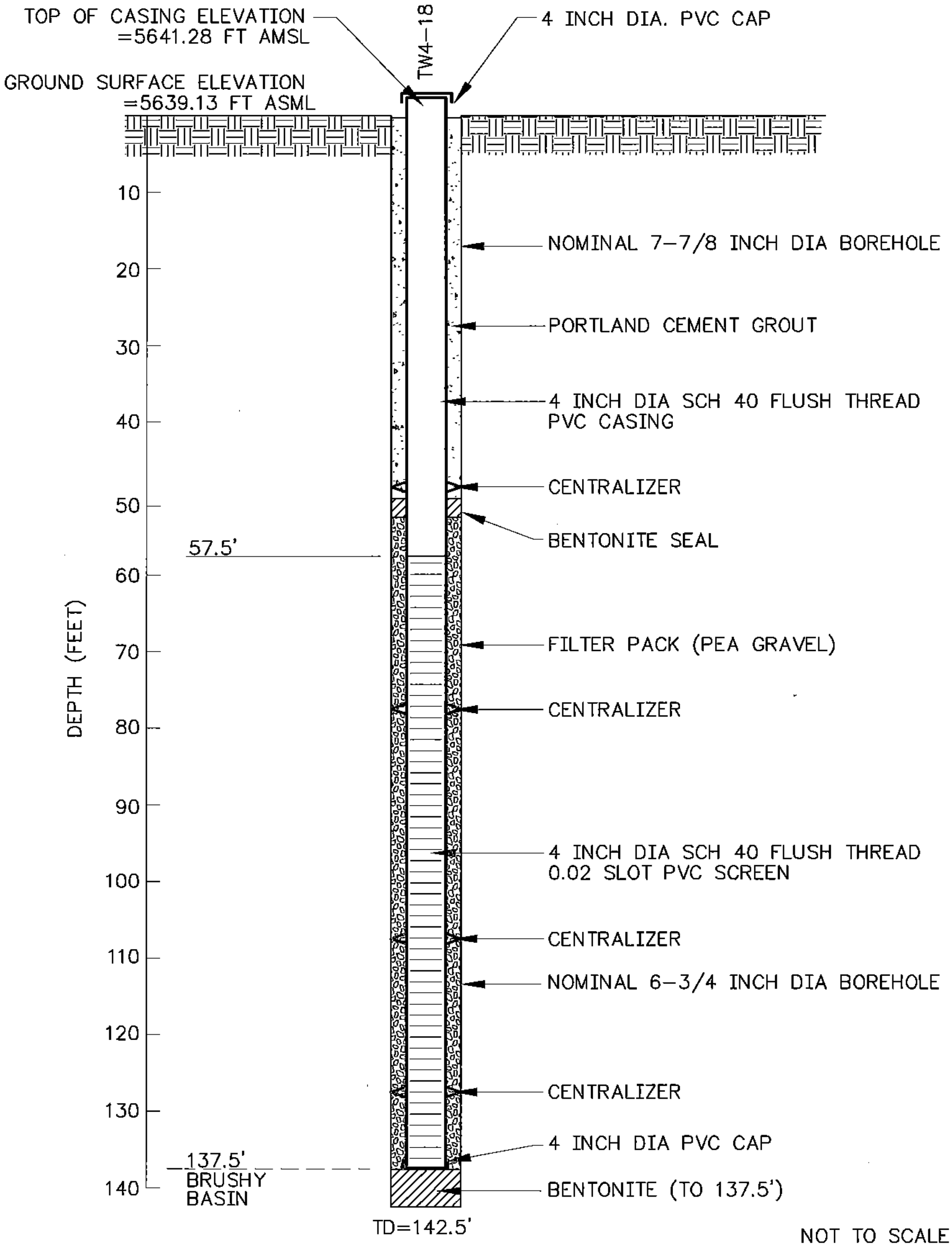
Approved	Date	Revised	Date	Reference:	FIG.
SS	8/30/02			7180205A	6



HYDRO GEO CHEM, INC.

TW4-17
WELL CONSTRUCTION SCHEMATIC

Approved SS	Date 8/30/02	Revised	Date	Reference: 7180206A	FIG. 7



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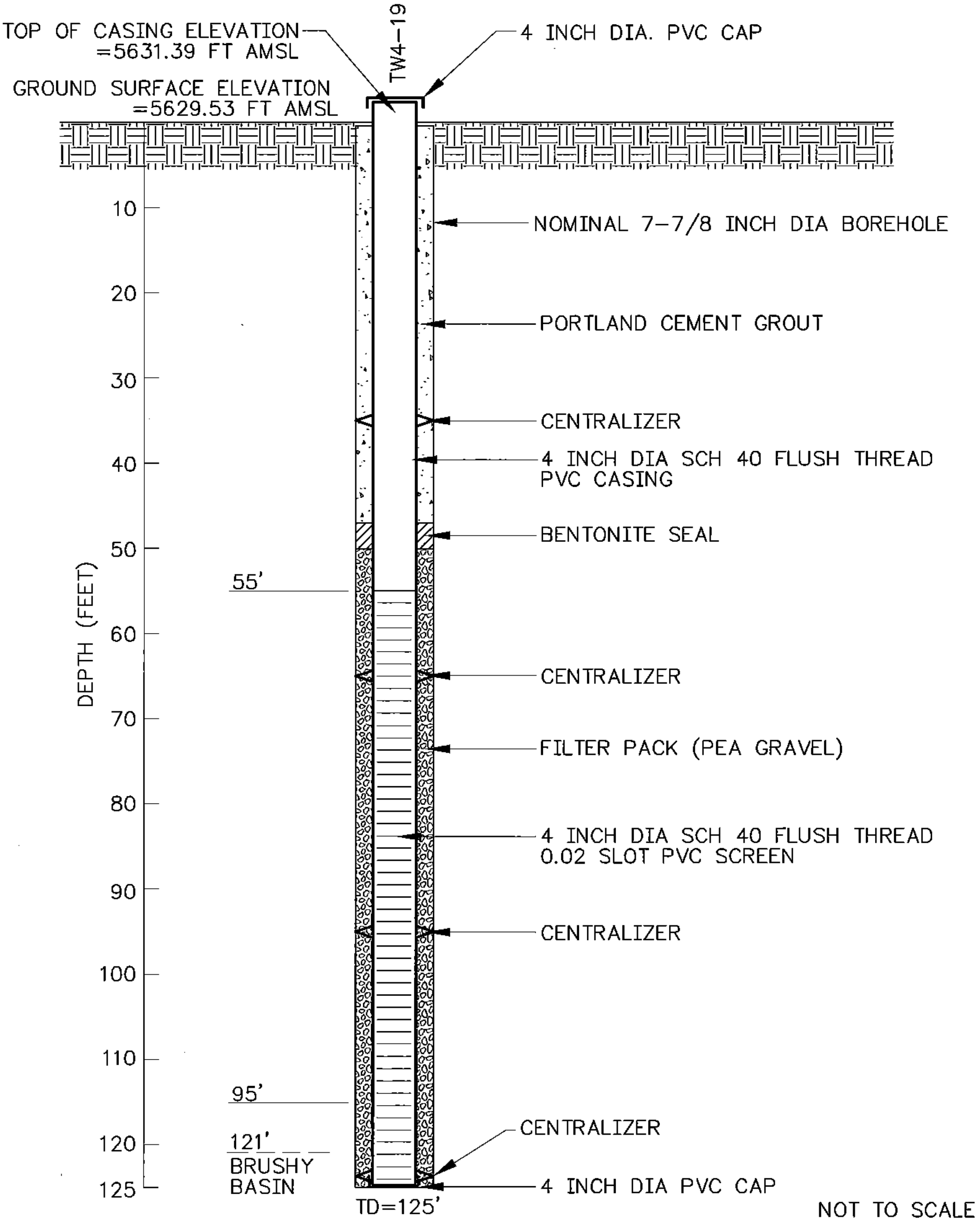
TW4-18
WELL CONSTRUCTION SCHEMATIC

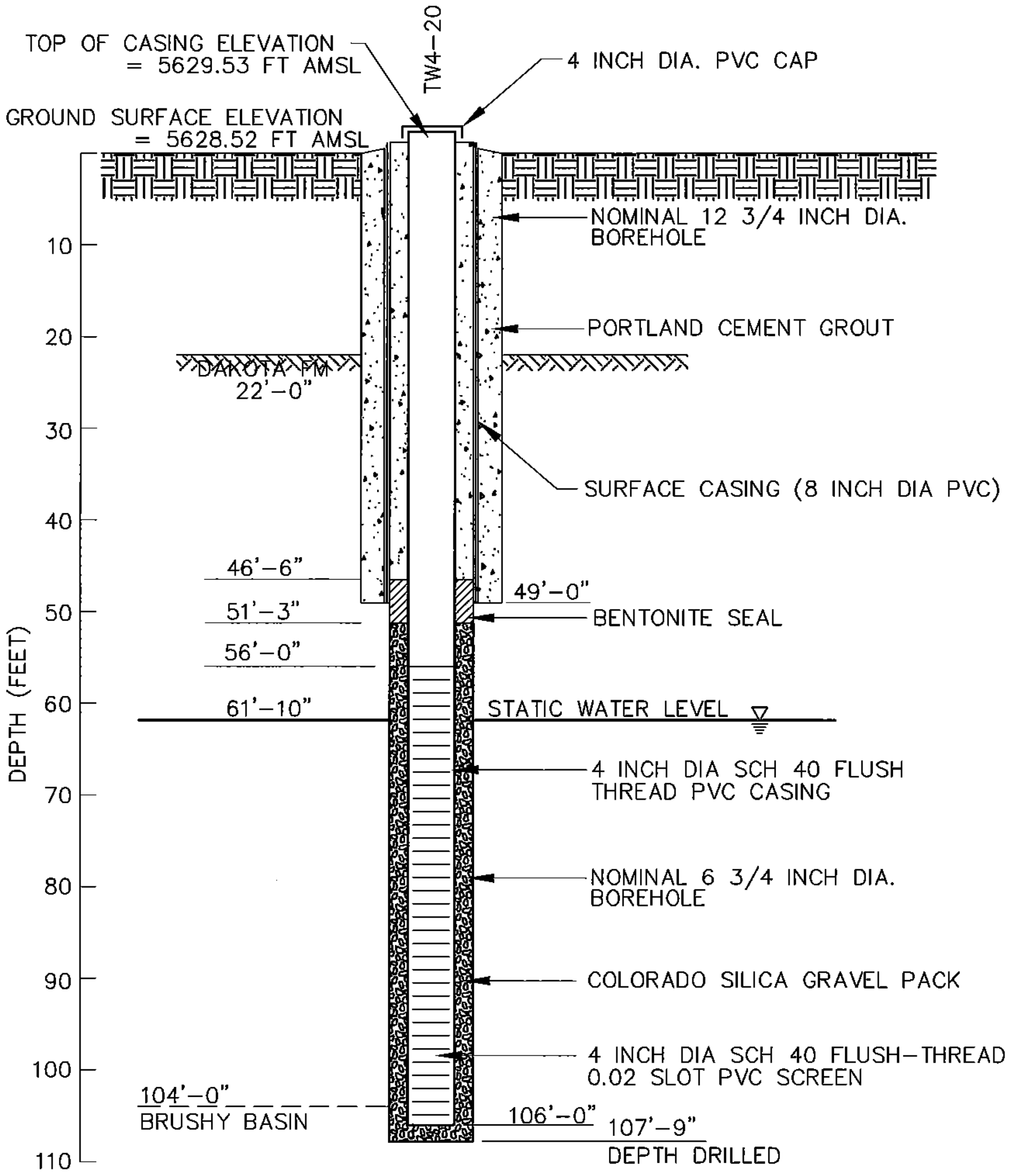
Approved SS	Date 8/30/02	Revised	Date	Reference: 7180207A	FIG. 8



HYDRO GEO CHEM, INC.

TW4-19
WELL CONSTRUCTION SCHEMATIC

Approved SS	Date 8/30/02	Revised	Date	Reference: 7180208A	FIG. 9

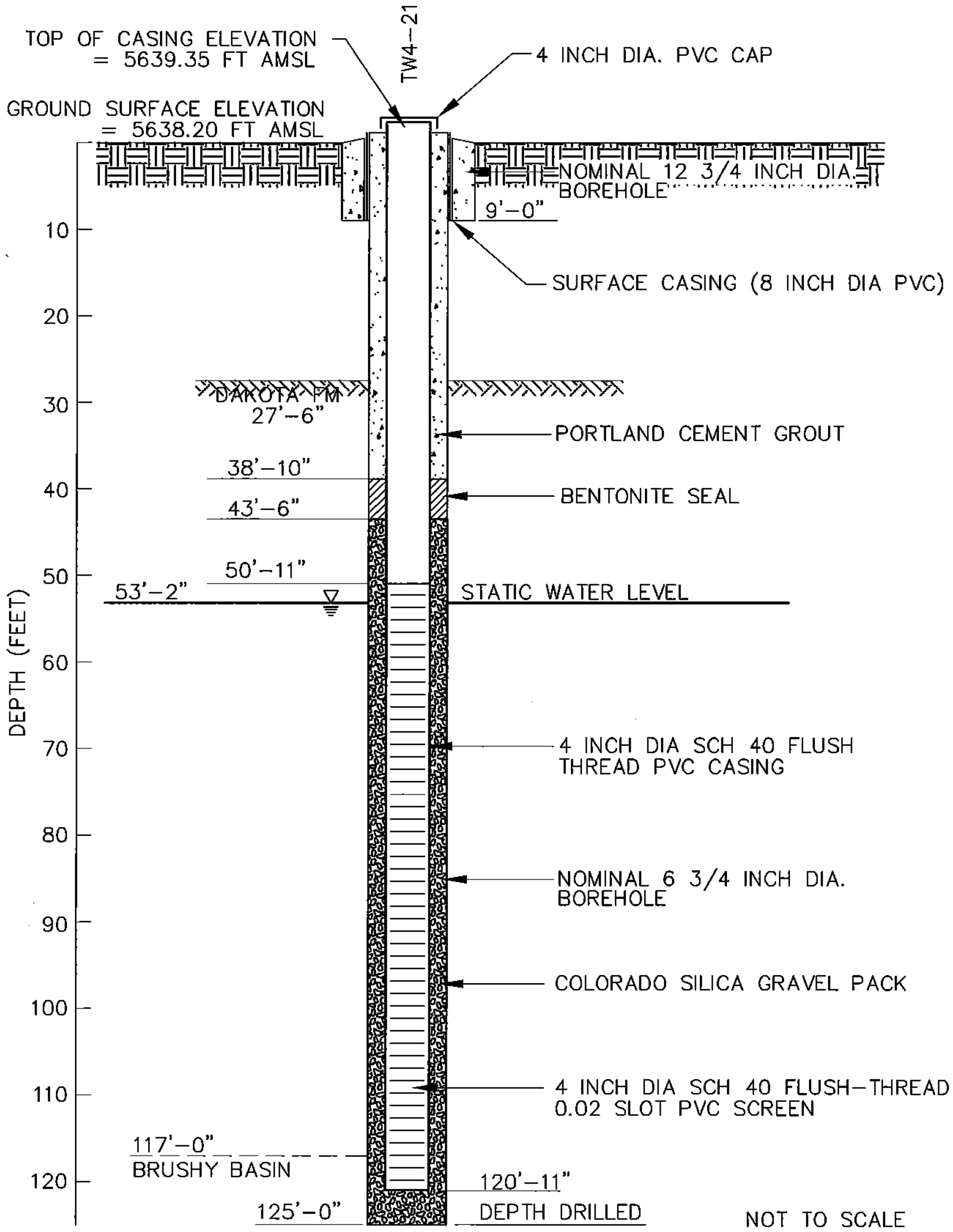


NOT TO SCALE

HYDRO GEO CHEM, INC.

TW4-20
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	8/01/05			7180219A	11



HYDRO
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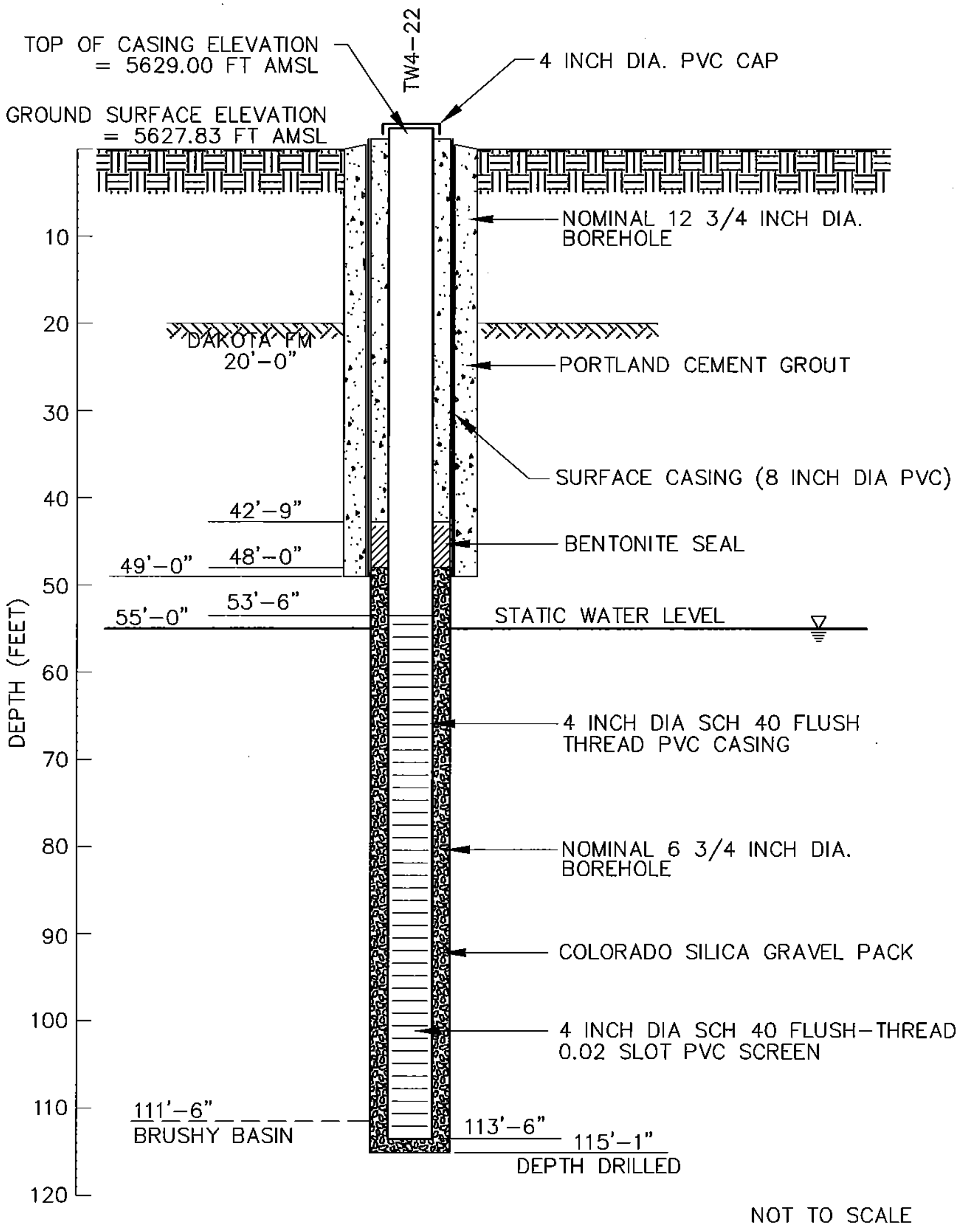
TW4-21
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	8/01/05			7180220A	12



HYDRO
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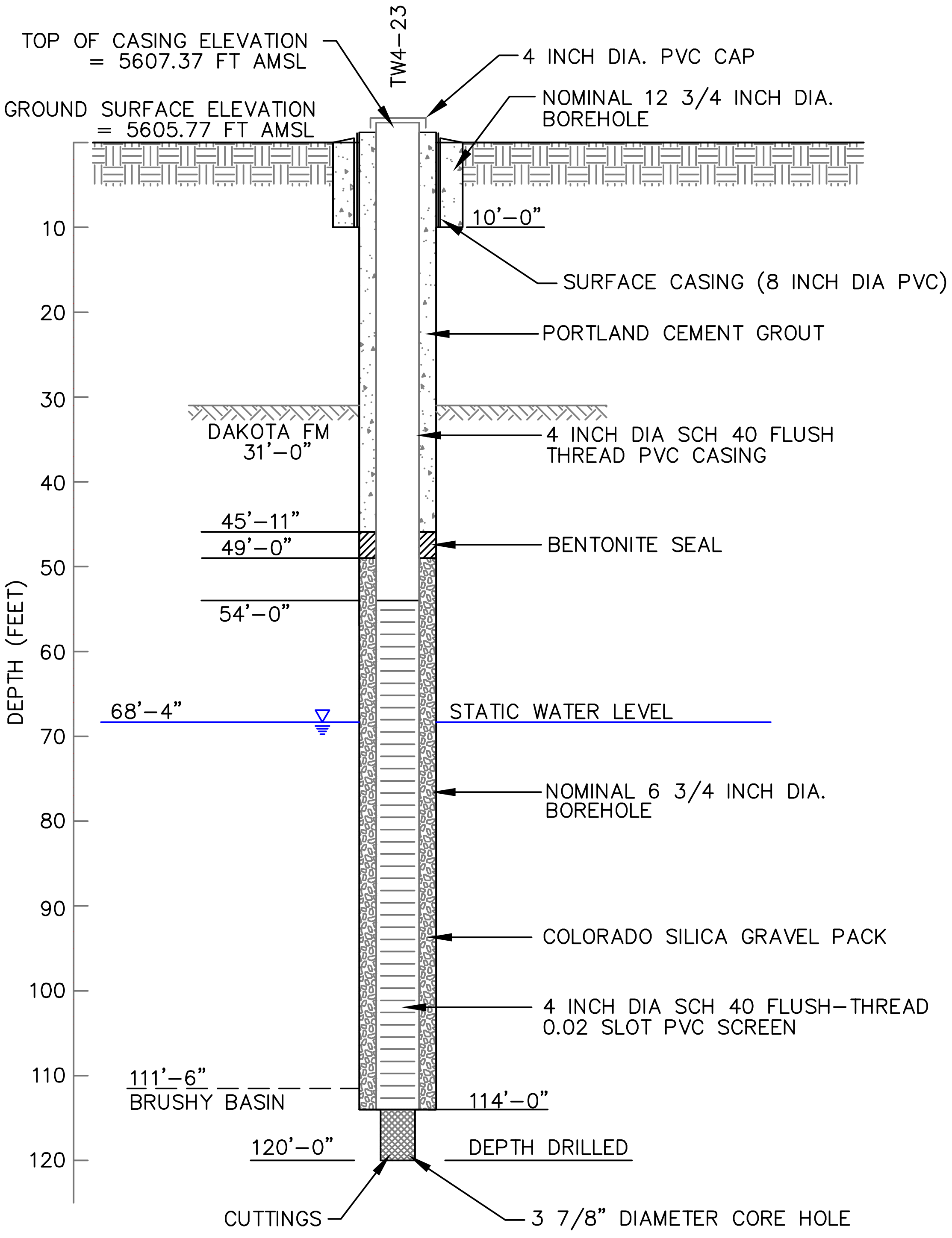
TW4-22
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	8/01/05			7180221A	13



NOT TO SCALE

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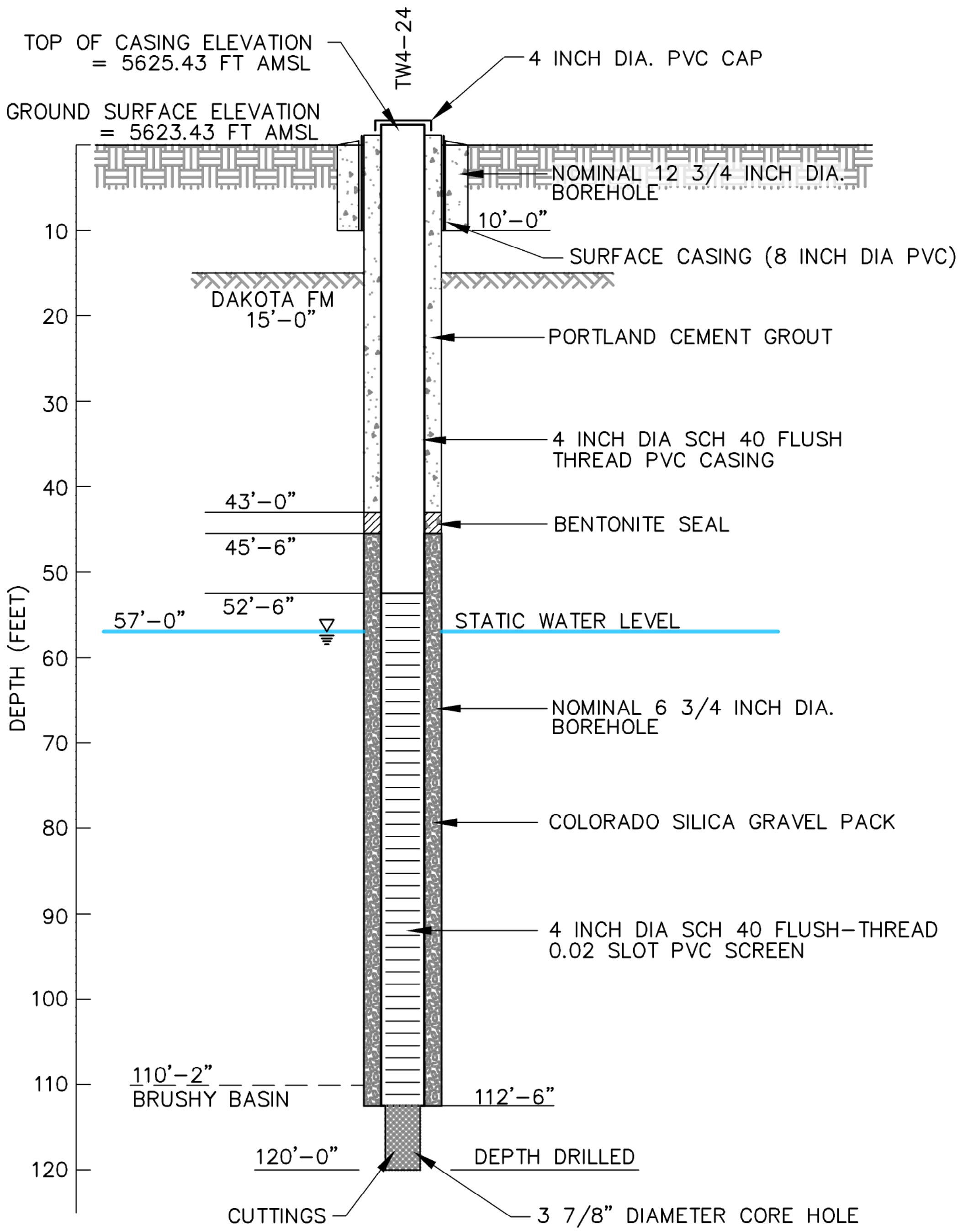
TW4-23
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	06/16/11	JAA	06/16/11	7180244A	2



NOT TO SCALE

HYDRO
GEO
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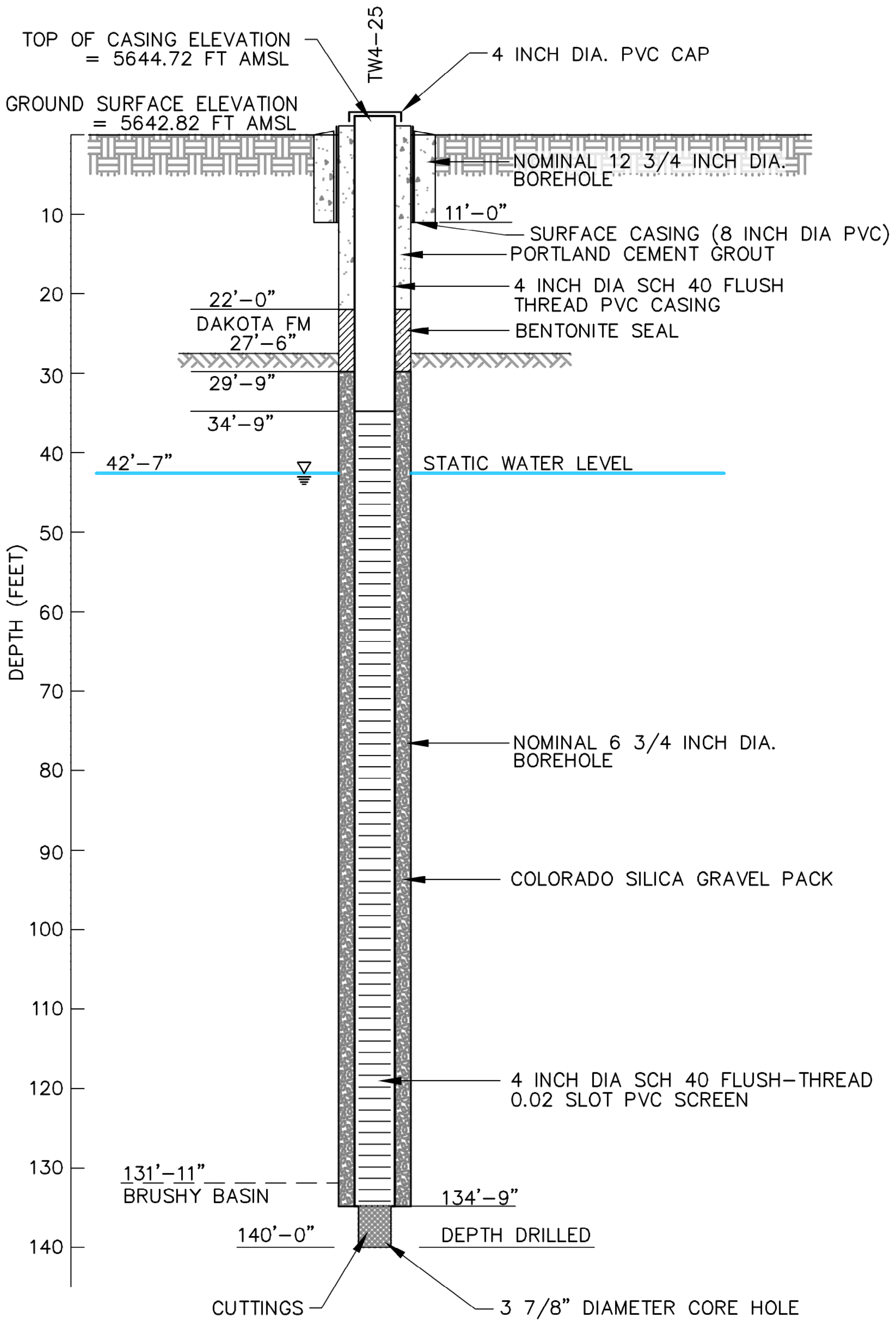
TW4-24
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/17/10	AMC	03/17/10	7180245A	3



NOT TO SCALE

HYDRO
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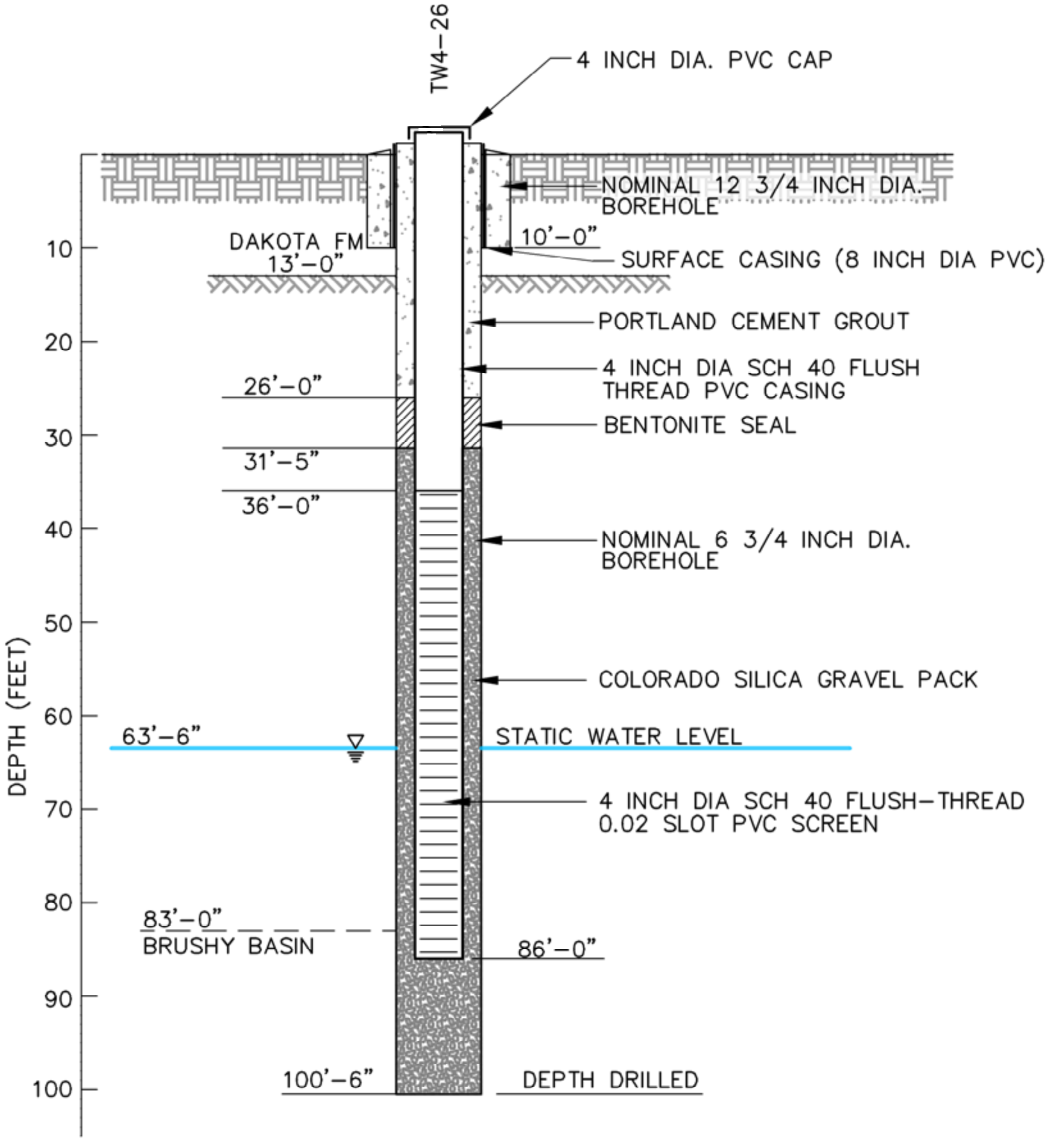
TW4-25
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/17/10	AMC	03/17/10	7180246A	4



NOT TO SCALE

HYDRO
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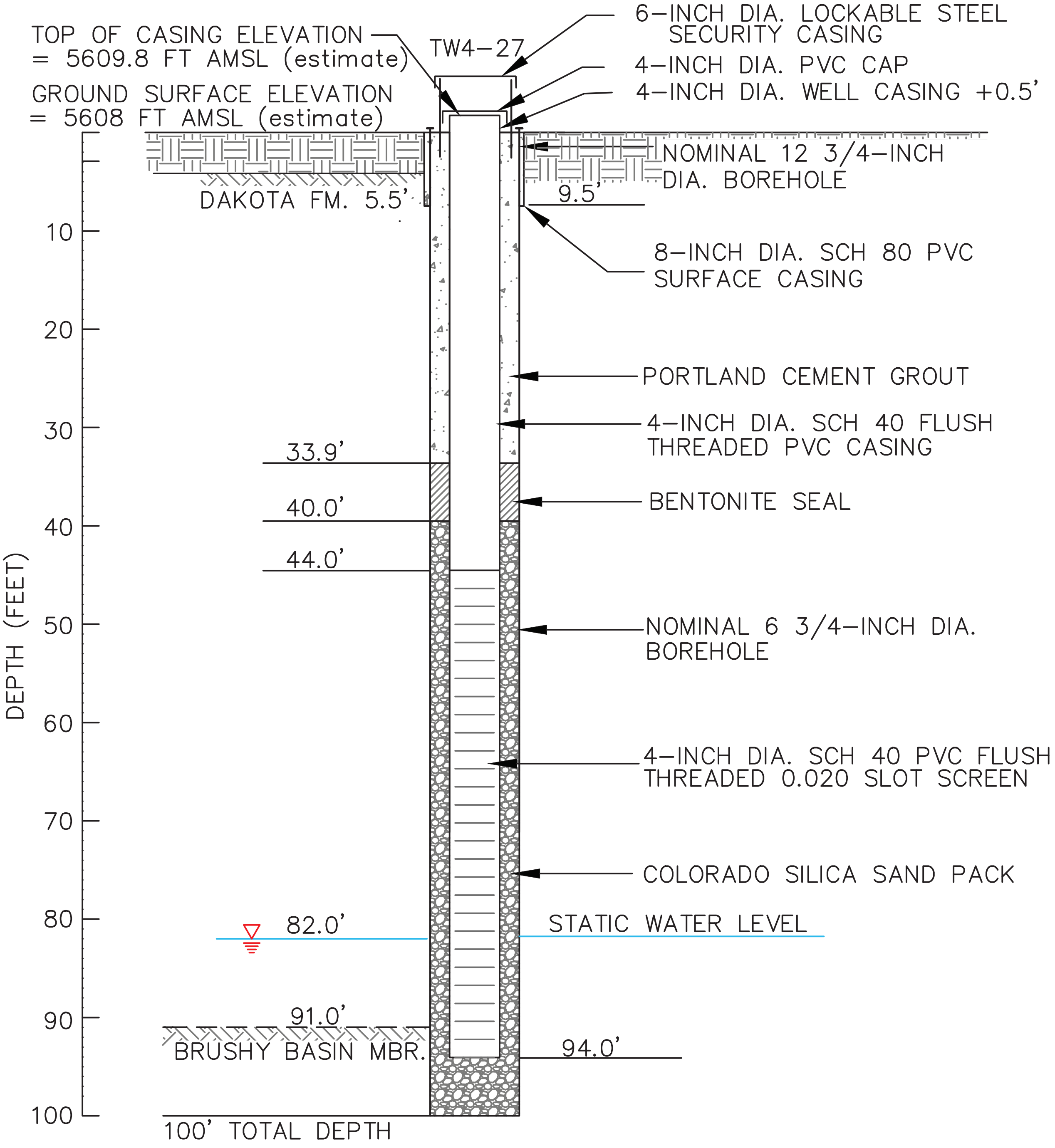
TW4-26
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	07/21/10	AMC	07/21/10	7180247A	**2**



NOT TO SCALE

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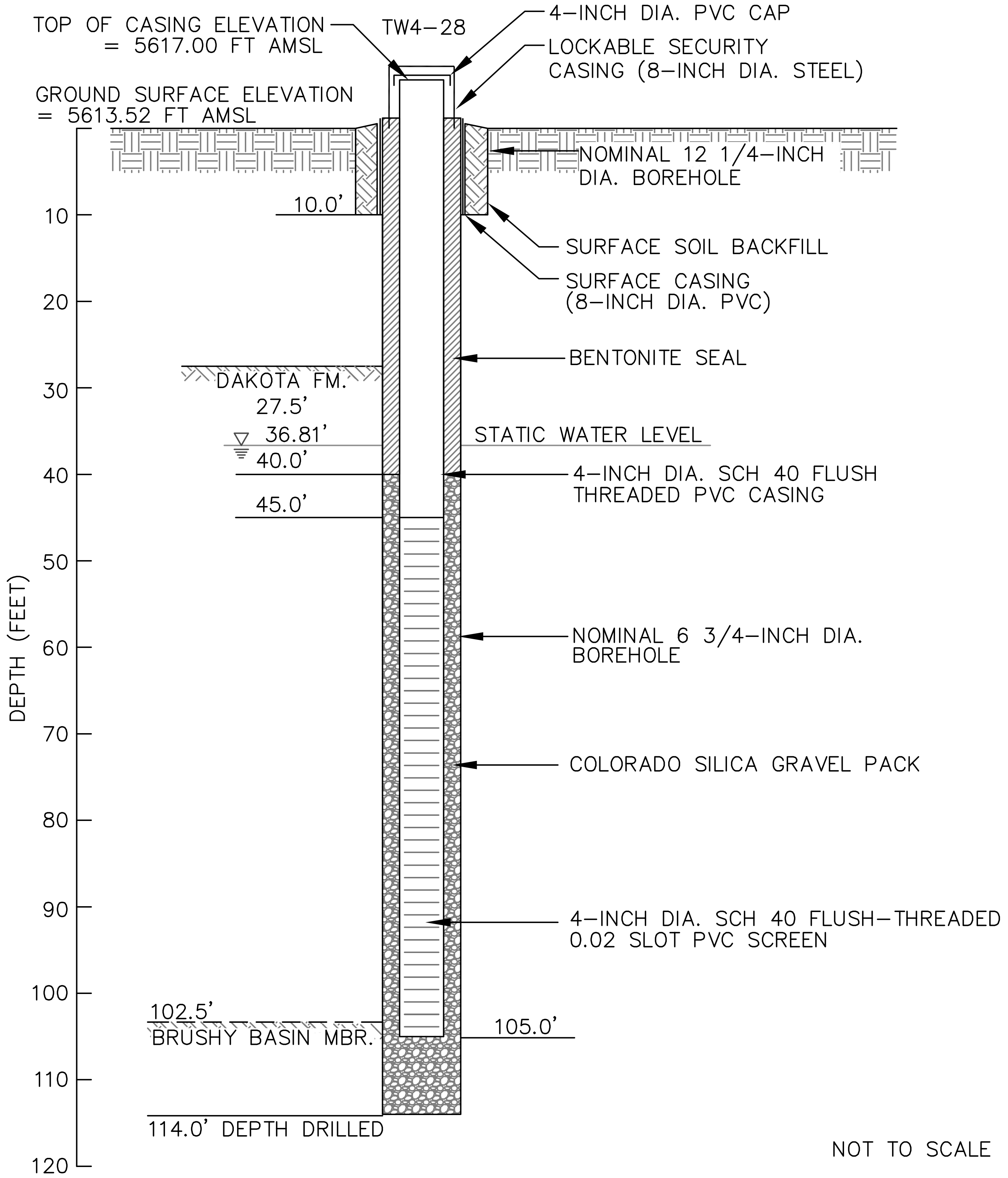
TW4-27
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Reference	Figure
SJS	10/25/11	K:\7180272A Well Construction Diagram	2



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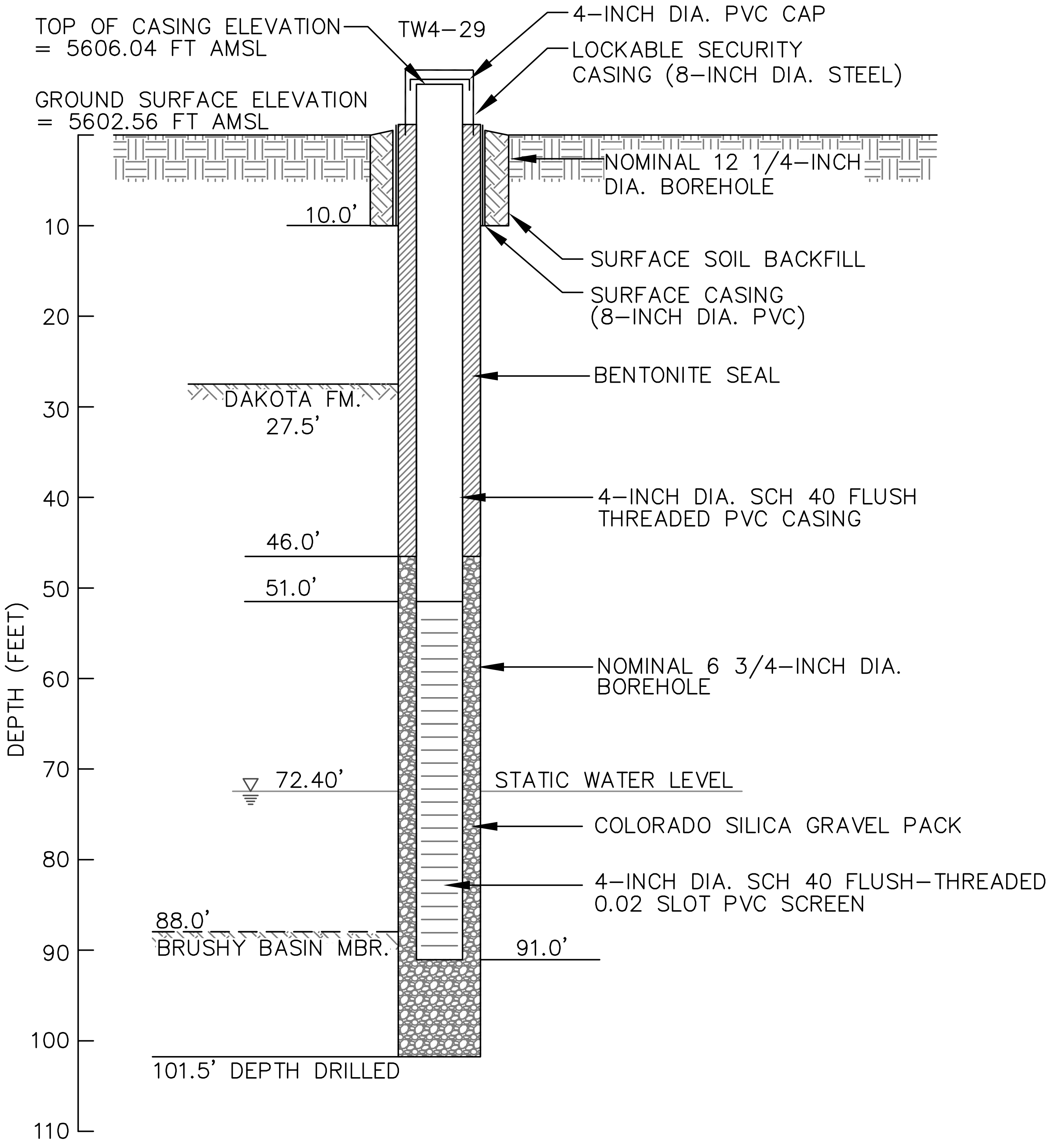
TW4-28
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	3/29/13	CAD	4/19/13	7180273A	2



NOT TO SCALE

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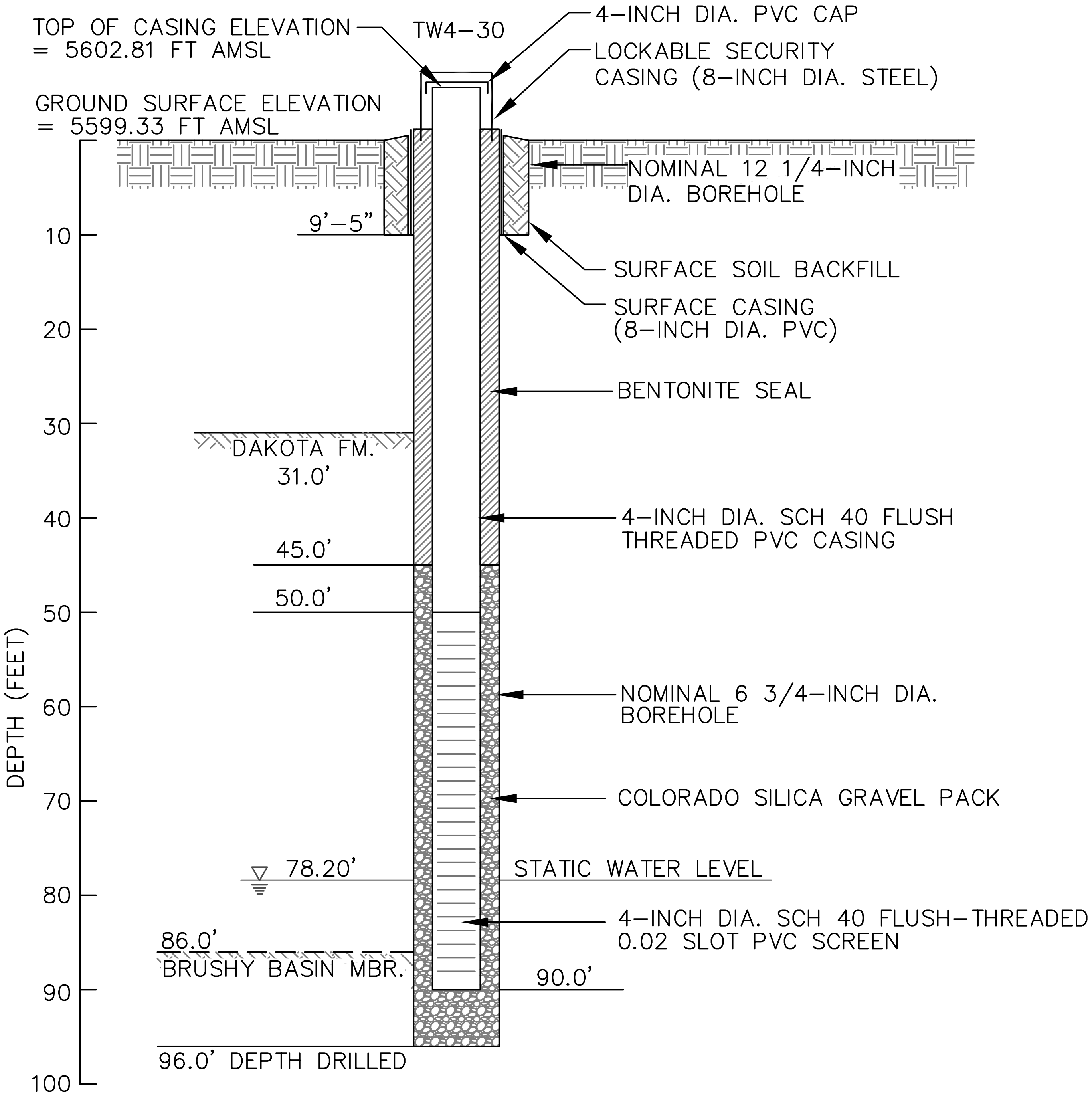
TW4-29
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	4/02/13	CAD	4/19/13	7180274A	3

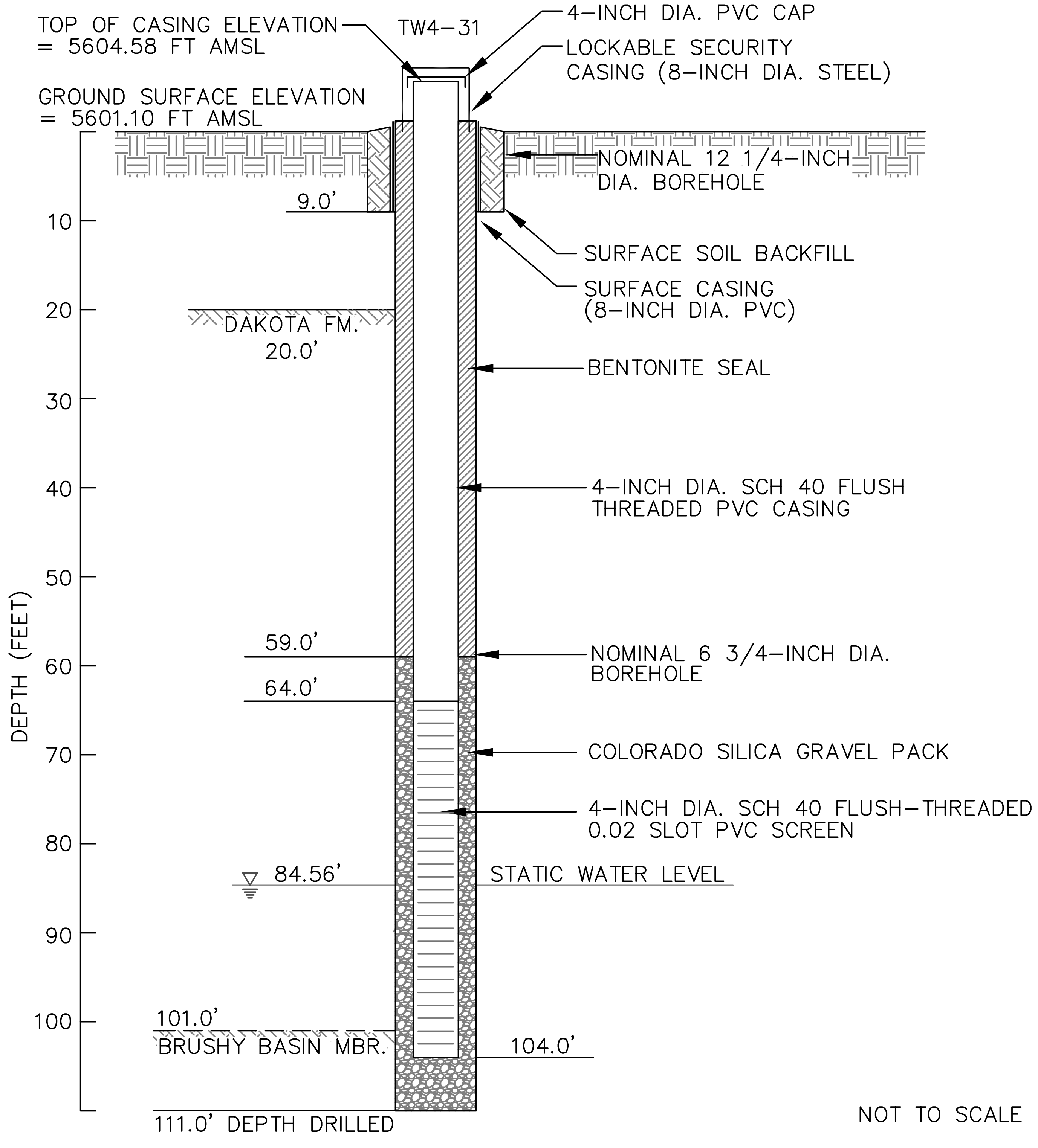


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TW4-30
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	4/02/13	CAD	4/19/13	7180275A	4



HYDRO
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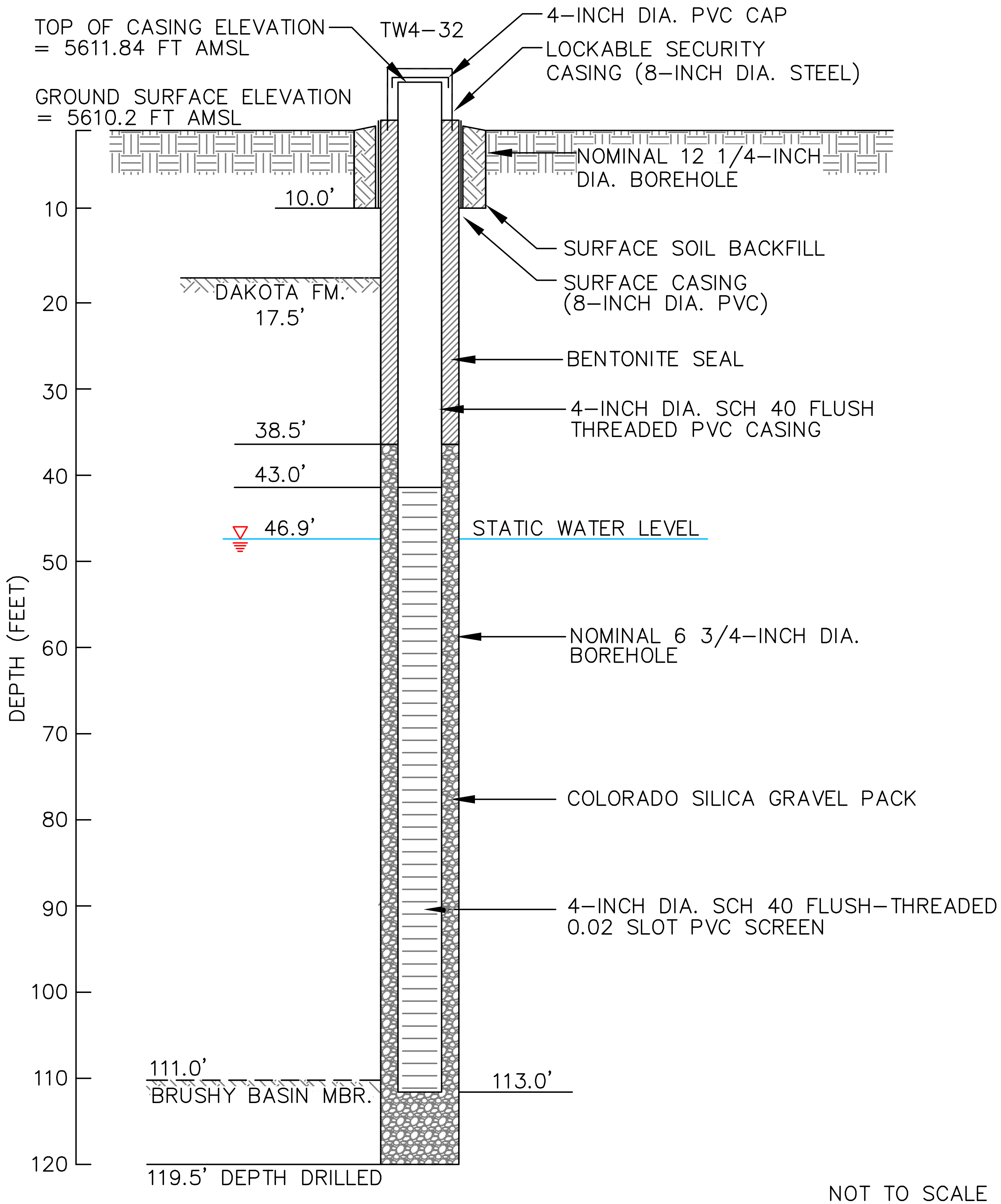
CHEM, INC.

TW4-31
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	4/02/13	CAD	4/19/13	7180276A	5



NOT TO SCALE

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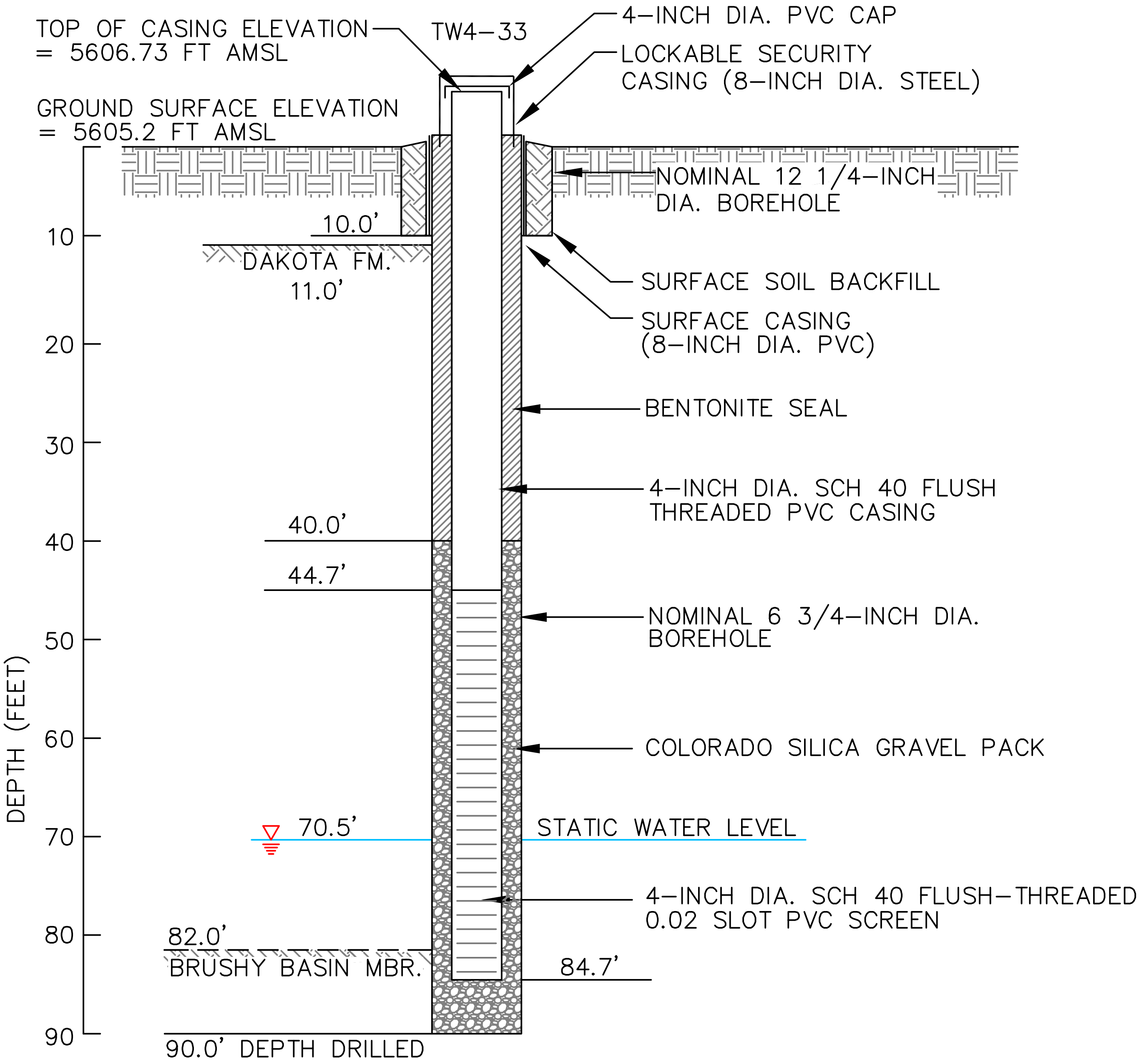
GEO
CHEM, INC.

TW4-32
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	10/04/13	JAA	10/04/13	7180277A	2

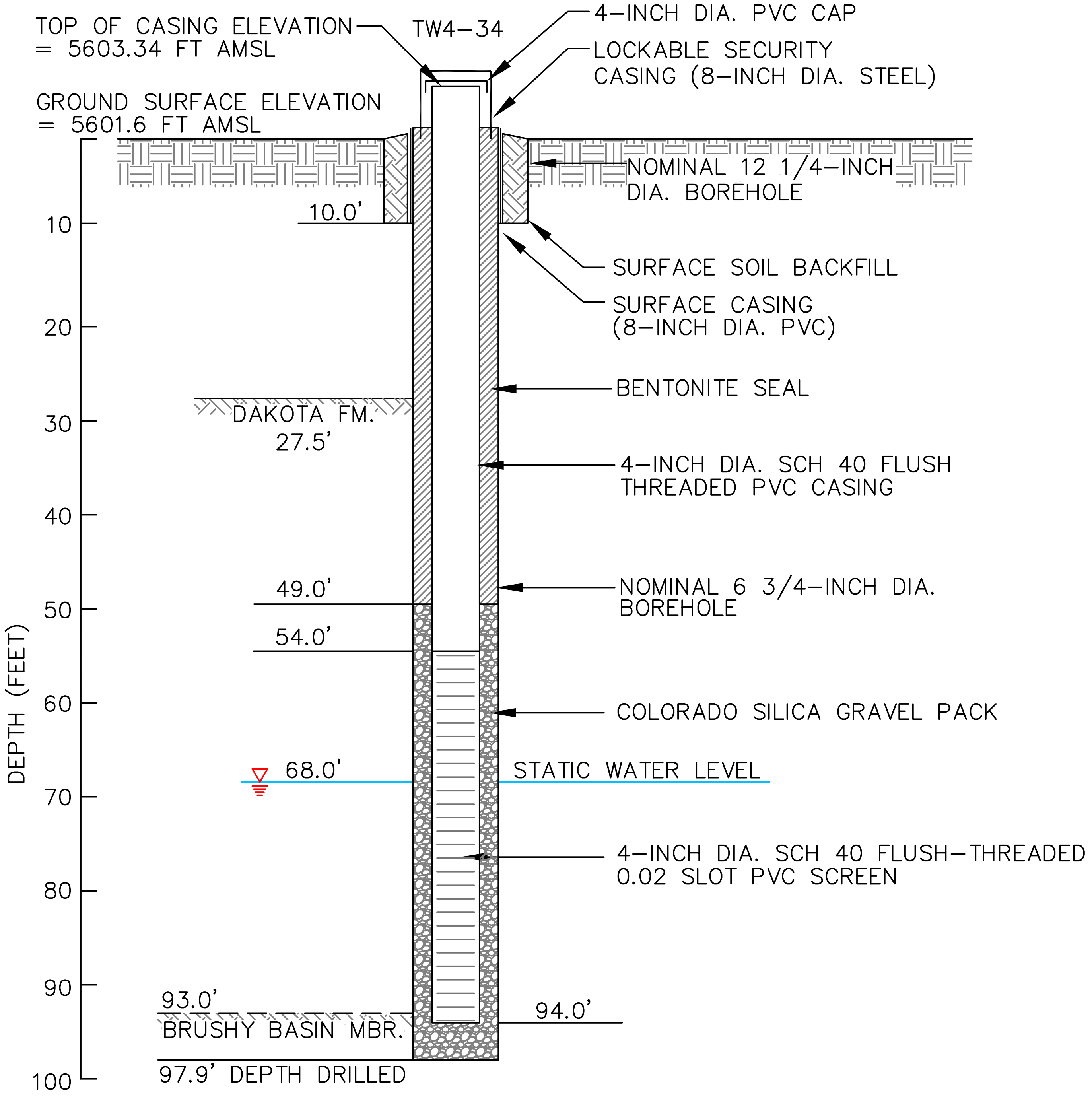


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TW4-33
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	10/04/13	JAA	10/04/13	7180278A	3



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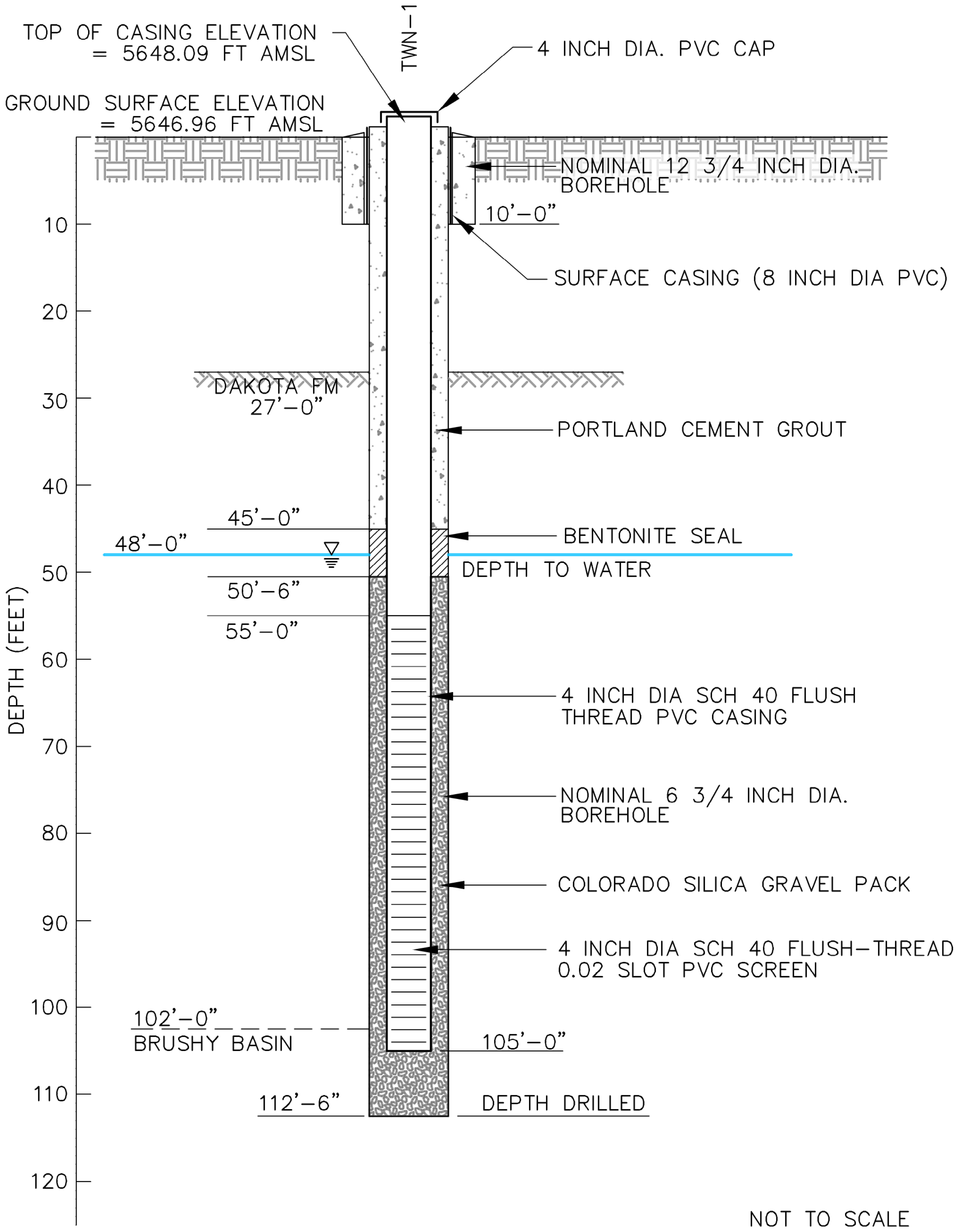
HYDRO
GEO
CHEM, INC.

TW4-34
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SJS	10/04/13	JAA	10/04/13	7180279A	4

APPENDIX B.4

TWN - SERIES



HYDRO
GEO
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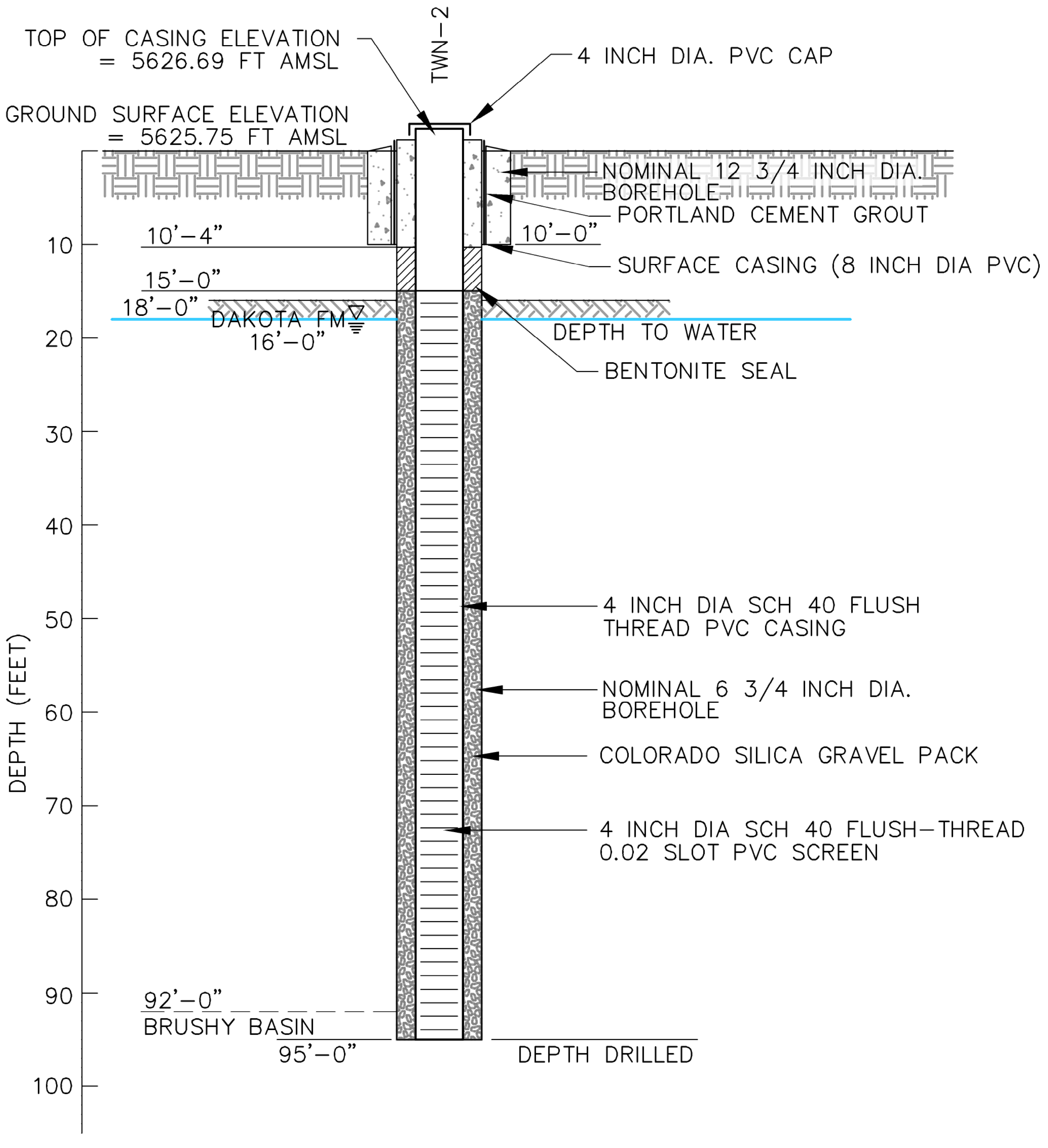
TWN-1
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180222A	2

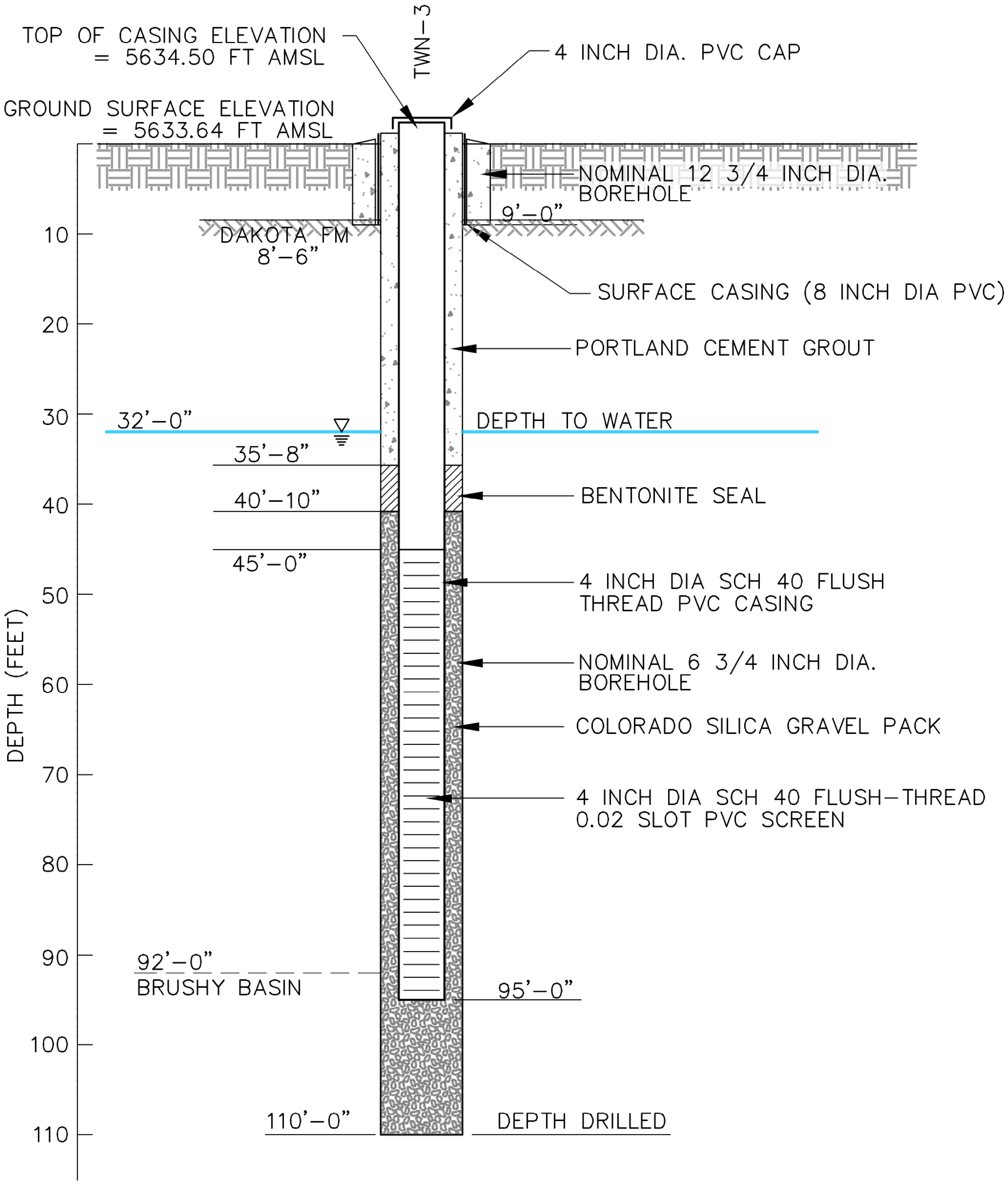


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-2
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180223A	3

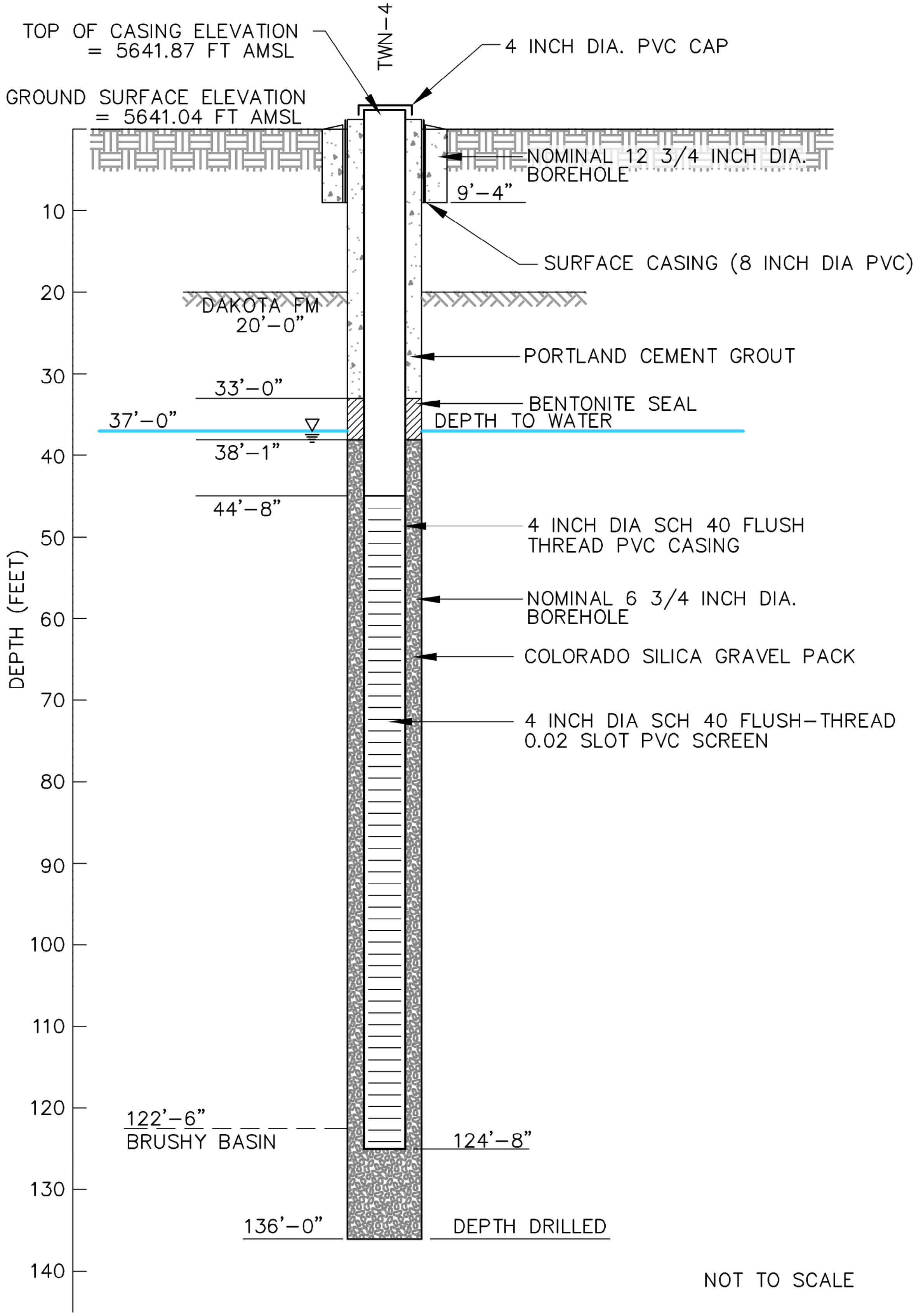


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-3
AS-BUILT WELL CONSTRUCTION SCHEMATIC

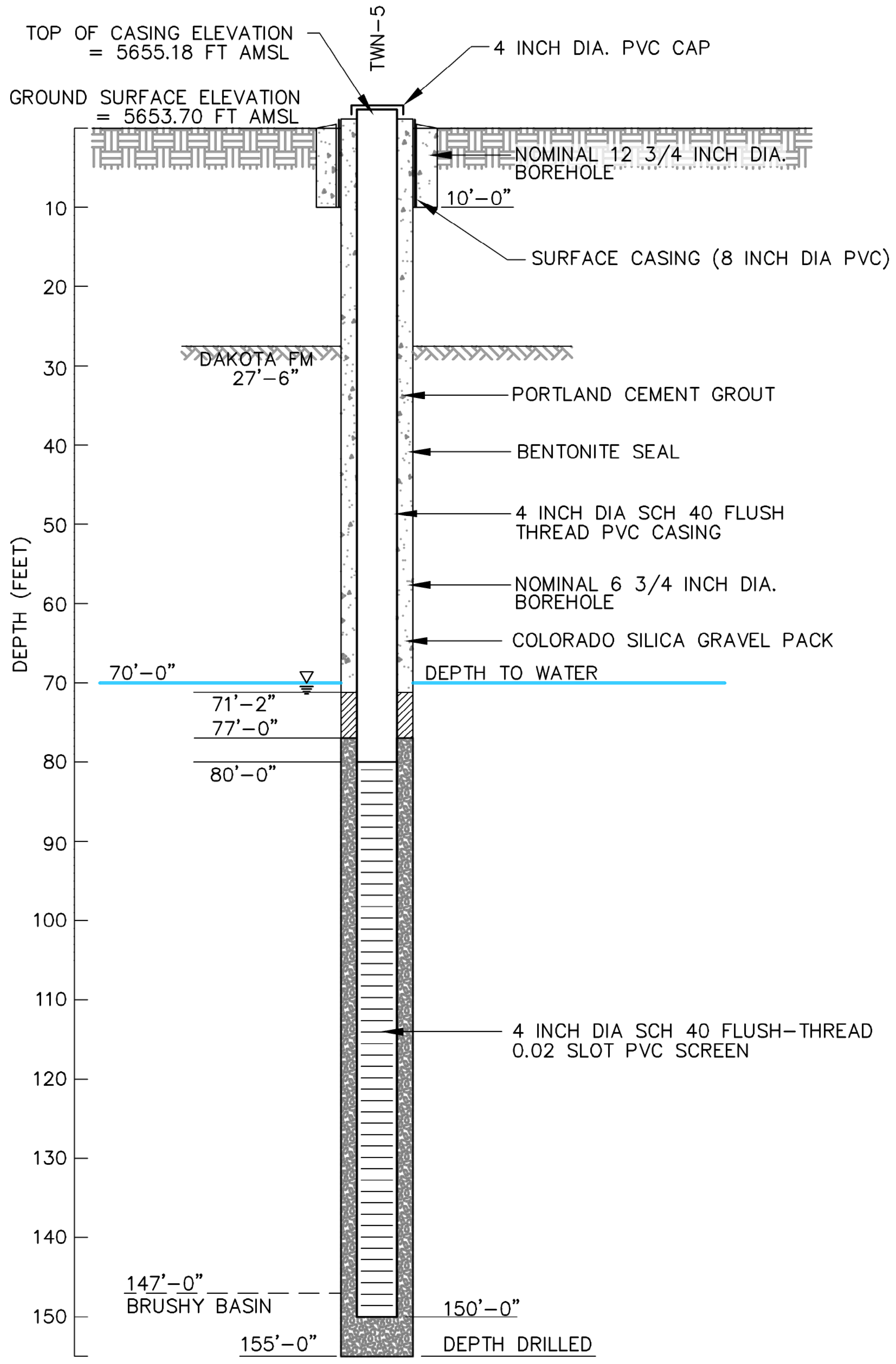
Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180224A	4



HYDRO
GEO
CHEM, INC.

TWN-4
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180225A	5

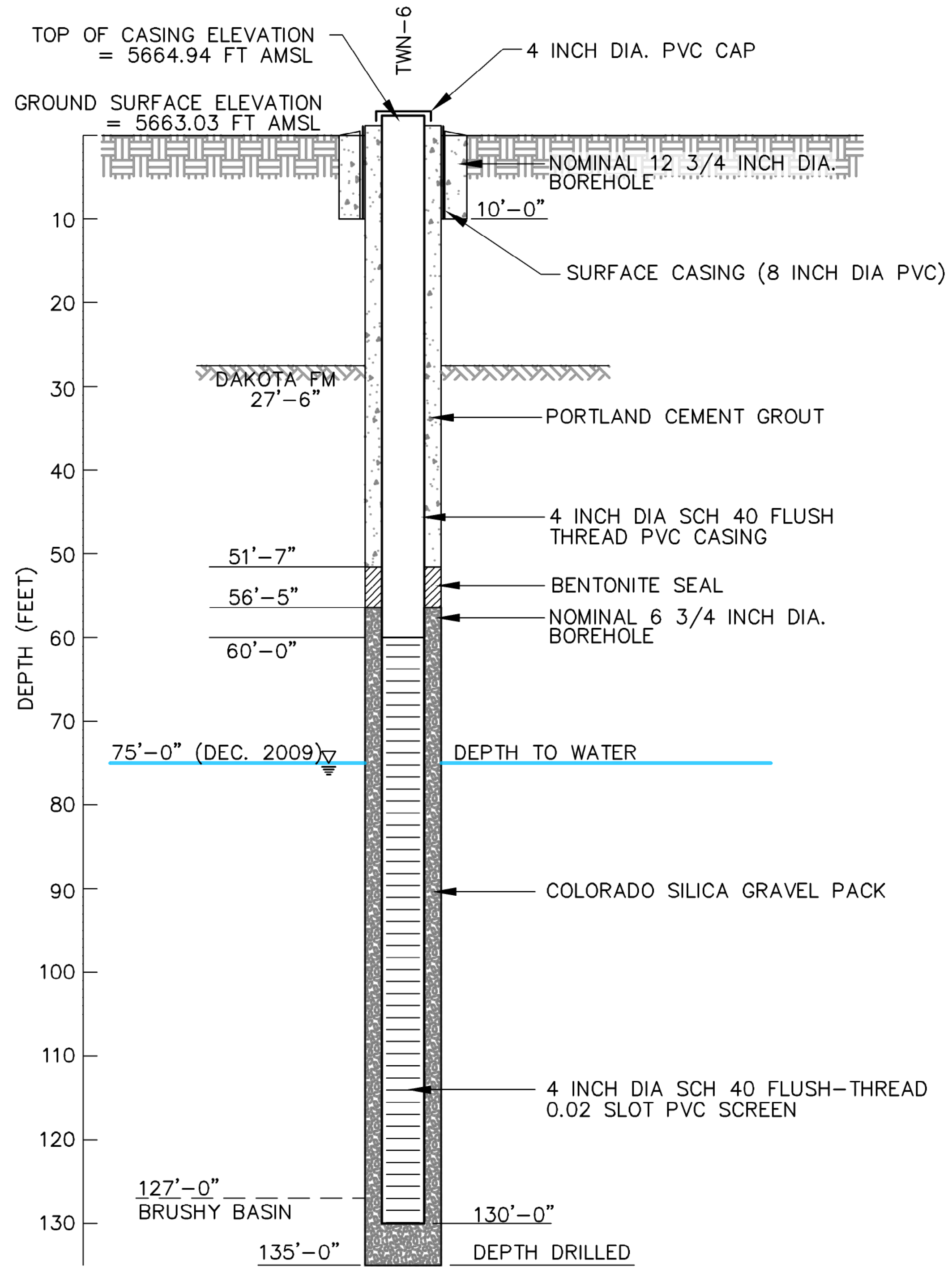


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-5
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180226A	6



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HYDRO
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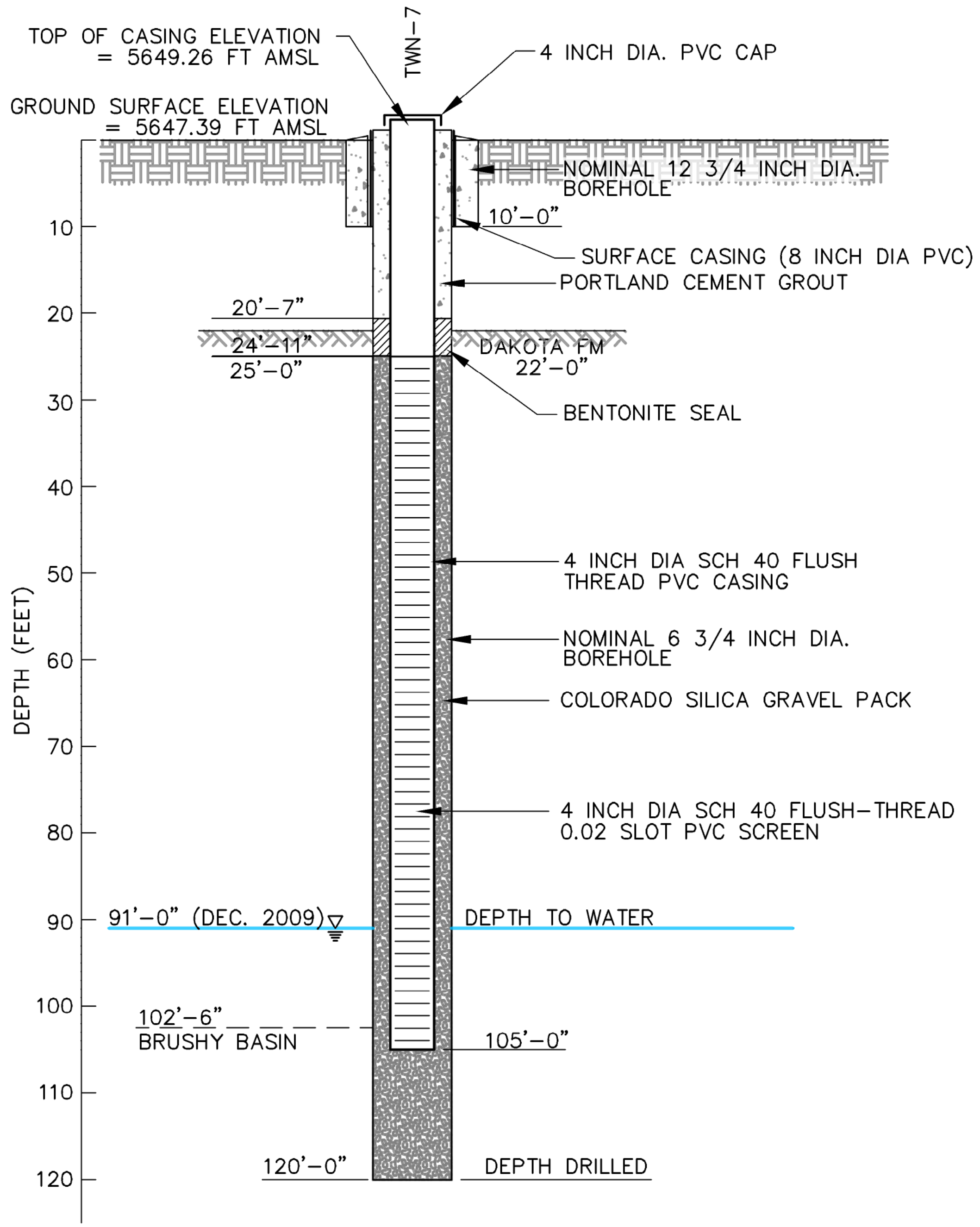
CHEM, INC.

TWN-6
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180227A	7



NOTE: TWN-7 WAS INSTALLED DRY

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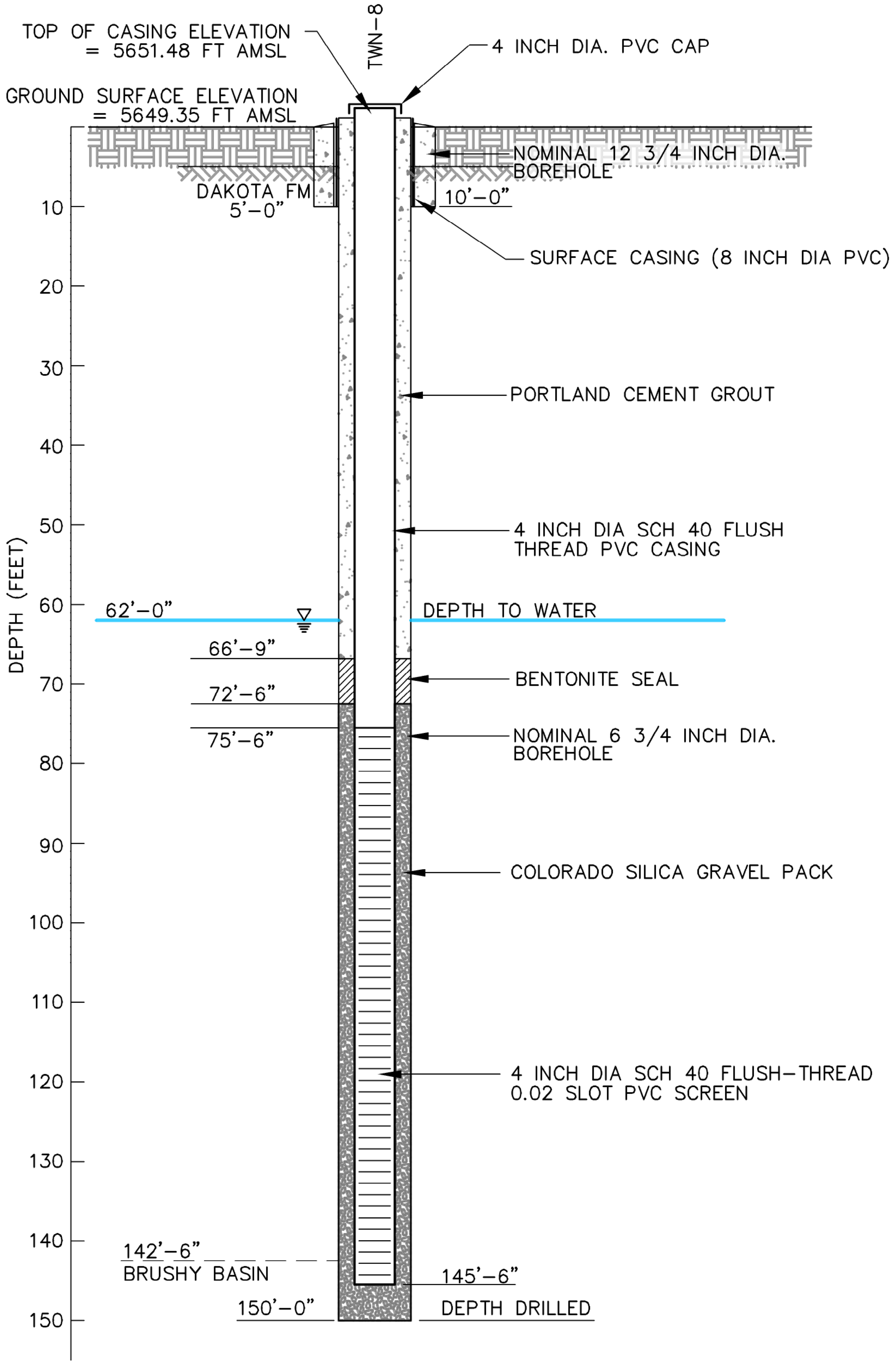
GEO
CHEM, INC.

TWN-7
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180228A	8



NOT TO SCALE

HYDRO
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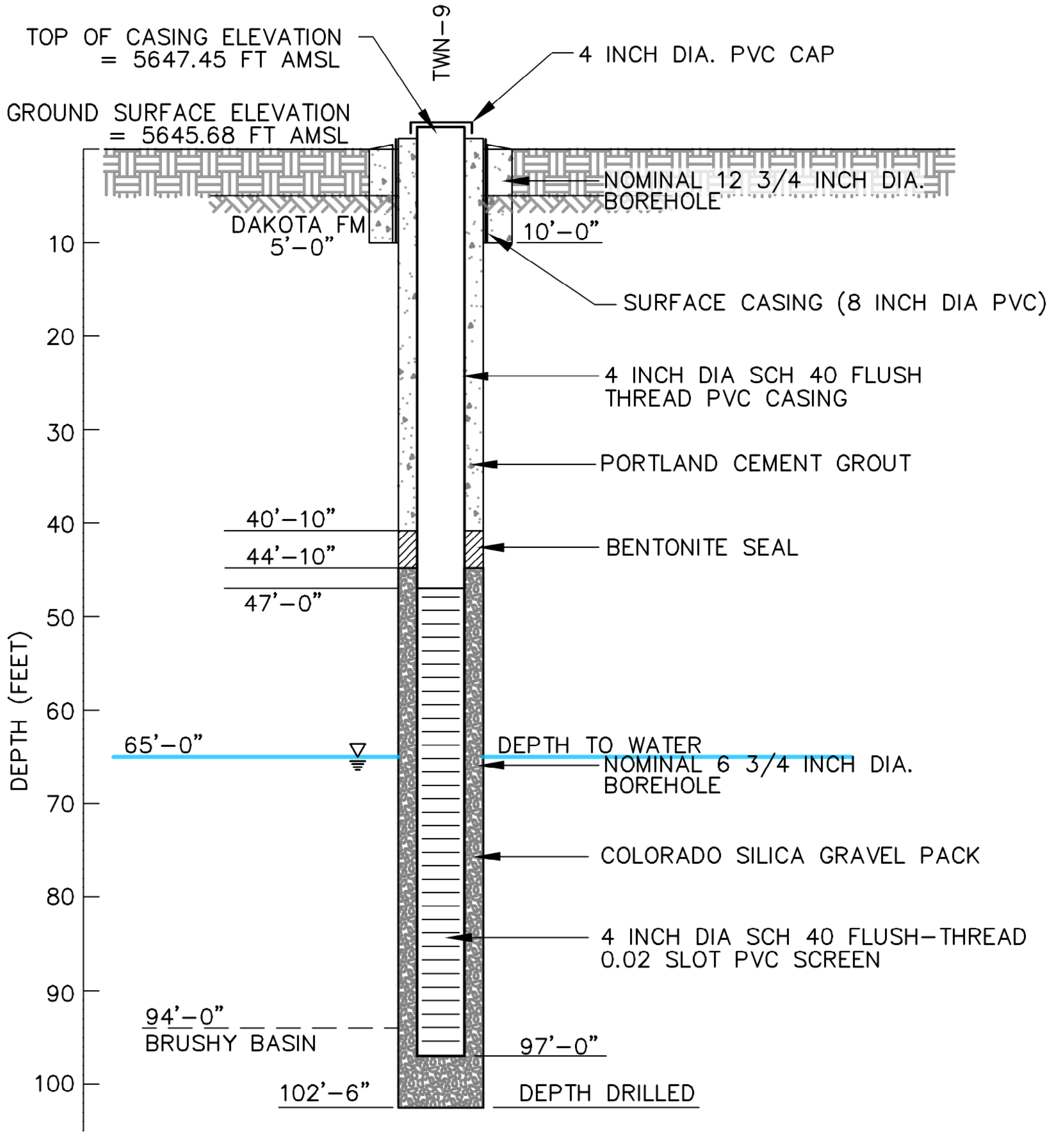
CHEM, INC.

TWN-8
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180229A	9

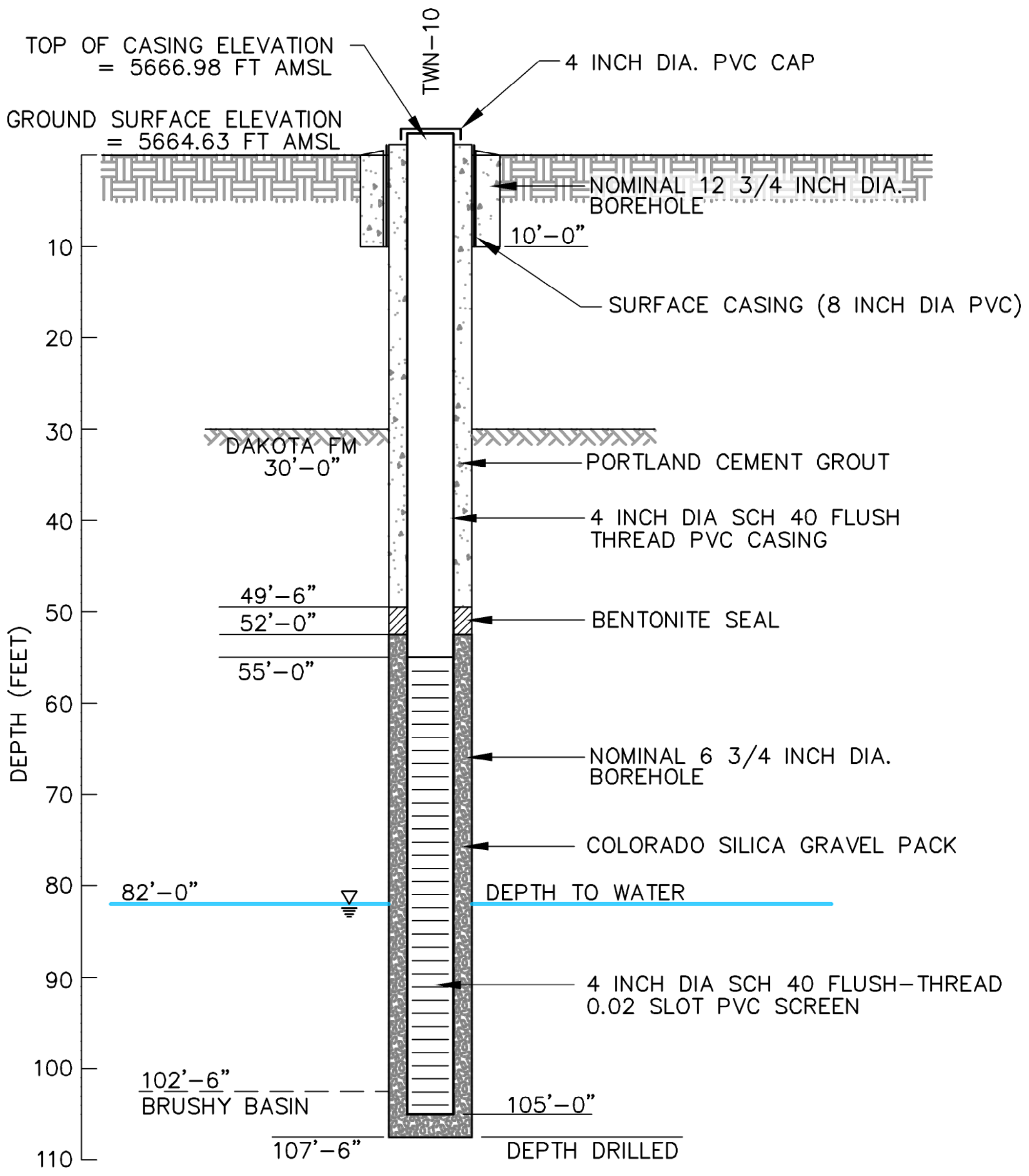


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-9
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180230A	10

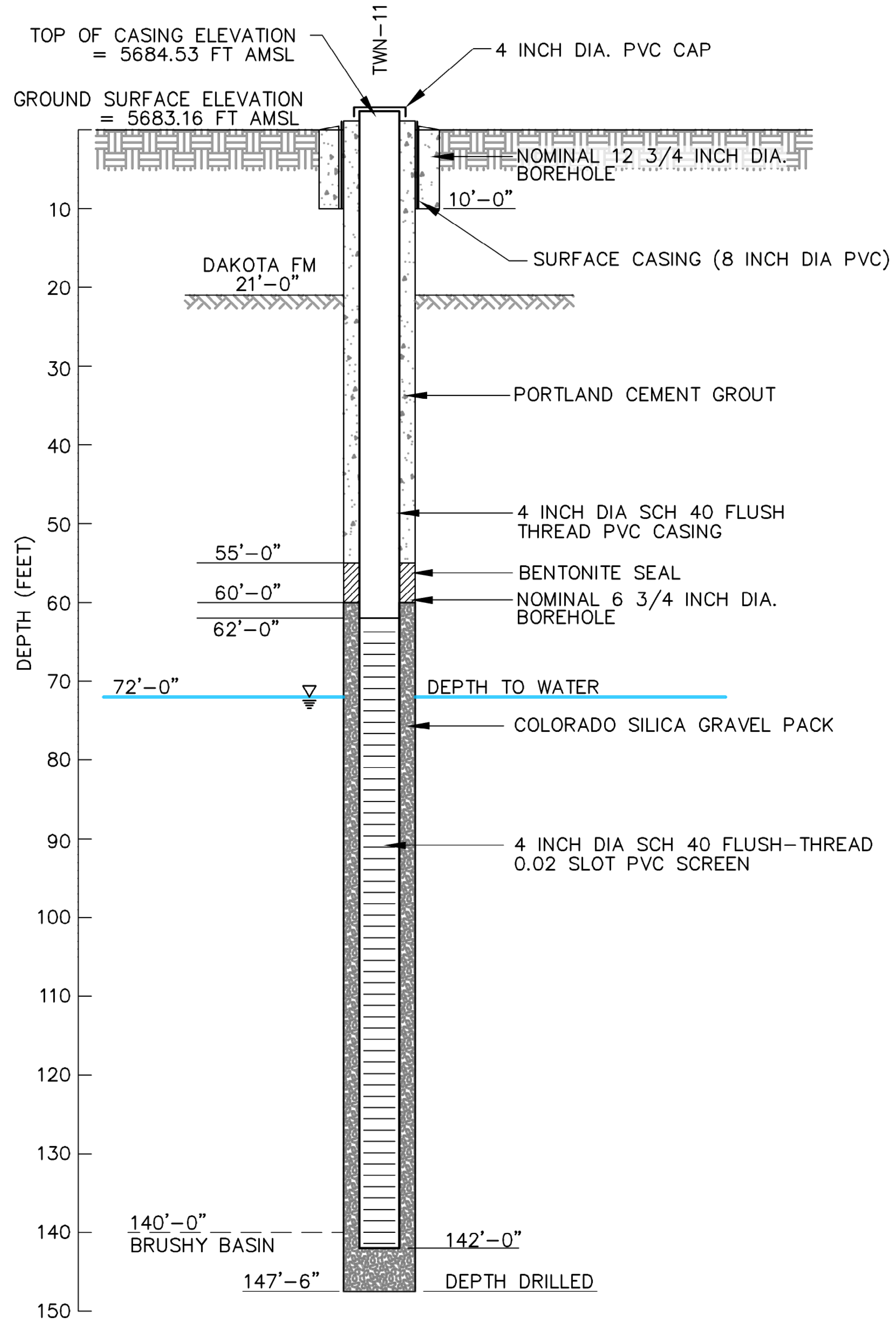


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-10
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180231A	11

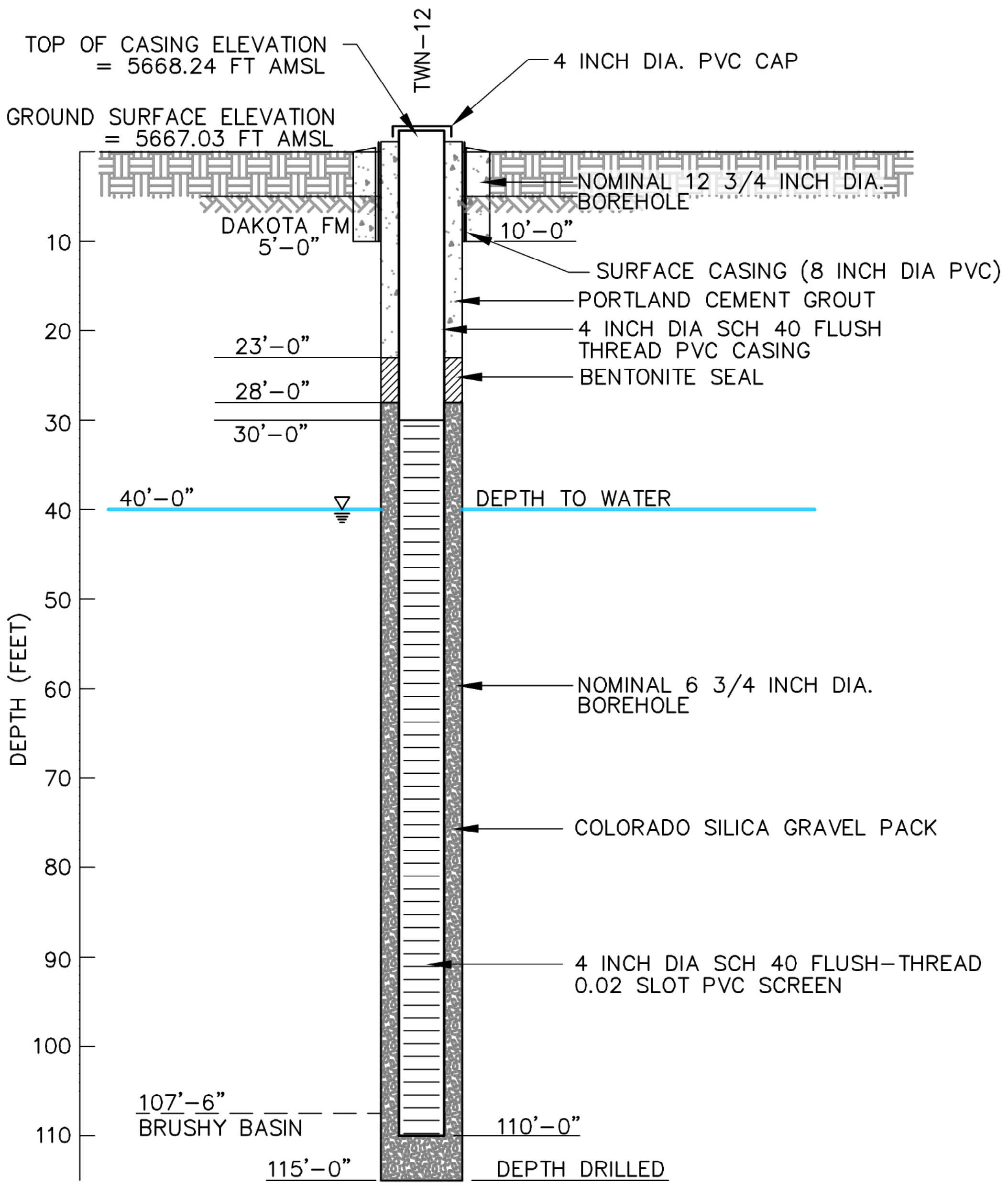


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-11
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180232A	12

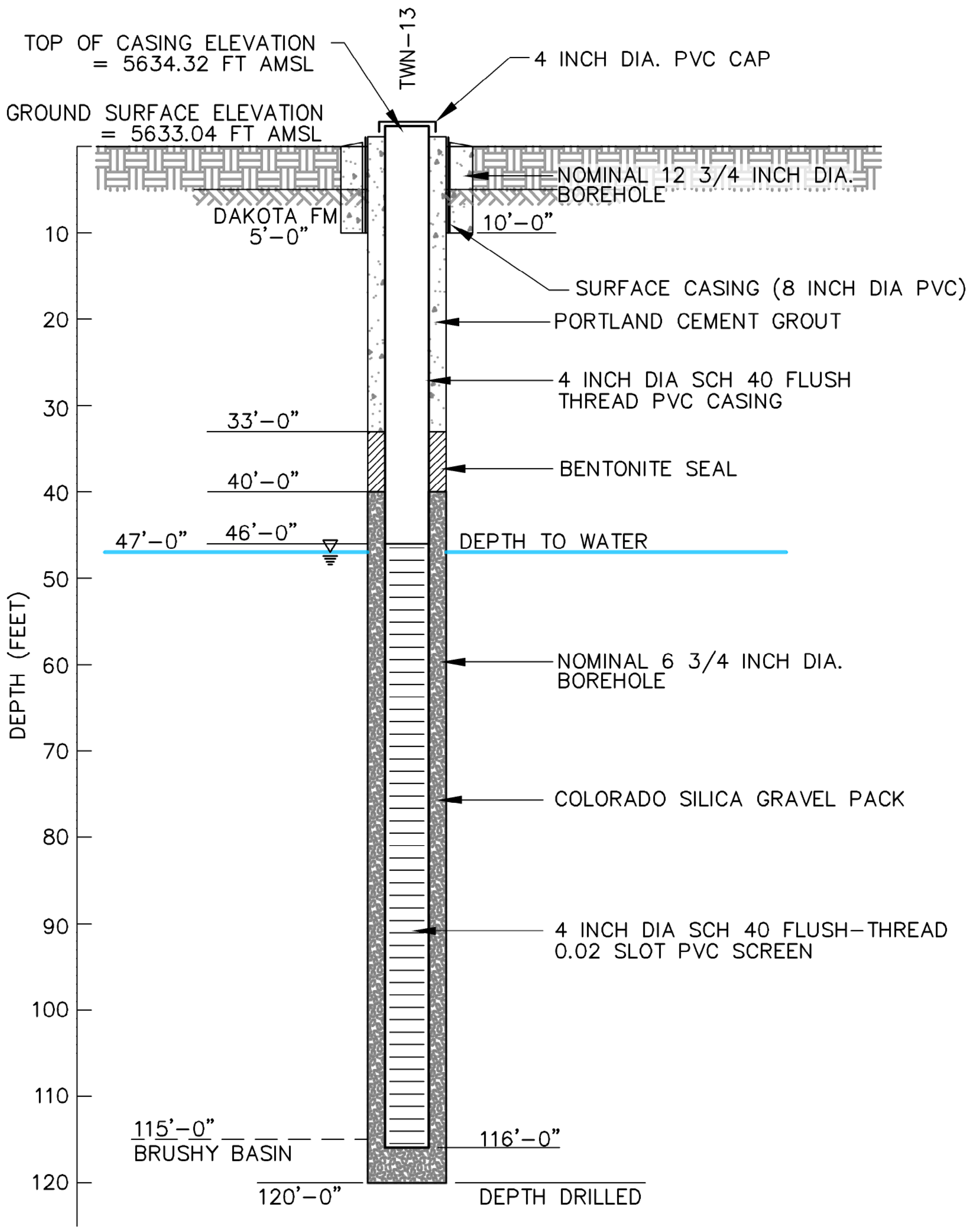


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-12
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180233A	13

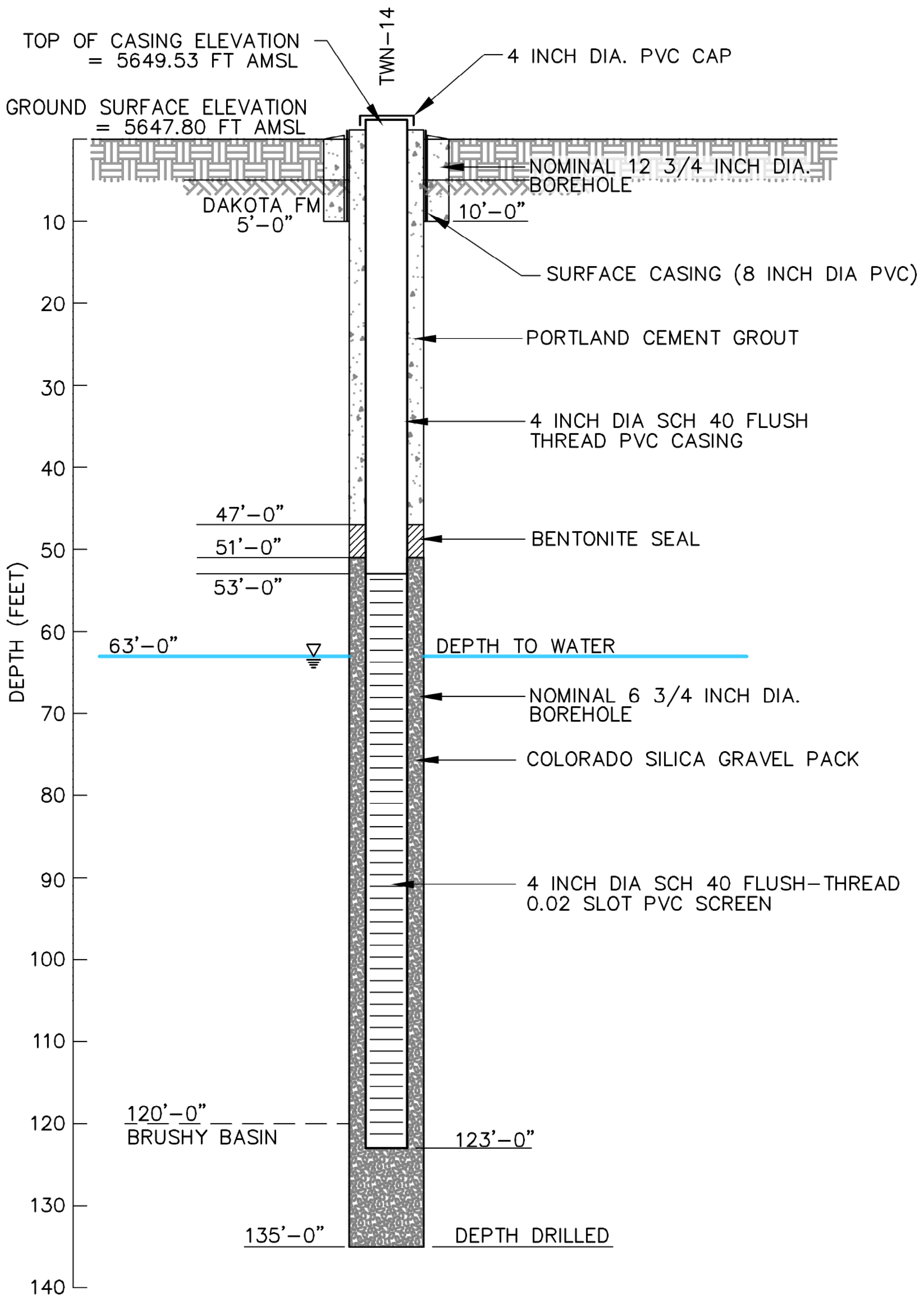


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-13
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180234A	14

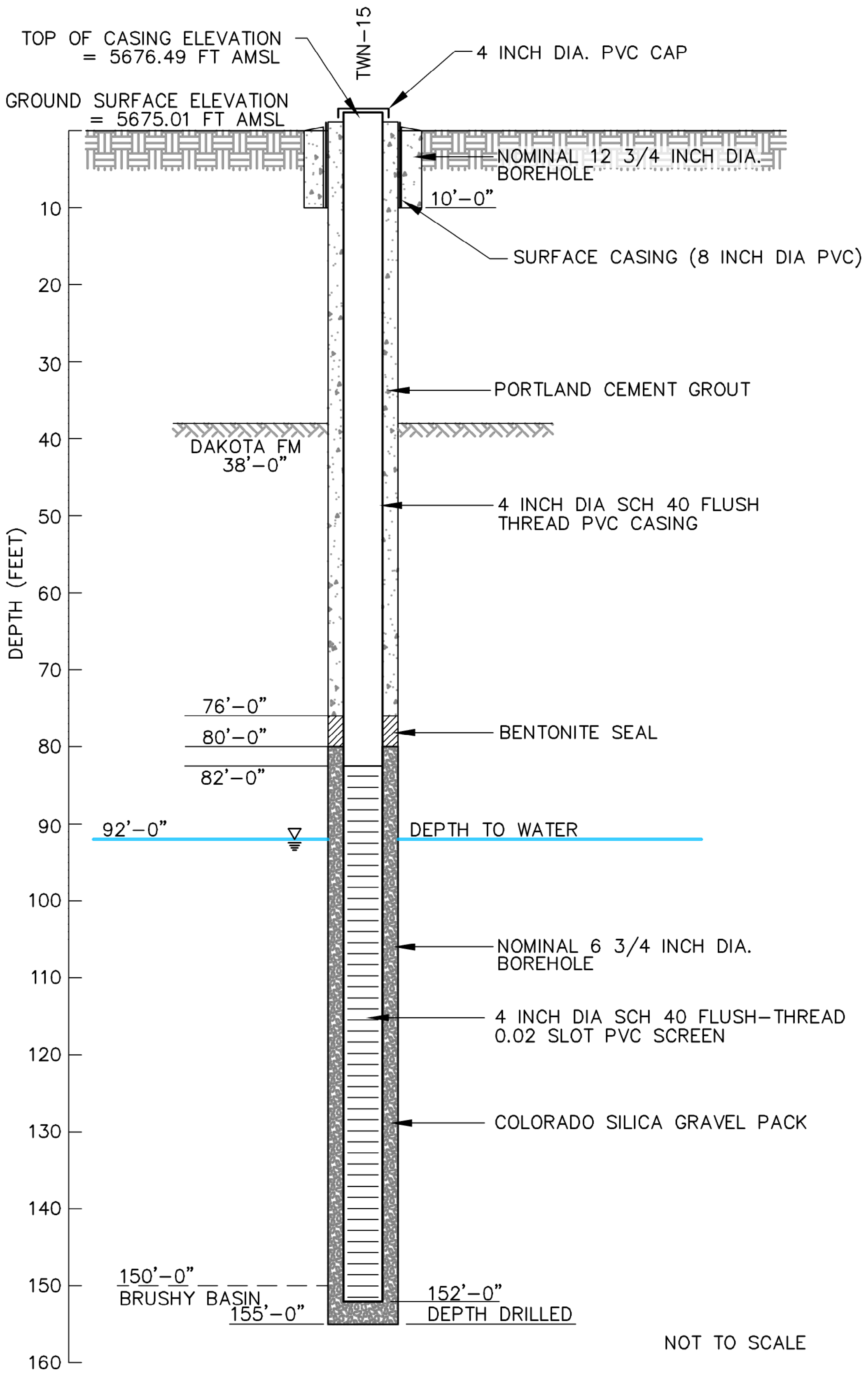


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-14
AS-BUILT WELL CONSTRUCTION SCHEMATIC

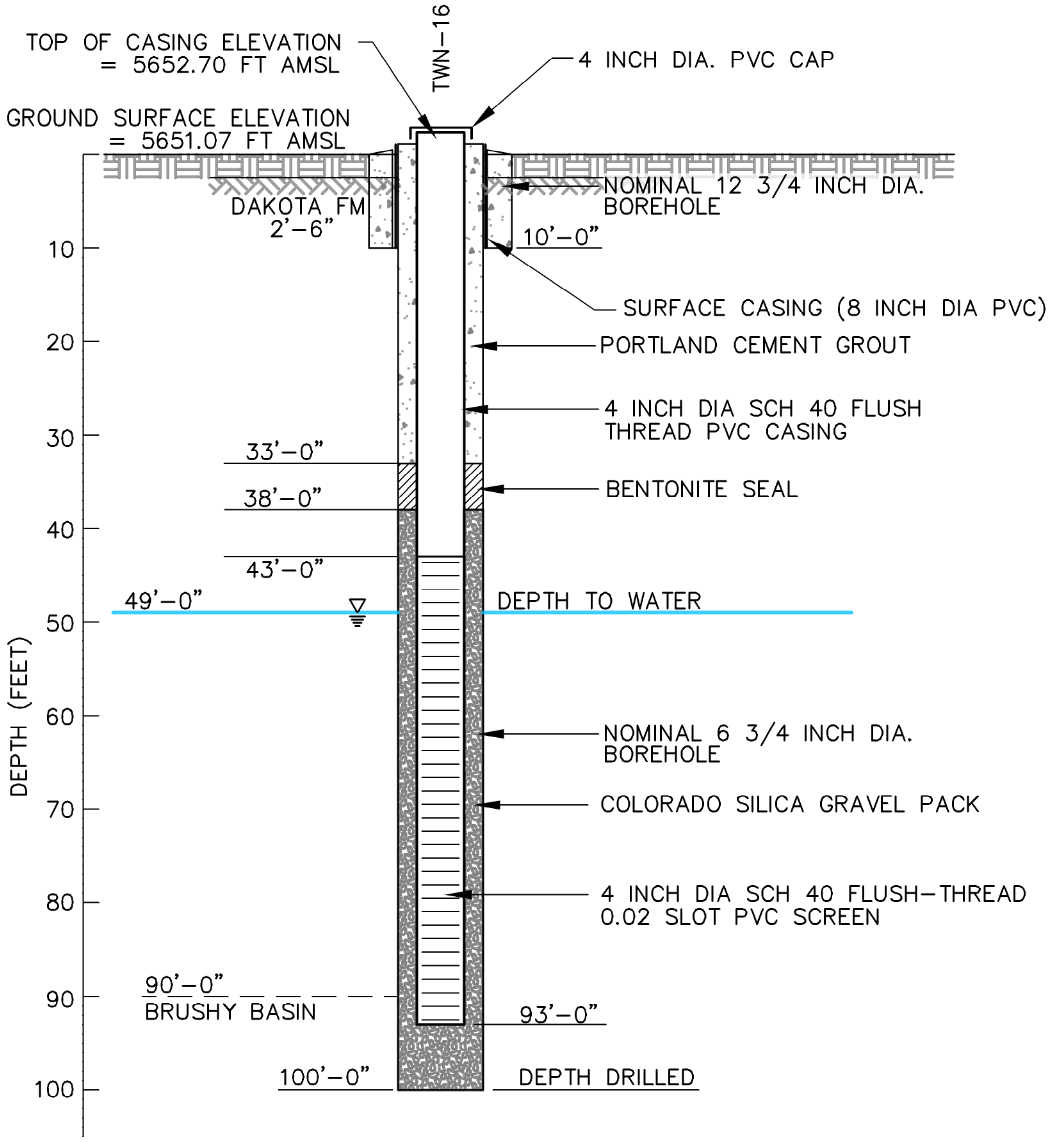
Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180235A	15



HYDRO
GEO
CHEM, INC.

TWN-15
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180236A	16

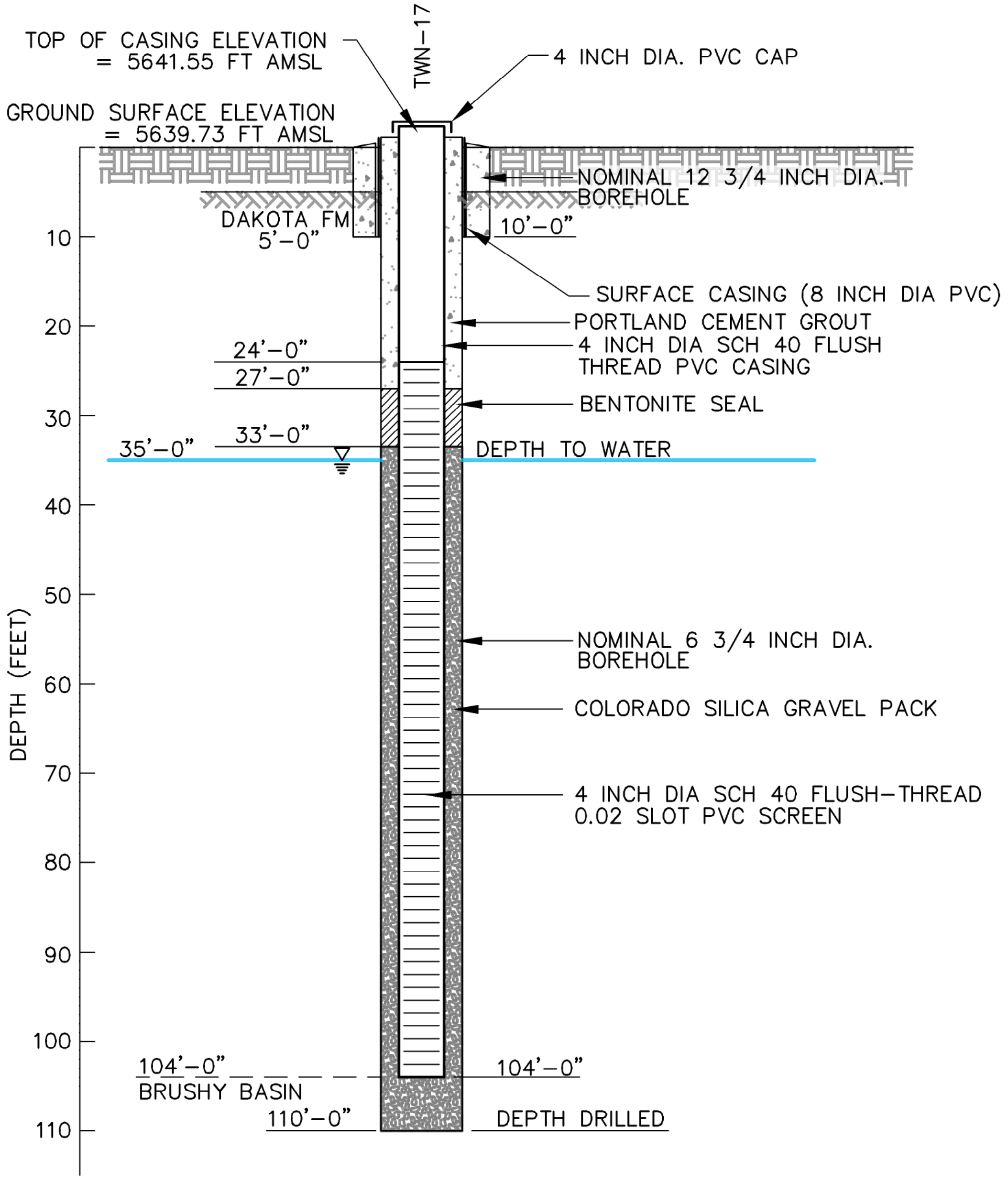


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-16
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180237A	17

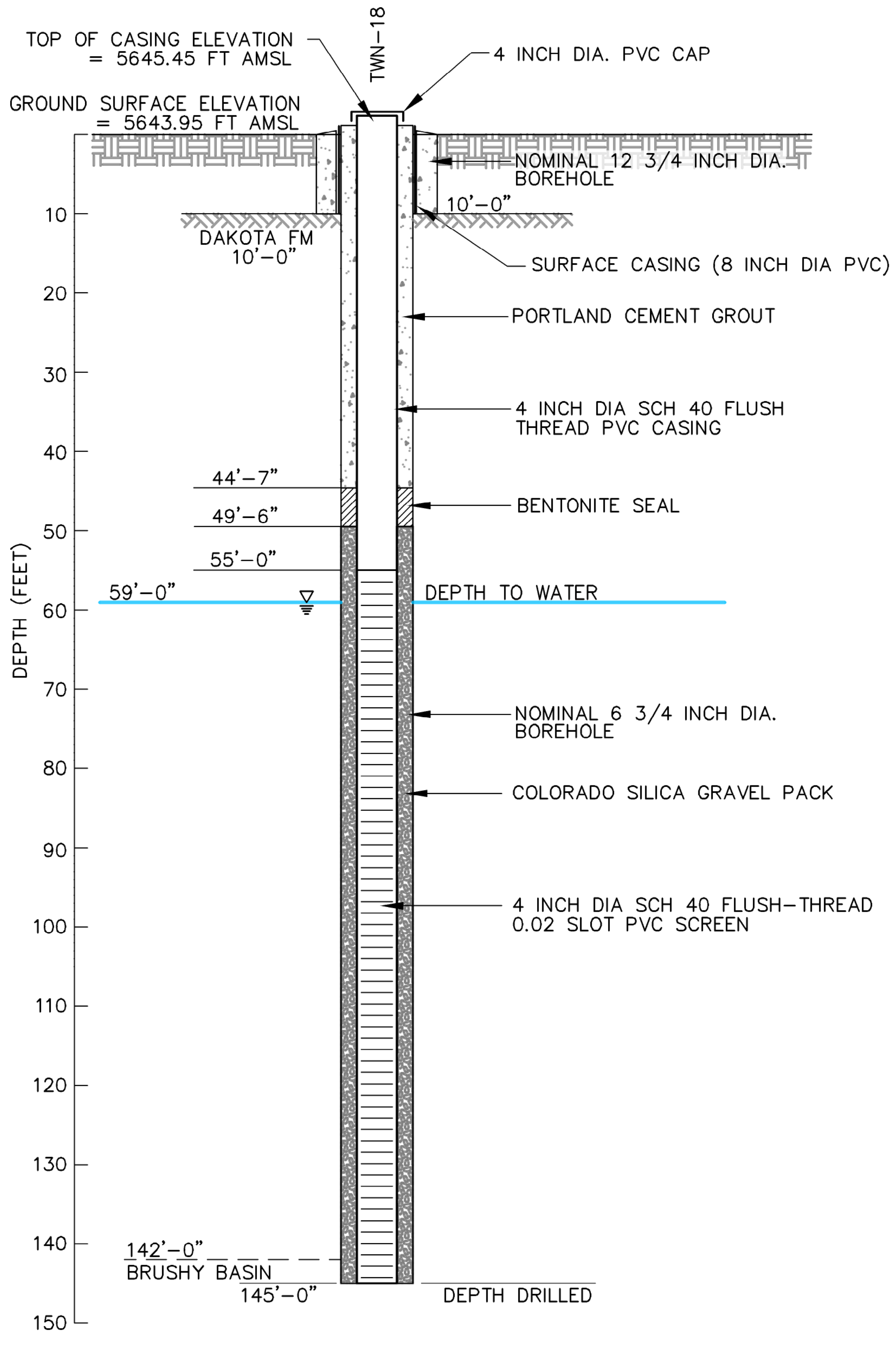


NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-17
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180238A	18

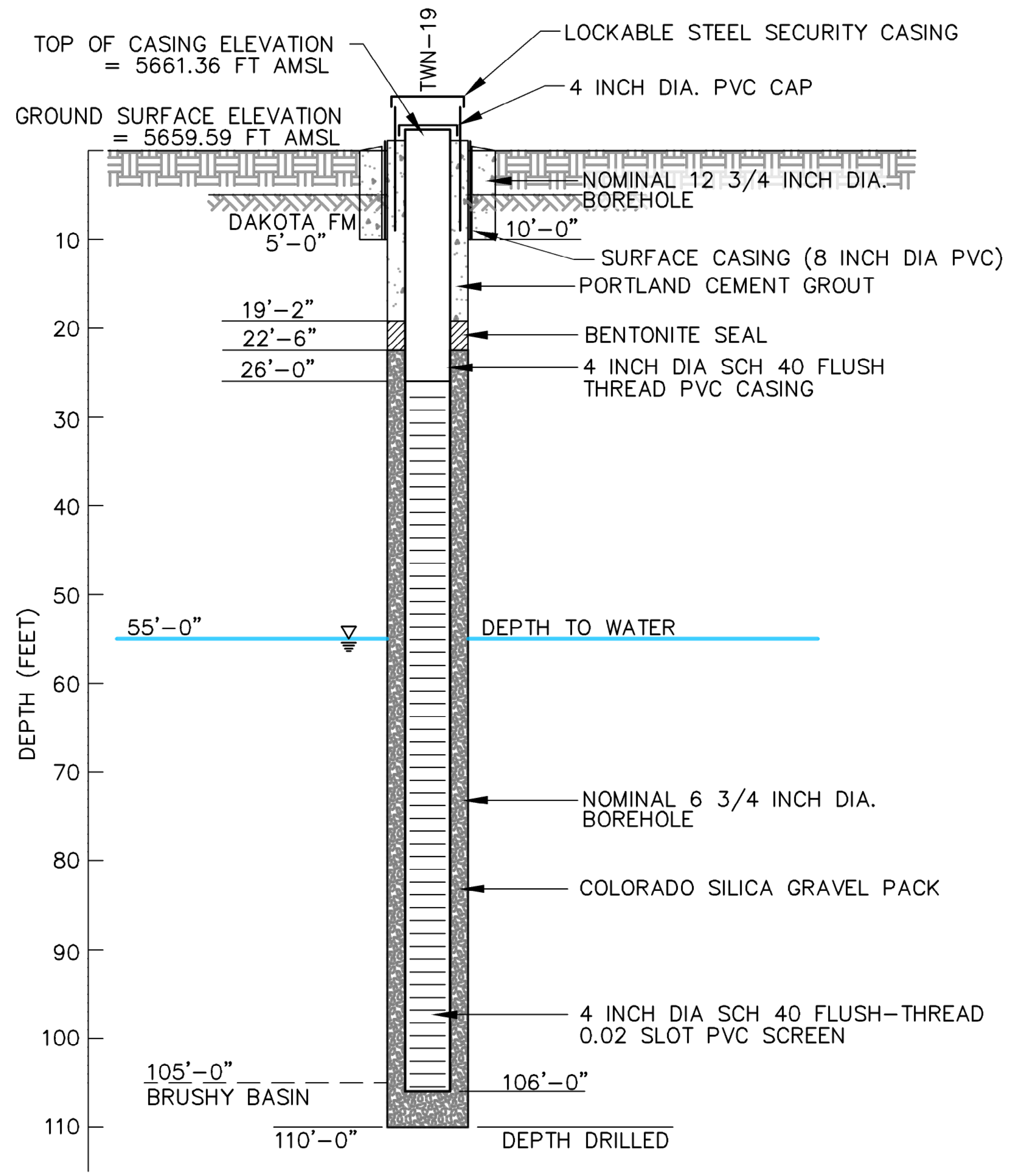


NOT TO SCALE

HYDRO GEO CHEM, INC.

TWN-18
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180239A	19



NOT TO SCALE

HYDRO
GEO
CHEM, INC.

TWN-19
AS-BUILT WELL CONSTRUCTION SCHEMATIC

Approved	Date	Author	Date	File Name	Figure
SS	03/04/10	AMC	03/04/10	7180240A	20

APPENDIX C

INTERA SOIL BORING LOGS

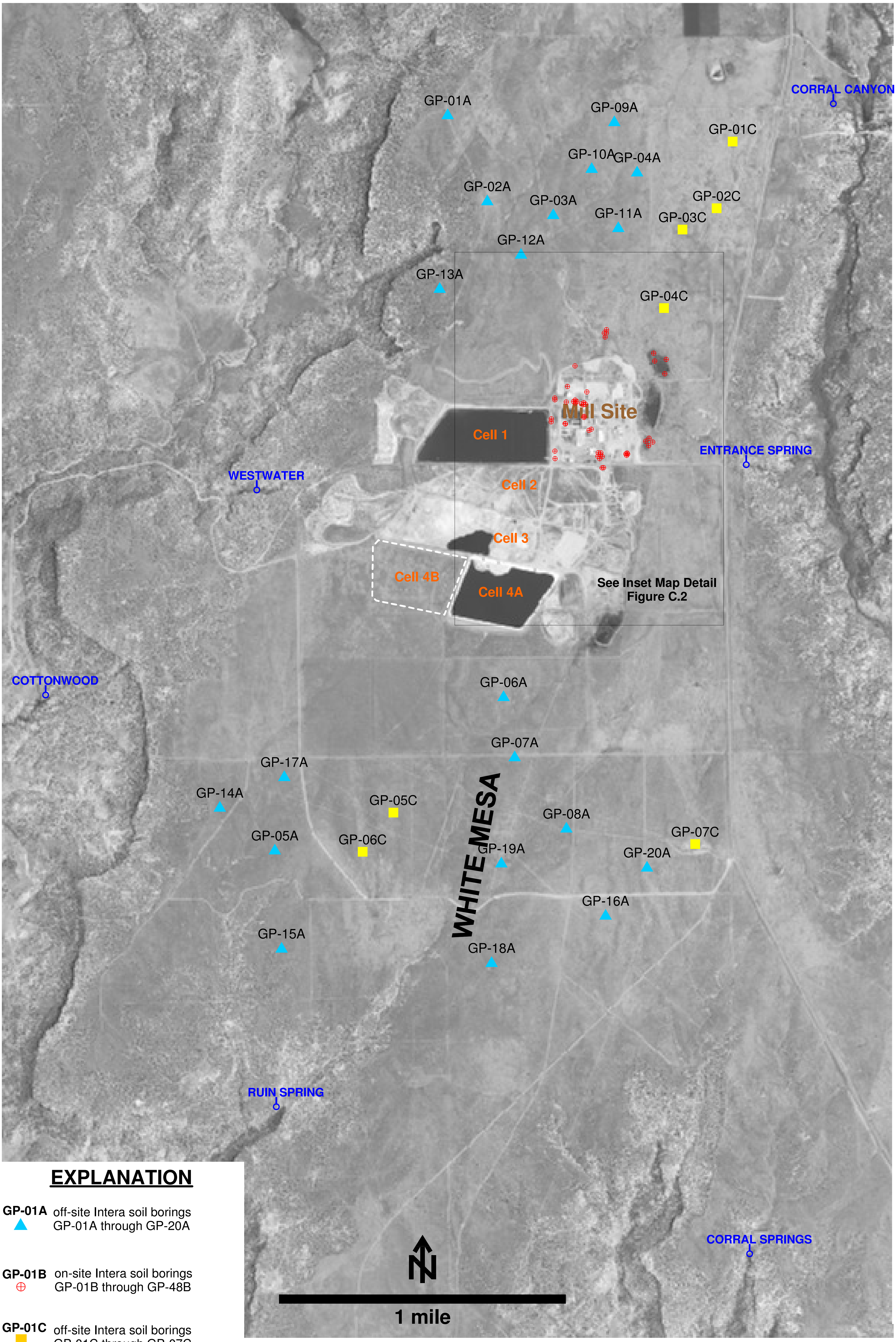
APPENDIX C
INTERA SOIL BORING LOGS SUMMARY

In May and June 2011, INTERA, Inc. installed 75 soil borings in the vicinity of the mill site. Borings GP-01A1 through GP-02A1 and GP-01C through GP-07C were installed to the north and south of the mill site and tailings cells; GP-01B through GP-48B were completed within and immediately outside the area of the mill site. Borings were drilled by Earth Worx using the Geoprobe push probe method. Soil samples for lithologic logging were collected using the continuous dual tube method. Locations of soil borings are provided on Figures C.1 and C.2; copies of the boring logs are provided in Appendix C.1.

Soil samples from the GP-A1 and GP-B series borings showed a consistent lithology. Depths of refusal ranged from 2.7 ft bgs to 9.7 ft bgs. Yellowish-red, silty, fine sand predominated from the ground surface to about four to six ft bgs, generally transitioning to pink, silty, fine sand or pink sandstone to the depth of refusal. Roots were occasionally present in the top several feet of the borings.

Soil samples from the GP-C series borings within or near the mill site showed more variable lithology. Depths to refusal were deeper overall than in the GP-A1 and GP-B series borings, and ranged from 1.7 to 24.5 ft bgs. Yellowish-red silty sand predominated in the upper portion of the GP-C borings, from approximately four to 10 ft bgs, and was typically underlain by interbedded reddish clay or clayey silt, and pinkish silt or silty sand to the depth of refusal. Gypsum precipitate was commonly seen in the lower portions of the GP-C series borings, and fine gravel was present in low proportions in multiple borings.

FIGURES



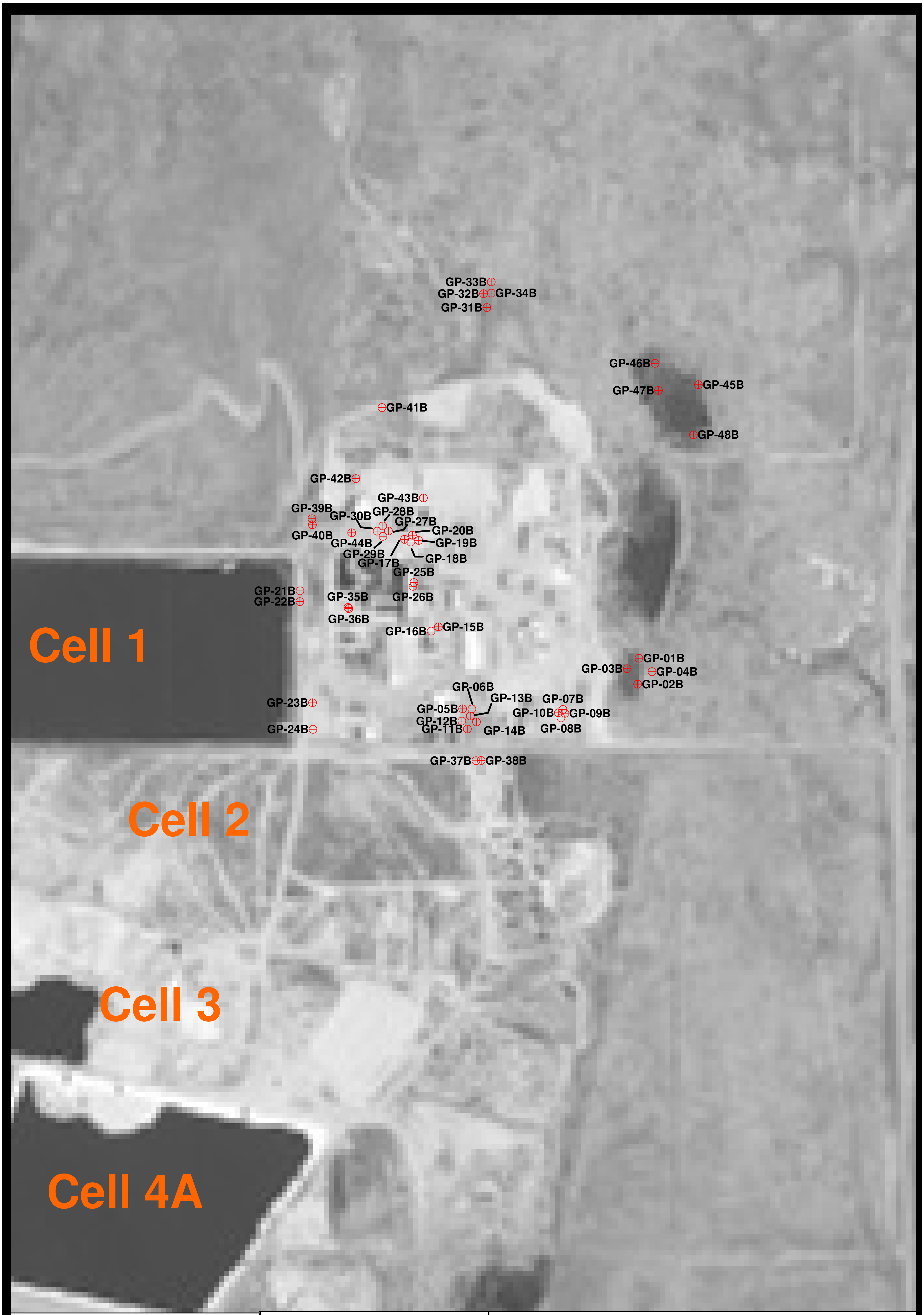
EXPLANATION

GP-01A ▲	off-site Intera soil borings GP-01A through GP-20A
GP-01B ⊕	on-site Intera soil borings GP-01B through GP-48B
GP-01C ■	off-site Intera soil borings GP-01C through GP-07C
RUIN SPRING ○	seep or spring

HYDRO
GEO
CHEM, INC.

INTERA SOIL BORING LOCATIONS
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/Intera_logs/interaloc.srf	C.1



EXPLANATION

GP-01B

⊕ on-site Intera soil borings GP-01B through GP-48B

HYDRO
GEO
CHEM, INC.

INTERA BORING LOCATIONS
GP-1B THROUGH GP-48B
(DETAIL MAP)
WHITE MESA SITE

APPROVED	DATE	REFERENCE	FIGURE
		H:/718000/hydrpt14/ Intera_logs/intera_loc_det_rev.srf	C.2

APPENDIX C.1

INTERA BORING LOGS

Log of Soil Boring GP-01A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	 ▨ ▨ ▨	4.0/ 2.95	0-3.7' Silty SAND, reddish brown (5YR 4/4), very fine-grained sand, silt, poorly graded, very loose, dry, little white mottling, HCl strong	SM	
			3.7-4.5' Silty SAND, pink (5YR 6/4), very fine-grained sand, silt, poorly graded, medium dense, dry, HCl strong		
		0.5/ 0.65			
5			Total depth of boring 4.5' bgs (refusal)		
10					

Note(s):

Log of Soil Boring GP-02A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

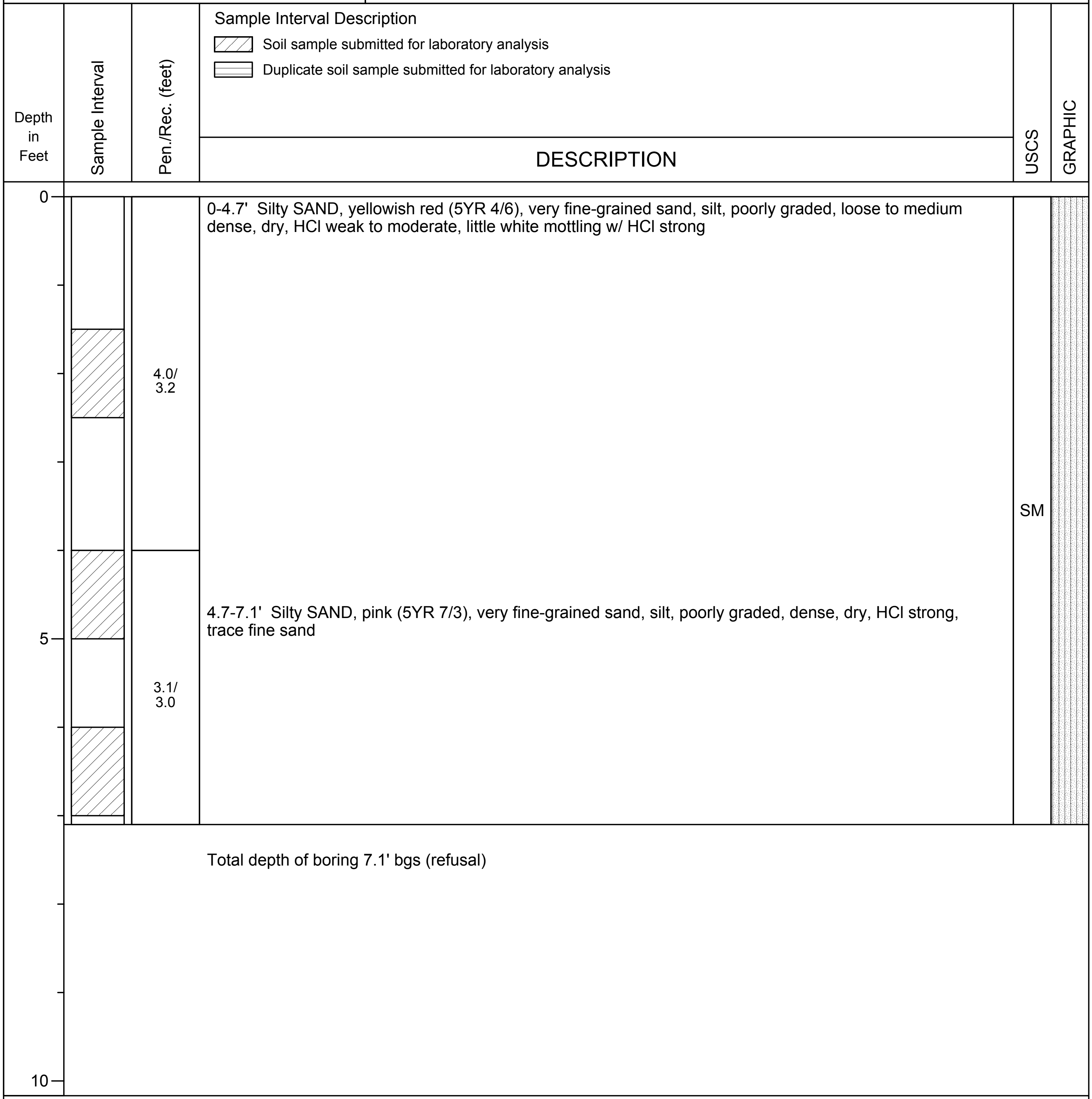
Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



0-4.7' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl weak to moderate, little white mottling w/ HCl strong

4.7-7.1' Silty SAND, pink (5YR 7/3), very fine-grained sand, silt, poorly graded, dense, dry, HCl strong, trace fine sand

Total depth of boring 7.1' bgs (refusal)

Note(s):

07-28-2011 S:\Projects\BoreLogs\Denison\GP-02A1.bor

Log of Soil Boring GP-03A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

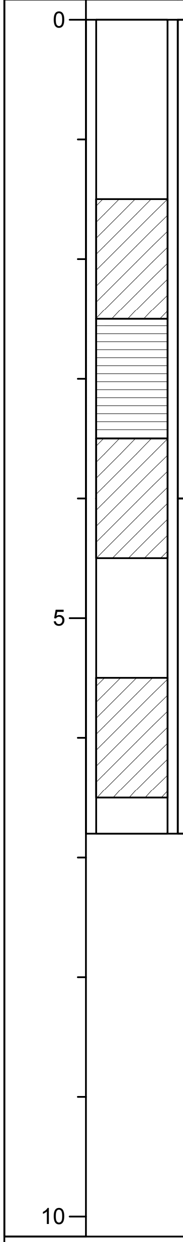
Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis (1)



Pen./Rec. (feet)	DESCRIPTION	USCS
4.0/ 3.0	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose, dry, root at top, HCl strong	SM
2.8/ 3.1	4.0-6.8' Silty SAND, reddish yellow (6/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace fine sand	

Total depth of boring 6.8' bgs (refusal)

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate additional sample volume required by the analytical laboratory.

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INTERA

Log of Soil Boring GP-04A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/17/11
Date/Time Completed : 05/17/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	☐ ▨ ☐ ▨ ▨	4.0/ 3.6	0-3.7' Silty SAND, reddish brown (5YR 4/4), very fine-grained sand, silt, poorly graded, very loose, dry, little white mottling, HCl strong 3.7-4.0' Silty SAND, pink (5YR 6/4), very fine-grained sand, silt, poorly graded, medium dense, dry, HCl strong	SM	▒
			Total depth of boring 4.0' bgs (refusal)		
5					
10					

Note(s):

Log of Soil Boring GP-05A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

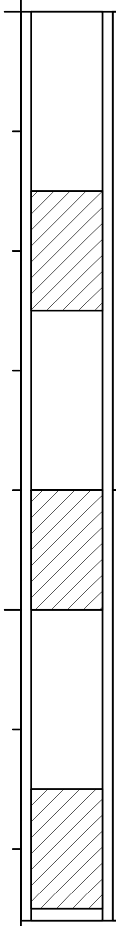
Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Duel Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



Depth in Feet	Pen./Rec. (feet)	DESCRIPTION	USCS
0	4.0/ 2.7	0-6.4' Silty SAND, yellow red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose, roots at top, HCl moderate	SM
5	3.6/ 3.6	6.4-7.6' Silty SAND, light brown gray (10YR 6/2), very fine-grained sand, silt, poorly graded, dense, dry, HCl strong, trace fine sand	
10		Total depth of boring 7.6' bgs (refusal)	

Note(s):

INTERA

Log of Soil Boring GP-06A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/17/11
Date/Time Completed : 05/17/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx
Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis (1)

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.1	0-5.9' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl moderate, trace roots at top, little white mottling w/ HCl strong	SM	
5	▨ ▤ ▨	4.0/ 3.8	5.9-8.0' Silty SAND, very pale brown (10YR 8/4), very fine-grained sand, silt, poorly graded, dense, dry, HCl strong, trace fine sand		
			Total depth of boring 8.0' bgs (refusal)		
10					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-07A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.0	0-4.9' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong, little white mottling, HCl strong 4 to 4.9' bgs		
5	▨	4.0/ 3.3	4.9-7.5' Silty SAND, pink (7.5YR 7/4), very fine-grained sand, silt, poorly graded, medium dense to dense, dry, HCl strong, trace loose fine sand 7 to 7.5'	SM	
	▨	1.7/ 1.8	7.5-9.7' Silty SAND, pink (7.5YR 7/3), very fine-grained sand, silt, poorly graded, loose to dense, dry, HCl strong, trace fine sand		
10			Total depth of boring 9.7' bgs (refusal)		

Note(s):

Log of Soil Boring GP-08A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/17/11	Driller	: L. Trujillo
Date/Time Completed	: 05/17/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 3.3	0-3.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose, dry, trace gravel, roots at top, HCl none	SM	▒
			3.5-4.0' Silty SAND, pink (7.5YR 8/4), very fine-grained sand, silt, poorly graded, dense, dry, HCl strong		
5			Total depth of boring 4.0' bgs (refusal)		
10					

Note(s):

INTERA

Log of Soil Boring GP-09A1

(Page 1 of 1)

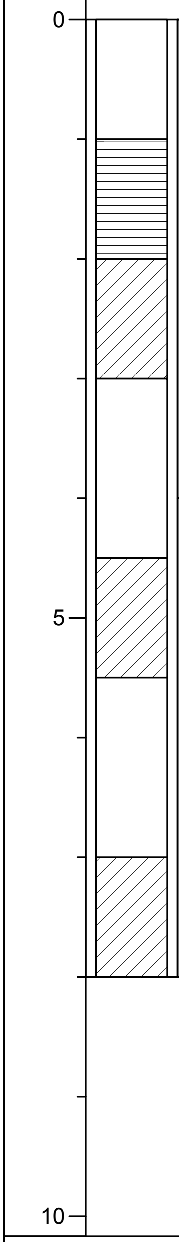
Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/17/11
Date/Time Completed : 05/17/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis



Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
4.0/ 2.95	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose, dry, HCl none, trace roots		
4.0/ 3.75	4.0-8.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand trace fine-grained sand, silt, poorly graded, loose, HCl none, trace mica, trace white mottled w/ HCl strong	SM	

Total depth of boring 8.0' bgs (refusal)

Note(s):
Duplicate sample collected. Sample interval was increased to 2 feet to accommodate additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-10A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/18/11	Driller	: L. Trujillo
Date/Time Completed	: 05/18/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		2.66/ 1.25	0-2' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none to weak	SM	
	▨		2.0-2.7' Sand/Silty Sand, very pale brown (10YR 8/3), very fine-grained sand, trace silt, poorly graded, loose, dry, subangular to subrounded, HCl none, little very fine sand	SP/ SM	
			Total depth of boring 2.7' bgs (refusal)		
5					
10					

Note(s):

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INTERA

Log of Soil Boring GP-11A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/18/11	Driller	: L. Trujillo
Date/Time Completed	: 05/18/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▤	4.0/ 3.6	0-3.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none	SM	
	▨				
	▨		3.0-5.0' Silty SAND, yellowish red (5YR 5/8 & very pale brown 10YR 8/2), fine-grained sand, silt, poorly graded, loose to medium dense, dry, some white mottling w/ HCl strong, mottled but little red or very pale brown, HCl weak to medium, trace fine sand		
	▨	1.0/ 1.2			
5			Total depth of boring 5.0' bgs (refusal)		
10					

Note(s):
Duplicate sample collected. Sample interval was increased to 2 feet to accommodate additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-12A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/18/11	Driller	: L. Trujillo
Date/Time Completed	: 05/18/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0			0-2' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none		
	▨	4.0/ 3.2	2.0-4.0' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, medium dense loose to medium dense, trace fine sand, dry, some white mottling w/ HCl strong	SM	
			Total depth of boring 4.0' bgs (refusal)		
5					
10					

Note(s):

07-28-2011 S:\Projects\BoreLogs\Denison\GP-12A1.bor

Log of Soil Boring GP-13A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 3.1	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, trace white mottling w/ HCl strong	SM	
		0.7/ 0.7	4.0-4.7' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace fine sand		
5			Total depth of boring 4.7' bgs (refusal)		
10					

Note(s):

07-28-2011 S:\Projects\BoreLogs\Denison\GP-13A1.bor

Log of Soil Boring GP-14A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

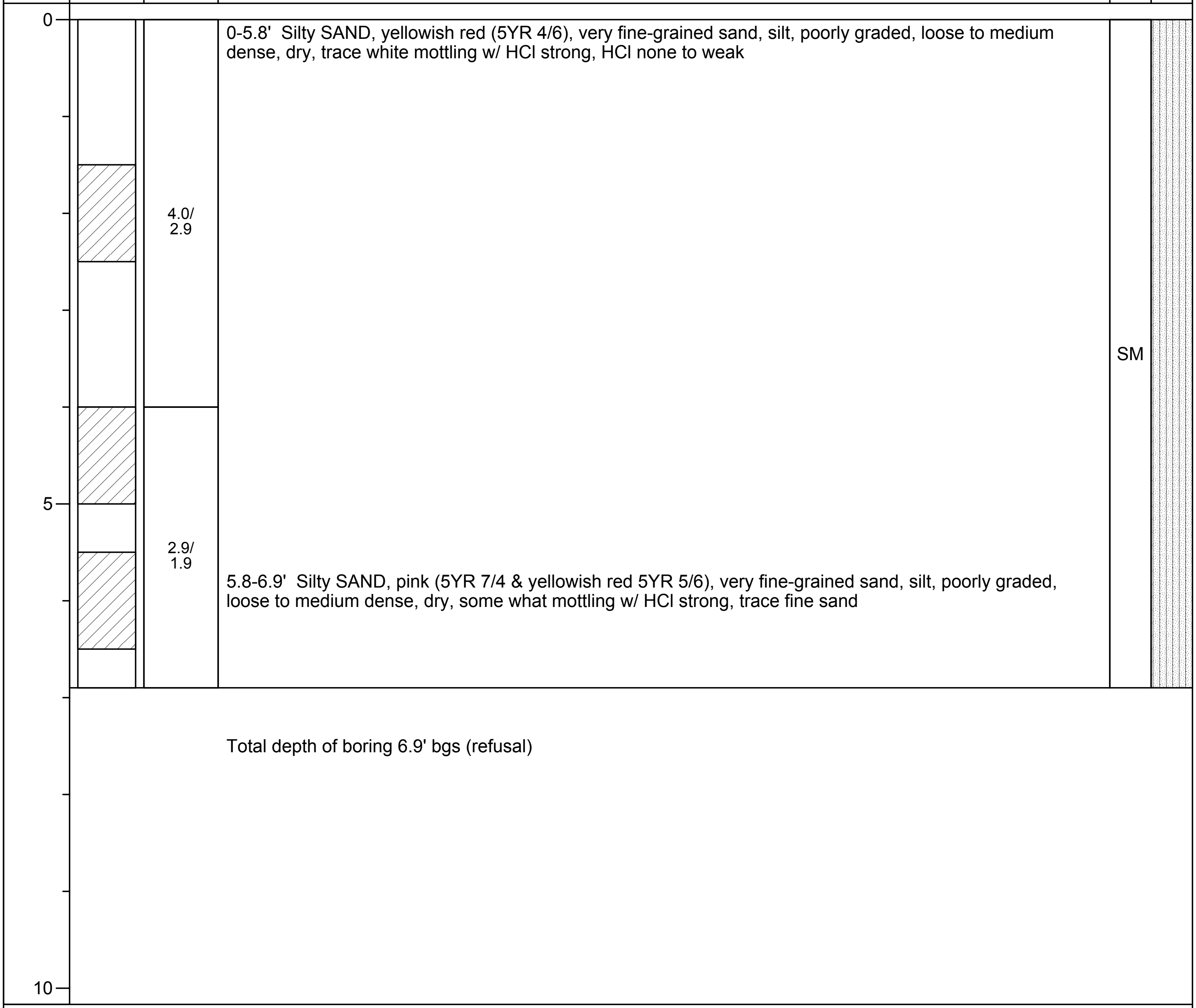
Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



0-5.8' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, trace white mottling w/ HCl strong, HCl none to weak

5.8-6.9' Silty SAND, pink (5YR 7/4 & yellowish red 5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, some what mottling w/ HCl strong, trace fine sand

Total depth of boring 6.9' bgs (refusal)

Note(s):

INTERA

Log of Soil Boring GP-15A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.0	0-5.1' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, trace white mottling w/ HCl strong, HCl none to weak	SM	░
5	▨ ▨	3.6/ 4.0	5.1-7.6' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, medium dense, dry, trace fine sand, HCl strong, some white mottling w/ HCl strong		
10			Total depth of boring 7.6' bgs (refusal)		

Note(s):

Log of Soil Boring GP-16A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▤ ▨	4.0/ 3.7	0-3.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none		
			3.1-7.1' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace fine sand	SM	
5	▨ ▨	3.1/ 3.3			
			Total depth of boring 7.1' bgs (refusal)		
10					

Note(s):
Duplicate sample collected. Sample interval was increased to 2 feet to accommodate additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-17A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/18/11
Date/Time Completed : 05/18/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	3.2/ 2.9	0-2.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl weak	SM	
	▨				
	▨		2.5-3.2' Silty SAND, pink (5YR 7/4), very fine-graindded sand, silt, loose to medium dense, dry, HCl strong, trace fine sand, little white mottling w/ HCl strong		
			Total depth of boring 3.2' bgs (refusal)		
5					
10					

Notes:

Log of Soil Boring GP-18A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/18/11	Driller	: L. Trujillo
Date/Time Completed	: 05/18/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description
- ▨ Soil sample submitted for laboratory analysis
- ▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0			0-6.9' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace white mottling w/ HCl strong, trace roots at top		
	▨	4.0/ 3.0			
				SM	
	▨				
5		3.3/ 3.1			
	▨				
			6.9-7.3' Silty SAND, pink (5YR 7/4), very fine-grainded sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace fine sand		
			Total depth of boring 7.3' bgs (refusal)		
10					

Notes:

Log of Soil Boring GP-19A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

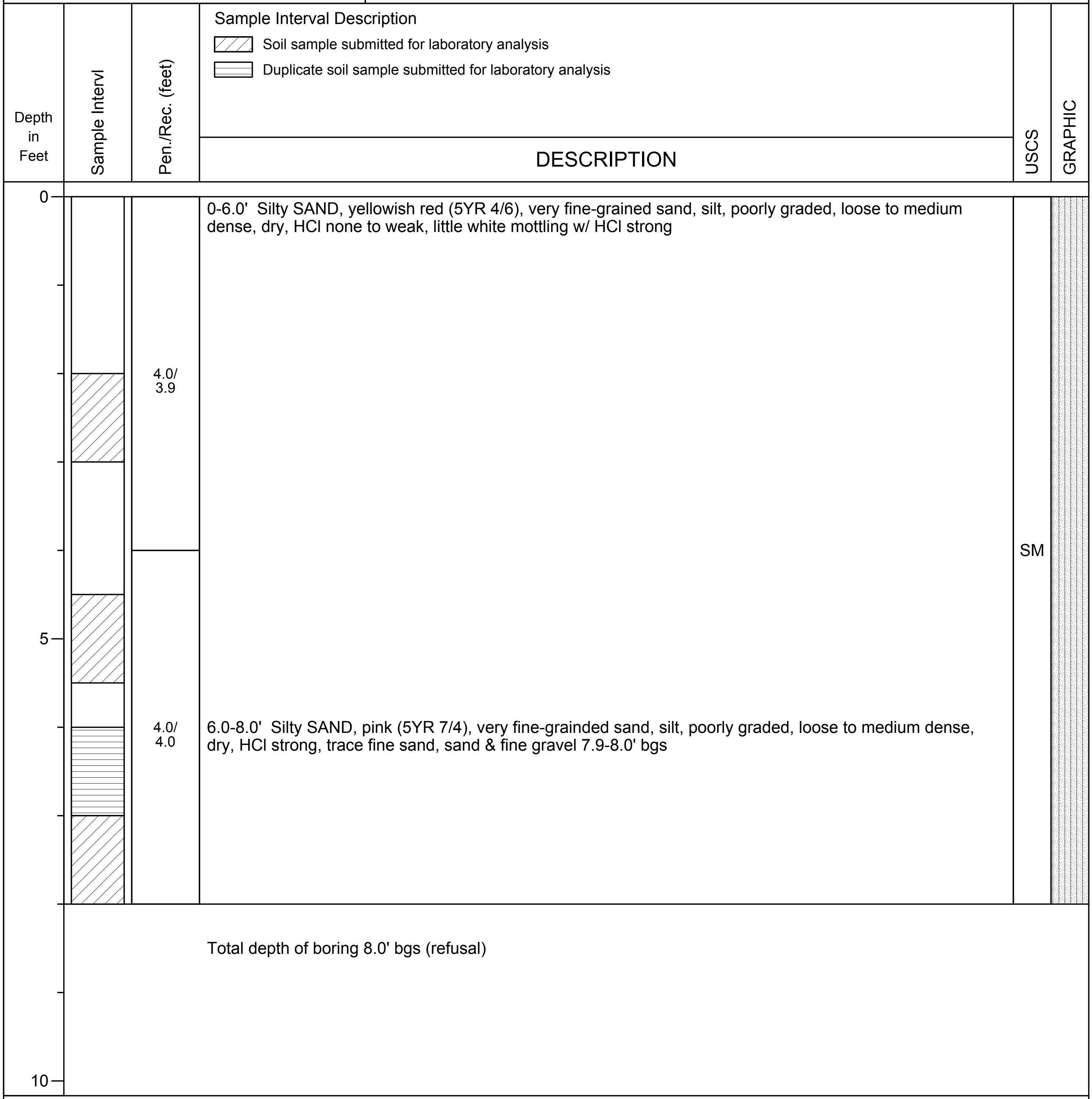
Project #: DENMC.C002.000

Date/Time Started	: 05/18/11	Driller	: L. Trujillo
Date/Time Completed	: 05/18/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



0-6.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none to weak, little white mottling w/ HCl strong

6.0-8.0' Silty SAND, pink (5YR 7/4), very fine-grainded sand, silt, poorly graded, loose to medium dense, dry, HCl strong, trace fine sand, sand & fine gravel 7.9-8.0' bgs

Total depth of boring 8.0' bgs (refusal)

Note(s):
Duplicate sample collected. Sample interval was increased to 2 feet to accommodate additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-20A1

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/18/11
Date/Time Completed : 05/18/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx
Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0			0-3.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none		
	▨	4.0/ 3.0			
	▨			SM	
			3.1-5.1' Silty SAND, pink (5YR 7/4), very fine-grainded sand, silt, loose to medium dense, dry, HCl weak to strong, little white mottling w/ HCl strong, trace fine sand		
5	▨	1.1/ 1.3			
			Total depth of boring 5.1' bgs (refusal)		
10					

Notes:

Log of Soil Boring GP-01B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/12/11	Driller	: L. Trujillo
Date/Time Completed	: 06/12/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 3.15	0-3.1' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, loose to dense, dry, HCl strong, mottling common	SM	
		0.4/ 0.6	3.1-4.4' Silty Gravelly SAND, pinkish gray (5YR 7/2), very fine- to coarse-grained sand (~60%), gravel to 0.1" diameter (~30%), well graded, angular to subrounded, very loose, non-plastic, dry, no HCl	SW/ SM	
5			Total depth of boring 4.4' bgs (refusal)		
10					

Note(s):

Log of Soil Boring GP-02B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/12/11
Date/Time Completed : 06/12/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 1.5	0-3.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~65%), poorly graded, subangular to subrounded, loose, dry, HCl strong, roots abundant top 0.5'	SM	
	▨		3.0-7.0' Lean CLAY, light reddish brown (5YR 6/3), very fine-grained sand (~25%), subangular to subrounded, soft, medium plastic, moist, HCl moderate	CL	
5	▤	4.0/ 3.8			
	▨		7.0-11.8' Clayey SAND, light reddish brown (5YR 6/3), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose to dense, medium plastic, moist, HCl strong	SC	
10	▨	3.8/ 3.5			
			Total depth of boring 11.8' bgs (refusal)		
15					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

INTERA

Log of Soil Boring GP-03B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/12/11
Date/Time Completed : 06/12/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.2	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, dry, HCl strong, mottling common	SM	
	▨				
		4.0/ 4.0	4.0-8.6' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, moist, HCl strong, mottling common		
5	▨				
	▨	1.6/ 2.2	8.6-9.6' Lean CLAY, pink (5YR 7/4), very fine-grained sand (~25%), subangular to subrounded, soft, moderately plastic, moist, HCl strong	CL	▨
10			Total depth of boring 9.6' bgs (refusal)		
15					

Note(s):

Log of Soil Boring GP-04B

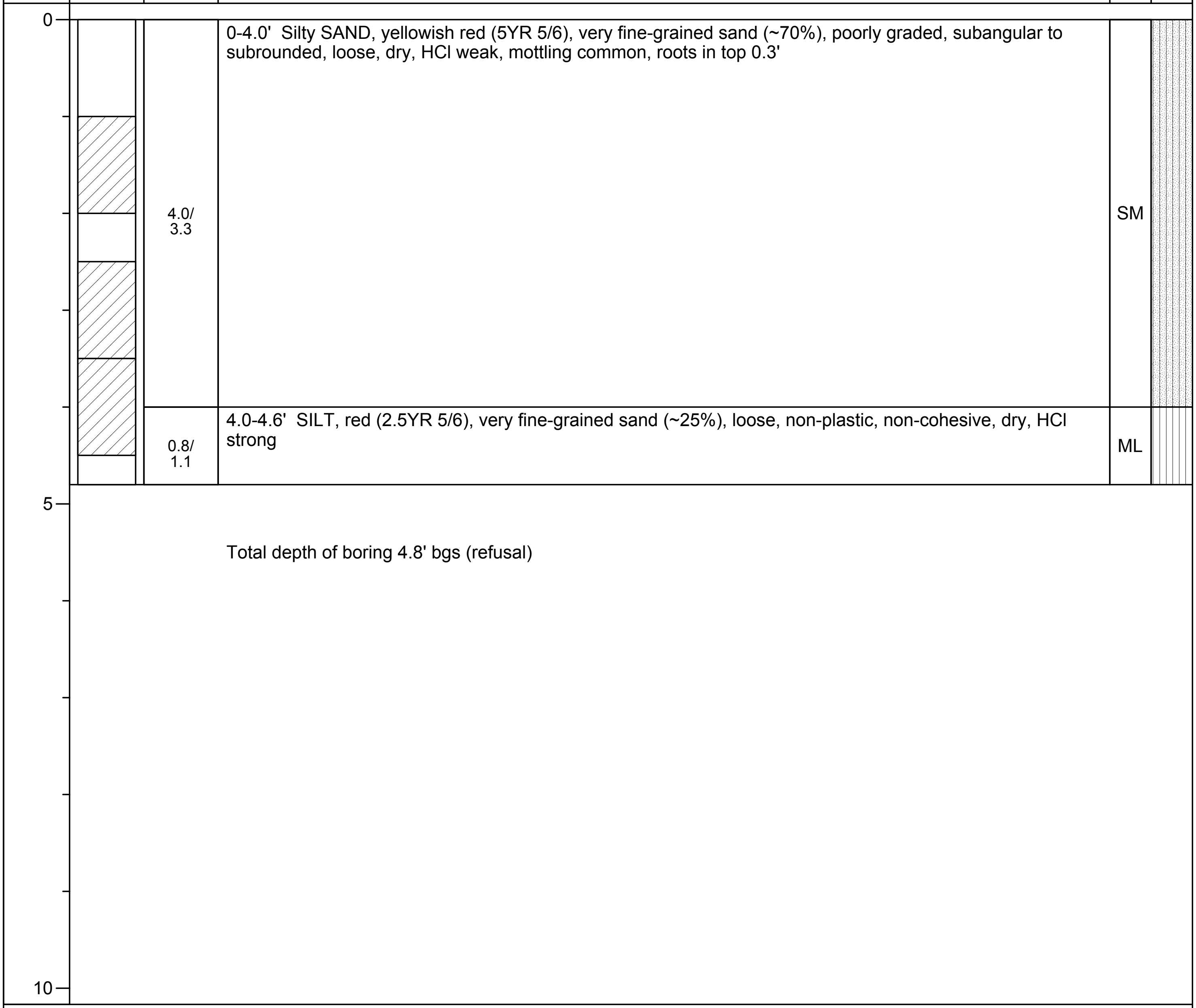
(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/12/11	Driller	: L. Trujillo
Date/Time Completed	: 06/12/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis



Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.3	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry, HCl weak, mottling common, roots in top 0.3'	SM	
		0.8/ 1.1	4.0-4.6' SILT, red (2.5YR 5/6), very fine-grained sand (~25%), loose, non-plastic, non-cohesive, dry, HCl strong	ML	

Total depth of boring 4.8' bgs (refusal)

Note(s):

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INTERA

Log of Soil Boring GP-05B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.0	0-6.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common, roots in top 1.3'	SM	
	▨				
5		4.0/ 3.4			
			6.5-13.3' Clayey SILT, yellowish brown (10YR 5/4), loose to dense, non- to slightly plastic, dry to moist, HCl slight, gypsum stringers and precipitate common	ML	
	▨				
10		4.0/ 3.9			
	▨	1.3/ 1.3			
15			Total depth of boring 13.3' bgs (refusal)		

Note(s):

Log of Soil Boring GP-06B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.0	0-1.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, angular to subrounded, very loose, dry, no HCl 1-4' HCl strong and 5YR 4/4		░
5	▨	4.0/ 4.0	4.0-8.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, angular to subrounded, very loose, dry, HCl	SM	░
10	▨	4.0/ 4.0	8.0-12' Clayey SILT, yellowish brown (10YR 5/4), poorly graded, loose, non-plastic, dry to moist, HCl slight	ML	▥
	▨	1.8/ 1.8	12-13.8' Clayey SILT, yellowish brown (10YR 5/4), poorly graded, loose, non-plastic, dry, HCl slight, laminated		▥
15			Total depth of boring 13.8' bgs (refusal)		

Note(s):

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Log of Soil Boring GP-07B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/09/11
Date/Time Completed : 06/09/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.5	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common	SM	
5	▨	4.0/ 3.5	4.0-8.0' Silty SAND, reddish brown (5YR 5/4), very fine-grainded sand (~80%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common		
10	▤ ▨	2.8/ 4.0	8.0-10.2' Silty SAND, reddish brown (5YR 5/4), very fine-grainded sand (~60%), poorly graded, subangular to subrounded, slightly dense, dry, HCl strong, white mottling common		
			10.2-10.8' SILT, pink (5YR 7/4), very dense to hard, non-plastic, dry, HCl strong	ML	
15			Total depth of boring 10.8' bgs (refusal)		

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

INTERA

Log of Soil Boring GP-08B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/09/11
Date/Time Completed : 06/09/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.6	Road base	
	▨		0.8-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, dense, dry, HCl strong, white mottling throughout	SM
5	▨	4.0/ 3.9	4.0-8.0' SILT, pink (5YR 7/4), trace very fine-grained sand, loose, non-plastic, dry, HCl strong	ML
10		4.0/ 4.0	8.0-11.3' Silty SAND, pink (5YR 7/4), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose to dense, dry, HCl strong	SM
	▨		11.3-12' SILT, pink (5YR 7/4), very dense, hard, non-plastic, dry, HCl strong	ML
15			Total depth of boring 12' bgs (refusal)	

Note(s):

Log of Soil Boring GP-09B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/09/11
Date/Time Completed : 06/09/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 2.2	0-4.0' Silty SAND, reddish brown (5YR 5/4), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common	SM	
5	▨	4.0/ 3.75	4.0-8.0' Silty SAND, reddish brown (5YR 5/4), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common		
10	▨	3.4/ 3.4	8.0-10.8' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, slightly dense, dry to moist, HCl strong, white mottling common		
			10.8-11.4' SILT, pink (5YR 7/4), very dense, hard, non-plastic, dry, HCl strong	ML	

Total depth of boring 11.4' bgs (refusal)

15

Note(s):

Log of Soil Boring GP-10B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/09/11
Date/Time Completed : 06/09/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.6	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common	SM	
5	▨	4.0/ 4.0	4.0-8.0' Silty SAND, reddish brown (5YR 5/4), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common		
10	▨	4.0/ 4.0	8.0-11.5' Silty SAND, reddish brown (5YR 5/4), very fine-grained sand (~60%), poorly graded, loose to dense, dry, HCl strong, white mottling common		
			11.5- 12' SILT, pink (5YR 7/4), very dense, hard, dry, HCl strong	ML	
15			Total depth of boring 12' bgs (refusal)		

Note(s):

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INTERA

Log of Soil Boring GP-11B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.2	0-2.0' Silty SAND, reddish brown (5YR 4/4), very fine-grained sand (~60%), poorly graded, subangular to subrounded, very loose, dry, HCl slight, roots	SM
			2.0-4.0' Silty SAND, light reddish brown (5YR 6/3), very fine-grained sand (~60%), poorly graded, subangular to subrounded, very loose, dry, HCl strong	
	▨	4.0/ 3.2	4.0-7.0' Silty SAND, light reddish brown (5YR 6/3), very fine-grained sand (~60%), poorly graded, subangular to subrounded, very loose, dry, HCl strong	
5				
	▨	4.0/ 3.2	7.0-12.1' Clayey SILT, pinkish gray (7.5YR 6/2), loose to dense, non-plastic, dry, HCl strong, white mottling common, laminated	ML
10				
	▨	0.1/0.1		
			Total depth of boring 12.1' bgs (refusal)	
15				

Note(s):

INTERA

Log of Soil Boring GP-12B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.5	0-1.5' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, no HCl 0-1.5' bgs, HCl slight 1.5-8.0' Silty SAND, reddish brown (5YR 5/4), very fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, HCl slight, laminated	SM
	▨			
5		4.0/ 3.1		
	▨			
		4.0/ 3.4	8.0-12.4' Clayey SILT, light olive brown (2.5YR 4/3), poorly graded, loose, non-plastic, dry, HCl, laminated, gypsum precipitate throughout	ML
10	▤		10.5-12' 5-10mm gypsum stringers	
	▨			
		0.4/0.4		
15			Total depth of boring 12.4' bgs (refusal)	

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-13B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/07/11	Driller	: L. Trujillo
Date/Time Completed	: 06/07/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.6	0-1.5' Silty SAND, yellowish red brown (5YR 4/6), very fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, HCl slight	SM	
5	▨	4.0/ 4.0	1.5-6.2' Silty SAND, light reddish brown (5YR 6/3), very fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, HCl slight		
			6.2-8.0' Clayey SILT, reddish brown (5YR 5/4), trace very fine-grained sand, loose to dense, non-plastic, dry to moist, HCl strong, white mottling throughout	ML	
10	▨	4.0/ 4.0	8.0-12' Clayey SILT, dark grayish brown (10YR 4/2), dense, slightly plastic, dry, HCl weak, thin bedding		
	▨	1.8/ 1.8	12-13.8' Clayey SILT, light yellowish brown (10YR 6/4), loose, non-plastic, dry, HCl slight, thin bedding		
15			Total depth of boring 13.8' bgs (refusal)		

Note(s):

Log of Soil Boring GP-14B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.0	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, no HCl		
5	▨	4.0/ 3.0	quartz fragments 4.0-4.7' bgs 4.7-8.0' Silty SAND, reddish yellow (2.5YR 6/6), very fine-grained sand, poorly graded, loose to dense, dry, HCl moderate, white mottling throughout	SM	
10	▨	4.0/ 3.5	8.0-12' Clayey SILT, brown (7.5YR 5/2), poorly graded, loose to dense, non-plastic, dry, HCl slight	ML	
	▨	2.0/ 2.0	12-14' Clayey SILT, yellowish brown (10YR 5/6), poorly graded, loose to dense, non-plastic, dry, HCl slight		
15			Total depth of boring 14' bgs (refusal)		

Note(s):

INTERA

Log of Soil Boring GP-15B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/08/11
Date/Time Completed : 06/08/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.4	0-3.5' Silty SAND, yellowish red (5YR 4/6), very fine- to medium-grained sand (~80%), well graded, angular to subrounded, loose, dry to moist, HCl moderate, minor white mottling	SM	░
			3.5-4.0' Clayey SILT, light reddish brown (5YR 6/4), poorly graded, dense, slightly plastic, moist, HCl moderate	ML/ CL	▨
5	▨	4.0/ 3.4	4.0-10' Silty SAND, yellowish red (5YR 4/6), very fine-grainded sand (~75%), poorly graded, subangular to subrounded, loose, dry to moist, HCl strong, white mottling throughout	SM	░
10	▨	4.0/ 2.8	10-12' CLAY, yellowish red (5YR 4/6), dense, low to medium plastic, cohesive, moist, HCl slight	CL	▨
15	▨	4.0/ 4.0	12-16' CLAY, pale brown (10YR 6/3), very dense, low plastic, slightly cohesive, dry, HCL moderate, minor FeO staining		
20			Total depth of boring 16' bgs (refusal)		

Note(s):

INTERA

Log of Soil Boring GP-16B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/08/11
Date/Time Completed : 06/08/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.0	0-5.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, loose, dry to moist, no HCl	SM	░
5	▨	4.0/ 3.2	5.5-8.0' Silty SAND, reddish yellow (5YR 6/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling throughout		░
10	▨	4.0/ 3.1	8.0-11.3' CLAY, reddish yellow (5YR 6/6), hard, medium plastic, cohesive, dry to moist w/ increasing moisture towards base of interval, HCl strong	CL	▨
15	▨	4.0/ 4.0	11.3-16' CLAY, pale brown (10YR 6/3), very hard, slightly plastic, slightly cohesive, moist, HCl strong	ML	▥
20			Total depth of boring 16' bgs (refusal)		

Note(s):

Log of Soil Boring GP-17B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

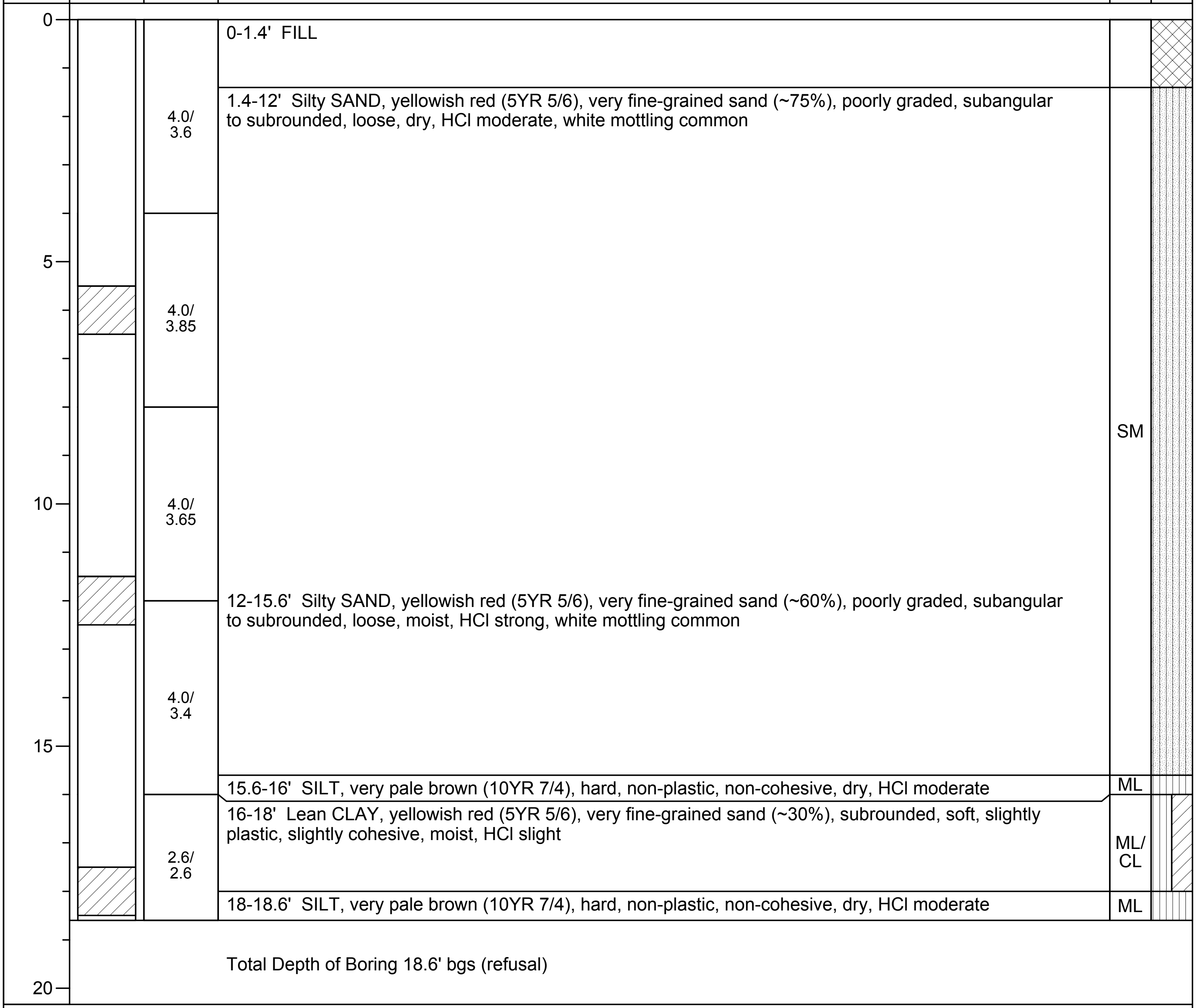
Project #: DENMC.C002.000

Date/Time Started	: 06/09/11	Driller	: L. Trujillo
Date/Time Completed	: 06/09/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



Pen./Rec. (feet)
4.0/ 3.6
4.0/ 3.85
4.0/ 3.65
4.0/ 3.4
2.6/ 2.6

DESCRIPTION	USCS
0-1.4' FILL	
1.4-12' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, loose, dry, HCl moderate, white mottling common	SM
12-15.6' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, moist, HCl strong, white mottling common	
15.6-16' SILT, very pale brown (10YR 7/4), hard, non-plastic, non-cohesive, dry, HCl moderate	ML
16-18' Lean CLAY, yellowish red (5YR 5/6), very fine-grained sand (~30%), subrounded, soft, slightly plastic, slightly cohesive, moist, HCl slight	ML/ CL
18-18.6' SILT, very pale brown (10YR 7/4), hard, non-plastic, non-cohesive, dry, HCl moderate	ML

Total Depth of Boring 18.6' bgs (refusal)

Note(s):

Log of Soil Boring GP-18B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/09/11	Driller	: L. Trujillo
Date/Time Completed	: 06/09/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 4.0	0-1.5' FILL		▩
			1.5-12' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, loose, dry, HCl strong, white mottling common, caliche rich 10-10.5' bgs	SM	▒
5	▨	4.0/ 3.8			
10		4.0/ 3.8			
	▨		12-16' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, loose, slightly moist with moisture increasing w/ depth, HCl strong, occasional white mottling		
15		4.0/ 3.25			
		2.5/ 2.85	16-17.9' Sandy Silty CLAY, yellowish red (5YR 5/6), very fine-grained sand (~30%), soft, slightly plastic, slightly cohesive, moist, HCl slight	ML/ CL	▥
	▨		17.9-18.5' SILT, very pale brown (10YR 7/4), hard, non-plastic, non-cohesive, dry, HCl strong, shale	ML	▥
20			Total depth of boring 18.5' bgs (refusal)		

Note(s):

INTERA

Log of Soil Boring GP-19B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/09/11	Driller	: L. Trujillo
Date/Time Completed	: 06/09/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.85	0-2.5' FILL		
5 10	▨ ▨	4.0/ 3.85 4.0/ 3.95	2.5-12' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, loose, dry, HCl moderate, occasional white mottling	SM	
15	▨	4.0/ 3.8	12-17.1' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose to dense, slightly moist to moist increasing w/ depth, HCl strong, occasional white mottling		
			17.1-17.9' SILT, very pale brown (10YR 7/4), very dense, hard, non-plastic, dry, HCl strong, weathered shale	ML	
20			Total depth of boring 17.9' bgs (refusal)		

Note(s):

Log of Soil Boring GP-20B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/09/11	Driller	: L. Trujillo
Date/Time Completed	: 06/09/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 4.0	0-1.0' FILL		▩
			1.0-12' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry, HCl moderate, occasional white mottling	SM	░
5	▤ ▨	4.0/ 3.9			
10	▨	4.0/ 3.5			
		4.0/ 3.2	12-16' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, moist, HCl moderate, occasional white mottling		
15					
	▨	1.4/ 1.4	16-16.7' Sandy Lean CLAY, very fine-grained sand (~15%), yellowish red (5YR 5/6), soft, medium plastic, medium cohesive, very moist, HCl slight	CL	▨
			16.7-17.4' SILT, very pale brown (10YR 7/4), hard, non-plastic, dry, HCl strong, shale	ML	▥
			Total depth of boring 17.4' bgs (refusal)		
20					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

INTERA

Log of Soil Boring GP-21B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/12/11	Driller	: L. Trujillo
Date/Time Completed	: 06/12/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨	4.0/ 2.3	0-4.5' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, moist, HCl weak, gravel from 3.8-4.0'	SM	
5		2.7/ 2.9	4.5-5.5' Silty SAND, pink (5YR 7/3), very fine-grained sand (~60%), poorly graded, subrounded, loose, slightly cohesive, wet, HCl moderate		
	▨		5.5-6.7' Sandy SILT, light yellowish brown (10YR 6/4), very fine-grained sand (~15%), poorly graded, subrounded, loose, dry, thin bedding, HCl strong	ML	
			Total depth of boring 6.7' bgs (refusal)		
10					
15					

Note(s):

INTERA

Log of Soil Boring GP-22B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/12/11	Driller	: L. Trujillo
Date/Time Completed	: 06/12/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.2	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~75%), poorly graded, subrounded, loose, dry to slightly moist, HCl no to weak	SM
	▨ (2.0-3.0)			
		4.0/ 2.9	4.0-7.6' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, moist to very moist, HCl weak	
5	▨ (5.0-6.0)			
	▨ (7.5-8.5)		7.6-8.0' SILT, pink (5YR 8/3), very fine-grained sand (~25%), poorly graded, subrounded, dense, slightly cohesive, moist, HCl strong	ML
		0.9/ 1.9	8.0-8.9' SILT, brownish yellow (10YR 6/6), very fine-grained sand (~25%), poorly graded, subrounded, loose, slightly moist, HCl weak, thin bedding	
10			Total depth of boring 8.9' bgs (refusal)	
15				

Note(s):

INTERA

Log of Soil Boring GP-23B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/11/11
Date/Time Completed : 06/11/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.2	0-2.0' Silty SAND, reddish gray (5YR 5/2), very fine- to coarse-grained sand, well graded, angular to subrounded, loose, non-plastic, dry, HCl moderate	SW/ SM
			2.0-4.0' Lean CLAY w/ Sand, brownish yellow (10YR 6/6), fine- to coarse-grained sand (~20%), well graded, angular to subrounded, hard, slightly plastic, moist, HCl slight, burned (ash?) layer from 2.0-2.2' bgs	CL
5	▨	4.0/ 2.5	4.0-15.3' Sandy Lean CLAY, reddish brown (5YR 5/4), fine- to coarse-grained sand (~30%), up to 0.05' diameter gravel (<10%), well graded, angular to subrounded, soft, low to moderate plastic, moist, HCl weak	
10	▤ ▨	4.0/ 2.0		
15	▨	3.3/ 2.3		
20			Total depth of boring 15.3' bgs (refusal)	

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-24B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

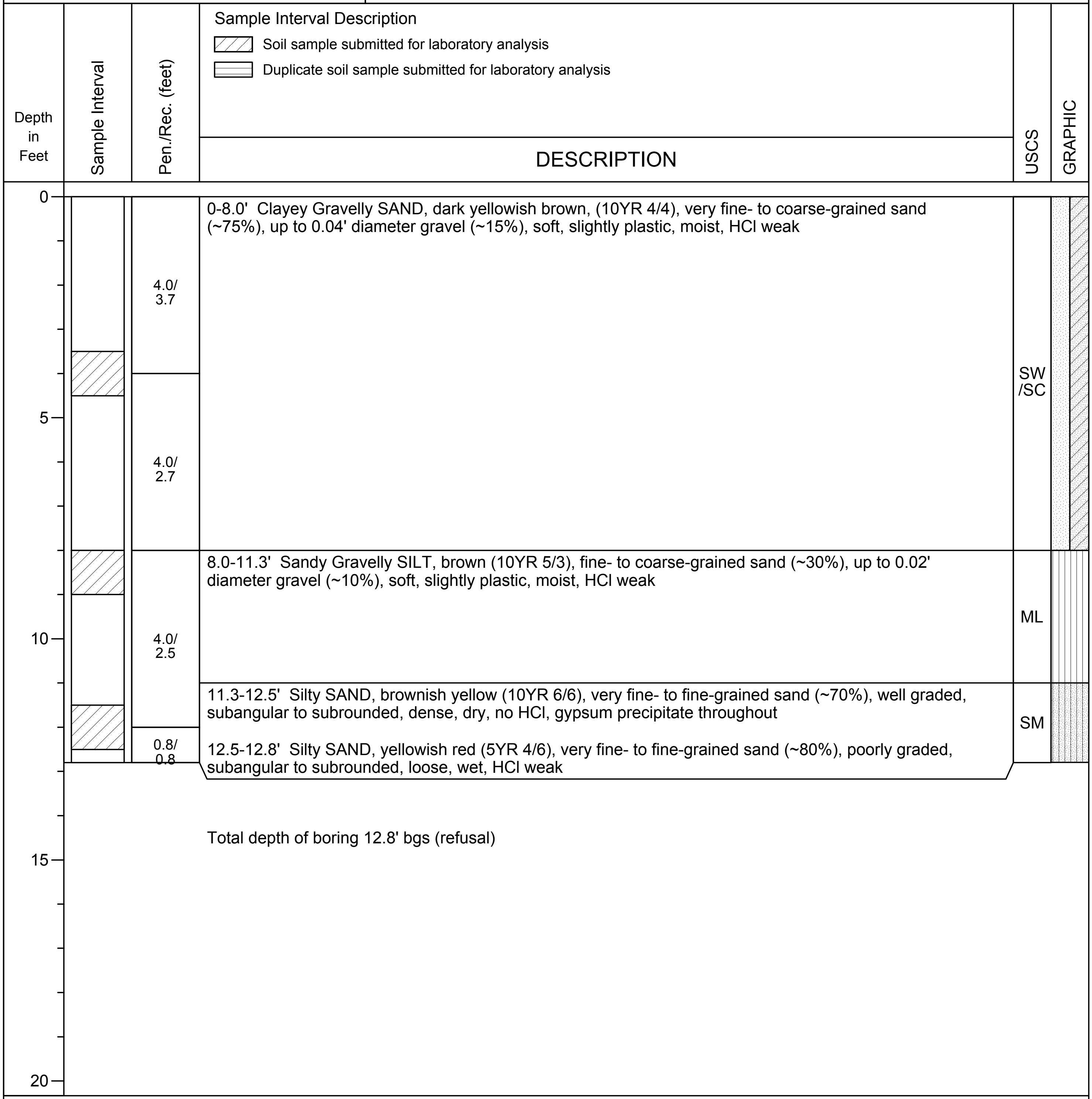
Project #: DENMC.C002.000

Date/Time Started	: 06/11/11	Driller	: L. Trujillo
Date/Time Completed	: 06/11/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

☰ Duplicate soil sample submitted for laboratory analysis



0-8.0' Clayey Gravelly SAND, dark yellowish brown, (10YR 4/4), very fine- to coarse-grained sand (~75%), up to 0.04' diameter gravel (~15%), soft, slightly plastic, moist, HCl weak

8.0-11.3' Sandy Gravelly SILT, brown (10YR 5/3), fine- to coarse-grained sand (~30%), up to 0.02' diameter gravel (~10%), soft, slightly plastic, moist, HCl weak

11.3-12.5' Silty SAND, brownish yellow (10YR 6/6), very fine- to fine-grained sand (~70%), well graded, subangular to subrounded, dense, dry, no HCl, gypsum precipitate throughout

12.5-12.8' Silty SAND, yellowish red (5YR 4/6), very fine- to fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, wet, HCl weak

Total depth of boring 12.8' bgs (refusal)

Note(s):

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Log of Soil Boring GP-25B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

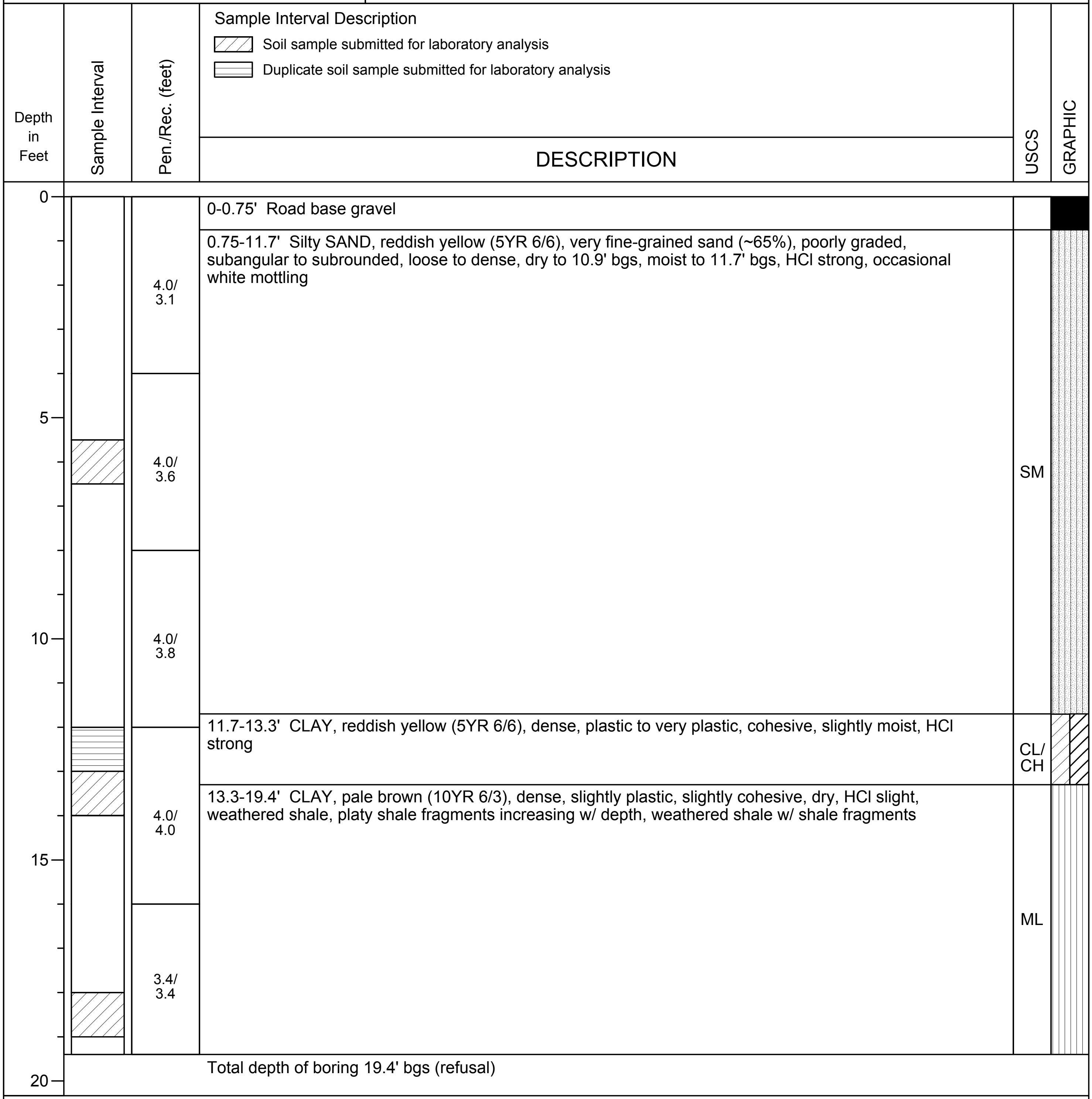
Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



Pen./Rec. (feet)
4.0/ 3.1
4.0/ 3.6
4.0/ 3.8
4.0/ 4.0
3.4/ 3.4

DESCRIPTION	USCS
0-0.75' Road base gravel	
0.75-11.7' Silty SAND, reddish yellow (5YR 6/6), very fine-grained sand (~65%), poorly graded, subangular to subrounded, loose to dense, dry to 10.9' bgs, moist to 11.7' bgs, HCl strong, occasional white mottling	SM
11.7-13.3' CLAY, reddish yellow (5YR 6/6), dense, plastic to very plastic, cohesive, slightly moist, HCl strong	CL/ CH
13.3-19.4' CLAY, pale brown (10YR 6/3), dense, slightly plastic, slightly cohesive, dry, HCl slight, weathered shale, platy shale fragments increasing w/ depth, weathered shale w/ shale fragments	ML

Total depth of boring 19.4' bgs (refusal)

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

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Log of Soil Boring GP-26B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/09/11
Date/Time Completed : 06/09/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.3	0-0.3' Road base gravel 0.3-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, dense, moist, HCl strong, white mottling common	
4			4.0-10.1' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, dense, dry to moist, HCl moderate, white mottling common	
5	▨	4.0/ 3.3		SM
10	▨	4.0/ 3.6	10.1-13' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, dense, moist, HCl moderate	
13		4.0/ 4.0	13-16' SILT, yellowish brown (10YR 5/4), very dense, hard, dry, HCl strong	ML
15	▨			
16			Total depth of boring 16' bgs (refusal)	
20				

Note(s):

Log of Soil Boring GP-27B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/10/11	Driller	: L. Trujillo
Date/Time Completed	: 06/10/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description
- ▨ Soil sample submitted for laboratory analysis
- ▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.2	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, dry, HCl moderate, mottling common	SM	
5	▨	4.0/ 3.3	4.0-11.8' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, moist, HCl weak, mottling rare		
10	▨	4.0/ 3.6			
		2.6/ 2.6	11.8-13' Clayey SAND, yellowish red (5YR 4/6), very fine-grained sand, subrounded, loose, slightly plastic, moist, HCl strong, mottling throughout	SC	
	▤ ▨		13-14.6' Sandy SILT, yellowish brown (10YR 5/6), very fine-grained sand (~25%), subrounded, loose, non-plastic, non-cohesive, dry, HCl strong	ML	
15			Total depth of boring 14.6' bgs (refusal)		
20					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-28B

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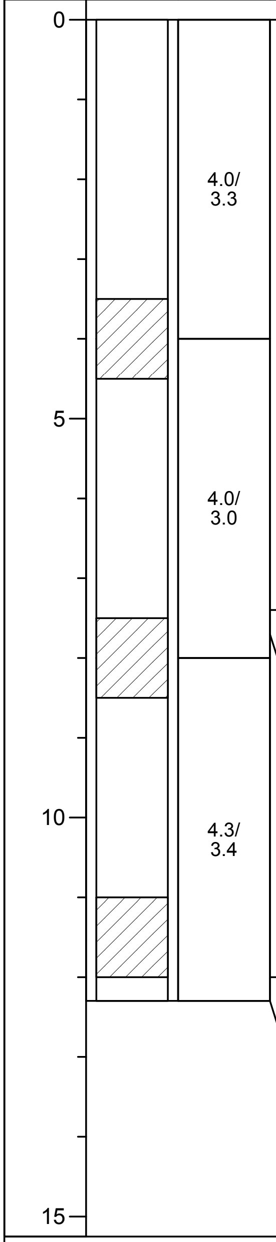
Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/10/11
Date/Time Completed : 06/10/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx
Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis



Pen./Rec. (feet)	DESCRIPTION	USCS
4.0/ 3.3	0-7.4' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, moist, HCl weak to strong	SM
4.0/ 3.0	7.4-7.7' Lean CLAY w/ Sand, very dark gray (5YR 3/1), very fine-grained sand (~15%), soft, plastic, moist, HCl weak	CL
4.3/ 3.4	7.7-12' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, moist, HCl weak, occasional mottling	SM
	12-12.3' Clayey SAND, very pale brown (10YR 7/3), very fine-grained sand w/ plastic fines, poorly graded, subangular to subrounded, loose, slightly plastic, moist, HCl strong	SC

Total depth of boring 12.3' bgs (refusal)

Note(s):

INTERA

Log of Soil Boring GP-29B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/10/11
Date/Time Completed : 06/10/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0			0-1.3' Road base		■
		4.0/ 2.95	1.3-3.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, dry, HCl moderate, white mottling throughout	SM	▒
			3.0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, loose, moist, gravel and wood fragments common, HCl moderate,		
5 10	▨ ▤ ▨	4.0/ 3.0 4.0/ 3.25	4.0-12' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry to moist, HCl weak, occasional mottling		
			12-13.2' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, moist, HCl moderate		
	▨	2.4/ 2.6	13.2-14.4' Silty SAND, yellowish brown (10YR 5/4), very fine-grained sand (~60%), poorly graded, subangular to subrounded, dense, moist, HCl moderate		
15 20			Total depth of boring 14.4' bgs (refusal)		

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-30B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/10/11	Driller	: L. Trujillo
Date/Time Completed	: 06/10/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Pen./Rec. (feet)	DESCRIPTION	USCS
0	4.0/ 3.3	0-7.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, loose, dry to moist, HCl weak, occasional mottling	SM
5	4.0/ 3.15	7.1-7.2' Clayey SAND w/ low plastic fines, dark reddish brown (5YR 3/4), very fine-grained sand, poorly graded, subrounded, soft, slightly plastic, moist, HCl moderate	SC
10	4.0/ 3.3	7.2-12' Silty SAND, Yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, moist, HCl none to weak	SM
		12-13.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, wet, HCl moderate	
15		Total depth of boring 13.1' bgs (refusal)	

Note(s):

INTERA

Log of Soil Boring GP-31B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/08/11
Date/Time Completed : 06/08/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▤ ▨ ▨	4.0/ 3.1	0-4.7' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~65%), poorly graded, subangular to subrounded, very loose, dry, HCl moderate, white mottling throughout	SM	
5	▨	1.6/ 1.6	4.7-5.6' SAND w/ minor Silt, pinkish gray (7.5YR 6/2), very fine- to fine-grained sand, poorly to well graded, subangular to subrounded, very loose, moist, HCl strong	SP/ SM	
			Total depth of boring 5.6' bgs (refusal)		
10					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-32B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 2.9	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subangular to subrounded, very loose, dry to moist increasing w/ depth, HCl moderate	SM	
5			Total depth of boring 4.0' bgs (refusal)		
10					

Note(s):

Log of Soil Boring GP-33B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0 1	▨	1.7/ 1.7	0-1.2' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~75%), poorly graded, subangular to subrounded, very loose, dry, HCl moderate, minor white mottling	SM	
			1.2-1.7' SAND w/ minor Silt, pinkish gray (5YR 6/2), very fine- to fine-grained sand, poorly to well graded, subangular to subrounded, very loose, dry, HCl strong	SP/ SM	
2			Total depth of boring 1.7' bgs (refusal)		
3					
4					
5					

Note(s):

Log of Soil Boring GP-34B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/08/11
Date/Time Completed : 06/08/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	3.8/ 2.7	0-3.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~65%), poorly graded, subangular to subrounded, loose, dry to moist, HCl slight, minor roots 0-0.8' bgs	SM	
			3.0-3.8' SAND w/ minor silt, pinkish gray (5YR 6/2), very fine- to fine-grained sand, poorly to well graded, subangular to subrounded, very loose, moist, HCl strong	SP/ SM	
			Total depth of boring 3.8' bgs (refusal)		
5					
10					

Note(s):

Log of Soil Boring GP-35B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/11/11
Date/Time Completed : 06/11/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.5	0-4.0' SAND w/ gravel FILL, dark reddish brown (5YR 3/3), fine- to coarse-grained sand, gravel to 0.06' diameter, well graded, angular to subrounded, loose, dry, HCl moderate	SW	░
5	▨	4.0/ 1.8	4.0-11' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~75%), poorly graded, subrounded, loose, moist, HCl moderate, mottling common	SM	▥
10		4.0/ 2.7	11-12' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~75%), poorly graded, subrounded, dense, moist, HCl weak		
	▨	4.0/ 3.7	12-17.4' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~75%), poorly graded, subrounded, loose, moist to wet near bottom of interval. HCl weak		
15	▨	2.9/ 2.8	17.4-18.9' Clayey SILT, yellowish brown (10YR 5/4), dense, slightly plastic, moist, HCl strong	ML/ CL	▨
20			Total depth of boring 18.9' bgs (refusal)		

Note(s):

Log of Soil Boring GP-36B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/11/11
Date/Time Completed : 06/11/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.5	0-2.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, loose, dry, HCl moderate, mottling common	SM	░
5 10	▨	4.0/ 2.6 4.0/ 2.8	2.5-11' Clayey Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, soft, slightly plastic, moist, HCl moderate	SM/ SC	▨
	▨		11- 13' Clayey Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, dense, slightly plastic, moist, no HCl		
15		4.0/ 3.4 9.3/ 3.1	13-18.3' Silty SAND, reddish yellow (5YR 6/8), very fine-grained sand (~70%), poorly graded, subrounded, loose, dry to moist increasing with depth, HCl strong, mottling common	SM	░
	▨		18.3-19.3' SILT, light gray (10YR 7/2), very fine-grained sand (~30%), subrounded, dense, non-plastic, dry, HCl strong, FeO staining	ML	▥
20			Total depth of boring 19.3' bgs (refusal)		

Note(s):

INTERA

Log of Soil Boring GP-37B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/11/11
Date/Time Completed : 06/11/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.3	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, dry, HCl strong, mottling throughout	SM	
5	▨	4.0/ 3.2	4.0-9.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subrounded, loose, moist, HCl slight, occasional mottling		
10	▨	4.0/ 4.0	9.0'-13.2' Clayey SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subrounded, soft, slightly plastic, moist, HCl strong, ~30% motttling	SC	
15	▨	4.0/ 4.0	13.2-16' Clayey SILT, yellowish brown (10YR 5/6), soft to hard, slightly plastic, moist, HCl strong, ~5% mottling	ML/ CL	
20			Total depth of boring 16' bgs (refusal)		

Note(s):

Log of Soil Boring GP-38B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/11/11	Driller	: L. Trujillo
Date/Time Completed	: 06/11/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.3	0-5.0' Silty SAND, yellowish red (5YR 5/8), very fine-grained sand (~70%), poorly graded, subrounded, loose, dry, HCL strong, mottling common	SM	
5	▨	4.0/ 3.3	5.0-11.9' Silty SAND, yellowish red (5YR 5/8), very fine-grained sand (~60%), poorly graded, subrounded, dense, moist, HCl weak		
10	▨	4.0/ 3.1			
		4.0/ 4.0	11.9-16' Clayey SILT, yellowish brown (10YR 5/6), soft to hard, slightly plastic, moist, massive-transitions to platy structure near bottom of interval, HCl slight	ML/ CL	
15	▤ ▨				
			Total depth of boring 16' bgs (refusal)		
20					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-39B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

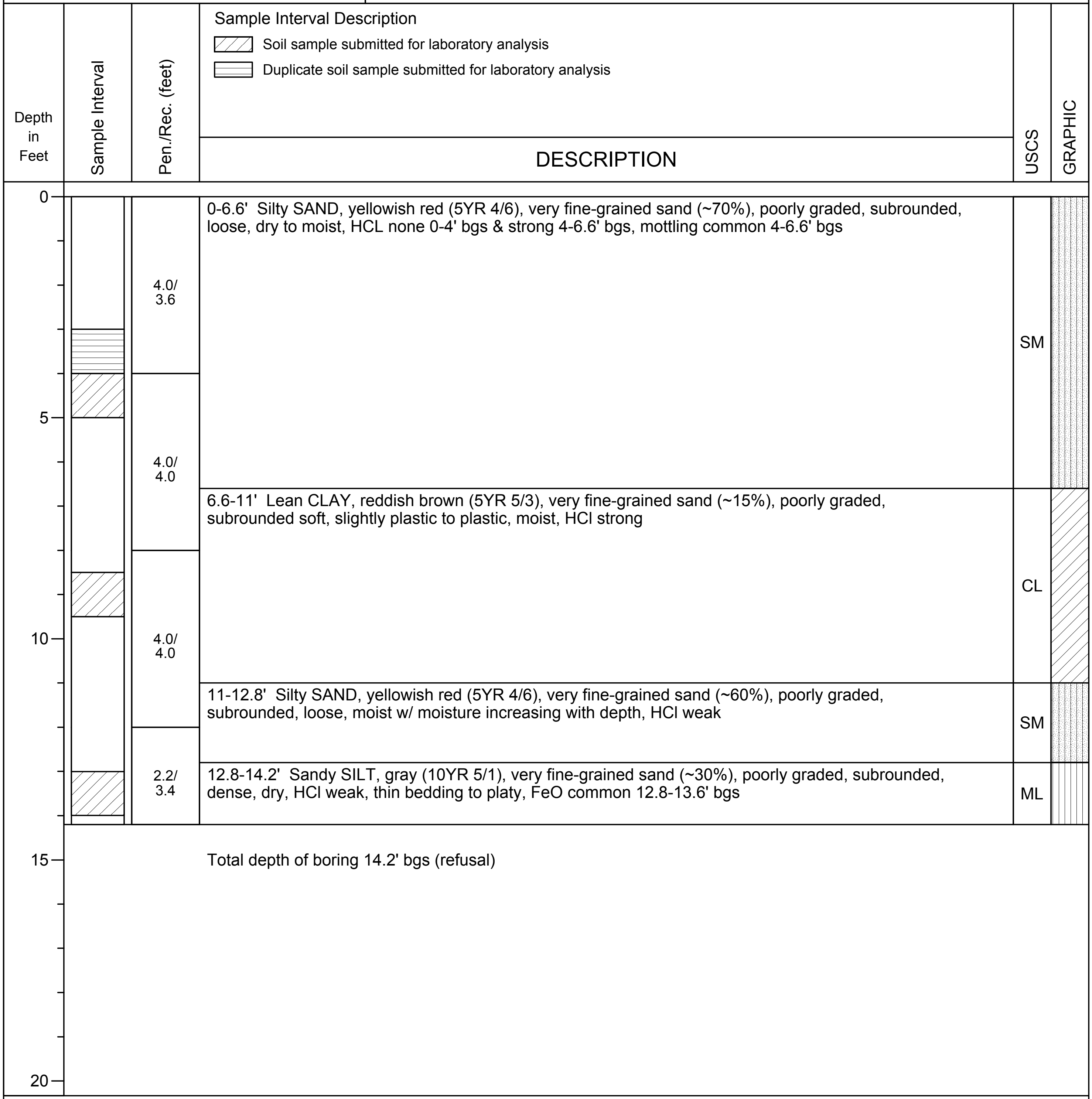
Date/Time Started : 06/12/11
Date/Time Completed : 06/12/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis



DESCRIPTION

Description	USCS
0-6.6' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~70%), poorly graded, subrounded, loose, dry to moist, HCL none 0-4' bgs & strong 4-6.6' bgs, mottling common 4-6.6' bgs	SM
6.6-11' Lean CLAY, reddish brown (5YR 5/3), very fine-grained sand (~15%), poorly graded, subrounded soft, slightly plastic to plastic, moist, HCl strong	CL
11-12.8' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, moist w/ moisture increasing with depth, HCl weak	SM
12.8-14.2' Sandy SILT, gray (10YR 5/1), very fine-grained sand (~30%), poorly graded, subrounded, dense, dry, HCl weak, thin bedding to platy, FeO common 12.8-13.6' bgs	ML

Total depth of boring 14.2' bgs (refusal)

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

INTERA

Log of Soil Boring GP-40B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/12/11
Date/Time Completed : 06/12/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS
0		4.0/ 3.3	0-4.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subrounded, loose, dry to moist, HCL moderate	SM
5	▨	4.0/ 4.0	4.0-8.0' Sandy Silty Lean CLAY, yellowish red (5YR 5/6), very fine-grained sand (~20%), poorly graded, subrounded, soft, slightly plastic, moist, HCl moderate, occasional mottling	ML/ CL
10	▨	4.0/ 3.9	8.0-13' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, moist, HCl moderate, occasional mottling	SM
	▨	1.6/ 1.8	13-13.6' Sandy SILT, yellowish brown (10YR 5/4), very fine-grained sand (~30%), poorly graded, subrounded, soft, slightly plastic, moist, HCl moderate	ML
15			Total depth of boring 13.6' bgs (refusal)	
20				

Note(s):

Log of Soil Boring GP-41B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/11/11	Driller	: L. Trujillo
Date/Time Completed	: 06/11/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 2.4	0-6.5' SAND, pale yellow (5Y 8/2), very fine- to fine-grained sand (~85%), poorly graded, subangular to subrounded, dense, dry, HCl none	SP	
5	☰ ▨	4.0/ 2.8	6.5-19' Silty SAND, light brown (7.5YR 6/3) to pinkish gray (7.5YR 7/2), very fine-grained sand (~60%), poorly graded, subangular to subrounded, loose, dry, HCl none, thin bedded, occasional sandstone fragments, occasional FeO stains	SM	
10		4.0/ 3.0			
15	▨	4.0/ 2.8			
		4.0/ 2.7	19-24.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, loose, dry, HCl strong, mottling common		
20	▨	4.0/ 3.8 0.5/0.9			
25			Total depth of boring 24.5' bgs (refusal)		
30					

Note(s):

1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-42B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/11/11
Date/Time Completed : 06/11/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨	4.0/ 3.4	0-5.5' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~65%), poorly graded, subangular to subrounded, loose, dry to moist, HCl strong, mottling common	SM	
5	▨ ▨	4.0/ 3.8	5.5-8.0' Clayey Silty SAND, reddish brown (5YR 5/4), very fine-grained sand, poorly graded, subrounded, dense, slightly plastic, moist, HCl strong, mottling common	SM/ SC	
		0.5/1.1	8.0-8.5' Silty CLAY, dark reddish brown (5YR 3/2), soft, slightly plastic to plastic, non-cohesive, dry, HCl strong, weathered shale, thin bedding	ML/ CL	
10			Total depth of boring 8.5' bgs (refusal)		

Note(s):

Log of Soil Boring GP-43B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/11/11	Driller	: L. Trujillo
Date/Time Completed	: 06/11/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 3.5	0-1.8' Fill		▩
	▨		1.8-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~65%), poorly graded, subrounded, loose, dry, HCl moderate	SM	
5	▨	4.0/ 4.0	4.0-5.8' Well Graded GRAVEL, very pale brown (10YR 2/3), fine- to medium-grained sand (~10%), gravel (~40%), well graded, subangular to subrounded, very loose, non-plastic, dry, HCl moderate	GW/ GM	
			5.8-8.4' Clayey SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, dense, plastic, moist, HCl strong	SC	▨
	▨	1.7/ 1.9	8.4-9.7' SILT, light yellowish brown (10YR 6/4), soft, non-plastic, non-cohesive, moist, HCl strong	ML	
10			Total depth of boring 9.7' bgs (refusal)		
15					

Note(s):

Log of Soil Boring GP-44B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/10/11	Driller	: L. Trujillo
Date/Time Completed	: 06/10/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		4.0/ 2.3	0-4.0' Silty SAND, pale brown (10YR 6/3), very fine- to medium-grained sand (~80%), well graded, subrounded, loose, dry, HCl moderate, fine crystals precipitate throughout	SW/ SM	
5	▨	4.0/ 2.8	4.0-6.0' Clayey Sitly SAND, very pale brown (10YR 7/4), very fine-grained sand (~60%), poorly graded, subrounded, loose, slightly plastic, dry, HCL none, small rocks, wood scattered throughout 6.0-8.0' Clayey Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~60%), poorly graded, subrounded, slightly plastic, moist, HCl weak	SM/ SC	
10	▨	4.0/ 3.7	8.0-12' Lean CLAY, dark reddish brown (5YR 3/2), silt, soft, slightly plastic, moist, HCl weak	CL	
		4.0/ 3.5	12-14.3' Sandy Lean CLAY, dark reddish brown (5YR 3/2), very fine-grained sand (~20%), poorly graded, subrounded, very soft, plastic to very plastic, very cohesive, moist, HCl weak	CL/ CH	
15			14.3-16' Lean CLAY, gray to blueish gray (2 6/1), hard, plastic, non-cohesive, moist, HCl none, laminate bedding, weathered shale	CL	
	▨	2.4/ 3.1	16-18' Lean CLAY, blueish gray to gray (2 6/1), loose, plastic, moist, HCl none, thin bedding, FeO staining throughout, weathered shale	CL	
			18-18.4' SILT, blueish gray to gray (2 5/1), hard, laminate bedding, shale fragments	ML	
20			Total depth of boring 18.4' bgs (refusal)		

Note(s):

INTERA

Log of Soil Boring GP-45B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description
▨ Soil sample submitted for laboratory analysis
▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▤ ▨ ▨ ▨	4.0/ 3.0	0-4.0' Silty SAND, dark reddish brown (5YR 3/4), fine- to very fine-grained sand, poorly graded, subangular to subrounded, very loose, moist to wet, HCl none, roots 0-2' bgs	SM	
	▨	0.6/ 0.6	4.0-4.6' SAND w/ minor silt, pinkish gray (5YR 6/2), very fine- to fine-grained sand, poorly graded, subangular to subrounded, very loose, moist, HCl none	SP/ SM	
5			Total depth of boring 4.6' bgs (refusal)		
10					

Note(s):
1. Duplicate sample collected. Sample interval was increased to 2 feet to accommodate for additional sample volume required by the analytical laboratory.

Log of Soil Boring GP-46B

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Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 06/07/11
Date/Time Completed : 06/07/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx
Driller : L. Trujillo
Depth to Water : NA
Logged by : E. Muller

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 2.8	0-3.7' Silty SAND, dark reddish brown (5YR 3/4), very fine-grained sand (~70%), poorly graded, subangular to subrounded, very loose, moist to wet, HCl slight	SM	
		0.3/0.6	3.7-4.3' SAND w/ minor silt, yellowish red (5YR 5/6), very fine- to fine-grained sand, poorly graded, subangular to subrounded, very loose, moist, HCl none	SP/ SM	
5			Total depth of boring 4.3' bgs (refusal)		
10					

Note(s):

Log of Soil Boring GP-47B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

▤ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨ ▨	4.0/ 2.6 0.7/0.7	0-4.7' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand (~80%), poorly graded, subangular to subrounded, very loose to loose, moist to wet, HCl none, roots 0-2.5' bgs	SM	░
5			Total depth of boring 4.7' bgs (refusal)		
10					

Note(s):

Log of Soil Boring GP-48B

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 06/08/11	Driller	: L. Trujillo
Date/Time Completed	: 06/08/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: E. Muller
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

▨ Soil sample submitted for laboratory analysis

☰ Duplicate soil sample submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0			0-2.0' Silty SAND, yellowish red (5YR 5/6), very fine-grained sand (~70%), poorly graded, subangular to subrounded, very loose, dry, HCl none, roots 0-1.4' bgs		
1	▨	2.3/		SM	
2			2.0-2.3' SAND w/ minor Silt, light gray (10YR 7/2), very fine- to fine-grained sand, poorly graded, subangular to subrounded, very loose, dry, HCl strong	SP/ SM	
3			Total depth of boring 2.3' bgs (refusal)		
4					
5					

Note(s):

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Log of Soil Boring GP-01C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample

▨ Field test sample collected; not submitted to lab (1)

▧ Field test sample submitted for laboratory analysis

☒ Duplicate soil sample not submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0		3.5/ 2.8	0-3.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none, trace white mottled HCl strong	SM	
	▧				
	▨				
	▨		3.1-3.5' Sandstone, pink (5YR 7/3), very fine- to fine-grained sand, dense, dry, HCl medium to strong		
			Total depth of boring 3.5' bgs (refusal)		
5					
10					

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

Log of Soil Boring GP-02C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description
- ▨ Field test soil sample collected; not submitted to lab (1)
- ▨ Field test soil sample submitted for laboratory analysis
- ☒ Duplicate soil sample not submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	☒ ▨	2.7/ 2.7	0-2.3' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl strong 2.3-2.7' Sandstone, brownish yellow (10YR 6/6), very fine- to fine-grained sand, poorly graded, loose to dense, dry, subangular to subrounded, HCl none	SM	
			Total depth of boring 2.7' bgs (refusal)		
5					
10					

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

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Log of Soil Boring GP-03C

(Page 1 of 1)

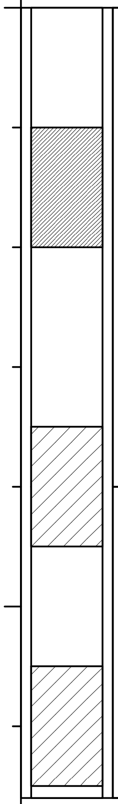
Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description

- ▨ Field test soil sample collected; not submitted to lab (1)
- ▧ Field test soil sample submitted for laboratory analysis
- ☒ Duplicate soil sample submitted for laboratory analysis



Depth in Feet	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	4.0/ 2.8	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none	SM	
	2.6/ 2.7	4.0-5.4' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, trace fine sand, HCl medium to strong, white mottling w/ HCl strong		
5		5.4-6.6' Sandstone, light brown gray (10YR 6/2), very fine- to fine-grained sand, loose to dense, dry, HCl none to weak, subangular to subrounded		
		Total depth of boring 6.6' bgs (refusal)		
10				

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

Log of Soil Boring GP-04C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/19/11
Date/Time Completed : 05/19/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description

▨ Field test soil sample collected; not submitted to lab (1)

▧ Field test soil sample submitted for laboratory analysis

☒ Duplicate soil sample not submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨	4.0/ 3.3	0-5.1' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none, trace white mottling w/ HCl strong, roots at top	SM	
5	▨	1.5/ 1.7			

Total depth of boring 5.1' bgs (refusal)

10

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

INTERA

Log of Soil Boring GP-05C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/19/11
Date/Time Completed : 05/19/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

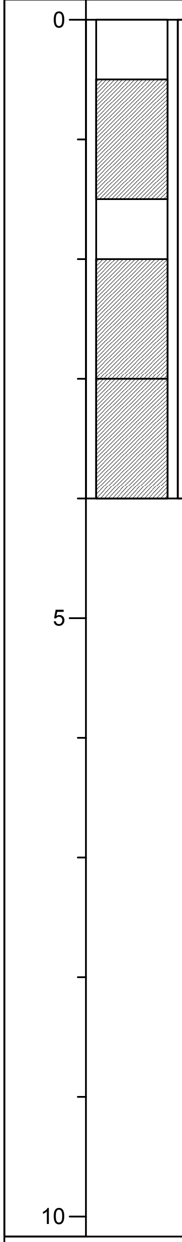
Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description

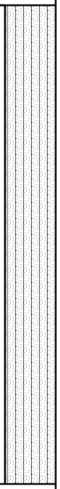
▨ Field test soil sample collected; not submitted to lab (1)

▨ Field test soil sample submitted for laboratory analysis

☒ Duplicate soil sample not submitted for laboratory analysis



Depth in Feet	Pen./Rec. (feet)	DESCRIPTION	USCS
0	4.0/ 3.6	0-4.0' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose, dry, HCl none, trace white mottling w/ HCl strong	SM



Total depth of boring 4.0' bgs (refusal)

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

Log of Soil Boring GP-06C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started	: 05/19/11	Driller	: L. Trujillo
Date/Time Completed	: 05/19/11	Depth to Water	: NA
Drilling Method	: Geoprobe	Logged by	: J. Reed
Sampling Method	: Continuous Dual Tube		
Drilling Co./Driller	: Earth Worx		

Sample Interval Description
- ▨ Field test soil sample collected; not submitted to lab (1)
- ▧ Field test soil sample submitted for laboratory analysis
- ▩ Duplicate soil sample not submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▨ ▨	4.0/ 3.4	0-4.4' Silty SAND, yellowish red (5YR 4/6), very fine-grained sand, silt, poorly graded, loose to medium dense, dry, HCl none to strong, some white mottling w/ HCl strong 3.2-4.4' bgs	SM	
5	▧	1.6/ 1.7	4.4-4.9' Silty SAND, pink (5YR 7/4), very fine-grained sand, silt, poorly graded, loose to medium dense, HCl strong, trace fine sand 4.9-5.6' Rock fragments, white, HCl none, very fine grained		
			Total depth of boring 5.6' bgs (refusal)		
10					

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

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INTERA

Log of Soil Boring GP-07C

(Page 1 of 1)

Project Name:
Denison Nitrate Investigation
White Mesa Mill, Blanding, Utah

Project #: DENMC.C002.000

Date/Time Started : 05/18/11
Date/Time Completed : 05/18/11
Drilling Method : Geoprobe
Sampling Method : Continuous Dual Tube
Drilling Co./Driller : Earth Worx

Driller : L. Trujillo
Depth to Water : NA
Logged by : J. Reed

Sample Interval Description
▨ Field test soil sample collected; not submitted to lab (1)
▧ Field test soil sample submitted for laboratory analysis
☒ Duplicate soil sample not submitted for laboratory analysis

Depth in Feet	Sample Interval	Pen./Rec. (feet)	DESCRIPTION	USCS	GRAPHIC
0	▧	4.0/ 3.2	0-1.5' Sandy Clayey SILT, reddish brown (5YR 4/4), very fine-grained sand, medium stiff, dry to moist, cohesive, HCl none	ML	
			1.5-1.7' CLAY, dark red brown (5YR 3/4), stiff, moist, medium plastic	CL	
	▨		1.7-4.9' Sandy SILT/Silty SAND, reddish brown (5YR 4/4), very fine-grained sand, silt, medium stiff/medium dense, slightly moist to moist, trace clay (cohesive), trace fine sand, HCl none to weak, trace white mottling at 2.5' bgs, little more sand or more silt	ML/ SM	
5	▨	2.1/ 2.1	4.9-6.1' Silty SAND/SAND, brownish yellow (10YR 6/4), very fine- to fine-grained sand, silt (varying amounts), medium dense, slightly moist, trace medium sand, slightly cohesive, HCl none, little iron stained	SM/ SP	
			Total depth of boring 6.1' bgs (refusal)		
10					

Note(s):
1. Field test soil sample not submitted to laboratory due to no detectable results during test kit analysis.

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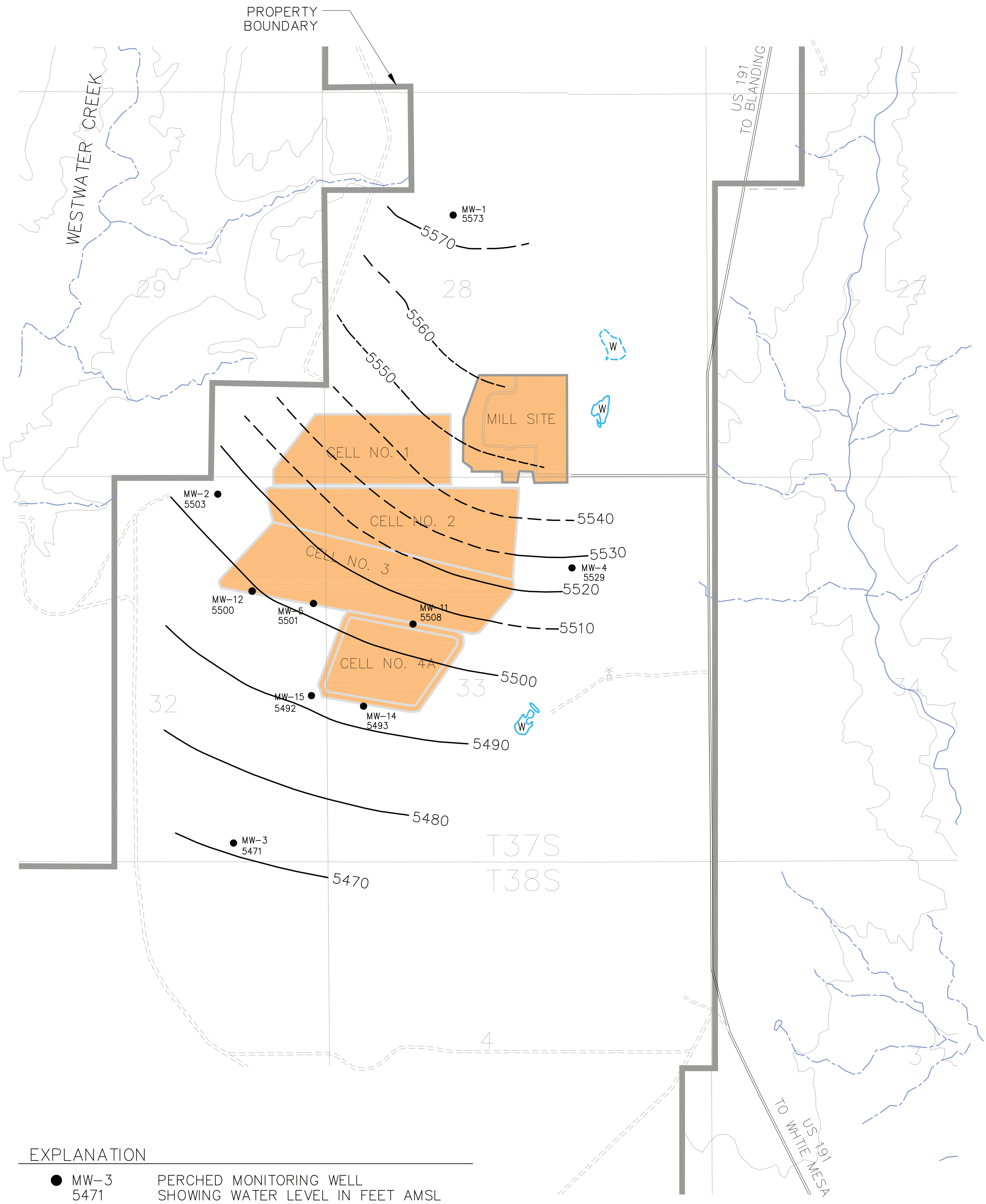
APPENDIX D

HISTORIC WATER LEVEL MAPS



EXPLANATION

● MW-3 5471	PERCHED MONITORING WELL SHOWING WATER LEVEL IN FEET AMSL
W	WILDLIFE POND
5580 ——— – – –	WATER LEVEL CONTOUR LINE, DASHED WHERE UNCERTAIN

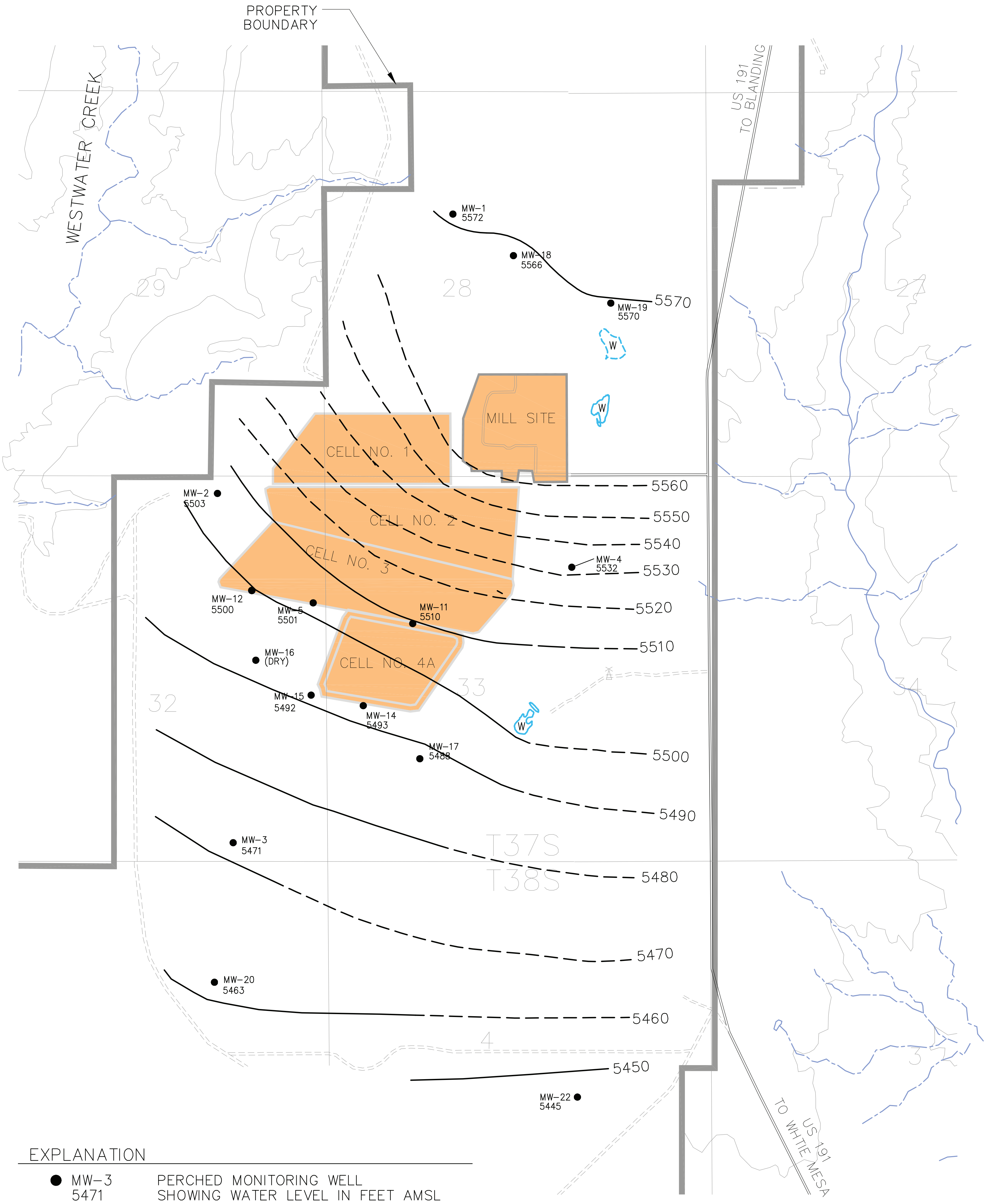
N

0 3000
SCALE IN FEET

HYDRO
GEO
CHEM, INC.

PERCHED WATER LEVELS
AUGUST 1990

Approved:	Date:	Author:	Date:	File Name:	Figure:
SS	06/22/07			71800086	D.1



EXPLANATION

● MW-3 5471	PERCHED MONITORING WELL SHOWING WATER LEVEL IN FEET AMSL
W	WILDLIFE POND
5580 — —	WATER LEVEL CONTOUR LINE, DASHED WHERE UNCERTAIN

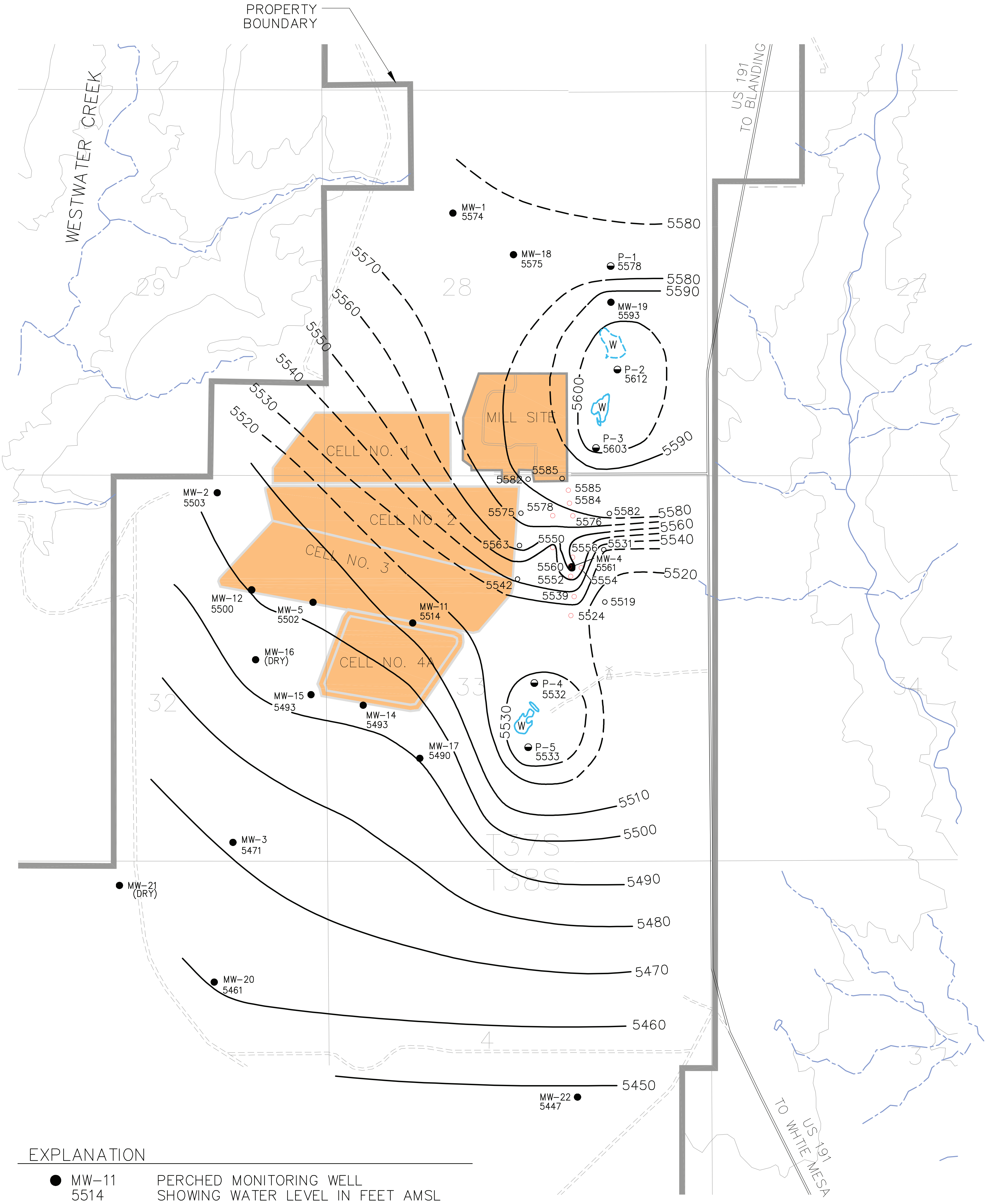
N

0 3000
SCALE IN FEET

HYDRO
GEO
CHEM, INC.

PERCHED WATER LEVELS
AUGUST 1994

Approved	Date	Revised	Date	Reference:	FIG:
SS	06/2/07			71800070	D.2



EXPLANATION

● MW-11 5514	PERCHED MONITORING WELL SHOWING WATER LEVEL IN FEET AMSL
○ 5524	TEMPORARY PERCHED MONITORING WELL SHOWING WATER LEVEL IN FEET AMSL
◒ P-5 5533	PIEZOMETER SHOWING WATER LEVEL IN FEET AMSL
5580 ——— — — —	WATER LEVEL CONTOUR LINE, DASHED WHERE UNCERTAIN
W	WILDLIFE POND

NOTE: WATER LEVELS FOR PIEZOMETERS ARE FROM AUGUST, 2002

N

0 SCALE IN FEET 3000

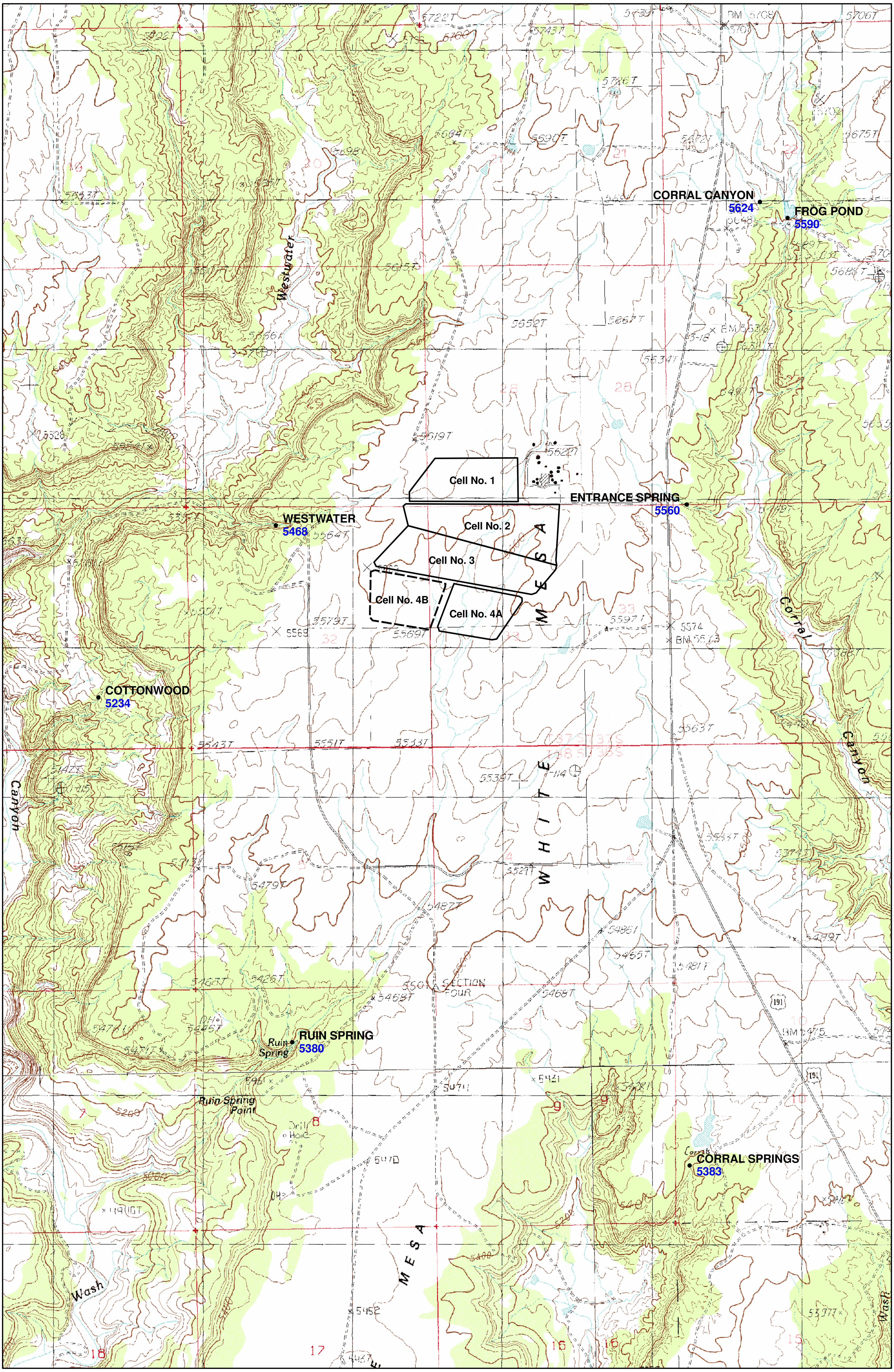
HYDRO
GEO
CHEM, INC.

PERCHED WATER LEVELS SEPTEMBER 2002

Approved	Date	Revised	Date	Reference:	FIG:
SS	06/22/07			71800088	D.3

APPENDIX E

TOPOGRAPHIC AND GEOLOGIC MAPS



0.5 0.25 0 0.5 1 Mile

● **WESTWATER** Seep or Spring
5468 Elevation (feet) above mean sea level

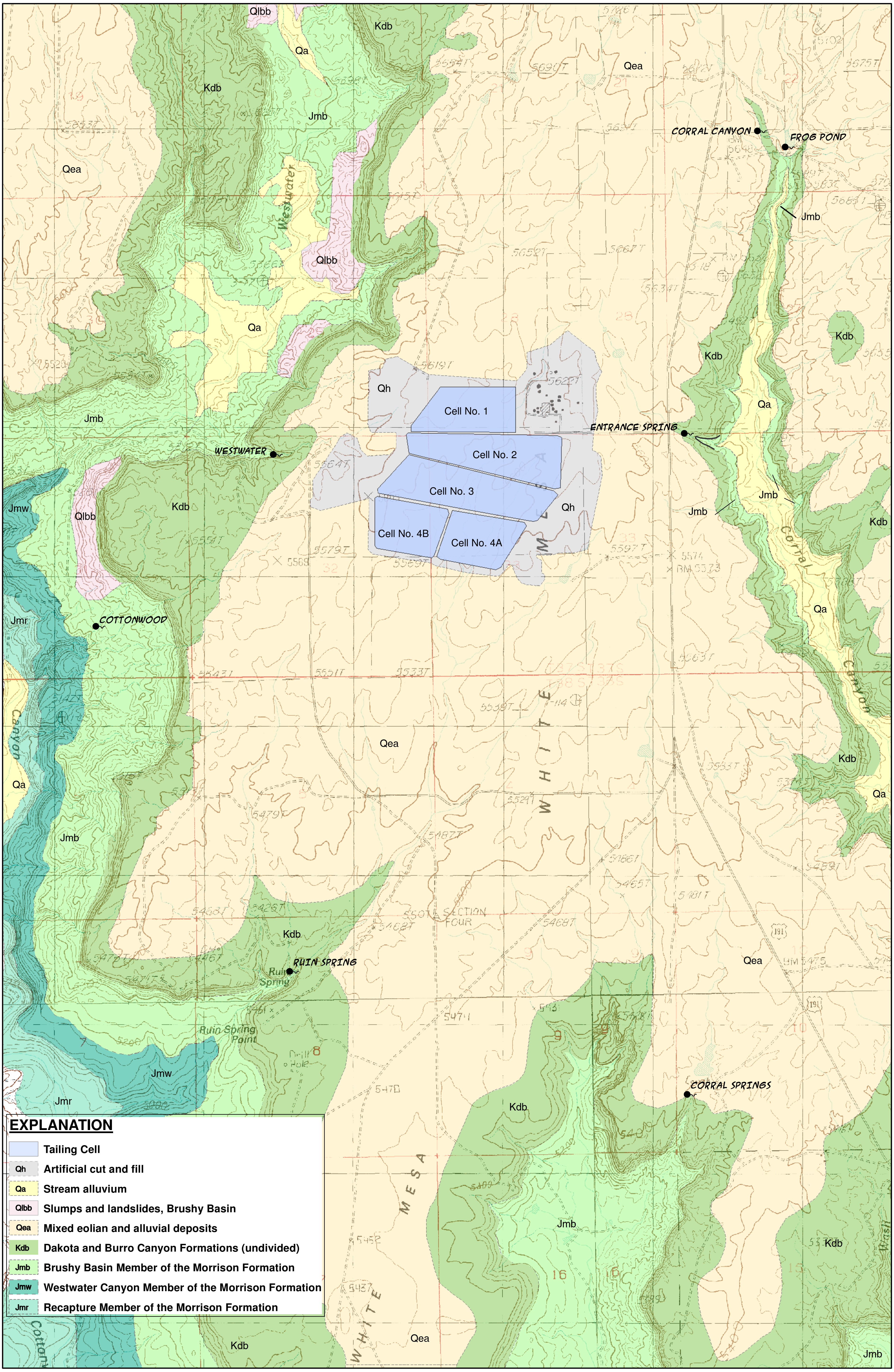
NORTH

HYDRO GEO CHEM, INC.

SEEPS AND SPRINGS ON USGS TOPOGRAPHIC BASE WHITE MESA

Approved	Date	Author	Date	File Name	Figure
SJS	09/17/10	DRS	07/16/10	7180002G	E.1

K:\718000\GIS\7180002G.mxd: Friday, September 17, 2010 1:02:59 PM



HYDRO GEO CHEM, INC.

GEOLOGIC MAP
WHITE MESA, UTAH

Approved	Date	File	Figure
SJS	12/28/11	K:\718000\GIS\Geology	E.2

Geological Map of the Blanding Area, San Juan County, Utah (modified from Haynes et al., 1962; Dames & Moore, 1978 and Kirby, 2008)
Base Map Prepared from Portions of the Blanding South, Black Mesa Butte, Big Bench and No Mans Land U.S.G.S. 7.5' Quadrangles.